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Standardisation Systems in the Defence Industries of the European Union and the United States

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ESL & NETWORK

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List of acronyms

AA	Anti-Air
AAP	Allied Administrative Publication
ABCA	"America, Britain, Canada, Australia" Standardisation group involving the four countries
AC	Alliance Committee
ACCSQ	Southeast Asia regional standardisation group
AECMA	European Association of Aerospace Materiel Manufacturers
AENOR	Asociación Española de Normalización (Spanish SDO)
AFNOR	Association Française de Normalisation (French SDO)
AGD	Armament General Directorate (Greece)
AGS	Aerospace General Spare (SBAC)
AIA	Aerospace Industries Association (US)
AIDMO	Arab regional standards organisation
ANSI	American National Standards Institute (US SDO)
APS	Allied Publications
AQAP	Allied Quality Assurance Publications
ARBG	Acquisition Reform Benchmarking Group
ARSO	African Regional Standards Organisation
ARSSG WG	Acquisition Reform Senior Steering Group Working Group
AS	Avionics Systems
ASIC	Application Specific Integrated Circuit
ASQC	American Society for Quality Control
ASSIST	Acquisition Streamlining and Standardization Information System
ASTM	American Society for Testing and Materials
BAF	Provisions Concerning Procurement for the Armed Forces (Norway)
BBS	Bulletin Board Systems
BEC	Belgian Electrotechnical Committee
BEC	British Electrotechnical Committee
BINORM	Bureau Interarmées de Normalisation
BNAE	Bureau de Normalisation de l'Aéronautique et de l'Espace (France)
BOD	Official Bulletin of (the Spanish Ministry of) Defence
BSI	British Standards Institute (British SDO)
BWB	Federal Office for Defence Technology and Procurement (Germany)
C3I	Command, Control, Communications and Information
CAD	Computer Aided Design
CAGE	Contractor and Government Entity
CALS	Continuous Acquisition and Life-Cycle Support
CDE	Commercial Derivative Engine
CECC	CENELEC Electronic Components Committee
CEI	Italian Electrotechnical Committee
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CFSP	Common Foreign and Security Policy
CIN	Commissions Intearmées de Normalisation (France)
CINORM	Comité Intearmées de la Normalisation (France)

CJTF	Combined Joint Task Forces
CMI	Commercial-Military Integration
CNAD	Conference of National Armaments Directors
COPANT	Pan-American regional standardisation organisation
COPNORM	Comité d'Orientation et de Programmation de la Normalisation (French Ministry of Defence)
CPO	Centralised Private Organisations
CPS	Cardinal Point Specifications
CWA	CEN Workshop Agreement
Dstan	(UK MoD) Directorate of Standardisation
DAPP	Defense Acquisition Pilot Programs
DCAA	Defense Contract Audit Agency
DCMA	Defense Contract Management Agency
DCMC	Defense Contract Management Command
DCN	Direction des Constructions Navales (France)
DCSP	(BSI) Defence Standards Conversion Panel
DDI	(European countries with a) Developing Defence Industry
DECT	Digital European Cordless Telephony
Def Stan	British Defence Standard
DERA	Defence Evaluation and Research Agency (UK)
DGA	General Delegation for Armament (France)
DGAM	Directorate General for Arms and Materiel (Spain)
DIDs	Data Item Descriptions
DIN	Deutsches Institut für Normung (German SDO)
DKE	Deutsche Elektrotechnische Kommission (German electrotechnical organisation)
DLA	Defense Logistics Agency
DMP	Defence Materiel Selection Process (Netherlands)
DMSC	Defence Materiel Standardization Committee (UK MoD)
DMSDMC	Defence Materiel Standardisation Development and Management Committee (UK MoD)
DoD	Department of Defense (United States)
DPO	Decentralised Public Organisation
DS	Dansk Standardiseringsraad (Danish SDO)
DSMC	Defense Systems Management College
D Stan	Directorate of Standardization (UK MoD)
DUSD(AR)	Deputy Under Secretary of Defense for Acquisition Reform (United States)
ECISS	European Committee for Iron and Steel Standardisation
ECSS	European Co-operation for Space Standardisation
EDEM	European Defence Equipment Market
EIS	Electronic imaging systems
EEA	European Economic Area
ELOT	Hellenic Organisation for Standardisation (Greek SDO)
EMP	Electro-Magnetic Pulse
EMPORDEF	Empresa Portuguesa de Defesa
EMS	Electronic messaging systems
EN	European Standard
ENS	Electronic navigation systems

ENV	European Pre-standard
ETCI	Electrotechnical Council of Ireland
ETSI	European Telecommunications Standards Institute
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
EW	Electronic Warfare
FARA	Federal Acquisition Reform Act of 1995
FASA	Federal Acquisition Streamlining Act of 1994
FiF	Association of Swedish Defence Industries
FINABEL	(Committee of the Army Chiefs of Staff of) France, Italy, Netherlands, Germany, Belgium, Luxembourg, Britain
FLA	Future Large Aircraft
FMS	Foreign Military Sales (US programme)
FMV	Defence Materiel Administration (Sweden)
FSC	Federal Supply Class
FTP	File Transfer Protocol
GAM	Guerre, Air, Marine (French defence standard)
GAO	Government Accounting Office
GD	Government Department
GDADE	General Directorate for Armament and Defence Equipment (Portugal)
GIS	Geographical Information Systems
GPRA	Government Performance Reform Act of 1993
JPEG	Joint Photographic Experts Group
GSM	Global System for Mobilecommunication
HD	(European) Harmonisation Document
HDL	High-level Design Language
IBN	Institut Belge de Normalisation (Belgian SDO)
ICAO	International Civil Aviation Organization
ICC	International CALS Council
ICT	Information and Communication Technologies
IDS	Electronic identification systems
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IEPG	Independent European Programme Group
IGO	Inter-Governmental Organisation
ILS	Integrated Logistics Support
IPA	Industrial and Professional Organisations
IPQ	Instituto Português da Qualidade (Portuguese SDO)
IPR	Intellectual Property Rights
ISO	International Organisation for Standardisation
IT	Information Technologies
ITMRA	Information Technology Management Reform Act of 1995
ITU	International Telecommunication Union
JDAM	Joint Direct Attach Munition
LN	Normenstelle Lufifahrt (German standard)
LSA	Logistics Support Analysis
LSAR	Logistics Support Analysis Record
MAS	(NATO) Military Agency for Standardisation
M&EP	Materiel and Engineering Practices

MILSPECs	Military Standards and Specifications
MILSTANDs	Military Standards (US)
MIS	Medical Informatics Systems
MLRS	Multiple Launch Rocket System
MM	Multimedia - virtual reality
MND	Ministry of National Defence (Belgium)
MNs	Military Norms (Spain)
MoD	Ministry of Defence (UK and other countries)
MoU	Memorandum of Understanding
MPEG	Motion Picture Experts Group
MRA	Mutual Recognition Agreements
MRAV	Multi Role Armoured Vehicle
MUAHAG	Military Usage And Harmonisation Advisory Group
NAC	National Armaments Committee
NAFTA	North American Free Trade Agreement
NAPNOC	No Acceptable Price NO Contract
NATO	North Atlantic Treaty Organisation
NC3B	NATO C3 Board
NCMB	NATO CALS Management Board
NCS	NATO Committee for Standardisation
NEC	Netherlands Electrotechnical Committee
NF	Norme Française (French standard)
NFPA	National Fire Protection Association (US)
NGO	Non-Governmental Organisation
NIAG	NATO Industrial Advisory Group
NICG	NATO Industry CALS Group
NNI	Nederlands Normalisatie Instituut (Dutch SDO)
NPODs	Navy Print on Demand System
NPR	National Performance Review
NSAI	National Standards Authority of Ireland (Irish SDO)
NSLB	NATO Standardization Liaison Board
NSP	NATO Standardization Programme
OCCAR	Organisation de Coopération Conjointe en matière d'Armement
OECD	Organisation for Economic Co-operation and Development
ÖKE	Austrian Electrotechnical Committee
ÖN	Österreichisches Normungsinstitut (Austrian SDO)
ONS	Office of NATO Standardisation
OPR	Office of Primary Responsibility
OSD	Office of the Secretary of Defense (United States)
PAS	Publicly Available Specifications
PASC	Asia-Pacific regional standardisation conference
PDI	Product Data Information systems
PE	Procurement Executive (UK Ministry of Defence)
PfP	Partnership for Peace
PGM	Precision Guided Munitions
PPCG	Pilot Programs Consulting Group
PSA	Public Service Agency
QA	Quality Assessment

QUALIFAS	Qualité des Approvisionnements pour les Industries Françaises Aéronautiques et Spatiales
R&D	Research and Development
R G Aéro	Recommandation Générale Aéronautique (BNAE standard)
R&M	Reliability and Maintainability
RIC	Reinvention Impact Center
RMN	Responsable Ministériel pour la Normalisation (French Ministry of Defence)
RSN	Responsable Sectoriel de la Normalisation (France defence agencies)
SAE	Society of Automotive Engineers
SBAC	Society of British Aerospace Constructors
SDO	Standards Development Organisation
SECDEF	Secretary of Defense (United States)
SEE	Electrotechnical Organisation of Luxembourg
SEK	Swedish Electrotechnical Commission
SESKO	Finnish Electrotechnical Standards Association
SFS	Suomen Standardisoimisliitto (Finish SDO)
SGD	General Secretary of Defence (Italy)
SGML	Standard Generalised Markup Language
SIC	Standard Industrial Classification
SIS	Standardiseringskommisionen I Sverige (Swedish SDO)
SPI	Single Process Initiative
SPIS	Single Process Initiative System
STANAG	(NATO) Standardisation Agreement
TRANSEC	Transmission Security
UIE	Union Technique de l'Electricité (French Electrotechnical Organisation)
UK	United Kingdom
UN	United Nations
UMTS	Universal Mobile Telecommunication System
UNE	A Spanish Norm (Spanish civil standard)
UNI	Ente Nazionale Italiano di Unificazione (Italian SDO)
US	United States
USD(AT)	Under Secretary of Defense for Acquisition and Technology (United States)
VG	German defence standards
WEAG	Western European Armaments Group
WEAO	Western European Armaments Organisation
WEU	Western European Union
WTO	World Trade Organisation

1

INTRODUCTION

1 Introduction

1.1 Background

This Draft Final Report constitutes the third deliverable of the "Study on the Standardisation Systems in the Defence Industries in the EU Member States and the USA" contracted by European Commission (DG III) in January 1998 (Contract ETD/97/501185), to a team lead by SPRU, and including TASC, and ESL&Network.

Changes in the political, economic, industrial, and technological environment of defence production are posing key challenges to the way in which defence agencies have traditionally procured weapons systems and support equipment and materiel. Defence agencies world-wide are considering, or have already implemented, ambitious procurement reform programmes. One of the main issues under scrutiny is the role of military standards and specifications in defence procurement.

As a consequence of the above trends, the role of the standardisation bodies and processes of relevance to the European defence industries, is being reassessed. In January 1996, the European Commission (EC) published a Communication on *The Challenges Facing the European Defence-Related Industry, A Contribution for Action at European Level* (COM(96) 0010, 24 January 1996). It recognised the strategic importance of standards for the efficiency of the internal market, and pointed out that standardisation had passed from being a marginal issue to become an area receiving priority attention within the European industry as a means of reducing costs and promoting industrial competitiveness. It was noted that in many areas civil standardisation activity was proceeding faster than similar military efforts, and that civil standards were becoming more widely used in defence procurement. Hence the communication recommended that one of the main objectives of EU policy in respect of the defence-related industry should be to "further convergence of civil and military use of standardisation".

Further, in November 1997, the Commission issued another Communication on *Implementing European Union Strategy on Defence-Related Industries* (COM(97) 583 final). In this Communication the Commission proposed an Action Plan for the defence-related industries, describing 14 areas in which immediate EU action was deemed necessary. One of these areas was standardisation. The Commission stated that "setting up a European defence equipment market and consolidating Europe's defence industrial base will call for an effort to rationalise the sets of standards currently being used by the defence ministries of the Member States".

Against this background the Commission issued an open call for tenders to carry out the present "Study on the Standardisation Systems in the Defence Industries in the EU Member States and the USA".

1.2 Scope

Following the requirements of the call for tender and the structure of our proposal, this study provides the Commission with:

a "situation" report on

- the changing institutional framework of standardisation, both general and with specific reference to European civilian standardisation;
- the European defence procurement procedures, and the institutional framework for European action in defence industrial matters including defence standardisation;
- the defence standardisation procedures at international (NATO...) and national (EU member countries and US) levels;
- the changes in the US approach to military standardisation ("MILSPEC reform") in the context of defence acquisition reform initiatives;

an analysis of

- European requirements in defence standardisation as expressed through a survey of leading industry and government executives in EU Member Countries;
- the migration from defence to commercial practices and standards by US defence suppliers, including a detailed sector assessment of US companies that are leading in acquisition reform related initiatives;
- an industry survey conducted with US leading industry and government executives concerning the impact of defence acquisition reform;
- an analysis of standardisation dynamics and policy options in key defence technology areas.

Based on our analysis, the study concludes by identifying the policy options open to the Commission to promote and facilitate the linking of civil and defence standardisation regimes, and support defence industrialists in their standards-making efforts.

1.3 Research team and acknowledgements

The study has been structured into three work streams of work:

1. The core research team was located at SPRU (University of Sussex), the project's prime contractor. At SPRU, Jordi Molas-Gallart coordinated and managed the project and was responsible for drafting the sections on European defence procurement and defence standardisation regimes. Richard Hawkins was responsible for developing the analytical methodology and for its application in Chapter 7, and drafted the analysis of the institutional framework of standardisation. Richard Hawkins and Jordi Molas-Gallart edited the interim and final reports, and drafted the conclusions, project recommendations and Executive Summary with the advice of the team of consultants at ESL and TASC. Together with Tim Bendix (TASC UK office) the core research team was responsible for data collection and for the development of the formal survey questionnaire of European government and industrial executives applied by ESL&Network. Tim Bendix also

provided a major contribution to the planning and execution of the informal interview programme, and the field research carried out by the core research team.

2. ESL&Network was responsible for administering and analysing the programme of formal interviews with European industrial and government executives. These were conducted by ESL's network of European offices and coordinated by Professor Keith Middlemas at ESL's London office. Keith Middlemas, Jordi Molas-Gallart, and Richard Hawkins wrote the analysis presented in Chapter 5. Keith Middlemas also provided liaison with high-ranking industrial and government officials.

3. The analysis of US policies and the assessment of the implementation of MILSPEC reform and its impact on US competitiveness was carried out by TASC's Washington DC office. The US TASC team was led by Michael Chinworth. The US section of the study (Chapter 6) was developed, researched and written by Michael Chinworth, Michael Sherman, and Roger A. Romack, all at the TASC Washington DC office. TASC US also offered advice in the drafting of conclusions and recommendations.

We acknowledge the assistance of many officials and industrial executives in Europe and the US who responded to our questionnaires and freely offered information, assistance, and comments on previous drafts of this report. Without which this study would not have been possible. The European Commission, DG-III also provided assistance hosting two meeting to discuss report drafts. The meetings were attended by Commission officials, defence standardisation officials from NATO and PfP countries, and industrial representatives. We are indebted to them for their comments and suggestions.

1.4 Report structure

The report is organised into two main parts. Chapters 2, 3, and 4 provide the general background to the study by presenting a detailed description of the institutional framework of standardisation both at national and international levels, and of European defence procurement practices and defence standardisation practices. Against this background, the following chapters provide the main analytical thrust of the study.

Chapter 5 analyses the responses of European industrialists and officials, stressing the national differences and suggesting a number of policy recommendations that are further explored in the concluding chapter.

Europe has been looking with interest to developments in the US. One of the most important elements of the high-profile process of US defence procurement reform has is an extensive and well-documented initiative to change the ways in which the US military deals with product specifications and standards. The outcome of US policies is likely to affect the competitive position of European defence firms, as well as providing lessons for the processes of reform being launched in Europe. Chapter 6 presents a detailed analysis of the reforms implemented in the US, and of their effects on industry.

Policy responses to the present challenges cannot only be based on a reaction to the requests from industrialists and officials, and to the situation in the US. Standardisation policy is a highly complex field, where different technological dynamics and market structures are likely to lead to different institutional arrangements. Any policy strategy must also take into account the differences across sectors of activity and be based on a sound understanding of the main standardisation dynamics across different product and technology fields. Chapter 0 provides an analysis of standardisation dynamics in 16 key defence technology areas grouped into five main categories (process management, general engineering, systems platforms and transport, materials and commodities, information and communication technology). This analysis provides the foundation for an assessment of generic policy options to support the construction of an efficient defence standardisation system in Europe.

The final chapter brings together the different analytical strands of the report to provide a structured listing of specific recommendations. Finally the recommendations are organised into a workplan for the European Commission to implement measures to promote and facilitate the linking of civil and defence standardisation regimes, and support defence industrialists in their standard-building efforts.

2

SITUATION REPORT:
THE INSTITUTIONAL FRAMEWORK OF STANDARDISATION

2 Situation report: The institutional framework of standardisation

2.1 The definition and role of standards

The term 'standard' has many definitions and can be applied in many diverse contexts. The terms of reference for this study focus on 'industrial standards' -those that apply specifically to the application of materials, technologies and processes to the production of industrial goods and services. In this context, the most basic definition we can suggest is as follows:

> A standard is a commonly accepted means by which the processes and physical characteristics of specific technologies are assessed and replicated.

Where a standard is available, it should be possible to determine from it how the technology in question functions, and to reproduce its characteristics. By this basic definition, a standard could take the form either of a physical example (as with a material sample), or of a document that uses words and graphics to specify material characteristics and qualities, dimensions, weights, tolerances, processes, performance characteristics and so forth. Some standards employ both physical and textual media.

Yet, standards have an institutional as well as a technological dimension. In this context, standards must be considered not just in terms of how adequately they describe technological conditions, but in terms of the particular social and economic interests and of the functions they may perform.

Standards can be established institutionally in one or more of three ways:

1. by ***fiat*** according to the dictates of laws, regulations or other rules;

2. through the ***protracted common use*** in the market of specific technologies, methods and processes;

3. by ***voluntary negotiated agreement*** among stakeholders.

It is common to refer to standards in the first category as 'technical regulations' *per se*, those in the second category as '*de facto*' or 'market' standards, and those in the third as '*de jure*' or 'committee' standards. In practice these designations are neither exclusive nor especially accurate. As will be demonstrated throughout this report, both *de facto* and *de jure* standards can become referenced in regulations. Moreover, some *de facto* standards are proprietary whereas others are not, and standards committees often synthesise inputs drawn from regulations and from proprietary and non-proprietary *de facto* standards.

Definitions that are based on the institutional context focus almost exclusively on standards that are negotiated by voluntary agreement. As such, they tend less to define the form and function of standards, and more to define institutional guarantees to the effect that standards agreements will not be biased towards the interests of particular stakeholders, and will not negatively distort or prejudice technological or market conditions. This is reflected in the following definition accepted by ISO and the United Nations Economic Commission for Europe (UNECE):

> "A standard is a technical specification or other document available to the public, drawn up with the co-operation and consensus or general approval of all interests affected by it, based on the consolidated results of science, technology and experience, aimed at the promotion of optimum community benefits and approved by a body recognised on the national, regional or international level."

It is upon guarantees like these that the global standardisation system centred in national, regional and international Standards Development Organisations (SDO) is constructed. The rationales for this system are both social and economic, and focus on the qualities of consensus, public availability, and voluntary application. These values contributed greatly to the development of the SDO committee system (more below).

The third way of defining standards concentrates on the business incentives to set standards, thus synthesising elements of the above functional and institutional definitions. In industrial contexts, standards are developed among stakeholders who are also competitors - often fierce competitors! What compels them act collectively in this way? Much of the answer has to do with (a) efficiency - the elimination of redundant R&D, and (b) strategy - the co-ordination of key product and market elements. According to these criteria

> A standard defines the industry consensus at a given point in time as to which technological characteristics can promote and sustain competitive advantages for individual firms, and which ones cannot. (derived from Hawkins 1996b)

Figure 2-1 illustrates such incentive structure. For example, producers of advanced systems platforms will compete on their systems integration capabilities and develop systems integration technologies on which they base their competitive advantage. However, their products incorporate many components on which there is little technological competition among rival systems assemblers: in any of their systems one could find for instance common materials like steel and well-known alloys, thousands of nuts and bolts, electrical cables, seals, etc. Industry will have incentives to develop standards for all the components, sub-systems, procedures on which there is no competition on technical grounds. In these areas, the costs of diversity are higher than any potential benefits that could be gained from the technological dynamism derived from such diversity.Standards are also required on the basic components on which technological competition can be developed; it is at the dividing line between fields with potential for technological competition and the fields where there is little scope for such form of competition, where new standardisation activity is more likely to emerge. Circuit board manufacturers may, for instance, agree at what voltages will their electronic components operate; aircraft engine manufacturers may establish basic agreements on the characteristics of a number of alloys extensively used in their production.

Figure 2-1 Incentive structure for consensus standardisation

Competition on technology is feasible
STANDARD
Competition on technology is redundant

2.1.1 Basic rationales for industrial standardisation

The above incentive-based definition opens the door on a multitude of economic rationales for developing industry-wide standards (or not developing them, as the case may be). Basically, there are two sets of economic issues:

(1) increasing industrial efficiency;
(2) gaining strategic advantage.

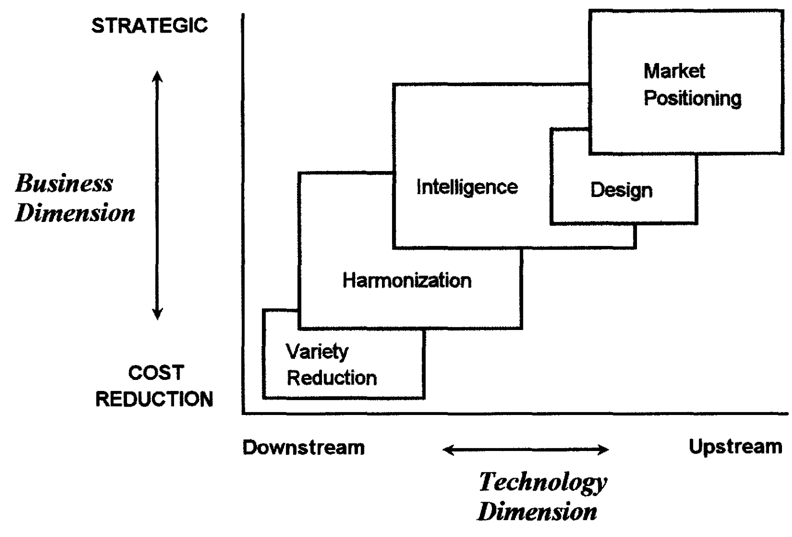
The issues are related, but not the same. Efficiency gains are easily transferable between competitors. Once one producer learns to do something more efficiently, others can follow. Being the first mover on the efficiency front does not necessarily lead to longer term competitive advantage (see Porter 1996), and may yield disadvantages as competitors exploit 'free rider' opportunities. Standards have some of the characteristics of 'public goods' in that their use by one party does not in principle diminish their usefulness to other parties. This can make industry-wide standardisation an attractive option where all competitors realise that there are no special advantages to any of them in doing something differently, and many advantages in doing things the same way. This is the logic behind obvious examples like standardised weights and measures, machining tolerances, and basic materials dimensions.

On the efficiency side, the basic economic rationale is cost reduction through the economies of scale that can be achieved through variety reduction. This is a good general goal, but not problem free. Too high a degree of standardisation can reduce variety to sub-optimal levels, thus reducing producer and consumer choice, inhibiting innovation and distorting markets. Once set, standards can be difficult to remove. Every standard sets up 'path dependencies' that can affect the future development of a technology. These effects can be adverse if technical paths are established in the standardisation process that impede further development of the technology, and inhibit competition among suppliers.

Strategic advantages, on the other hand, are not transferable. Where more strategic objectives apply, a much more complex set of economic phenomena come into play. In economic terms, all standards have one rather unique effect, at least to some degree. Market dynamics are generally described in terms of 'diminishing returns to investment' - i.e. at some point profits will decline because there are too many participants buying and selling a particular product. In such situations some standards can contribute to the reduction of profit margins because they stabilise the technology and open it to newcomers. Profit margins can only be regained through the injection of new variety. For some goods and services, however, standards can inject an element of 'increasing returns'. These will be areas where "network externalities" exist; that is where the benefits to the user increase the larger the number of other users with access to the same system. In other words, benefits that accrue to users from being part of networks of other users. In these cases, standards will increase the potential returns to all users, and in so doing, generate new demand on which profits can be sustained or even increased. The most obvious example is the telephone system, where common communication standards as negotiated by the world's network telephone equipment suppliers and network operators allow more users to be connected, thus increasing the value of the whole network to all users. The MS-DOS computer operating system is another example, but in this case the benefits are more contestable in that this is a proprietary technology monopolised by a single firm. The problem is that positive gains through network externalities can be offset by 'lock-in' to specific technologies, thus limiting future choices for technology developers and users (Arthur 1996). These issues are most visible in areas like information and communication technologies (ICT), but they are not unique to this sector.

Standards in many high technology fields now have a pronounced business dimension as well as a technological dimension. On the technology side, the incentive to standardise can now arise at the upstream R&D phase as well as at the downstream implementation phase. Likewise, on the business side, incentives can range from controlling costs at the production and implementation stages, to providing proactive technological support to services-based business strategies. Figure 2-2 shows these relationships, and suggests how a number of possible rationales for participating in standardisation are related to them.

Figure 2-2 Strategic and non-strategic standardisation rationales



Source: SPRU 1997

Depending on the nature of the products concerned, any or all of five basic standardisation rationales might apply (Hawkins 1996, 1997).

1. ***Variety reduction*** is an element of any standardisation initiative, but it becomes an explicit rationale where there is no competitive advantage to be gained from technological choice.

2. ***Harmonisation*** comes into play where different systems of standards must be reconciled for application in specific industrial and trade contexts.

3. ***Intelligence*** gathering is a pivotal rationale in many technologically dynamic fields in that it links efficiency and strategic objectives. The standardisation process is perhaps the only open forum in which otherwise competing firms share information on the collective state of technology development.

4. ***Design*** can be a rationale in that standards committees can be used in order to design whole new products and systems in a collective environment. Successful examples of this strategy in Europe include GSM and DECT.

5. ***Market positioning*** is the most strategic use of standardisation. In this case, standards are used to create an environment that will generate positive externalities for planned cycles of innovation.

Together, all of the above factors illustrate how standardisation is becoming a market-critical factor in the launch of many new products. Especially in high technology fields, it matters a great deal what is standardised, when it is standardised, and, often, in which institutional framework the standard is developed.

2.1.2 Classifying standards

In developing a taxonomy of standards, three aspects need to be considered. *First*, standards can be classified according to the basic function they serve. *Second*, they can be classified according to type - i.e. the form of the standard as determined by the kinds of industrial activities to which it applies. *Third*, standards can be classified according to their institutional affiliation and/or source.

Functional classifications

1. ***Descriptive standards*** set out desired states and characteristics for materials, processes and systems. All standards are descriptive to some extent, but some standards are primarily descriptive in that they do not specify contexts. Examples of the latter - metrology for instance - are sometimes referred to as 'fundamental' standards in that their application is basic to a broad range of industrial activities.

2. ***Prescriptive standards*** set out desired states and characteristics, along with the means for achieving them. For example, a prescriptive standard could specify that a particular building component be able to support a defined weight, and also that the component be made of steel rather than wood or concrete.

3. ***Performance standards*** specify ends but avoid specifying the means to achieve them. In the environmental area, for example, a performance standard for air quality might state that the desired end was 'x' parts per million of a particular contaminant. It would not specify how that reduction was to be achieved.

These three functional classifications will assume greater importance as this study progresses. Typically, different types and levels of standardisation bodies concentrate on different functional approaches to standards. International civil standardisation tends to focus on basic descriptive standards and on performance standards. National-level civil standardisation and much defence standardisation has in the past tended to favour prescriptive standards. In terms of public procurement of all kinds, descriptive and prescriptive standards conform most directly to the form of most public procurement specifications (more below). In general, however, there is a momentum on both civil and military sides to opt for performance standards wherever possible. The operational and economic implications of this option for the defence industries will be discussed at various places in the report.

Classification by formal type

Within the three functional classifications, individual standards can take a multiplicity of forms. The US section of our study will use a classification of standards according to formal type, based on the one used in the US Department of the Navy *Standards Improvement Program Plan*. The advantage of this classification system is that it has been validated during the development of the current US military standards policy. The definitions used are taken from the US document, amended where required to reflect better some of the areas of special concern to the Commission.

1. **Interface standards**: Documents specifying the physical or functional interface characteristics of systems, subsystems, equipment, assemblies, components, items or parts, to permit interchangeability, interconnection, interoperability, compatibility, or communications. They express performance criteria in terms of form, fit and function.

2. **Design or selection criteria**: Documents requiring the use of certain materials, parts or components.

3. **Test methods**: Documents providing a procedure to measure and evaluate qualities, characteristics, and properties of a product or process.

4. **Management standards**: Documents mandating common approaches for controlling and directing overall operations, performance, work division, accounting, paperwork, and other business and engineering control elements, including configuration management, and quality management.

5. **Manufacturing process standards**: Documents specifying actions or operations connected with the manufacture of a product.

6. **Codes of practice**: Documents laying out procedures on how to conduct tasks, functions or operations not related to manufacturing or maintenance.

7. **Maintenance standards**: Documents laying out procedures to conduct maintenance tasks, functions and operations related to system repair and maintenance.

8. **Data acquisition and interchange standards**: Documents specifying how to acquire data and the data formats used.

9. **Reference standards**: Systematic classifications of materials, products and processes, definitions, abbreviations, acronyms, symbols, and other terminology.

Institutional classification

Some of the practical difficulties in separating *de jure* and *de facto* standards activities were noted above. It is possible, however, to classify most standards into one of five general institutional classifications:

1. ***Public Standards*** - Standards that are formally adopted and promulgated by an organisation that has recognised authority to issue standards in designated areas. The issuing organisation can be in the public or private sector, but the standards must be available to the public on a commercial or non-commercial basis that is open and equitable to all stakeholders or potential stakeholders.

2. ***Public Pre-standards and Technical Reports*** are documents that are issued officially and circulated publicly by recognised standardisation bodies. They are temporary documents that are designed to fill immediate needs for technological clarification and/or co-ordination in advance of the availability of a public standard. Particularly in highly dynamic technical fields, applications based on these documents can be as or more widespread than those based on public standards.

3. ***Publicly Available Specifications (PAS)*** are documents issued by organisations that are not formally recognised as promulgators of 'public standards'. These organisations include trade, industry and professional organisations and industry consortia. PAS are available to the public on much the same non-discriminatory terms as public standards.

4. ***Proprietary standards*** are technologies owned by individuals, firms or groups that have become established as standards owing to their widespread use. Access to most proprietary standards is restricted by price or contractual agreements, but access to others can be open or even free to any user.

5. ***Standards priority agreements*** are an emerging category. They are documents drafted in a workshop setting by stakeholders and SDOs that set out preliminary consensus as to where and when standards will be needed in specific technical areas.

As shown in Table 2-1, however, attributing these institutional types of standards to institutional sources is not always straightforward. Public and public service institutions that produce standards include SDOs at national, regional and international levels, governments, inter-governmental bodies, International Organisations, and scientific research establishments. 'Private' institutions include firms, industry consortia, trade and industry associations, and professional groupings. In selected areas, trade, industry and professional bodies are also recognised producers of 'public standards' and 'pre-standards' by the above definitions. In general, there is now a great variety of standards products from an expanding variety of sources.

Table 2-1 Institutional classifications and sources for standards

	Public Standards	Pre-Standards	PAS	Proprietary Standards	Priority Agreements
Public and public service bodies					
· SDOs	•	•			•
· Governments	•	•			
· Intergovernmental bodies and International Organisations	•	•			•
· Research establishments	•	•			
Private bodies					
· Firms			•	•	
· Consortia		•	•	•	•
· Trade & industry bodies	•	•	•	•	•
· Professional bodies	•	•	•	•	•

2.1.3 Standardisation and Conformance

Clearly, standards must be accompanied by mechanisms to establish and certify conformance. Certification normally involves evaluating the item in question with a regime of prescribed tests. Usually these are set out in the standard itself. Tests can be administered by the organisation that sets the standard, or by an approved third party. In the standards systems of some countries (the US for example) self-testing is accepted in some instances. Some SDOs offer conformance testing and certification services and some do not. If not strictly separated from standards development as such, there is obvious scope for SDOs to become involved in a conflict of interest.

Tests for certification purposes are not the same as 'test methods' as described above. A *test method* is a type of standard - i.e. what is standardised in this case is the actual method of determining physical properties and performance parameters, not necessarily the properties and parameters themselves. Standardised test methods may be used is certification procedures, but many certification tests are designed specifically around the characteristics of the item to which a standard applies.

Certification is an important adjunct to standardisation. However, many conformance and certification issues go well beyond the dynamics of standards and standards-making as such. A comprehensive discussion of these issues would require a study virtually as extensive as the present one. Consequently, conformance and certification issues will be referred to where appropriate in the course of this report, but will be considered out of scope for detailed analysis.

2.1.4 Standards in procurement

In accordance with common practice, this study makes distinctions between three types of instruments that are used in public procurement processes in both defence and civil contexts.

1. **Regulations** are documents that specify rules and establish rule-making authority under parameters set out by legislation.

2. **Procurement specifications** are documents that set out physical and performance requirements that must be satisfied by suppliers of materials, products and systems processes along with criteria for ensuring conformance.

3. **Standards** are documents (as defined and described in the previous sections) that result from institutional initiatives to achieve consensus agreements among stakeholders.

It is important to make this distinction because frequently standards are referred to or developed within regulatory and specification-setting contexts. As a result, standards are often confused with regulations and procurement specifications, even though they may occupy a different position in the procurement hierarchy.

Regulations and specifications refer frequently to standards as set by national and international SDOs, as well as by governmental and intergovernmental agencies. The technical parts of national electrical and building regulations, for example, are typically set and maintained by industry groups under the auspices of national SDOs. Likewise, a procurement specification may in some cases take on the form of a consensus standard, or may even require that a new standard be developed. However, by far the most common practice is for a regulation or specification to refer to an existing standard.

Although not appropriate in all circumstances, there can be many advantages for governments in incorporating public standards and pre-standards as set by non-government bodies into procurement and regulatory contexts. For example:

- standards set and maintained by industry are seen generally to be closer to industry requirements and interests than technical regulations as such;
- the standardisation process permits government to harness a pool of private sector technological expertise at arms-length and often at modest cost;
- by referencing industry standards on a 'current' basis (i.e. accepting the most recent version of a standard) standards referenced in regulations can be automatically co-ordinated with advances in technology.

The important distinction is that regulations and specifications have primarily a mandatory orientation. Regulations and specifications *may* refer to standards, but *they do not have to refer to them*.

- A regulation may set technological criteria by fiat and may even countermand existing voluntary standards. Similarly, a specification may be issued on the basis of criteria that are unique to an individual purchase or technology development project.

- Standards have primarily a voluntary orientation but their actual compliance status can be ambiguous. Once referred to in regulations or specifications, however, compliance can become mandatory in practice.

The above separation of regulations, specifications and standards does not fit the defence procurement arena as well it does the civil arena. In particular, the distinction between specifications and standards is sometimes not drawn in a military procurement setting, or not drawn as clearly as it would be in a civil setting. As will be discussed in more detail below, some defence standardisation administrations refer to virtually every military procurement specification as a military standard, irrespective of the nature of the internal or external consensus-seeking procedures that may or may not have been applied.

2.1.5 Referencing civil standards in defence contexts

Much of the above discussion about rationales applies equally in civil and defence contexts. However, in a military context, the terms of reference are often different. Moreover, there can be competing internal rationales in the defence procurement process.

Over-standardisation is generally resisted by civil industries. As will be seen below, most institutional methodologies for setting standards have built-in safeguards to ensure consensus on the *need* for standards as well as on their content. Our enquiries in defence agencies indicated that on the operational side - i.e. among battlefield commanders and strategists - the logic favours adopting the minimum number of standards necessary in order to ensure the interoperability of battlefield systems. In other words, there are both tactical and strategic advantages in diversity. To paraphrase one senior officer, "the more similar your systems are, the easier it is for your enemy to figure you out and defeat you."

On the other hand, all military forces in the NATO alliance are becoming subject to tighter financial controls. Achieving economies of scale is crucial to containing costs, especially where co-ordination of forces from several countries is required. In this environment, the temptation could be to over-standardise, with the possible result that the operational forces become more vulnerable. There is also the problem for defence administrators, that military systems have extraordinarily long life cycles. For reasons of operational 'back-up', few systems are discarded until it is absolutely impractical to maintain them. Again to paraphrase defence officials - "if your high-tech arsenal has been knocked out and you are down to bows and arrows, but the enemy is down to sticks and stones, you still have a battle winning advantage." Thus, a military force is typically a mixture of many generations of technology, involving the retention of large catalogues of otherwise obsolescent standards.

With respect to standards for military use, there are basically two philosophies. One is to establish specific military standards as and when the need arises, as is done in civilian contexts. The other is to treat most military specifications for materials, components and systems as a military standard.

The former philosophy has applied in the UK for more then 15 years, and is the basic goal of the new US military standards programme. To an extent, this has been the practice in NATO also, although not always clearly the policy. The catalogues of military standards in countries adopting this approach tend to be patchworks - by no means would all of the technologies necessary to operate a defence force be supported by military standards, or even by specific references to civil standards.

On the other hand, countries like France and Spain follow the second philosophy. For example, the Spanish military standards catalogue lists a standard for the inner lining of neckties. Service personnel in other EU defence forces wear neckties also, but for the most part, determining the composition of the core is left up to individual procurement agreements with suppliers. Military standards catalogues in countries adopting this approach tend to be very comprehensive indeed - a range of technologies is covered that can be virtually equivalent to that covered by the national SDO catalogue of public standards.

Irrespective of which philosophy prevails, defence agencies can intersect with civil standards in three basic ways, all of which are significant in terms of how relationships might develop between different national standards systems and defence agencies.

1. Civil standards can be referenced specifically in military procurement and operational specifications.

2. Defence agencies can be ordinary users of civil standards as already embedded in procured goods and services.

3. Defence agencies can participate in the development of civil standards or 'outsource' the development of military standards to civilian SDOs.

Although the first point is the main focus of this study, the other two points are very significant also, as a great many goods and services used by the military are identical to those used in civil contexts. Indeed, one of the main reasons for defence procurement reform in the US was to avoid as many instances as possible of 'unique use' status being claimed for ordinary items, thus vastly inflating their price.

Information supplied to us by BSI provides an example of how 2 and 3 above must be taken into account in assessing the full extent of defence/civil interaction on standards. BSI indicated that participation by defence agencies in BSI technical committees was considerably larger than would be indicated by direct reference to BSI standards in the UK Ministry of Defence standards lists (there are remarkably few direct references). Nevertheless, MoD approved representatives participate in more than 350 BSI committees across a wide spectrum of technical areas. Some areas - like aerospace - have specific military applications, but many others are general. Furthermore, the MoD is also one of the largest single customers for BSI standards.

Information like this serves to demonstrate that as the military is an intensive user of goods and services that are not specific to defence use, it is also a major stakeholder in the development of civil standards, irrespective of whether or not they might become referenced specifically in defence contexts. As many of the standards in goods that are not specific to military use are 'embedded' in those goods, much of the requirement to access particular civil standards will come after purchases have been made - i.e. in product assessment, maintenance, upgrading and replacement.

Where defence agency participation in civil standards setting is already extensive, particularly if there is a doctrine of using civil standards in preference to military ones, it may seem reasonable that the development of military specific standards be outsourced to civil SDOs. The problems are numerous, however. In the first place, 'defence' is not an industrial sector as such, potentially causing administrative problems for SDOs, all of which have primarily sector-oriented management structures. Secondly, there are economic limitations on the administrative resources of civil SDOs. National SDOs must set administration priorities that are balanced to reflect the diversity of standards initiatives they must support - the administration costs of special priority projects for discrete clients, like the military, would probably have to be financed separately. Thirdly, for reasons of time and the increasing complexity of civil standardisation processes and agendas (more below), outsourcing may turn out to be the most expensive option for military authorities.

2.2 The EU and standardisation

In pursuit of an open trading environment among Member States, the European Union has had a long history of involvement with technical harmonisation. Involvement with voluntary standardisation is a more recent phenomenon, but the influence of the EU in this area has been profound. Between 1983 and the present day, the EU has promoted many structural and philosophical adjustments to the European standardisation system, and these have been accompanied by a surge of standardisation activity at the European level.

The 1957 Treaty of Rome was not very explicit on the subject of eliminating 'technical barriers to trade'. As the importance of removing technical barriers became more evident, the provisions of Articles 100, 30 and 36 of the Treaty were brought to bear, covering, respectively

- harmonisation of laws between Member States (Article 100)
- prohibition of 'quantitative' (or equivalent) restrictions on imports by Member States (Article 30)
- prohibition of the arbitrary use by Member States of public interest criteria (morality, health & safety, heritage, security etc.) to create trade barriers (Article 36).

Technical trade barrier issues were much amplified during the decade or so leading up to the implementation in 1992 of the provisions of the 1987 *Single Act*. In 1983, the main provisions for dealing with technical barriers were laid out *inter alia* in Directive 83/189/EEC (often referred to as the 'information Directive'). The basic principle established by 83/189/EEC was that all technical regulation and voluntary standardisation activity in the Member States should be transparent. Essentially this calls for mandatory notification of regulatory and standardisation agendas, and 'standstill' arrangements to prevent initiatives at the national level from conflicting with harmonisation Directives that are still under consideration. The other important provision in 83/189/EEC gives the Commission formal authority to issue 'standards mandates' to recognised European SDOs for the development of European standards (more below).

Until the mid-1980s, the basic provisions of the Treaty of Rome were supported by harmonisation Directives that incorporated highly detailed technical specifications. These Directives tended to be quite narrow in scope (typically covering single products or even parts of products), and large quantities of them would have been needed to cover a single sector. Not surprisingly, Directives were slow to appear and difficult to adapt to technical change.

The harmonisation process was assisted in some cases by such voluntary standards as existed at the European level - mainly those promulgated by CEN and CENELEC - or where products conformed to international standards. The main problem was that there were very few of these standards - voluntary industry-wide standardisation world-wide was very much centred in independent nationally-oriented SDOs.

The Directive system was overhauled in 1985 following a Council Resolution (85/C 136/01) adopting a 'new approach to technical harmonisation and standards'. The 'new approach' brought long-standing EU technical harmonisation agendas into much closer contact with the work of international, regional and European national SDOs. *Under the new approach, technically detailed harmonisation Directives would be replaced altogether by the principle of 'reference to standards'.* Henceforth, specifying the technical requirements for new approach Directives would be co-joined with the voluntary consensus standards-setting process.

The preferred institutions for supplying standards under the new approach are the officially recognised European regional SDOs, and the main international SDOs (primarily ISO, IEC and ITU). CEN and CENELEC were already officially recognised by the EU as the new approach came into force. ETSI was established only in 1988 and recognition followed later. Should appropriate regional or international standards not be available, the new approach allows for referencing of national standards on a transitional basis, i.e. until such time as European or international standards become available. These actions established a **hierarchy for reference to standards:**

- international (preferable);
- regional (essential);
- national (transitional);

This hierarchy is congruent in principle with existing policy in virtually all SDOs. It is already normal practice for SDOs to transpose international standards into their national standards catalogues, and to promote the use of international standards in preference to national standards wherever possible.

The new aspect in this hierarchy was the much increased regional focus. Prior to the new approach, regional standards bodies around the world were of marginal significance. The EU action introduced regional dynamics into the international standardisation system in a particularly forceful way (ISO 1992, Hawkins 1992). The repercussions have been extensive, particularly for trade relations with the US.

As will be discussed in more detail later on in the report, one of the most immediate factors driving all international and regionally-oriented standardisation programmes is the need to support intra-regional technology coordination and harmonisation agendas. In this context, particularly within the NAFTA framework, the US is becoming involved in regional standardisation initiatives of its own, although not on as formal a basis as in Europe. These initiatives are facilitated in that the US and Canadian standards regimes have been harmonised to a substantial degree for many years - especially in key civil and defence-related technological areas like automotives and aerospace where US-Canada trade has been intensive since the 1950s. The Mexican standards system is less well integrated, but much standards harmonisation will comes about as a direct result of foreign investment in new industrial plant that is tied to the importation of US or Canadian technology. Inevitably, as Mexico modernises, the national standards catalogue will evolve to resemble those of its northern neighbours.

The situation in the EU has always been considerably more complex. All but a handful of the 15 Member States were already highly developed industrial economies when they entered the Union, each operating its own extensive national standardisation system. Furthermore, whereas in the NAFTA framework, only the US is an internationally significant producer of defence products, five EU States qualify in this category (the UK, France, Germany, Italy and Sweden). Previous to the early 1990s, however, there had been very little by way of formal harmonisation of European national standards, either on the defence or civil side, and even less activity with respect to developing new standards at a pan-European level. In 1980, for example, there were fewer than 70 standards in the entire CEN catalogue.

Particularly in the last five or six years, and with the active encouragement of the European Commission, this situation has changed radically. Most new civil standardisation activity is now related in some way to the development of European regional standards rather than to national standards as such.

New approach Directives define technical areas much more broadly than under the old harmonisation Directives. They extend typically to a wide range of products, the technical characteristics of which are described where appropriate in standards as promulgated by SDOs. Compliance with these standards remains voluntary. Goods must be accepted for placement in the market of any Member State provided that they are certified as conforming to 'essential requirements' (mainly for product safety) as laid out in the relevant new approach Directive. Member States can avoid compliance only if they can show grounds under Article 36 of the Treaty of Rome (for reasons like public morality, policy, national security and so forth), or under the Directive itself when questions of health and property can be raised.

New approach objectives were further reflected in the *Single Act* itself. Article 100a of the *Act* streamlined the technical harmonisation process. This involved establishing 'qualified majority' voting principles along with 'safeguard' provisions for protecting the interests of Member States who might be adversely affected by 'qualified' decisions concerning new approach Directives. In effect, these safeguards are escape provisions, but their use has been rare. Article 118a gave more extensive policy underpinnings to 'essential requirements' matters relating to safety in the workplace.

Since the advent of the new approach, voluntary standards and standardisation bodies in the EU have been drawn further into the policy arena. The EU standardisation policy agenda is constructed to serve three basic, related goals:

1. to remove technical barriers to trade between the Member States;

2. to create critical mass in European regional markets through technological harmonisation such that the international competitiveness of European products will be enhanced;

3. to initiate and support industrial policies geared to co-ordinating the R&D activities of European firms across national boundaries.

In each case, a pivotal instrument for EU involvement has been the 'standards mandate' - in effect a contract made with one of the three recognised European SDOs under provisions of Directive 83/189/EEC. Mandates can be funded to varying degrees by the Commission. Some mandates have received substantial levels of funding, whereas others are funded only partially in order to contribute to the added costs of creating a European standard. Irrespective of the funding level, mandates have been used for two purposes:

1. to ensure the development of the standards required to support individual new approach Directives;

2. to add technical support to other technology and industry-related policy initiatives as selected by the Council and the Commission.

Mandates under the new approach give overall shape and momentum to the creation of appropriate standards regimes in technical areas covered by individual Directives. The primary policy function in this case is to remove trade barriers. An indication of the scale and extent of new approach activities is given in Table 2-2 which outlines current progress on new approach mandates in CEN. Additional mandates under other Directives are being undertaken in the specialist electrical and telecommunication areas covered respectively by CENELEC and ETSI, but the largest portion and spectrum of mandate work is undertaken in CEN.

Table 2-2 New Approach Directives and Mandates in CEN (as of December 1997)

New Approach Directive	Quantity of Mandates issued	Mandates completed or under approval
Simple Pressure Vessels	47	43
Safety of Toys	10	7
Construction Products	599	415
Machinery	710	483
Personal Protective Equipment	262	190
Medical Devices	191	150
In Vitro Diagnostic Medical Devices	17	4
Explosives for Civil Uses	52	0
Potentially Explosive Atmospheres	13	1
Recreational Craft	49	26
Lifts	15	6
Precious Metals	8	2
Pressure Equipment	773	534
Packaging & Packaging Waste	16	0
Water Supply, Drainage & Sewerage	196	187
Gas-Transmission & Distribution	17	17
Fuels	4	4
Power Engineering	29	29
Railways Equipment	57	7
Qualification of Construction Enterprises	8	0
Postal Services & Equipment	15	0

The awarding of mandates takes place within a 'framework contract', first set up in 1985 and revised in 1992 and 1998. Mandates can involve setting up entirely new initiatives in the SDOs, but they can also involve simple incorporation of an existing or proposed European standardisation initiative into the framework of a Directive. As shown in Table 2-2, the general success rate for delivery of standards covered under mandates has been good.

Under the new approach, a 'harmonised' standard is defined legally as "a technical specification adopted by a European standards institution on the basis of a mandate..." (Article

6, 85/C 136/01). This is an idiosyncratic use of the term 'harmonised' if compared to its meaning in other standards-related contexts. In ISO or IEC parlance, 'harmonisation' refers to bringing different national standards into alignment. In EU parlance, it may mean this also, but fundamentally it means bringing the content of a standard into agreement with the objectives of a new approach Directive.

Mandates have been used also for a variety of other purposes not specifically covered by new approach Directives - i.e. for reasons related to policy goals '2' and '3' above. For example, there are no Directives covering biotechnology or information technology, but mandates have been issued in these and other areas with the objective of co-ordinating R&D and markets in these important industries. Policy support for standards initiatives does not have to come via mandates. In the telecommunications area, for example, DECT was developed by an ETSI Project Team under a mandate, but GSM was not. The EU concentrated on creating a favourable policy environment for the implementation of GSM rather than contributing directly to its development through mandates.

Of special interest in the context of our study is the matter of linking standardisation to public procurement. Basic European policy in this respect was established in six key documents:

Document:	**subject:**
Directive 93/36/EEC	awarding public supply contracts
Directive 93/37/EEC	awarding public works contracts
Directive 92/50/EEC	awarding public service contracts
Directive 89/665/EEC	appeals regarding the awarding of public contracts
Directive 90/531/EEC	contracts in water, energy, transport and telecommunication sectors ('excluded' sectors in the previous documents)
Directive 92/13/EEC	appeals regarding 'excluded' sectors

As a group, these instruments specify what constitutes 'public' procurement in the EU, and lay out the basic rules for reference to standards in public procurement tenders. Originally, certain 'excluded' sectors were acknowledged. These were basically those 'utility' and 'quasi-utility' sectors that in most EU Member States were historically either public-sector bodies, arms-length public sector agencies, or private bodies having exclusive arrangements to provide specified services. In some Member States, markets for some of these services were at various stages of 'liberalisation' and/or 'privatisation' - telecommunication being the best example. Directive 93/37 allowed for these structural transitions by providing for both public agencies and 'equivalent bodies' to be included in its list of approved public contracting bodies, the latter subject to specific arrangements.

On the whole, European policy on public procurement does not deviate from basic open tendering practices as widely accepted in most OECD countries. Technical specifications must be transparent and non-exclusive such that specific proprietors, products and brand names are not favoured. Where the policy does begin to differ is in the reference to standards. The provision regarding standards is basically a reference hierarchy in which European standards and allied documents are to be specified in public procurement contracts in preference to all others. These documents include

- European standards (EN);
- European Pre-Standards (ENV);
- common technical specifications (for telecommunication), and
- European technical approvals.

Only where a European document does not exist can reference be made to standards from other sources. Here too, a hierarchy applies

- national standards incorporating international standards;
- national standards;
- and then other standards.

The hierarchy was instituted in order to clarify the public procurement environment in Europe and to force a measure of procedural compliance on the Member States. Allowances are made for problems of technical inadequacy or instability, and of sunk investment and technological path dependencies established by previously applied standards. In that it is the practice of CEN and CENELEC (ETSI to a lesser extent) to transpose international standards into European standards where applicable, the hierarchy implicitly assumes that ISO, IEC and ITU standards will be referenced as a matter of course.

Derogation for the above reasons notwithstanding, there is an element of ambiguity in the reference hierarchy on two fronts. The first is where determinations of standards quality are concerned - the implicit assumption is that European standards will always have to be of equivalent quality to standards from elsewhere (which may or may not be true). The second concerns the increasing use of specifications that are less formal than standards as such. For example, CEN, CENELEC and ETSI all issue technical reports for information purposes, but in practice, especially where the technology changes quickly, these can acquire virtually the same status as promulgated standards. Indeed, many industries show signs of preferring these less formal documents, as the recent proliferation of publicly available specifications (PAS) attests. The procurement status of the new CEN Workshop Agreements (CWA) which bridge the formal and informal spheres may become difficult to determine (more below).

To sum up, all of the above events and provisions have created a European regional standardisation system with unique characteristics, especially vis-a-vis the US system. One of the most important characteristics is the especially close connection between the European standards system and EU policy processes. Although relatively few of these links are formal, and the principal European regional SDOs are independent bodies, the public policy interface in the European system has no direct counterpart in the US system. This does not mean that policy agendas - particularly for public procurement - are absent from the US system, only that they are more openly visible in the European system.

2.3 Standards-making in the civilian arena

During the past fifteen years the institutional framework for standardisation in civil industries has undergone considerable change. This has been the result of two closely related factors:

1. In the advanced economies generally (the EU and OECD countries) there has been a decided shift in the basic focus of standardisation from national to regional and international arenas. This has been partly in response to an increasing focus on international trade, and pressures (as in WTO agreements) to curb technical barriers to trade. But it has come about mainly as the result of the increased regionalisation of economic activities - particularly as embodied in the EU and NAFTA. Inter-regional trade agendas are important, but as inter-regional trade volumes are in each case much smaller than intra-regional trade, it is the latter that drives most international as well as regional standardisation initiatives.

2. In many key industrial sectors, the speed of technical change, and of related changes in industry and market structures, has drawn attention to efficiency problems in standardisation processes. These relate to SDO structures and procedures, but also to the distribution of standardisation work and the elimination of duplication and redundancy. The revolution in information and communication technologies and their application to a vast range of administrative and industrial contexts has been a catalyst in this respect.

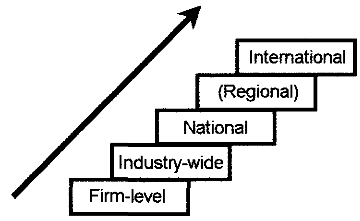
A general consequence of both factors has been increasing pressures to accommodate a wider range of approaches and organisational structures in the standardisation community, especially with respect to the integration of informal standardisation activities in industry bodies with formal SDO activities. All international and European regional SDOs have made or are making these accommodations, as are most of the major national SDOs.

Other important consequences include changes in the relationships between various levels of standardisation, and changes in the nature and function of standards documents. The former has important resource and revenue implications for the standardisation system generally. The latter has implications for both the standards development and application environments.

Currently, we are in a position where both **established and insurgent standardisation frameworks** for civil standardisation coexist in an increasingly uneasy relationship.

Standardisation within the established framework draws clear distinctions between standards as developed through stakeholder negotiation in SDOs, and *de facto* standards that are established in the marketplace. In this framework, the national SDO is the primary initiator of standards activities, and the primary interface with regional and international standards organisations. International activities are seen primarily as harmonisation processes designed to reconcile differences in national standards, or as processes to elevate selected national standards to international status. Although in this framework it is possible to initiate standards directly at the international level, the general assumption is that there is a linear progression from informal, industry-level specification-setting, to formal national and international levels of standardisation (Figure 2-3).

Figure 2-3 Hierarchy of Standardisation Institutions in the Established Civil Framework



Source: SPRU

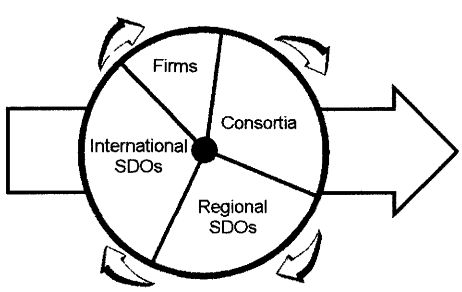
The primary economic rationale for this framework is the desire to realise scale economies through variety reduction. The framework was established initially on the assumption that standards would evolve out of long experience with relatively stable technologies. As such, it fits well with the procedures and *quasi* public-service ethics of national and international SDOs. As will be shown later in this report, the framework continues to work well for many types of standardisation initiatives in many technological areas.

Standardisation within the insurgent framework has emerged largely within the last five years out of recognition that stakeholders can have many complex motives for standardisation, and that variety reduction in itself may be a relatively minor incentive. As such the insurgent framework tends to stress ends over means, and seeks more open and flexible relationships between national and international activities, and between SDO and *de facto* standards.

The economic rationale for the insurgent framework is that much of the contemporary industrial environment is built upon a base of increasingly interdependent technologies and markets. The origins of the framework are in the information and communication technology (ICT) industries, but there are signs that it is spreading to other producer sectors as well, especially as they become permeated by ICT. The emphasis in these cases can be less on reducing costs - although this remains an important consideration - and more on creating new markets built upon the positive network effects generated by new standards.

The insurgent framework is pragmatic about the official or *de facto* status of most standards. The primary concern is the protection of proprietary IPR in industry-wide specifications, and the openness and transparency of access to intellectual property. The insurgent framework is also much less hierarchical - often resulting in the formal and/or informal distribution of parts of standards initiatives among several organisations, ranging in diversity from international SDOs to industry consortia and private laboratories (Figure 2-4).

Figure 2-4 The Insurgent Standardisation Framework



Source: SPRU

In institutional terms, particularly at the regional and international levels, the most significant consequence of the insurgent framework is that many new bridges are being built between formal and informal standards development structures. In recent years, all of the major international and regional SDOs, and many of the national ones, have adapted their procedures in order to accommodate aspects of the insurgent framework.

However, although there is at present a measure of uncertainty and conflict, the two frameworks are not inherently incompatible. Indeed, it may be a very bad idea to advocate wholesale replacement of the old framework with the new. It is not clear that the insurgent framework always succeeds where the established framework fails, much less that the insurgent framework fits well with all standardisation agendas in all industries.

Moreover, the costs of the insurgent framework have yet to be evaluated in terms of business and/or policy goals. The costs in the established framework relate mostly to time and resources - factors that can be exacerbated by procedural inefficiencies. With the proliferation of consortia (more below), it is not clear that the time and resource costs in the insurgent framework are always less, whereas the added complexity of this framework almost certainly yields additional co-ordination costs.

Although individual SDOs and/or consortia often assume project management, or 'flag carrying' responsibilities for specific initiatives, the insurgent framework is highly diverse organisationally, leading to co-ordination costs that can be disproportionately high for smaller, less diverse firms. These are over and above the normal time and resource costs of making technical contributions. The result can be that the insurgent framework is controlled and co-ordinated much more directly by those economically and technologically dominant firms who are best able to accept these costs for commercially strategic reasons. Where this type of dominance becomes concentrated in one country, or in a few countries within a regional bloc, the implications for international trade and industrial strategy can be serious.

What has not changed amidst this evolving standardisation environment - particularly in a public procurement context - is the need to protect the public interest. In the insurgent framework, there is arguably added scope for proprietary concerns to exert greater control over standards content, access and use. Clearly, many of the characteristics, practices and products of existing national and international SDOs will have to change significantly in the next few years if these institutions are to survive and play positive roles. In the next few sections, we will assess this current stage in the evolution of standardisation institutions with an eye to determining their likely future role in facilitating civil/military technology transfer.

2.3.1 General characteristics and procedures of civil standardisation

Keeping in mind the pressures for change that are being exerted on the standardisation system as a whole, it is worth recounting some of the basic features of this system, emphasising those that are likely to present opportunities and challenges in a civil-military technology transfer context.

In the advanced industrial economies, organised industry-wide standardisation activity has been governed by the ***voluntary-consensus principle***. This holds that

- standards should be initiated and negotiated voluntarily in a public forum by as many stakeholders as possible, with due process being guaranteed to each stakeholder;
- agreements should be by a consensus of stakeholders (generally defined in terms of 'the lack of sustained opposition' rather than 'unanimity' as such);
- compliance with standards should be voluntary;
- standards should be available on equitable terms to any potential user.

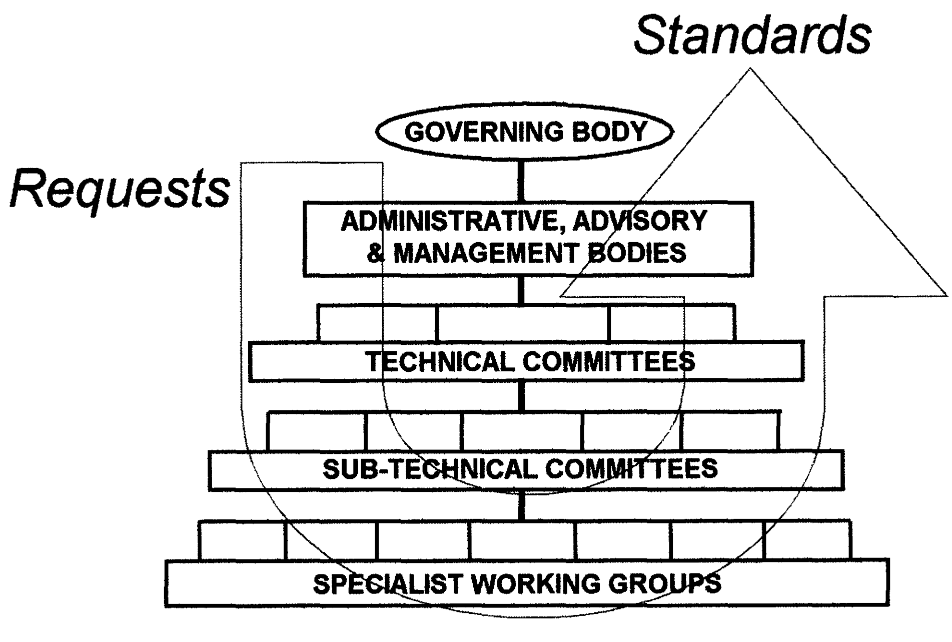
Over the course of the century, in different ways in different countries, this basic principle yielded the institutional form commonly known as the Standards Development Organisation. SDOs have a generic organisational structure that is oriented to a set of procedures commonly known as the ***committee method***.

The committee method involves formation and management of stakeholder committees by the SDO with the aim of achieving consensus on the content of a standard. SDOs convene a selection of technical committees and working groups, each with responsibilities in specific subject areas.

Under the committee method, decisions to accept new initiatives are made at the higher administrative levels of the SDO - typically also by consensus. The technical work is then shunted downwards to various sub-committees and specialist working groups. As consensus is achieved at each level, the initiative is shunted progressively back to the higher administrative levels where final consensus is sought. In virtually all cases, this involves a process of public notification and enquiry, followed by a final vote within the SDO. Subject to a positive result at each stage, a standard is promulgated.

The whole committee method process is illustrated graphically in Figure 2-5 as it relates to the generic SDO structure.

Figure 2-5 The Committee Method



Source: SPRU

In most standardisation systems, requests for standards development are generated 'bottom-up' by the stakeholders rather than 'top-down' by the SDO as such. Exceptions to this rule do occur, and standards organisations are sometimes proactive in identifying new areas for standardisation and in drawing them to stakeholder attention. Moreover, more recent pressures from participating stakeholders for SDOs to manage standardisation processes more efficiently have resulted often in more of a top down focus.

More top down pressures arise where SDOs are involved in co-ordinating public sector standardisation requirements, and preparing the content of technical regulations. The EU mandate system inevitably imposes pressures of this kind for reasons of trade and industrial policy, but national procurement regimes can initiate or reference SDO activities also. Some EU Member States maintain structural links between the national SDO and government departments (more below), but no country is precluded from engaging SDOs in this role on a case-by-case basis.

Irrespective of public sector links, most SDOs are self-financing non-profit agencies. General administrative expenses are met through membership subscriptions (usually a minor contribution) and the sale of standards documents and services (usually a major contribution). In some cases, some of the administration costs are accepted by industry bodies, but the full costs of the technical work are borne almost always by those stakeholders who elect to participate in the committee work on a voluntary basis.

These 'in kind' technical contributions are of very considerable economic significance to the process. It is generally acknowledged that only a small fraction of the total costs of developing standards in SDOs is reflected in the reported operating budgets of these organisations. Exact and comparable figures are impossible to obtain, but we can gain a reasonable impression of how disproportionate the figures can be by examining the standardisation activity in ISO that is related to information and communication technologies (ICT). The yearly operating budget of ISO is now about CHF 150 million. Some twenty percent of ISO work items are related to IT. Even if we assume that the ICT share of the operational budget is roughly proportional to the number of work items (it is probably considerably higher), this would stand at about CHF 30 million. Estimates provided informally to the research team by several major European and US ICT firms over the past couple of years indicate that standards-related work costs a typical multinational ICT firm in the range of CHF 8 - 12 million per year (spread across all of the SDOs and industry consortia in which they participate). If we consider that there are at least 30 firms worldwide making contributions of this magnitude (and many more making smaller contributions), the combined cost to firms of standards-making in this one sector is at least CHF 350-400 million per year. The real figure is probably much higher, but we are already well over double the entire ISO budget for just one out of about a dozen major ISO standardisation areas.

The committee method is at the same time self-directed and bureaucratic. As such, it is easily subject to inertia. This can be seen both as a strength and a weakness. Where the range of participant incentives and objectives is large and complex, initiatives can be seen frequently to be overcome by inertia. In areas like ICT where the standards activity is intensive and the expenditure quite extraordinary, calls for reform of the process are hardly surprising. On the other hand, it can be argued that the inertial tendencies in the system are a safeguard - that only initiatives that truly conform to the criteria set out by the voluntary-consensus principle will be able to overcome this inertia. The complicating factor is that not all standardisation initiatives are this straightforward, especially where public and private standardisation objectives intersect.

The officially neutral commercial stance of the SDO system, coupled with the 'bottom up' approach to the selection of initiatives gives rise to a number of financial and procedural quirks. Clearly, although an SDOs has the responsibility to accept any standardisation initiative that meets its selection criteria and is supported by the stakeholders, not every standard will sell in the same quantities (i.e. yield comparable rates of return on administrative costs to the SDO). Although SDO criteria for initiative selection almost always preclude selection on the basis of commercial considerations, there is certainly an incentive for the creation of standards 'bandwagons' in those areas that do have high commercial or profile-raising potential for the SDO, especially in areas where there is also strong stakeholder support. Inevitably, this adds to pressures already generated externally by efficiency concerns, for a more 'managed' or 'top down' dimension to the standardisation process.

2.4 National Organisation of Standardisation Activity

Most civil standardisation activities at the national level in the EU are undertaken within officially recognised SDOs. In keeping with the overall focus of the study, we have chosen to describe these organisations collectively, concentrating on how they relate as a group to developments in regional and international standardisation. Thus, we will refrain from presenting their individual characteristics and structures except to point out specific areas of convergence or divergence that are likely to be relevant to the objectives of this study. We will concentrate on the European system, making references to the US system where appropriate.

In most countries, largely due to historical reasons, a bifurcation is maintained between electrotechnical standardisation and standardisation in other areas. However, in most cases, the national electrotechnical standardisation body is closely allied to the recognised national SDO and operates under its auspices. At the regional and international levels, the SDOs interface with ISO and CEN, whereas the electrotechnical SDOs or divisions interface with IEC and CENELEC. The European national SDOs and electrotechnical SDOs are presented in Table 2-3.

Table 2-3 National Standardisation Development Organisations in the European Union

Member State	SDO	Electrotechnical Organisation	Relationship
Austria	ÖN	ÖKE	operates under ÖN
Belgium	IBN	BEC	part of IBN
Denmark	DS	DS Sector	part of DS
Finland	SFS	SESKO	member body of SFS
France	AFNOR	UTE	AFNOR delegated body
Germany	DIN	DKE	operates under DIN
Greece	ELOT	ELOT	same agency
Ireland	NSAI	ETCI	operates under NSAI
Italy	UNI	CEI	operates under UNI
Luxembourg	n/a	SEE	SEE is the only SDO in Luxembourg
Netherlands	NNI	NEC	operates under NNI
Portugal	IPQ	IPQ	same agency
Spain	AENOR	AENOR	same agency
Sweden	SIS	SEK	operates under SIS
UK	BSI	BEC	part of BSI

There can be crossover of technical subjects between electrotechnical bodies and their counterparts in other engineering areas - particularly where ICT is involved. A typical example would be transmitter/receiver installations for mobile telephony, where the telecommunication standards come under the umbrella of regional and international organisations like ETSI and the ITU, but the electrical standards (voltages, insulation, safety, wiring, electronic components etc.) could come under the umbrella of national, regional and international electrotechnical bodies. Related agendas like these have yielded a number of joint agreements between electrotechnical and other standardisation bodies, but 'turf disputes' are not unknown.

In institutional terms, the intersection of general and electrotechnical engineering interests is perhaps most complex in the ICT field. As will be explained in more detail below, relatively few standards for computer and telecommunication technologies are set at national levels. Where national Technical Committees exist, they tend either to mirror international committees (sometimes regional ones as well), and to co-ordinate national contributions to these groups, or to concentrate on very specific application areas that are primarily of domestic interest, often in discrete industry sectors. None of the European national SDOs listed in the above tables is a member of ETSI or the ITU, but some SDOs co-ordinate ETSI-related public enquiry and voting procedures at the national level, and handle sales of ETSI standards. National level participation in ETSI and the ITU is usually through telecommunication administrations (where these still exist) or through government agencies that have responsibility for various aspects of the telecommunication system.

Although all EU SDOs follow very similar rules and procedures, there is no one institutional model for achieving industry-wide standardisation at the national level. There is a contemporary tendency to view all institutions in terms of opposites - public or private, liberalised or regulated, national or international, and so forth, but subjects like civil/military technology transfer and standardisation are good examples of how abstract and artificial these distinctions can be. Similarly, an opposition is commonly assumed to exist between ***'mandatory'*** and ***'voluntary'*** standards. Institutionally, this translates into an ***'administration approach'*** to standards setting, in which the standards are set by government or developed through close collaboration between government and industry, and a ***'market approach'*** which is responsive primarily to market forces.

This polarisation is immediately problematical when thrust into a public procurement setting - especially defence procurement - where major market forces revolve around government in its 'customer' role. All SDOs in the EU Member States are oriented exclusively or primarily to the production of voluntary standards. However, as noted above, many nominally 'voluntary' standards can become 'virtually' mandatory if large customers (particularly governments) insist on them in their procurement specifications.

To help unravel these problems, we can show that there are ***five basic categories of organisations*** within which voluntary consensus standards of various descriptions can be produced:

1. ***Government department*** - a civil service department or government agency with responsibility for setting national standards for industry and government, and participating in international standards organisations.

2. ***Public service agency*** - an officially recognised non-governmental body (often set up or accredited under law) that sets national standards for use by government and industry and participates in international standards organisations. A public service agency can receive direct funding from government to cover costs of its core operations.

3. ***Centralised private organisation*** - a privately incorporated nationally-based body with some form of official recognition as the national standards organisation and the national representative to international standards organisations. These organisations manage the technical work directly. They may or may not receive direct funding from government, but government funding is normally not a major source of revenue.

4. ***Decentralised private organisation*** - a privately incorporated nationally-based body with some form of official recognition as the national standards organisation and the national representative to international standards organisations. These organisations co-ordinate national and international standardisation activities but does not take a direct role in the management and administration of technical work. Typically, a decentralised organisation makes and administers rules and procedures, accredits and monitors industry committees, and formally adopts standards developed by accredited committees as national standards.

5. ***Industrial and professional associations*** - private national or international industry groupings and consortia with no official recognition, formed for the purpose of developing common technical specifications for the use of their members, usually in narrowly defined areas. Specifications from these groups commonly differ from proprietary standards in that they are made available publicly on non-discriminatory terms. They can be made available in their own right - as publicly available specifications (PAS) - or fed into officially recognised standards initiatives at national and international levels.

In general terms, the production of voluntary-consensus standards is associated most closely with SDOs in the middle three categories. Government departments may produce standards of this kind also - i.e. replicate within a government department the same or similar structures and rules of a privately administered SDO. In principle, all types of organisation can become involved with public sector standardisation agendas in a variety of ways. Industrial and professional associations do not yet feature as prominently at the national level in Europe as they do in the US, but they do play increasingly significant roles in this respect at the regional and international levels (more below).

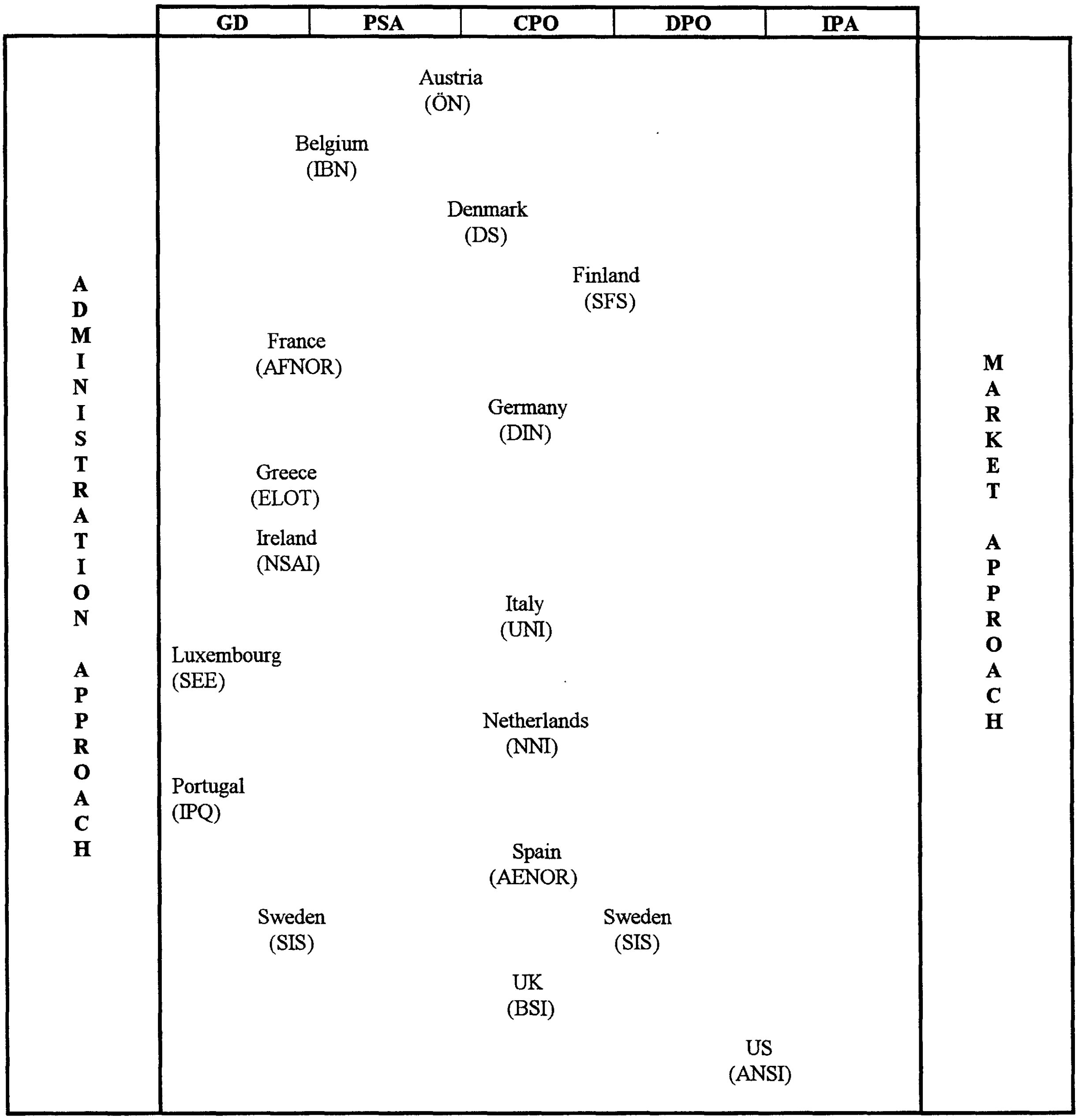
Standards initiatives in industrial and professional associations often adopt the voluntary consensus principle and the committee method. Some of these bodies are indistinguishable from SDOs except that their scope of activities is usually more specialised and their specifications are not officially recognised outside of the community that develops and uses them. The relationship between bodies of this kind and national standards is especially strong in the US where ANSI is essentially an umbrella organisation that accredits and monitors a group of several hundred otherwise independent industry and public interest organisations in which all of the technical work is undertaken. ANSI accreditation is contingent upon the acceptance of ANSI-specified voluntary consensus principles and procedures.

In practice, all five categories have different degrees of correspondence to the characteristics of the administration and market approaches to standards setting, and they can be arranged along a kind of scale - the government department being closest to the administration approach and the industry and professional associations being closest to the market approach.

The problem is that most of the world's major national SDOs cannot be classified neatly into any one category. As shown in Figure 2-6 Organisational Categorisation of EU and US SDOs, most national SDOs in the EU Member States and the United States straddle one or more categories. Moreover, the scale on which they are arranged is not perfectly continuous. In the Swedish system, for example, the national standards body (SIS) has close ties with government and its constitution is subject to government ratification. On the other hand, control over the technical work is in the hands of SIS-affiliated, but otherwise autonomous national standards bodies, each concentrating on specific technological areas. Finland has a similarly decentralised structure of national standards bodies, but less formal ties to government. However, neither the Swedish nor the Finnish systems are distributed in the same way or to the same extent as the US system.

The way the US system is distributed is very significant in terms of how European and US systems might eventually interact and evolve in the production of standards related to defence applications. Although ANSI is basically a Decentralised Private Organisation by our definition, many of the industry groups that operate ANSI-accredited standards committees also issue standards independently of ANSI - i.e. not all of their standardisation activities are undertaken within the ANSI framework as such. For example, ASTM is the largest single producer of standards in the US, only some of which become US National Standards via ANSI. Some ANSI-accredited bodies fulfil roughly the equivalent function of the SDO-affiliated national standards bodies in Finland and Sweden, or of some of the industry sector boards, standards management bureaux, and Technical Committees in other European SDOs; the difference being that in the US case these bodies are wholly independent.

Figure 2-6 Organisational Categorisation of EU and US SDOs



Source: SPRU 1998

Legend: GD = government department; PSA = public service agency; CPO = centralised private organisations; DPO = decentralised public organisation; IPA = industrial and professional associations

The basic organisational form for just under half of the SDOs in EU Member States (Austria, Denmark, Germany, Italy, the Netherlands, Spain and the UK) is that of a centralised private organisation that is officially recognised by government as the national standards body and as the national interface with ISO/IEC and CEN/CENELEC. The Finnish SDO has a similar status but operates in a more decentralised mode. Only two SDOs (Portugal and Luxembourg) are government departments, but five have especially close constitutional and/or working relationships with government (Belgium, Ireland, France, Greece and Sweden).

Table 2-4 lists the details concerning the legal and/or administrative status of national SDOs, along with the basis of stakeholder participation in technical committees.

Table 2-4 Status, Government Relationships, and Membership of National SDOs in the EU

Member State	SDO	Legal status	Government relationship	Participant basis
Austria	ÖN	private organisation	Accredited by *Standards Act 1971*, and formally recognised by government.	stakeholders
Belgium	IBN	semi-public agency	supervised by Ministry of Economic Affairs	stakeholders
Denmark	DS	private organisation	recognised by Ministry of Commerce	stakeholders
Finland	SFS	private organisation	set up by and recognised in the *Standardisation Law 1942*	stakeholders through domestic industry standards bodies
France	AFNOR	public service organisation	convened under the authority of the Ministry for Industry	stakeholders
Germany	DIN	private organisation	no formal recognition - undertakes contractual arrangements with federal and state governments	stakeholders
Greece	ELOT	public service organisation	established by law and supervised by the Minister of Industry	stakeholders
Ireland	NSAI	independent government-sponsored organisation	board appointed by Minister of Industry and Commerce	stakeholders
Italy	UNI	private organisation	recognised by government but no formal relationship	stakeholders
Luxembourg	SEE	civil service department (SEE has an electrotechnical remit, but is the only SDO in Luxembourg)	civil service department	n/a
Netherlands	NNI	private organisation	no formal relationship - recognition as a 'foundation'	stakeholders
Portugal	IPQ	government department	government department	stakeholders
Spain	AENOR	private organisation	recognised by government but no formal relationship	stakeholders
Sweden	SIS	private organisation	recognised by government with government ratification of constitution	stakeholders through domestic industry standards bodies
UK	BSI	private organisation	established under a Royal Charter, but no formal relationship	stakeholders through trade and industry associations

Although most national SDOs are private organisations, most also straddle the public/private divide. Only in Germany, Italy, the Netherlands, Spain and the UK do the SDOs have no formal ties with government. All European SDOs receive at least some measure of public financial support, either directly or indirectly, although this amount varies considerably from country to country.

As the role of national SDOs in Europe may have to change quite radically in the next few years in response to global and regional pressures, it is important to understand the economic basis that sustains them. European SDOs derive most of their operating revenues from three main sources:

1. government contributions and subsidies;
2. member contributions via subscriptions and fees;
3. commercial revenues from sales of standards, publications and services (ranging from certification and testing to consultancy and educational services).

These are illustrated in Table 2-5 As the relative volumes in each revenue category varies from year to year, we have made a qualitative assessment based on data reported to ISO over approximately a five year period (ending in 1995, the most recent date for which collected figures are available). Indications have been given where there have been significant general trends upwards or downwards in each category. Particularly significant figures are given in parentheses.

Table 2-5 Sources of Operating Revenue for European National SDOs between 1990 and 1995

		Revenue Source		
Member State	**SDO**	**Government**	**Members**	**Commercial**
Austria	ÖN	L ↓	L ⇔	H ↑
Belgium	IBN	M ↓	M ⇔	H ↑
Denmark	DS	M ↓	L ⇔	H ↑
Finland	SFS	M ↑	L ↓(< 2%)	H ↓
France	AFNOR	M ↓	L ↑	H ↑
Germany	DIN	L ⇔	L ⇔	H ⇔
Greece	ELOT	H ↑ (>70%)	L ⇔(< 2%)	M ⇔
Ireland	NSAI	L ↓ from 52% to 4 %	L ↓	H ↑ from 48% to 94%
Italy	UNI	M↑	M ⇔	H ⇔
Luxembourg	SEE	not available	not available	not available
Netherlands	NNI	L ↓(<2%)	M ⇔	H ↑
Portugal	IPQ	M ↓ from 86% to 35%	L ↑ from <1% to 5%	H ↑
Spain	AENOR	L ↓	L ↓from 14% to 5%	H ↑ from 61% to 81%
Sweden	SIS	M ⇔	L ↓	H ⇔
UK	BSI	L ↓	L ↓	H ↑

Source: Own elaboration of ISO and SDO Annual Reports

H = averaging ca 40% of revenues or more
M = averaging between ca 20% and 40% of revenues
L = averaging less than 20% of revenues
↑ = increasing; ↓ = decreasing; ⇔ = stable

As Table 2-5 indicates, eight of the SDOs receive significant (i.e. medium to high) portions of their revenues from government. Where government funding is a significant factor, this can come in the form both of direct subsidy or of contractual amounts paid to SDOs for technical work. However, only in the cases of Finland, Greece and Italy is government support increasing significantly or stabilising at high levels. In most instances, the trend has been for government support to decline. It is particularly notable that in the case of Portugal (where the SDO is a government department) government financial contributions decreased by more than 60% in less than five years, and that in Ireland the decline was more than 90% in the same period. Government support is still significant, however, with seven European SDOs receiving between 25% and 30% of revenues from government. The German and Spanish SDOs receive about 15% of revenues from government and only Austria, Ireland, the Netherlands and the UK receive small or negligible government contributions.

No European SDO is primarily dependent upon member subscriptions and fees as a portion of total revenue, although Belgium, Germany, Italy and the Netherlands derive between ca 20% to ca 30% of revenues in this way. In all but one case (Greece) commercial activities comprise most of the SDO revenue base. Principally, these consist of

- sales of standards and publications;
- certification and testing services; and
- miscellaneous standards-related research, educational and consultancy services.

Table 2-6 gives a breakdown of the commercial concentrations of the European SDOs.

Table 2-6 Approximate commercial revenues of European SDOs (as of December 1995)

Member State	SDO	Commercial revenues as percent of total	Publications revenues	Certification revenues	Other revenues
Austria	ÖN	91%	53%	1.4%	36.4%
Belgium	IBN	47%	30%	2..5%	14.5%
Denmark	DS	66%	15%	27%	25%
Finland	SFS	75%	33%	33%	9%
France	AFNOR	70%	category break-downs not available for AFNOR		
Germany	DIN	66%	53%	4%	9%
Greece	ELOT	28%	6%	18%	4%
Ireland	NSAI	94%	4%	90%	0%
Italy	UNI	48%	35%	2%	11%
Luxembourg	SEE	n/a%	n/a	n/a	n/a
Netherlands	NNI	68%	57%	0%	11%
Portugal	IPQ	61%	4%	22%	35%
Spain	AENOR	82%	18%	50%	14%
Sweden	SIS	67%	50%	8%	9%
UK	BSI	85%	11%	63%	11%

Source of data: ISO 1996

It is clear from this table that commercial revenues are by far the most important source of revenues - making up more than 50% of income for all but three SDOs. It is clear also that the revenue structures of individual SDOs are biased in favour of different revenue categories. Publications revenues are extremely important to ÖN, DIN, NNI and SIS, and moderately important to IBN, SFS and UNI, but less important to the others. In the SFS case, moreover, sales of publications has actually declined as a portion of revenues (from 57% in 1991 to 33% in 1995). Certification revenues vary widely, but NSAI, BSI and AENOR are unique in that they now earn most of their revenues from this activity. Indeed, NSAI is primarily a certification agency. AENOR revenues shifted decisively between 1991 and 1995, from a publications base (ca 30%) to a certification base (ca 50%). BSI has derived most of its earned revenue from certification for many years.

If the revenue structures of European national SDOs are diverse, the technical areas in which they concentrate are for the most part very similar. Examining quantities of standards in different technological fields in national catalogues does not necessarily indicate relative national technological strengths and weaknesses, but it is notable that in the seven largest European SDOs (defined arbitrarily as administering over 9,000 standards), approximately half of the standards they promulgate fall into a group of seven broad technical fields (Table 2-7), clustered in different ways for each country.

Table 2-7 Activity concentrations of SDOs by technological field

AFNOR	DIN	UNI	NNI	AENOR	SIS	BSI
Mechanical	Mechanical	Mechanical		Mechanical	Mechanical	Mechanical
Civil Eng.	Civil Eng.	Civil Eng.	Civil Eng.	Civil Eng.		Civil Eng.
Materials		Materials		Materials	Materials	Materials
	IT				IT	IT
Chemicals	Chemicals		Chemicals			
Packaging			Packaging			
			Medical			

For each of the largest SDOs, Table 2-7 lists the areas in which the bulk of the national standards catalogue is centred - i.e. in each case, this is the minimum number of fields in which approximately 50% of the standards promulgated by the SDO could be contained. The largest categories in each country cluster appear at the top of the table, and the smallest at the bottom. In all but two cases (AFNOR and NNI), mechanical engineering is the largest single arena for standards activity. DIN lists some 8000 mechanical engineering standards - the next biggest area being civil engineering with less than a quarter of that number. This gap is narrower in other SDOs, but in most cases the quantity of mechanical engineering standards is at least double the quantity in the next largest category. All of the smaller SDOs display a very similar pattern of clusters, with mechanical engineering dominating in most cases.

The dominant impression left by Table 2-7 is that SDOs concentrate mainly on technologies related to 'traditional' industrial contexts, but this needs qualification. Much of the technical subject bias reflects historical accumulation - the need to retain standards that apply to a large installed base of industrial equipment across several technological generations. Importantly, however, it can be seen also that information technology is now a very significant category in most of the major and minor SDOs. Increasing amounts of activity in 'traditional' industries concern 'non-traditional' technologies and are concerned with new ways to control and monitor industrial processes. This will be shown below in more detail (in the Value-added Inventory).

Given all of the above organisational and financial factors, probably the main challenge for national SDOs in the current environment is to preserve profiles at the national level that continue to provide products and services to clients that offer unique value in themselves and/or add value to standardisation activity at regional and international levels. Only in this way will they be able to maintain revenue flows given that the production of country-specific standards in Europe and elsewhere is likely to decline in the next decade.

2.4.1 Public sector involvement in standards at national levels

World-wide, public sector agencies account typically for a very high proportion of GDP, and of goods and services consumption. Thus, they are very significant stakeholders in standardisation processes. In the best case scenario, effective standards can lower costs and increase efficiency in public administration as much as in private industry. Government agencies in most EU countries participate directly in SDO committees (at *supra*-national as well as national levels) and are often proactive in setting agendas in technical areas that affect the public interest. For example, the financial departments of several European governments were among the main protagonists promoting interconnection standards for computer systems.

The sheer size of the public sector consumption requirement means that government procurement requirements can be decisive in establishing standards in the marketplace. Historically, defence procurement has been a major factor in this regard. Even though these dynamics are changing, the formation of closer links between defence and civil standards regimes must take into account the general effects of government procurement power on national standards systems.

As will be discussed in more detail below, the vast majority of defence production capability in Europe is concentrated in just five EU Member States - France, Germany, Italy, Sweden and the UK. It stands to reason that promoting co-ordination in defence production and procurement between EU Member States through greater use of civil standards will have to take account primarily of the similarities and differences between these five systems.

Basically, the systems can be placed into three categories according to how they are organised and how closely they are connected structurally to public sector agencies. However, the procurement roles of SDO standards as set out in Table 2-8 require some explanation. In principle, and on the understanding that European and/or international standards (where available) have been transposed into national standards catalogues, there is nothing to prevent any Member State from specifying standards promulgated by national SDOs in procurement documents. Indeed, for reasons of transparency, governments should be encouraged to do this. Problems arise (a) whenever there is uncertainty over the degree of transparency about which standards are required, (b) where national certification requirements create barriers to foreign and/or national suppliers, or (c) where path dependencies become established due to the historical use in procurement of specific national standards.

Close structural linkage between national standards and national procurement policies can exacerbate these problems, but the problems do not go away entirely even if asymmetries in structural linkages are minimised. It is clear from the outset that although the national systems in categories 1 and 2 are different, the basic relationship between them and national procurement structures is similar enough that the effects of any asymmetries should be minimal. The difficulties have more to do with what *in practice* constitutes voluntary or mandatory reference to standards in public procurement.

Most SDOs administer catalogues of mandatory as well as voluntary standards, according to various arrangements with their governments. The only exceptions in the EU are DIN, NNI, SIS and BSI. ÖN, DS, SFS, UNI, IPQ and AENOR all administer significant quantities of mandatory standards. Of this group, UNI has the lowest quantity of mandatory standards in its catalogue (ca 5%) and AENOR has the highest (ca 20%). Less than 1% of IBN and AFNOR, ELOT and NSAI standards are mandatory.

Table 2-8 Standardisation systems in the five major EU defence producer countries, classified according to public sector links

Category	Country	Characteristics of system
(1) Centralised and not integrated into public procurement	Germany Italy UK	· voluntary standards · national SDO administers standards initiatives directly · no government administrative role in SDO · no structural link between SDO and government procurement
(2) Decentralised and not integrated into public procurement	Sweden	· voluntary standards · standards initiatives administered by independent sector-based bodies · SDO co-ordinates activities of sector standards bodies · minor government administrative role in SDO · no structural link between SDO and government procurement
(3) Centralised and integrated into public procurement	France	· voluntary standards · national SDO administers standards initiatives directly · SDO linked structurally to government department(s) - manages and co-ordinates both public and private sector standards requirements · required reference in public procurement to standards promulgated by national SDO

As pointed out above, however, governments can specify *voluntary* standards in procurement as well as mandatory ones, thus creating ambiguity in practice as to the actual status of a nominally voluntary standard. In the case of France, the relationship is at least clear and consistent. The French approach is to strive for national co-ordination of all standards activity - i.e. not to separate public sector requirements from private sector ones. Unlike DIN, UNI, SIS and BSI, AFNOR is connected closely to the French Ministry of Industry. Although virtually all AFNOR standards are voluntary in principle, about half of these are 'homologated standards' (*normes homologueés*) - officially recognised by government as normative for reference in various government contexts, including procurement.

To conclude this section, it is important to stress that to the extent that national SDOs will be a factor in defence procurement, the principal interorganisational interfaces will be between the US standards regime as embodied in ANSI and those embodied in the SDOs of the five major European defence producer countries. Although the ANSI system has more obvious affinities with categories 1 and 2 in Table 2-8, it is not fully congruent with any of them.

Unlike any of the European national systems, the US system is built upon (a) a highly decentralised range of independently organised, sector-specific SDOs, (b) much greater incidence by these SDOs of 'line-straddling' between independent and ANSI sanctioned activities and products, (c) historically low levels of direct linkage between the US government and SDOs (whether ANSI affiliates or not) and (d) much less inclination to favour national standards over sector-centred or proprietary standards.

Indeed, the current US defence procurement policy which promotes the use of civil standards is in many respects atypical of historical US government attitudes to SDOs. In the past, US anti-trust authorities have been ambiguous towards industry-wide standards - regarding them at times as potential inhibitors of competition (Swankin 1990). Indeed, the ANSI system with its emphasis on decentralisation, transparency and ensuring diversity of stakeholder involvement evolved in part to dispel government concerns that industry standards bodies might engage in cartel-like behaviour.

2.5 International organisation of standardisation activities

Voluntary consensus standardisation in formally recognised international SDOs has achieved a high profile mostly in the past decade. This has been due largely to the pressures noted above to promote liberalisation of international trade, and to increase the efficiency of the standardisation system as a whole by undertaking as much standardisation as possible at as international a level as possible. In part, it has been due also to the high public visibility of flagship international standards programmes like ISO 9000 (Quality Assurance) and more recently, ISO 14,000 (environment).

The term 'international standard' now has important regional as well as global dimensions. In our view, it is important to consider them together, in order to dispel the impression that regional standardisation serves merely as an intermediary between national and international levels. In many cases this occurs, but the linkages and dynamics are far more sophisticated than this.

Indeed, in analytical terms, it is now probably better to consider both global and regional dimensions as incorporated into a complex and rapidly evolving process of ***supra*-national standardisation**. We will employ this more generic term at various places in the report wherever the global and regional dimensions of international standardisation must be considered simultaneously. Consistent with our approach in the above section, we will discuss international standards and standards organisations collectively, concentrating on the articulation between *supra*-national and national levels of standardisation.

For most countries in the world, international standards are perceived primarily in terms of activities in international SDOs like ISO and IEC. The regional dimension involves standards activities undertaken within a group of countries for reasons of geographical proximity and/or political and economic cooperation. There are several regional standards alliances, the most prominent being AIDMO (Arabic region), ACCSQ (Southeast Asia), ARSO (Africa), COPANT (Latin America) and PASC (Pacific rim). In the past, these bodies have concentrated primarily on cooperation and coordination in the downstream implementation of standards, but several are now becoming more active in standards development as well. There are also structures that function as regional standards bodies by our definition, even though they have no formal identity as such - for example, the NATO STANAG regime is virtually a regional standards system for defence technologies.

Arguably, however, the regional dimension has become a major force in international standardisation primarily as the result of initiatives taken within the EU to support European market integration. Most of the significant developments facilitating closer working agreements between regional and international SDOs were established to accommodate the emerging reality of a pan-European standards system (more below). These may become applied more widely now that similar regional dynamics have begun to evolve elsewhere - particularly in the Americas and the Asia-Pacific. Europe's trading partners in the rest of the world must consider both regional and international dimensions simultaneously when pursuing trade relationships with European states. All states may soon have to take this *supra*-national perspective on standards in all international trade relationships.

It should be noted that the United States was not a particularly active participant in international standardisation of any kind until the late 1970s (Cerni 1983). Before that time, the major European powers (particularly France, Germany and the UK) were the major supporters of work in organisations like ISO and IEC. Much of this involvement stemmed from historical circumstances. Until the 1940s European countries were the major source of technology for much of the world outside of North America, the technology transfer routes following colonial trading patterns. US exports of technology increased markedly in the last half of the century - especially more recently with respect to ICT - and the US is now a major force in international standardisation. By the early 1990s, the US had become the largest individual contributor to the ISO work programme. On average, the US now participates in 70-75 percent of ISO Technical Committees, holds the International Secretariat for 15-20 percent of these, and is an observer in virtually all of the other committees.

2.5.1 International standards in international procurement

Even though activity in international and regional SDOs has increased remarkably in recent years, it remains generally difficult to achieve formally recognised international standards in many key technology areas. This is largely because the tensions between the established and insurgent standardisation frameworks (as discussed above) become more acute at international levels. Firms and government agencies seeking to liberalise the international procurement environment for civil and defence technologies must take these special difficulties into consideration along with the often special characteristics and scope of *supra*-national standards.

In most of the world, it is generally the case that most *supra*-national industrial standards are not actually implemented at *supra*-national levels. Certainly they are referenced with respect to the exchange of goods produced in different countries, but products do not have to be intended for export, or even tradable, for an international standard to be applied to them. Most mechanical engineering undertakings use ISO standards for screw threads and machining tolerances, for example, irrespective of whether the product will be traded domestically or internationally. Likewise, *supra*-national governance structures being much less extensive than national ones, scope for reference to *supra*-national standards in legislation or regulations is greatest at national levels.

In this respect, the European situation is unique. Only in the EU is there a functioning *supra*-national governance structure with a comprehensive enough scope to cover most of the industrial activities in which standards are applied, even if intervention powers in this structure are by no means comprehensive or uniform.

International procurement can be facilitated by common standards, and impeded by idiosyncratic ones, but it is not always *dependent* on common or harmonised standards. Examples abound of long-standing international trade relationships involving conversion between very different sets of standards, or the simultaneous use of several different standards systems. Metrology is the most ubiquitous example - even where the same measurement system is used, it is common for dimensions, quantities and measurement criteria to vary from country to country.

In normal circumstances, conversion between standards has long been accepted as part of the cost of doing business. Problems arise when costs become uniquely or disproportionately biased against one or more trading partners. But often these problems can be solved without recourse to altering technical specifications as such. Furthermore, biases do not necessarily disappear even if an international standard is applied.

In the international trade governance framework, it is recognised that national standards and certification procedures can constitute non-tariff trade barriers. WTO mechanisms for settling trade disputes involving standards follow principles laid out previously in the GATT Standards Code. These are predicated on multilateral principles of transparency and disclosure where standards and conformity assessment are concerned. The WTO and ISO are beginning to co-operate more closely in this respect by maintaining a register of national and regional SDOs agreeing to implement the WTO's Technical Barriers to Trade (TBT) provisions in their standardisation practices.

Over and above the WTO framework, however, bilateral arrangements in the form of Mutual Recognition Agreements (MRA) can be negotiated between trading partners. Several such agreements exist already between the US and the EU. However, MRAs that for any reason are not or can not be extended to the global trading community may in themselves become trade barriers.

For the most part, the arguments made by bodies like ISO and IEC about the value of international standards focus more on promoting trade *efficiency* than on removing non-tariff barriers as such. This emphasis is correct in our view. In highly competitive industries, efficiency barriers can be just as effective as tariffs and much harder to demonstrate in arbitration.

From the trade efficiency perspective, the rationale for seeking international standards can be seen in a different light. Standardising everything internationally could be a very inefficient way to proceed for most industrial sectors, as it could place counterproductive restrictions on markets. Indeed, replacing national standards entirely with international standards is seldom the aim of *supra*-national standards initiatives except in a few selected areas where the technical issues are international in nature - quality assurance and environmental standards being notable examples. Accordingly (not unlike the philosophy behind the European 'new approach'), the emphasis of formal *supra*-national standards is often upon standardising key general aspects of a technology or commodity and on establishing frameworks to facilitate international coordination of markets.

In practice, most international standards activity *articulates* with national activities. All of the international SDOs active in areas of major relevance to this study operate constitutionally under the authority of their member bodies. For the most part, these are national SDOs or other nationally-based public and private agencies. As a result, the initiatives selected for international action tend to reflect those areas that complement or enhance the national systems. Typically, the committee structures of national and international bodies mirror one another. Thus, international standards are often qualitatively different from national standards and directed at different objectives. It is common for international standards to specify sub-sets and derogation criteria in order to accommodate implementation conditions that are peculiar to individual countries.

This articulation can be illustrated in a simple example. ISO has promulgated a standard aimed at establishing a single international set of dimensions for paper sheets. This has positive cost reduction effects for all suppliers and users of these products. Yet, ISO issues no standard calling for all paper to be of the same weight, composition or colour. This could be seen to limit competition and customer choice unnecessarily. On the other hand, national standards bodies might be called upon by domestic stakeholders to set standards specifying paper quality parameters based on local production methods and materials. These in turn would likely reference the ISO dimension standards, thus giving domestic users the benefit of both. Moreover, the domestic standards need not result in trade barriers; often they are designed to maintain quality levels for products with specific domestic characteristics. Standards for French cheese for instance are designed in accordance with the local conditions of production, and will play a quality assurance role for specific types of quality cheese. Although the standards may be irreproducible outside the country, they are not a trade barrier but rather a tool to support the competitiveness of very specific products.

Even where the benefits of international standards may be clear, international standardisation tends inevitably to compound stakeholder coordination difficulties, and often adds a significant geo-political element to the already complex process of making technical decisions. On occasion, the policy rationale for an increased regional role is given as facilitating the international process by first coordinating national stakeholder interests at a regional level. Results of this process have so far been difficult to determine in practice. International and regional standardisation bodies have made many mechanical improvements in their administrative and committee procedures. Nevertheless, as with every international negotiation process, there are inherent difficulties that resist mechanical solutions.

2.5.2 Determining the 'status' of an international standard?

The international standardisation environment is complex, and there is as yet no comprehensive global governance framework for the application of industrial standards. In these circumstances it can be a difficult undertaking to define exactly what in practice constitutes an 'international standard'.

Standards vacuums at all levels are frequently filled by the market long before the SDO system can respond. Many technologies that are international standards in all but name, have no officially determined status of any kind. Obvious examples are Microsoft Windows and the video cassette and Compact Disc formats. Frequently, proprietary *de facto* standards like these must be referenced in procurement contexts. For instance, most of the desktop computer installations in NATO and in the defence agencies of its Member States are utterly dependent upon the Microsoft Windows operating system.

Indeed, as pointed out in the introduction to this report, in fields like ICT the normal strategy for establishing *de facto* standards is to create extensive *international* networks of users as soon as possible. The more international the use of *de facto* standards becomes, the harder they can be to replace in domestic as well as international use.

Even where conventional committee-made international standards are wanted, the status and authority of international standards institutions can be ambiguous. Most national SDOs are recognised formally in some way by governments, as are regional bodies in the EU. ISO, on the other hand, is recognised formally only by the national SDOs belonging to it. Its status with respect to governments is often ambiguous. Some governments are in effect 'members' of ISO in that the national SDO is a government department, but ISO procedures are not 'intergovernmental' as such. Most EU and OECD governments have no official association at all with ISO or IEC other than to recognise the role of the national SDO as the national representative in international standards bodies. On the other hand, the ITU is a UN body with treaty-based national membership, and national ratification of all actions and outputs. Participation in the standards-setting arms of the ITU is nevertheless open to any stakeholder subject to national approval. Ambiguities like these are now the rule rather than the exception in international standardisation.

It is also not uncommon for formally promulgated national standards to become *de facto* international standards by virtue of the fact that the dominant world suppliers of a particular technology are based in one country, or where an informal international consensus has formed that a particular national standard is state-of-the-art. National standards tend to reflect particular national industrial competencies, and tend to be of high technical quality and/or utility where the national industrial base that develops and supports them is likewise superior.

In the 1950s and 60s, for example, standards of European origin for electrical distribution equipment became established in many non-European countries because European products were preferred by many electric utilities on quality grounds. In the 1980s, for similar reasons, computer local area networking standards from ANSI-accredited committees in the IEEE had become virtual international standards even before they had cleared formal ANSI procedures. Informally generated consensus of this kind often motivates formal international standardisation initiatives in the first place. It is the experience of standards professionals consulted for this study that where such prior consensus exists, and the technical parameters do not change too radically too soon, the path of an initiative is more likely to be smooth.

A further difficulty is that officially sanctioned hierarchical relationships between organisations (as illustrated in Figure 2-3 above) do not necessarily represent the actual dynamics of international standardisation. Rather, they reflect only the assumed hierarchy of the established standardisation framework, which in some sectors may never have existed in practice, or has been otherwise upset by an emerging insurgent framework.

For example, a number of mostly US-based trade and professional organisations, who also sponsor ANSI-accredited standards committees, are in any case already some of the preferred global sources of standards in several key industries. The IEEE has already been mentioned in this respect. Equivalent examples are the ASTM which (among its many other activities) sets standards for fuels that are used in many countries; the API which is a dominant supplier of standards for petroleum extraction and refining installations; and the SAE which sets internationally influential standards for the automotive industry. European bodies play similar roles. For example, as the European aerospace industry steadily increases its share of the world market for commercial aircraft, standards developed by AECMA and EUROCAE are likely to acquire international acceptance irrespective of any eventual official status they may acquire as European or international standards.

Telecommunication provides a good example of the kinds of insurgent relationships that are undermining the hierarchy. ETSI is the only telecommunication standards organisation that is organised on a specifically regional basis. However, the membership of ETSI is becoming increasingly international, with more-and-more avenues opening up for participation by non-European interests. Furthermore, although constituted as a US national standards body for telecommunication, ANSI T1 is actually at the centre of an emerging hemispheric telecommunication region in the Americas, having developed extensive ties with equivalent bodies in Canada, the Caribbean, and Latin America. The Japanese Telecommunication Technology Committee is building up similar regional significance in Asia. Taken together, these regionally focused standards activities are now probably as significant internationally as any of the activities in the ITU. Indeed, much of the ITU technical agenda is necessarily driven by inputs from these three regional telecommunication hubs.

To complicate the picture even further, a significant number of industry 'consortia' have appeared during the last 6-7 years. So far, consortia involved in the generation of PAS are mostly a phenomenon in ICT. They are very significant in the context of this study, however, in that ICT is the major part of capital expenditure for many defence systems. Typically, consortia maintain arms-length relationships with selected SDOs. For the most part, they develop PAS in specialised technical areas that either become established in the market as *de facto* standards, or, on occasion, are introduced into existing (usually international) SDO initiatives. Importantly, most consortia adopt consensus principles and employ variants of the committee method. The main difference is that the range of stakeholders represented is confined to those interests who belong to the consortium and pay membership fees. Some consortia are open to all interested parties, while membership in others is restricted to selected partners. In practice, however, there is often little difference in the stakeholder composition of consortium and SDO committees - indeed, they often share technical experts (Hawkins 1998).

To sum up, although the general thrust of current public and private sector economic policy favours the ideal of 'globalisation', the environment for setting the *supra*-national (i.e. international or regional) standards on which this might depend is arguably more complex now than at any previous time, and it is becoming more complex not less. In practice, formally established regional and international SDOs are only one of many sources of *supra*-national standards, especially in rapidly changing high technology areas.

As a result, the definition of a '*supra*-national standard' is fluid - dependent largely on the industrial sector concerned and the structure of its markets. For most industrial products, there is in practice a 'marketplace of standards' from all kinds of sources. In the absence of laws, regulations and guidelines to limit the choice of standards for specific reasons, industries will tend to select individual standards in the marketplace according to practical assessments of quality and suitability.

Therefore, for purposes of this study, we will propose two definitions, neither of which is exclusive, many standards complying with both.

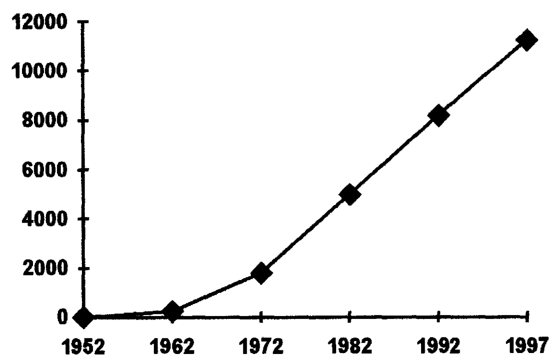
1. ***Formal definition*** - A *supra*-national standard is a technical document, drawn up by a committee of stakeholders according to consensus principles, formally promulgated by a recognised regional and/or international standards body, and available for public use on a voluntary basis.

2. ***Pragmatic definition*** - A *supra*-national standard is a technology or technical document, available to the public on a non-discriminatory basis, and deployed by a significant number of users world wide.

2.5.3 The rise of supra-national standards

The quantity of supra-national standards has risen dramatically in the past 20 years. Only part of this rise is explained by accumulation. In many fields, the tendency has been to initiate more standards at *supra*-national levels in the first instance, rather than to wait for national standards to be harmonised at international levels, or for international initiatives to build on national ones. The questions concern how much longer this tendency will continue, once a certain critical mass of supra-national standards has been achieved.

Figure 2-7 Growth in production of ISO standards



Source of data: ISO

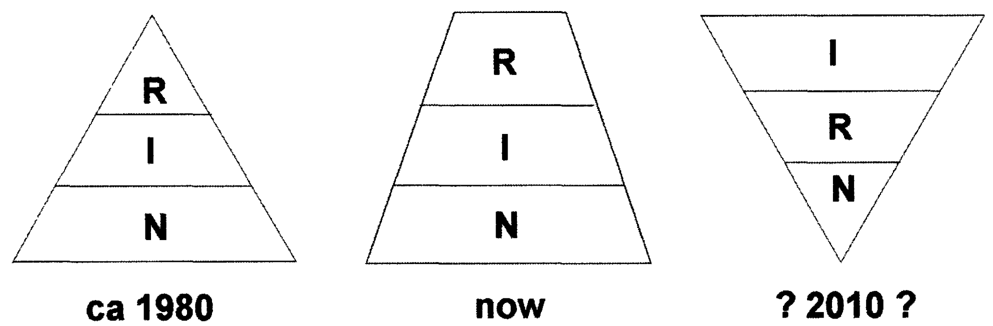
Figure 2-7 shows the steep rise in production at ISO since its first standards were promulgated in 1952. Similar rises have occurred at the European level in CEN, CENELEC and ETSI. These are more difficult to illustrate in a graph because of the huge backlog of initiatives still at the drafting and approval stages. The aftermath of the new approach, and completion in 1992 of the Single Market generated very large amounts of work for the European regional SDOs. In the short to medium term, progress in this case must be measured in terms of the progress of initiatives through the system and not just by the production of finished standards.

Starting from a base of fewer than 100 standards in the early 1980s, CEN now claims to issue about 900 standards per year. At present, however, a further 9 to 10 thousand items are at the drafting or approval stages. The CEN catalogue is expected soon to contain 10 - 12 thousand standards, but it is probably too early to assess what the sustained production rate might be once the backlog has been cleared.

For national SDOs, the changing shape of standardisation can be illustrated quite strikingly in a simple diagram (Figure 2-8). As illustrated by the pyramid to the left, before 1980 national standards were the bedrock on which the other standardisation regimes were built. At that time, the catalogues of large SDOs like DIN, AFNOR and BSI were on average three to four times larger than the ISO catalogue, and regional standardisation was barely a force at all (a mere handful of CEN standards, for example).

The current situation is very different, at least in Europe. Standards production now has more rhomboid characteristics with international and regional standards being promulgated at much more significant rates. By the close of the next decade (at the current rate of change), it might be predicted that the shape of standardisation will resemble an inverted pyramid with standards that are uniquely national occupying a relatively minor position in the structure as a whole. Already, most of the major national SDOs in Europe report that only 20-30% of their current standards activity has a purely national orientation. In this scenario, the role of national SDOs would become focused on 'downstream' applications of standards developed in *supra*-national organisations.

Figure 2-8 The Changing Shape of the *Supra*-national Standardisation System



ca 1980 **now** **? 2010 ?**

N = national; R = regional; I = international

Source: SPRU

If a fully inverted structure were to occur, this would put national SDOs under considerable pressure to redefine their roles. Much of the rationale and resource base that has sustained them in the past would come under threat. Some SDOs have made inroads into new service areas already - advisory and consultancy services, information services and so forth. Increasingly, many of these services are connected to national quality assurance programmes. In other cases, however, SDOs remain heavily dependent on established product areas for most of their revenue. More crucially, they depend on these as the source of most of the technical contributions which are the real life-blood of the SDO system.

However, this scenario assumes that *supra*-national standards only replace national ones. In practice, much of the increase in international standards production is either complementary to national standards, or simply reflects the fact that more and more technical areas are being opened up to international and regional standardisation activity.

It is interesting to compare the major areas of activity in national and *supra*-national SDOs. As shown in Table 2-9, the bulk of ISO activity is concentrated in most of the same areas as illustrated for national SDOs (in Table 2-8 above). The main exceptions are 'construction' and 'packaging', both areas that are closely linked historically to local materials and conditions.

Table 2-9 Current ISO activity levels (standards and drafts produced) ranked according to subject area

Rank	Area	Drafts (%)*	Standards (%)
1	Mechanical Engineering	28.2	28.8
2	Information processing,	20.2	15.5
3	Non-metallic materials	10.4	10.4
4	Basic Chemicals	7.0	10.6
5	Agriculture	5.6	6.9
6	Ores and metals	4.2	7.6
7	Special technologies	6.6	4.3
8	Health and medicine	5.3	4.2
9	Construction	4.2	3.8
10	Environment	3.8	3.2
11	Basic subjects	3.7	3.1
12	Packaging & distribution	0.7	1.6

Source of data: ISO, January 1998
NOTE: rounded percentages

At this point, only in Europe is there an extensive programme to replace national standards, and then only in selected areas, mostly as defined by new approach Directives. Similar programmes may develop in other regions, but it is likely that national standards will continue to be a force domestically and internationally. Most national standards arise in response to unique domestic conditions, and often apply to non-tradable products and services.

Taking into account the often different focus and objectives of international standards, and the increasing role of standards that become established at *supra*-national levels through informal, market-led routes, a more likely scenario is that the three levels of standardisation could roughly equalise. Each technical subject could eventually acquire parallel but different sets of standards, each oriented to the respective purpose for which standards are required.

It must be expected that at some point the rate of increase for new standards at *supra*-national levels will level off or even decline. This does not necessarily mean a decline in new work items, however, as much standards work is concerned with maintenance and revision of existing standards. Furthermore, as recognised by all supra-national SDOs, supra-national standards are not required for every technological application. In the European case, this recognition is linked directly to 'subsidiarity' - one of the key principles guiding relationships between the EU and its Member States.

2.5.4 European regional standards and the *supra*-national standards system

There are a number of basic interfaces between the major organisations in the European regional standardisation system and the major international standards organisations. Our purpose in this section is to show general patterns at the level of the major *supra*-national SDOs. Many additional organisations are involved in supra-national standardisation activities in specialised areas. These will be introduced and discussed as appropriate as part of the value-added inventory.

European regional standards bodies assume a number of pivotal roles in the *supra*-national system:

- raising European national standards to regional status;
- harmonising European national standards with each other and with the objectives of new approach Directives;
- developing new European standards to replace or supplement national standards;
- bringing European standards forward for consideration at international levels;
- transposing international standards to the regional level;
- co-ordinating European positions in international standards bodies.

In performing these roles, interfaces with major international SDOs have evolved at organisational and procedural levels, and there has been mutual expansion in the types of standards documents issued. Largely as a result of this evolution, the overall structures and forms of organisations involved in supra-national standardisation have been harmonised and expanded to a greater extent than ever before.

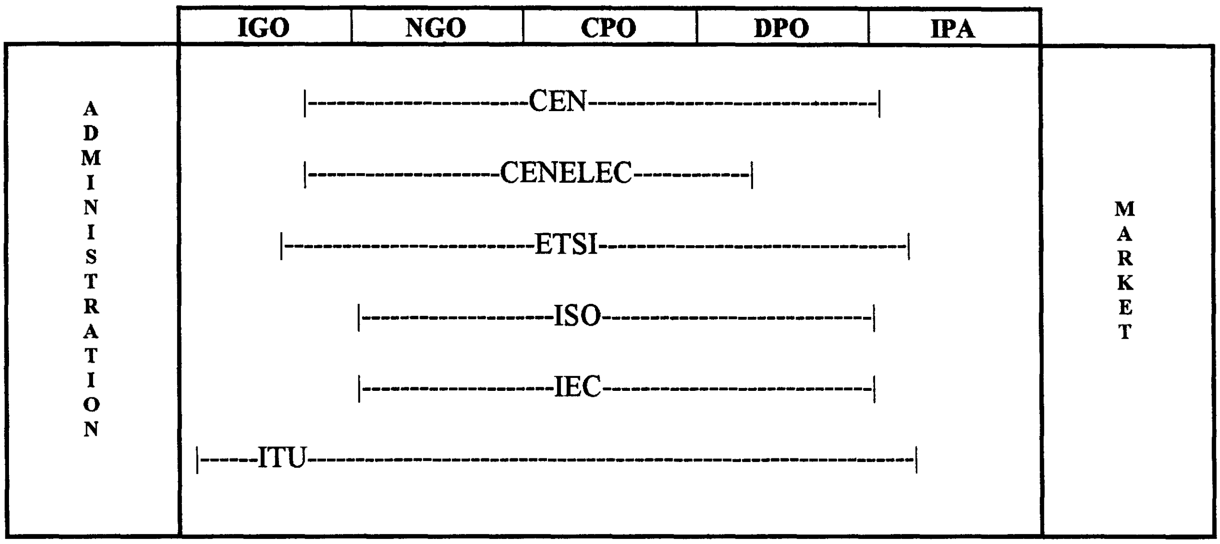
Comparative structures of supra-national SDOs

If we examine some of the main regional and international SDOs in terms of the organisational categories we used above for national bodies, we see that each international SDO now typically spans the characteristics and practical functions of several categories (Figure 2-9). Most of the above category definitions can be transposed easily to the international context, but two changes in terminology are appropriate - the Government Department must in this case be replaced by the Inter-Governmental Organisation (IGO), and the public service agency by the Non-Governmental Organisation (NGO).

Of the major *supra*-national bodies discussed so far, all but the ITU are organised basically on the same lines as most of the major European national SDOs. ISO, IEC, CEN, CENELEC and ETSI are all privately incorporated institutions that operate a mostly a centralised system of standards committees.

Looking at the left side of the diagram, CEN, CENELEC and ETSI display also some of the characteristics of IGOs and NGOs in that they have particularly close formal ties to the European policy structure and conduct voting procedures on a national basis. ETSI is somewhat more of an IGO in that many of its key members are national telecommunication administrations. This role may change as more national telecommunication systems are turned over to the private sector. ISO and IEC are generally referred to as NGOs. Although privately incorporated, they are generally acknowledged internationally as fulfilling a public service role. As a UN body, the ITU is constitutionally an Inter-Governmental Organisation.

Figure 2-9 Organisational Categorisation of Regional and International SDOs



The right hand side of the diagram is of much greater interest. CEN and ETSI (CENELEC to a lesser extent) have made major overtures to trade associations and consortia - seeking in selected areas to decentralise some of the standards activity and to build bridges with industry-led groupings. ETSI has decentralised much of its internal operations, giving individual technical committees considerable autonomy in setting agendas. ISO and IEC are following much the same approach. ITU standardisation activities are now open to direct participation by private companies as well as by government administrations. Thus, in practice at least, the ITU is at the same time an intergovernmental treaty organisation and a trade association, encompassing at some point most of the organisational characteristics that fall in between.

Organisational and procedural links

All of the European regional SDO recognised by the Commission - CEN, CENELEC and ETSI - maintain formal liaisons with each other. In addition, each maintains pairing arrangements with its equivalent at the international level: CEN with ISO, CENELEC with IEC, and ETSI with ITU.

The constitutions of ISO and IEC are set up such that regional bodies can not be formal voting members. CEN/CENELEC and ISO/IEC co-ordinate their work programmes under two special agreements: the 'Vienna Agreement' between ISO and CEN, and the 'Dresden Agreement' between IEC and CENELEC. The aim of these agreements is to ensure that the same work is not undertaken in more than one body at the same time. This involves work sharing and parallel voting arrangements.

As a United Nations body, membership in the ITU, as such, is open on to countries by treaty. However, as the result of a string of restructuring initiatives in the ITU that began in the early 1990s, membership in the Standardisation Sector of the ITU (ITU-T) and the Radiocommunication Sector (ITU-R) is now open to stakeholders and stakeholder organisations. ETSI is a member of ITU-T and ITU-R, but there are no exclusive agreements between these organisations to co-ordinate work programmes. Rather, this is accomplished through framework initiatives involving other national and regional telecommunications agencies and organisations.

The scope of co-operative initiatives among all of these bodies is being extended to various extents in order to encompass trade and industry associations and industry consortia. CEN and ISO maintain extensive liaisons with industry groups engaged in various aspects of developing and applying standards. Some of the CEN liaisons - notably AECMA and ECISS - are Associated Standards Bodies (ASB) of CEN. Recently, CEN has instituted the 'CEN Workshop' concept oriented to achieving preliminary industry consensus on standards priorities. IEC has a similar initiative in process, and both ISO and IEC will soon allow direct participation of consortia in ISO Working Groups (IEC does so already). ETSI has established formal working relationships with many consortia.

Comparison of outputs

Supra-national standards are available in all of the five main categories listed in the introduction to this report. The types of documents issued by or associated with European regional and international SDOs are shown in Table 3-10.

Official outputs from ISO are confined at this time to International Standards. However, ISO is presently seeking greater flexibility in the way it can reference and incorporate other kinds of documentation in its work. For many years, ISO has maintained a 'fast track' by which standards as developed by designated industry groups can enter the ISO process directly as draft standards, circumventing the pre-selection process for new initiatives.

Table 2-10 Types of documents issued by supra-national bodies

	ISO	CEN	IEC	CENELEC	ITU	ETSI	Consortia
Public standards	I	I	I	I	I	I	
Pre-standards		I		I	L	I	I
Technical Reports		I		I	L	I	I
PAS	T	L	I		L	L	I
Priority statements	T	I	I		L	L	I

I = issues these documents officially;
L = liases officially with organisations that issue these documents;
T = transition under development in relationship to documents of this kind.

IEC has extended its range of documents to include the Industry Technical Agreement (ITA) - a consortium-developed standard for which IEC has provided administrative infrastructure and project management. IEC issues the standard under authority of the consortium, but does not claim it as an IEC standard as such.

CEN, CENELEC and ETSI all issue three basic types of documents:

- European Standards (EN) and Harmonisation Documents (HD) - both formally promulgated standards;
- European Pre Standards (ENV) - to fill immediate needs for standards guidance in advance of the availability of an EN or ENV;
- Technical Reports (TR) - documents for technological clarification in preparation for standardisation;

Through its new Workshop programme CEN will now produce CEN Workshop Agreements (CWA) - statements of industry consensus on standardisation priorities. As the first of these Workshops to be organised is the Information Society Standards System (ISSS), ETSI and CENELEC will be closely involved with CWAs as well.

3

SITUATION REPORT: DEFENCE PROCUREMENT

3 Situation report: defence procurement

3.1 Introduction: Patterns of change in the defence industries

Changes in the political, economic, industrial, and technological environment of defence production are posing key challenges to the way in which defence agencies have traditionally procured weapons systems and support equipment and materiel. Governments and defence ministries world-wide are considering, or have already implemented, ambitious procurement reform programmes. One of the main issues under scrutiny is the role of military standards and specifications in defence procurement. There are several interrelated factors forcing European defence agencies and international organisations to reassess their defence procurement practices in general, and their standardisation policies in particular.

3.1.1 The decline in defence expenditures

The combination of general budgetary constraints and the end of the Cold War, resulted in substantial downward pressure on the defence budgets of most EU Member States. Defence expenditures in general, and military procurement in particular have been fallen since the late 1980s. Defence procurement in EU countries has fallen by an average of 30% in real terms between 1985 and 1994.

3.1.2 Growth in the cost of new weapons systems

As budgetary constraints were placing pressures on defence procurement agencies, the cost of new military systems has, generally, continued to rise. The growth in the unit cost of advanced military equipment has been a common feature dating back several decades. Defence procurement strategies have long tried to grapple with the constant increases in product and maintenance costs without much success. Partly, the premium that military customers placed on system performance above other considerations including costs, explains the growing complexity and increasing costs of defence systems.

This situation has changed with the fall in defence procurement budgets; a fall that, given the end of the Cold War, does not appear to be transitory. Maintaining the development and production of complex, increasingly costly weapons systems in an environment of budgetary stagnation is now one of the main problems facing procurement agencies and defence industrialists. Cost considerations have moved rapidly to the top of their agendas and have resulted in initiatives to reform procurement practices and project management.

The use of cheaper commercial alternatives to specialised military components and sub-systems is one of the avenues being used to control cost escalation; yet this requires profound changes in the practices regarding the drafting of product specifications and the practices governing the use of particular defence standards.

3.1.3 The changing relationship between military and civilian technologies

Increasingly, commercial components and sub-systems are providing reasonable alternatives to the development of specialised military items. The reasons for this lie in the changing relationship between military and civilian technologies. In the decades immediately following the Second World War, military production emerged as the source of many innovations that later were adapted for application in other civilian uses. It was the performance requirements of military applications that generated the investment necessary for the early development of many key technologies in fields like electronics, communications and new materials.

As these technologies matured, an increasing number of applications could be found for them in the more cost-conscious civilian markets. In areas like electronics, for example, the percentage of the total market accounted for by defence applications has declined steadily since the early 1960s. The size of the commercial markets offered a much bigger growth potential for new advanced technologies, and by the early 1980s it became apparent that commercial activities had started to dominate innovation processes in many high-technology sectors.

Increasingly, the large R&D investments needed for the development of new generation high technology products could only be justified by the large and growing markets in the commercial sectors. Defence customers found that their research resources were falling compared with R&D expenditures in the civilian sectors. Consequently, their interest increased in finding ways to exploit civil technological advances in military contexts.

3.1.4 The response: new defence procurement and industrial policies

These changes have led to the development of new defence-industrial policies and fresh approaches to defence procurement. Of particular concern were existing inefficiencies in the management of complex weapons systems programmes, and in the generation and application of new technologies. The high-profile procurement reform initiative that was launched in the United States in the early 1990s has undoubtedly contributed to placing the issue firmly in the policy agenda in other countries as well. The high publicity surrounding the US initiative, its boldly-stated goals, and the debates it triggered has made it the centre of attention for experts and policy-makers world-wide. However, many industrialised countries have also engaged in their own, more or less adventurous, reform attempts.

Over several decades, defence agencies in the NATO Alliance developed a complex web of requirements, specifications, standards and procurement practices. The general objectives of procurement regimes were

- to support the development and production of complex state-of-the-art weapons systems, capable of operating in demanding environments as envisioned by military users;
- to guarantee the long-term logistics requirements of complex weapons systems;
- to ensure consistency in the implementation of complex programs;
- to guarantee integrity in government contracting while assuring reasonable profitability for its defence contractors;
- to maintain public accountability and prevent contractor abuses.

Consequently, defence manufacturers and their customers developed a market shaped by strict and unique regulations. Because such regulations were defined by national governments who were concerned about the national security implications of importing defence equipment, defence markets became fragmented by country. This situation was a response to the complexity and special requirements demanded of defence systems, and their perceived importance for national security. Nevertheless, the operation of defence procurement programmes has been criticised for decades by countless internal government review panels and outside experts.

The costs associated with this highly restricted market environment have had significant negative effects on national competitiveness (see below for US analysis). Because of their relative isolation, defence researchers, producers and customers failed to exploit fully the possibilities offered by the technological advances generated elsewhere in the economy. This is specially relevant in key sectors like ICT, where civilian production has been able to combine impressive improvements in performance with substantial cost reductions. In Europe, furthermore, the perpetuation of separate national markets became a major factor restraining the exploitation of economies of scale in defence research and production. Policy efforts to bring together European defence industry capabilities have been driven by the prospect of substantial savings through the establishment of a single European market for defence goods, but progress has been very slow.

Reformers seek to expose defence-oriented industries to the same forces that govern the rest of the economy. This means placing greater emphasis on the use by defence customers and producers of commercial practices, standards and, ultimately, commercially available products and services. In US policy a main objective is to reach civil-military integration, whereby new weapons systems are designed to use advanced civilian components and subsystems. Whenever possible, these are to be built in plants with seamless production lines - turning out military and/or civilian products, according to market requirements. As we will see below, European policies may not be so bold in their statement of goals, but they are moving in the same direction.

3.1.5 A caveat: does obsolescence justify the maintenance of military specifications?

The issue of obsolescence

Despite economic and technological pressures, critics of the application of commercial goods to military uses and of civil/military integration point to reasons why commercial products and practices may be ill-suited to the requirements and needs of the military user. Among the potential problems, the obsolescence issue is causing special concern.

All products have a limited lifetime. At some point most must be replaced, either because new better items or improved processes emerge (technological obsolescence), or because of simple physical wear-out. Obsolescence emerges as a problem when the buyer finds that a replacement compatible with the systems he is operating can no longer be found.

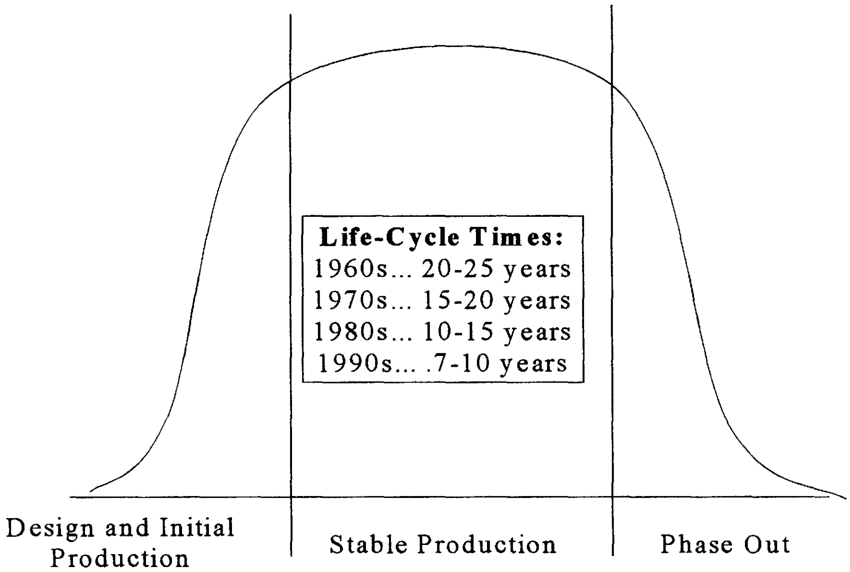
Obsolescence in defence systems is often discussed in relation to the use of commercial components. As the diffusion of commercial components in military systems is linked to the defence procurement and associated standardisation policies favouring the use of commercial items, a connection is often made between the new approaches and the growing difficulties created by obsolescence.

There are however potential difficulties rooted mainly in the different and diverging life-cycles of defence systems and of the commercial components and sub-systems they incorporate. This problem appears with particular intensity in electronics and other IT-related products.[1] The world of electronic commercial components is witnessing the rapid introduction of new, more

1 However, obsolescence is not only an IT problem; it can also affect processes, materials, mechanic parts, etc.

capable, generations of products. The example displayed in Figure 3-1 is typical: new semiconductors are being introduced with increasing speed. The life-cycles of many commercial components and IT products are becoming very short: there are developed very rapidly, commercialised for a short period of time, and become rapidly obsolescent. In contrast, the in-service period of complex defence systems is lengthening. As electronic component manufacturers announce hundreds of product discontinuances every month, a problem emerges for complex, long-life-cycle products incorporating them: spares become unavailable (and software systems are no longer supported).

Figure 3-1 Typical semiconductor life cycle (Bavister 1998)



It is important to note however that this is not only a defence problem but affects all large complex product systems like medical equipment, telecommunications infrastructure, transport systems (including commercial aircraft) and industrial plants. Also, it is a problem difficult, if not impossible, to avoid. With the relative decline in military markets the call to retain peculiar military specifications as a way to fight obsolescence problems is faced with the gargantuan costs of developing technologies that, besides, will increasingly fall behind their civilian counterparts. And the defence sector no longer has the purchasing muscle to influence the development of IT-related industries. Although the aerospace and defence sectors require high performance specifications from the components and sub-systems they use, they account for less than 1% of the total semiconductor market. Many manufacturers are no longer supplying components to military specifications. It is expected that some electronic components used in the defence industry, like ceramic packaged devices, will soon disappear from the market. The military is being forced to procure commercial parts, and learn to manage the obsolescence problem.

Managing obsolescence: problems and solutions

To the military user obsolescence can generate a variety of problems:

- It can impose unplanned redesigns at almost any phase of a project.

- It complicates maintenance and the management of spares holdings.[2]
- Obsolete CAD tools can make it difficult to redesign or update a system. As most software suites, CAD software is regularly updated by suppliers. Although such changes will rarely pose a critical problem during system design, once the product enters service the situation can be quite different. Maintenance costs do rarely include funding to upgrade the design software and hardware, which is no longer used. After a few years the computer development environment has missed several upgrades, and it is then that it is required for a mid-life upgrade programme (Bavister 1998).
- It creates a recertification problem, particularly for safety-critical systems. Some safety standards in the defence field (like the British Def Stan 00-55 and 00-56) can be very demanding. Certification against them will certainly lapse if part of a certified system becomes obsolete and has to be replaced by an unapproved COTS part (Newton 1998).

Faced with all these difficulties, a reactive strategy to address them (i.e. to deal with obsolescence problems as they arise) is not adequate for defence systems. Active obsolescence management through a system's life-cycle is required. Many of the measures required make good engineering sense, and are in line with current design philosophies. Take for instance:

- **Modular architecture and standardised interfaces.** The use of standardised interface structures and the consequent focus on data flows rather than interconnection architectures (i.e. an open systems approach) provides an avenue to tackle obsolescence problems. They also allow the system to be changed more easily to incorporate the additional functionality of new technological developments (Bavister 1998). This approach to design implies the specification of well-defined protocols and sub-system interfaces (Barnes 1998), identifying the product's architecture before the selection of components is made. Development becomes "integration driven", where a systems architecture expressed in terms of a set of interfaces is first established and then used to carry out component selection and bid evaluation (Looney 1998).
- **Use of standard design software language**. For instance, Application Specific Integrated Circuits (ASICs) are now being designed by software using High-level Design Languages (HDL). Designs expressed in HDL could be more easily recreated in modern silicon technology once the original process has become obsolete (Bavister 1998)
- **Life-cycle support and Continuous/Incremental Acquisition.** Although an "all time buy" can be in certain cases a feasible strategy to deal with forecasted obsolescence problems, this approach also faces problems related to long-term storage and unpredicted spares usage. A more sophisticated strategy is to plan upgradeablity stages into a product design, as a part of its life-cycle programme. Such "planned system upgrades" are being challenged by rapid technological changes. Present design philosophies are moving towards continuous acquisition as part of the life-cycle strategy for a system; that is to insert new technology constantly into the system through a process of small incremental upgrades.

However, obsolescence management is ultimately linked to the procurement practices and the systems engineering approaches they help generate. Therefore, present attempts to standardise obsolescence management in the defence field (like the UK Interim Def Stan 00-71 "A guide to managing obsolescence") need to be developed with extreme care not to present designers

2 It is important to note that suppliers can profit from obsolescence "either by charging premium rates to a captive customer for partial redesign and modifications, or by supplying new releases at a high cost" (Bavister 1998).

and manufacturers with requirements at odds, or slightly different, from emerging design engineering practice. As argued above, obsolescence is not a problem peculiar to defence systems. Experts agree that obsolescence management is based on good general engineering practice, and can be seen as a further element in the system engineering of large complex products. Large projects (defence and otherwise) have to set up an obsolescence management strategy tailored to the specific requirements of the case, but there is no apparent reason why the minima demanded in military environments should be different from those demanded in similar civilian projects.

3.1.6 Implications for defence standardisation

The changes in the context defence production examined in this section are behind the present reassessment of the European defence standardisation, both at national levels and within the European Commission. In January 1996, the Commission published a Communication on *The Challenges Facing the European Defence-Related Industry, A Contribution for Action at European Level* (Commission of the European Communities 1996). It recognised the strategic importance of standards for the efficiency of the internal market, and pointed out that standardisation was not a marginal issue, but an area receiving priority attention within European industry as a means of reducing costs and promoting industrial competitiveness. It also noted that in many areas civil standardisation activity was proceeding faster than similar military efforts, and that civil standards were becoming more widely used in defence procurement. Hence the communication recommended that one of the main objectives of EU policy with respect to defence-related industries should be further convergence of civil and military use of standardisation.

The Communication was followed in November 1997 by an 'Action Plan for the defence-related industry'. The plan defines a set of short-term goals in the area of defence standardisation as part of a larger number of action areas where the European Commission can play a constructive role in the definition of a new structure for the European defence-related industries. This new framework is reviewed later in the Report.

As argued above, the persistent fragmentation of European defence markets into national segments is perceived increasingly as an urgent problem for the competitiveness of the European defence industries. It also inhibits development of a distinct European identity in defence and security matters. The measures taken by European firms and governments to move towards a common defence market in Europe have met with mixed success. In the end, the outcome of such attempts is contingent upon the institutional framework of European defence and security policies, the main elements of which are reviewed in the next section.

3.2 Europe and the defence industries: the institutional framework

Defence issues have remained during a long period of time beyond the scope of the European Communities. This situation arose from an extensive interpretation of Article 223 of the Treaty of Rome, which allows Member States to derogate Treaty rules when essential security interests are at stake. Article 223 reads as follows:

1. The provisions of this Treaty shall not preclude the application of the following rules:

(a) No Member State shall be obliged to supply information the disclosure of which it considers contrary to the essential interests of its security;

(b) Any Member State may take such measures as it considers necessary for the protection of the essential interests of its security which are connected with the production of or trade in arms, munitions and war material; such measures shall not, however, adversely affect the conditions of competition in the common market regarding products which are not intended for specifically military purposes.

2. During the first year after the entry into force of this Treaty, the Council shall, acting unanimously, draw up a list of products to which the provisions of paragraph 1 (b) shall apply.

The specific list of products referred to in Article 223.2 was set up in a Council Decision of 15 April 1958 and never updated. However, the invocation of article 223 is subject to controls by the European Court of Justice according to Article 225:

If measures taken in the circumstances referred to in Arts. 223 and 224 have the effect of distorting the conditions of competition in the Common Market, the Commission shall, together with the State concerned, examine how these measures can be adjusted to the rules laid down in this Treaty.

By way of derogation from the procedure laid down in Arts. 169 and 170, the Commission or any Member State may bring the matter directly before the Court of Justice if it considers that another Member State is making improper use of the powers provided for in Arts. 223 and 224. The Court of Justice shall give its ruling in camera.

The Treaty on European Union as well as the new Amsterdam Treaty offer a new context for action in the area of defence-related industries by calling for enhanced cooperation between the European Union and the Western European Union. For this cooperation the European Commission could offer its experience and legal and administrative structures in support of this new relationship.

The necessary urgent restructuring of the European defence industries, which are still nationally-based, requires that a European dimension is provided to this industry and to the market in which it operates. On the market (demand) side, the role of Member States, the WEU, and other multilateral organisations is particularly important in areas such as the harmonisation in time and content of operational requirements and the creation of a European Armament Agency to run European defence programmes. On the industrial (supply) side, intense discussions during the recent months between the Commission and industry have been useful in identifying industry's requirements to establish a strong, integrated and competitive European defence technological and industrial base. These changes have led the European Commission to propose a strategy for the defence-related industries at European Union level (Communication 583, adopted 4 December 1997).

3.2.1 European Union strategy

The need to implement a European Union strategy to keep up with the major changes in the European defence-related industries is becoming more pressing every day. Leading defence firms, and the organisation representing the European defence industries (EDIG) are calling for action by EU institutions. The defence-related industry and the context in which it operates are changing fast, although not so fast as its American counterparts. The factors driving this change are still at work. The Commission Communication on the European aerospace industry stresses the importance of these changes in the United States and the need for drastic action in Europe. It is not possible for the aerospace industry of any single Member State alone to sustain adequate levels of performance and competitiveness, and it is therefore vital to engage in a process of industrial consolidation (of both military and civilian activities) at European level. Other defence-related sectors are in the same situation. In all these cases change within the industry must be accompanied by public measures at European level. The industry urgently needs a reliable and transparent frame of political and legal reference.

The Commission Communication of January 1996 (European Commission 1996) gave rise to a widespread debate, a key product of which was the Parliament resolution adopted in May 1997 strongly endorsing the Commission's ideas. The Council's working party on European armaments policy ("Polarm") has reviewed the positions of Member States and found a number of points of convergence:

1. The Union must maintain the industrial and technological base of its defence-related industry. This base, which increasingly involves dual-use products, is valuable for economic development and indispensable for a weapons capability. The reasons for its maintenance relate both to the establishment of a European defence identity and to the maintenance of competitiveness and jobs in crucial manufacturing sectors.
2. The Union is one of the preferred frameworks for action in this area. It complements others such as the national frameworks and those of the defence organisations to which most Member States belong. The Community framework has proved its efficacy in setting up European markets for non-defence products; Union instruments can now also serve the same purpose for defence products. This kind of market would be of great benefit to the defence industry. The Union should therefore apply a combination of legislative, non-legislative, "fist pillar" and "second pillar" instruments.[3]
3. The different strategies afforded by these instruments need to be combined because of the particular nature of the defence industry: it is both a major means of production and it is essential to foreign and security policy. Any action by the European Union has to take this dual nature into account, if necessary by adapting the resources within the Community's jurisdiction.
4. In conclusion, action should be taken at once, without waiting for a new institutional context to be established, in areas in which it is urgently needed to protect the defence sector's technological and industrial base.

The Commission proposes a global approach to implementing EU strategy:

- *A proposal for a Common Position on drawing up a European armaments policy*. The Commission sent to the Council a draft Common Position adopted under Article J.2 of the Treaty on European Union. This form of CFSP instrument was used because of the foreign policy and defence dimensions of any EU arms-related policy. Following work done earlier by the Council, the Common Position proposed by the Commission sets out a number of principles and indicates where the first steps should be taken. The areas specifically covered by the proposal are intra-community transfers, public procurement and common customs arrangements. The Council has already done work on them specifically in connection with armaments, and besidesEU measures in these areas could be based on a substantial *acquis communautaire*. This proposal for a Common Position should open up the debate on the major issues relating to European armaments by directly

[3] The Treaty on European Union (Maastricht Treaty), signed on 7 February 1992 sets up the structure of the European Union as resting upon three "pillars": (1) the European Communities, (2) the Common Foreign and Security Policy (CFSP), and (3) co-operation in Justice and Home Affairs.

involving policy-makers in the decision-making at appropriate levels. It is intended to promote Member States' political commitment to the progressive establishment of a genuine armaments policy.

- *An Action Plan for the defence-related industries.* The Commission has drawn up a number of areas in which it considers EU action necessary and specifies what measures should be taken at once to ensure progress towards a true European market for defence products. Some of these measures require legislation while others could be adopted under instruments already available to the Union. The Action Plan has been drafted for the attention of the EU institutions and the Member States, but also for the European defence industry. The Commission will take the necessary steps to develop more detailed versions of the measures outlined in the Plan.

3.2.2 The European Commission Action Plan

Given that European defence-related policies are in a transitional phase, European action in the field of military production has no solid institutional framework on which to rely. The embryonic existence of the CFSP means that most initiatives still have to take place within the framework of more mature EU and WEU arrangements. However, the present formal arrangements allow for a broad scope of action for which the political circumstances are becoming more favourable. Political support for the integration of the European defence industries is growing in response to the perceived need for increasing international integration and rationalisation of Europe's defence industries. At the same time, the CFSP discussions are progressively lifting many of the political apprehensions that had hitherto inhibited Commission action in the field of defence production.

These circumstances have prompted the Commission to issue a Communication on the implementation of an European Union strategy on defence-related industries, including a 'Draft Common Position on Framing a European Armaments Policy' and an 'Action Plan for the defence-related industry' (European Commission 1997). The document states that

> "An integrated European market for defence products must be set up using a combination of all the instruments at the Union's disposal: Community and Common Foreign and Security Policy legislative and non-legislative instruments".

The Action Plan lists the "areas in which immediate EU action seems necessary" and a summary outline of the measures required and proposed timelines for action. Among the main areas of proposed activity we find:

- the establishment of a simplified export licensing system applicable to the transfer of defence-related products within the Community;
- the creation of an European Community Statute which would help the creation and management of transnational European companies;
- the establishment of a new framework for defence procurement, "making provision for competitive tendering whenever possible", including new rules on the application of Article 223;
- the rationalisation of the standards used by the different national defence procurement agencies;
- the development of general policies to promote technology transfer and facilitate the civilian exploitation of defence technologies;

- the harmonisation of the different tariff arrangements applied in different Member Countries to the imports of military or dual-use equipment;
- the elaboration of a White Paper on options for progress towards a common arms export policy.

The Action Plan represents the first explicit and high-profile Commission strategy in the defence-industry field. Together with the WEU work within the CFSP framework, the Commission is framing EU defence-related policies, particularly concerning new EU involvement in defence production matters. The Commission initiatives are closer to the market side of defence-industry issues, and aim clearly at creating the conditions for building a common market for a wide range of defence products - particularly for dual-use products.

3.2.3 The role of the Western European Armaments Group

The WEU has worked to develop a defence procurement role with the creation of the Western European Armaments Group (WEAG). WEAG is in fact the successor to the Independent European Programme Group (IEPG) established in 1976 as a forum to promote armaments co-operation among European countries. In December 1992 the Defence Ministries of the 13 IEPG countries decided that the IEPG functions should be transferred to the WEU, five months later the forum was renamed as WEAG.[4] WEAG's objectives are:

- to use resources more efficiently through increased harmonisation of requirements;
- to strengthen the technological and industrial base of European defence production;
- to promote co-operation in R&D - *inter alia* through a co-operative defence R&D programme;
- to open up national defence markets to cross-border competition.

This latter objective is of special importance for developing national defence procurement policies. A WEAG panel (Panel III: Procedures and Economic Matters) has been tasked to develop guidelines and procedures for the creation and implementation of a European Defence Equipment Market (EDEM). One of its decisions has been the establishment of "focal points" for procurement affairs in all WEAG countries, to provide information on defence needs, and to facilitate access to the domestic defence markets of all WEAG countries for firms based in these countries. The "focal points" are responsible also for publishing details of all forthcoming defence purchases over ECU 1 million. WEAG countries have undertaken a commitment to announce these purchases in monthly English-language bulletins. Because of their defence character, notification does not have to be published through the European Commission. Excluded from this commitment are:

- nuclear items (weapons, propulsion systems);
- products already subject to the EU Supplies Directive;
- warships;
- toxic and radioactive agents;
- cryptographic equipment.

Although WEAG is committed to open up the defence markets to European competition, the basis of such competition is not expected to be purely commercial in nature. The final

4 WEAG membership is the same as that of its precursor, the IEPG: it comprises the 10 WEU members plus Denmark, Norway and Turkey, with Austria, Finland and Turkey as observers.

objective is the strengthening of the European industrial base. To this end, the impacts on the defence industrial capabilities of "Developing Defence Industry" (DDI) countries are taken into account through the consideration of "juste retour" and technology transfer issues.[5] WEAG decisions are not legally binding; and their application relies on the political will of WEAG members to accept them.

Although WEAG's work has helped national defence procurement processes become more transparent, progress in other fronts has been very limited. WEAG was supposed to be a transition body to negotiate the establishment of an European armaments agency. Yet, there were severe differences in the political agendas of the WEU and EU member countries and progress towards this objective was negligible.

Lack of progress induced France and Germany to create and independent organisation on the basis of new cooperation principles. The "Baden-Baden principles", at they are known, establish:

1. the abandonment of calculations of "just-retour" for every project, in favour of a global balance to be achieved over several programmes;
2. the creation of integrated transnational teams at both government and industrial levels to manage joint international programmes.

On the basis of these principles the two countries created OCCAR (Organisation de Coopération Conjointe en matière d'Armement) in November 1996. The UK and Italy have since joined. OCCAR's main purpose is the management of collaborative projects, and is now being seen as the possible precursor for the European Armament Agency. OCCAR already manages a number of international collaborative programmes, but it does not have the legal capacity to grant contracts.

Almost in parallel with the creation of OCCAR, WEAG defence ministers signed in December 1996 the MoU for the creation of the Western European Armaments Organisation (WEAO). The objective is, again, to provide an evolutionary route towards the European Armaments Agency. WEAO has become the first European armaments body with international legal identity, and it has the capability to place contracts. Yet, its range of activities is still very limited.

3.2.4 "Dual-use" and Article 223

The diffusion and increased awareness of "dual-use" technologies is bound to confuse the application of Article 223. It is widely acknowledged that there is a decrease in the amount of "specialised" parts and components, and machinery "exclusively conceived" for defence production purposes as defined by Article 223. As military production becomes more reliant on commercial technologies there is more scope for intra-European trade limitations that are imposed on the grounds of security to have an adverse effect on the conditions of competition in the common market for commercial products. This is an outcome that is explicitly precluded in the text of Article 223. It is in this context that the Communication on *The Challenges*

5 In Europe, the term "Defence Developing Industrial" nations (DDIs) has often been used to refer to countries that, despite having sizeable defence expenditures, cannot make commensurate investments in their defence industries, mainly because of limited industrial capability. The term is often used in official documents and reports, although it has never been officially defined. Neither have DDI countries been officially determined, although they are usually understood to include Portugal, Greece and Turkey. The "juste retour" principle establishes that in joint international projects the distribution of work among participating countries should reflect their financial contribution to the project.

facing the European defence-related industry expresses hopes that, in contrast with past practices, Member States will refrain from slack interpretation of the exemptions authorised under Article 223 (European Commission 1996, p. 14).

So far, there is still little support for the deletion of Article 223. Many in industry still support it as the only mechanism available to "guarantee reciprocity in dealing with third countries' defence industries" (Titley 1997, par. 22). The European Parliament in its Resolution (A4-0076/97) on the Commission Communication,[6] stated that the article should not be deleted until a common foreign and security policy has been "established". However, it must be stressed that Article 223 cannot be construed as an absolute barrier to the gradual construction of an European market for defence-related products; particularly as dual-use technologies and policies become increasingly common.

3.3 Defence procurement in Europe: National outlines

The approach to defence procurement and defence standardisation among European countries varies widely. Much of this variance is in accordance with the degree of involvement in defence production. The scope and detail of procurement and programme management practice will not be the same in a large country that develops and produces a variety of technologically advanced defence systems, as in a small country where defence-industry activity is limited to support and maintenance tasks.

Throughout this Report, we will make a distinction between three main groups of EU countries:

1. ***Major producers*** - France, Germany, Italy, Sweden and the UK. This group of countries has significant capabilities in defence research, development and production, extending from component production to systems design and assembly, and accounts for ca 90% of total EU total defence production (European Commission 1996).

2. ***Intermediate producers*** - The Netherlands, (Norway) and Spain. This group includes countries that are minor defence producers, but nevertheless have substantial research and production capability in certain niche areas. Intermediate countries are active participants in international arms development and production programmes, although usually they play a subordinate role in international consortia and joint ventures. Intermediate countries are more significant as customers for defence products than as producers. NOTE: Although not a member of the EU, Norway has been included in the discussion of procurement systems (below) because it is a member of the WEU.

3. ***Minor producers*** - Austria, Belgium, Denmark, Finland, Greece, Ireland, Luxembourg, and Portugal. This group includes countries some of which have small defence-related industries that are involved mostly in support and maintenance, production activities being limited mainly to mature technologies, or on very specialised niche components. Others, like Ireland and Luxembourg, have no defence industry of its own. All of these countries are significant primarily as procurers of defence technologies from other countries.

6 Voted by the Plenary on 15 May 1997.

3.3.1 Major producers

The United Kingdom

Overview

British defence procurement has undergone a series of important reforms during the past decade. Before 1985, the Ministry of Defence acted as prime contractor for the systems it required. By playing a systems integrator role, it would develop systems in-house and contract out their manufacture. With a higher priority granted to requirements over costs, many contracts were awarded on a 'cost plus' basis, and little cost control existed within the MoD offices and agencies involved in project development and management. A series of reforms starting in the mid 1980s have had the effect of transferring risks from the public customer to industrial suppliers.

Structure

The main office responsible for defence procurement is the Procurement Executive (PE). The PE aims to fulfil the needs of the Armed Forces by providing effective, reliable and supportable equipment delivered in time, and providing good value for money. To this end the PE exploits competition in order to maintain an understanding of project costs and evolution. The PE responds once an "operational requirement/priority" is set out by a sponsor in the Armed Forces. It then assumes responsibility for procurement and budget management. The PE was streamlined in 1993, and is now organised into business units.

Procurement reforms

The initiatives of the mid 1980s meant a profound restructuring in the nature of defence acquisition. The first set of significant reforms was introduced after Peter Levene was appointed Chief of Defence Procurement in 1984. They resulted in a transfer of risks inherent in complex product development from the government procurement organisations to industry:

- Prime contractorship was moved to industry. In a number of cases, instead of defining its equipment requirements in detail, the Procurement Executive has used "Cardinal Point Specifications" (CPS) in which only broad performance terms are defined, the solution being left to the bidders.

- Contracts were to be awarded on the basis of competitive, fixed-price agreements, and payments linked to performance milestones.

Although the MoD argued that the new procurement systems generated substantial savings,[7] independent analysts have suggested that "the MoD has not been successful in indemnifying itself from cost overruns, even on those projects cited as providing clear savings" (Dunne and Schofield, 1995). Contracts are often renegotiated, and specifications subjected to substantial changes, thus making it difficult to assess the nature and extent of cost overruns. Besides, the new contractual guidelines and philosophy generated an adversarial relationship between defence customers and industrial suppliers. Reliability problems and slippage in the delivery dates continued.

7 The MoD has estimated the savings at about £1billion per year; however, it has bee pointed out that such savings may reflect poor cost estimates rather than performance improvements and that they have been obtained mainly in the purchase of small items (components and sub-systems) rather than in large projects (de Fraja and Hartley 1996).

Further reforms have been introduced throughout the 1990s. Approval procedures were streamlined, emphasis was placed on reliability and life-cycle costs, and the NAPNOC principle (No Acceptable Price NO Contract) was established for those projects that could not be opened up to competition. Under previous non-competitive arrangements the price was often agreed after the work is completed. NAPNOC was introduced in 1992, and aims to agree a price before the contract is signed, or by the time a quarter of the work is completed. The agreed NAPNOC price should reflect what the work would cost in a competitive environment. An integrated pricing report provides the basis for negotiations and is based on the contractor's own cost estimates and comparisons of industrial efficiency and historical cost data.

While the reform of the mid 1980s stressed the benefits of competition and relied on market responses to provide the best solutions to defence customers, the long-term impact of procurement decisions is now being given more consideration. Soon after being elected in 1996, the Labour government launched a major "Strategic Defence Review" and an associated "Smart Procurement Initiative". As part of the latter, a comprehensive study of defence procurement practices has taken place, recommending further reforms to improve the working relationship between customers and suppliers, with emphasis being placed on building partnerships with industry. The Smart Procurement studies have recommended a new "Through-Life Systems Approach", allied to the implementation of commercial practices in defence procurement. Besides, in the programme stages proposed, the applicability of COTS will be considered at the very beginning of a programme (in the Project Initiation stage).

Contract and project management principles

As a direct result of the Levene reforms, the number of cost-plus contracts declined to negligible levels by the early 1990s. The number of competitively placed contracts has increased from under 50% in the mid 1980s to nearly 70% in the mid 1990s. Although procurement processes are formally open and competitive,[8] there are still a substantial number of non-competitive contracts. Between 1993 and 1996 almost 50,000 contracts representing 23% of the value of all MoD contracts were granted on a non-competitive basis (National Audit Office 1994). About 90% of MoD equipment investment is spent with British companies.[9] This reflects the depth of the British defence-related industries, but also the implicit interest in maintaining and developing state-of-the-art defence-industry capabilities as a leading high-technology activity in the national economy.

In 1990 a new project management strategy was defined, its main effect being the delegation of accountability and budget allocation authority to project managers. The project manager is appointed during project formulation, and is responsible for the success of the project, holding responsibility for all aspects of the procurement of a system within the authorised budget. As a consequence of the Smart Procurement Initiative described above, project management principles will be adapted to comply with the new "through-life and programme partnership approaches.

8 The only exception is shipbuilding, where it is MoD policy to buy only from British shipyards.

9 Yet, this represents a substantial growth of imports if compared to the early 1980s, when only about 5% of British defence equipment was imported.

Germany

Overview

The German armaments policy is framed by German membership of the EU and NATO. Germany has not endeavoured to reach levels of self-sufficiency but rather to define capability levels enabling German defence forces and industrial firms to play a role in defence co-operation with its NATO allies.

The German Constitution establishes a clear separation within the *Bundeswehr* between the Armed Forces and the civil administration, which is responsible, among other things, for supplying the equipment requirements of the Armed Forces. Therefore, defence equipment is not procured separately by the branches themselves, but by an Armaments Agency.

Structure

The Armaments Agency is divided into three sets of organisations:

1. Directorate General for Armaments, Ministry of Defence. The Directorate is responsible, among other tasks, for the planning and control of the development and procurement of military equipment.

2. The Federal Office for Defence Technology and Procurement (*Bundesamt für Wehrtechnik und Beschauffung* -BWB). The BWB is the central procurement service, responsible for development, procurement, testing, quality assurance and logistics support of military materiel. It is an independent civil organisation operating under the control of the Ministry of Defence. Headquartered in Koblenz, it has an office in Berlin responsible for the contract administration of materiel that had belonged to the former East German Army.

3. The research laboratories and technical centres subordinated to the BWB, including two facilities of the Naval Arsenal involved in maintenance work for the Navy.

Contracting and project management principles

Defence contracts are normally awarded on a competitive basis, and are open to foreign bidders. However, Germany recognises the importance of retaining a viable industrial base "without the loss of technological capabilities and skills essential to national security" (Koerner 1994). In November 1992, the Federal Ministry of Defence, in consultation with industry, outlined the areas in which key industrial capacities had to be maintained. These included "the manufacture of aircraft, helicopters, tanks, submarines and modern ammunition as well as electronic components for modern weapon systems" (Guddat 1994).

New procurement procedures have placed increased emphasis on life-cycle costs, and the use of off-the-shelf components and systems. In their procurement decisions, the responsible agencies must follow a set of basic guidelines:

- Given budget restrictions, a more cost-oriented approach is required, economy must be a predominant consideration from the early design phases.
- Commercial-off-the-shelf products will be used as a rule.
- New developments, even at the component level, should be treated as exceptions requiring justification and special approval.

- When starting new developments, international co-operation is preferable to national projects.
- Contracts should be awarded on a competitive basis, and exceptions should be justified.
- Contracts should require specific deliverables at fixed prices.
- In the maintenance phase, commercially available items should not be subjected to central spare parts provisioning.

Defence project management has also been reformed. In the past, a project would have three management representatives:

- the systems manager in the Directorate General of Armaments who was responsible for carrying out the project; including planning, control and supervision;
- the project manager in the Federal Office of Defence Technology and Procurement (BWB);
- the system office in the service office of the chief of staff.

This structure has been simplified, and management will be performed at a single level by two management representatives:

- the project manager at BWB will be responsible for carrying out the project;
- the project office in the service office will be responsible for the military elements of the project.

The procurement of a new weapons system is divided into several sequential stages, the end of each phase requiring a document setting out the basis for the following phase.

Procurement reforms

The changes in the project management structure described above are part of a broader set of reforms to be completed by the year 2000. The reforms aim at avoiding duplications and streamlining processes, making the development and procurement cycles shorter. The BWB is to cut some 4,000 of its 17,000 staff, and, at the same time centralise procurement related decision-making within the BWB and its subordinate agencies. BWB will become entirely responsible for the central management of weapons systems programmes, and for the handling of contracts and prices.[10]

The central ministerial offices at the Directorate General of Armaments will no longer be directly involved in the management of specific projects, but rather on the planning, control and supervision of all projects. It will also perform central functions in international projects. Similarly, a range of offices in the Armed Forces have also transferred their tasks to the BWB. Of special relevance to this Report, quality assurance responsibilities have been reorganised: the office of the Directorate of Aeronautical Equipment Qualification for Federal Armed Forces has been dissolved and its responsibilities integrated into a BWB technical centre (WTD 61) in charge of military aircraft testing and type certification.

10 Testing and evaluation will take place at the technical and research centres.

France

Overview

The French approach to defence procurement differs substantially from that of Britain and Germany. The formal responsibilities of the French State have traditionally extended to the maintenance of a defence industrial base, and the management of its international links. With these objectives in mind, the goals and management of defence procurement are more extensive and pervasive than in other European countries.

The agency in charge of arms development and procurement is the Délégation Générale pour l'Armement (DGA). Created by General de Gaulle, the DGA became the central element of French defence technology and industrial strategy. The DGA is deeply involved in all aspects of defence systems development and production, stretching from generic defence-industry strategy issues to project definition and programme management. As a result, the DGA plays a key role in the French defence-industry system, acting as the axis of a tight network of firms and government research establishments. The close relationship between DGA and industry is also reflected in the low level of French defence imports. In the early 1990s France purchased only 3% of its defence equipment from other countries (National Audit Office, 1994).

Structure

The DGA is part of the Ministry of Defence and its head has the same rank as the commander-in-chief of the Armed Forces (Serfati 1997). With a staff of over 49,000, the DGA is organised into several directorates including 'programmes, acquisition methods and quality', 'arms systems', 'industrial co-operation', 'expert centres and testing', 'naval construction', and 'aircraft maintenance', among others. It has the following main missions:

- to prepare and manage weapons programmes throughout their life-cycle (i.e.: from design to disposal);
- to evaluate proposals from industry, test prototypes and certify equipment;
- to monitor and promote international co-operation and defence exports;
- to produce and maintain naval equipment, and to maintain aircraft;
- to engage in scientific and technological research.

The DGA is therefore involved in every stage of a product's life-cycle, including the establishment of operational requirements. Not only does it define the policy framework (from general orientations in armament policy to the design of requirements for specific weapons systems), but it is also involved to varying extents in research, production and maintenance through its various establishments.[11]

Contracting and project management principles

The French understanding is that military equipment falls under article 223 of the Treaty of Rome and it is therefore not subjected to the EU competition rules; this understanding is applied to the majority of DGA contracts.

French public procurement practice allows for a variety of cost/price arrangements. Although fixed prices are the rule (sometimes adjustable to take into account changing economic conditions), provisional price and cost-based contracts are allowed in some cases.

11 The main French military shipbuilders, the Directorate for Naval Construction is part of the DGA.

The methodology for the DGA's management of an armament programme is laid out in a series of formal instructions establishing, *inter alia*:

- the main programme management specifications (RG Aéro 00040);
- general instructions on budgetary and programme authorisation procedures (IM 31475);
- the sequence of a weapons programme (IM 1514);
- instructions for the management of weapons programmes (800 EMX, 60 800 DGA/DPA);
- statements of military characteristics (336 EMA/PPE-2).

During the design stage the trade-offs between characteristics and costs is established. The approach to costs has been radically altered since 1994. Previously, the objective was to obtain prices that were both competitive and suitable for the firm. The 1994 White Book stated that costs increases were becoming unbearable, and granted priority to cost reduction objectives. This meant setting up competitive procedures and structures and a complete revolution in defence-industrial policy (Hébert and de Penanros 1995).

Procurement Reforms

The central role of the DGA is being reassessed. The 1994 White Book and the report from the Commissariat du Plan on the future of the defence industries (Commissariat Général du Plan 1993) almost ignored the DGA when addressing defence-industrial issues. If French defence production is to react to current economic pressures by becoming more open and European-oriented, the scope of the DGA will likely be progressively constrained, limiting its role to that of a contracting authority (Fontanel and Hebert 1997).

The DGA has been subjected to important reforms throughout the 1990s. The last reorganisation was implemented in January 1997 and resulted in a new structure of directorates, clearly separating regulatory and operating functions (Délégation Générale pour l'Armement 1998). New principles as the progressive establishment of customer/supplier relationships within the DGA are leading to a process of internal "contractualisation" and to a progressive improvement of cost control procedures.

Cost reduction in the development, production and operation of equipment has also become a paramount consideration in procurement policy. It is now officially recognised that to reduce costs it is necessary to:

- simplify the equipment operational requirements;
- simplify technical definitions;
- reorganise the means of production and increase industrial productivity;
- use civilian products;
- eliminate unnecessary military-specific standards;
- introduce multi-year contracts (Délégation Générale pour l'Armement 1998).

There is also a policy to harmonise procurement policies and project planning methods and tools across the DGA. New project management methods as used in industry will be introduced. The sequential process of procurement - starting with the definition of an Operational Requirement by the General Staff, followed by the definition of system requirement by the DGA and finishing with the development and production of the system by industry - is to be substituted by a concurrent process. For every arms programme, an integrated team will be set up comprising DGA specialists, armed forces staff, and industrial collaborators. The team will work together on the project. This strategy is similar in approach to the options being considered in the UK under the "Smart Procurement" initiative. Finally, the adoption of commercial standards rather than military specification and standards will become the rule rather than the exception.

Italy

Overview

The organisation of defence procurement in Italy is undergoing a substantial change, moving away from its previously decentralised structure. However, and partly because of political difficulties, the pace of reform has been slow. A similar situation extends to related areas like contracting procedures and mechanisms, which often remain long and complicated.

Structure

The Italian defence procurement system was characterised by the lack of a strong centralised authority (Graziola et al. 1997). The Army, the Navy and the Air Force have General Directorates for Procurement responsible for procurement in their branches. These Directorates report to their service chiefs of staffs. The General Secretary of Defence (GSD) played a co-ordinating role but its influence on the decisions of the different Directorates could be tenuous. A reform process has been launched with the objective of strengthening GSD's co-ordinating role, and placing the Directorates for Procurement under its direct control.

Contracting and project management principles

In Italy defence contracts are subjected to procedures that are different from other public procurement. Defence contracts procedures are divided into more phases than normal public contracts, and are ruled by specific norms. Consequently, contracting procedures are protracted, especially because of the "consultative" procedures established in the norm, which can involve different offices depending on the object of the contract. There is however an urgent procedure (*"procedura in economia"*), to be used in special cases and within certain budgetary limits.

It has been argued that the length of the purchasing processes have been extended even further because of the harmonisation of national procedures with EU rules.

Procurement reform

A study from the Italian Ministry of Defence has proposed that all defence contracts be ruled by a single norm, which would also be harmonised with the procedures of partner countries. This would require substantial organisational reforms, but in the meantime some of the procedures are already being simplified.

The suggested reforms extend to the pricing of contracts. At present the rule is to issue fix-price contracts, except for contracts which are executed periodically or continuously over a period of time. The present reform proposals suggest that price revisions be reintroduced for all contracts involving periods of execution of over 730 days.

Sweden

Overview

Sweden's non-alignment policy is partly responsible for the development of a substantial domestic defence-industry capability. The Swedish government has worked to maintain a level of defence industry competence to secure supply in areas of vital importance, and to develop and maintain the capability to participate in international projects. There is a recognition that a domestic industrial capability can only be maintained through international collaboration, but a strong preference for in-country development and manufacturing is still present.

A characteristic of the Swedish system is the pervasive role of the Defence Materiel Administration (FMV), the government agency in charge of defence procurement. Although it is sometimes likened to the French DGA, FMV's responsibilities fall well short of running production facilities as with its French counterpart. However, FMV is still remarkable among European defence procurement organisations for the extent of its involvement in project design and development.

Structure

In Sweden, individual defence agencies with different functional responsibilities enjoy substantial independence. The FMV, the Ministry of Defence, the Armed Forces and the Defence Research Establishment are separated from each other. Consequently, the Swedish MoD is very small with a staff of only 130, while other agencies are much larger (FMV has a total staff of about 2600).

FMV is in charge of purchasing and maintaining equipment and supplies for the Swedish Armed Forces, as well as being engaged in R&D, testing and inspection of equipment. The FMV also draws detailed procurement plans on the basis of the long-term requirements plans of the services.

The FMV was subjected to a major restructuring in the early 1990s that resulted in internal reorganisation and the emphasis placed in the establishment of a "customer-supplier relationship" between FMV and the armed forces. The FMV is an independent organisation, and therefore unusual among procurement agencies. It sees its role as establishing a link between industry and the armed forces. FMV is involved in hundreds of technological fields, from advanced electronics to clothing.

Within FMV a group of product-oriented directorates (including missiles, aeronautical systems, ships and naval materiel, electronic systems, combat vehicles, etc.) are engaged in the development of systems jointly with industry. FMV has developed a close relationship with local industries, and FMV and industry researchers commonly work together in R&D projects.

Contracting and project management principles

FMV is conscious of the effect that project timing and schedules may have on the domestic defence industry of a small country like Sweden. Typically, it prefers to spread large projects over longer periods in order to smooth the cycle of demand on production facilities which are not very large.

Although contracts are awarded on the basis of open competition, the Swedish Government has made exceptions because of political and security considerations or to address possible economic difficulties in specific regions. The strong preference for domestic manufacturers[12] involves the payment of acceptable cost premiums; these premiums are determined in advance and laid out in the contracts. Because of a collaborative agreement among Nordic countries,

12 About 80% of FMV's extra-mural investment is placed with Swedish-owned companies.

Sweden publishes a monthly bulletin in English listing future purchases, like those published by members of the Western European Armaments Group.

As part of a cost-cutting exercise FMV developed new methods of financial control, and have introduced customer-supplier relationships based on specific costed assignments, both with their clients in the Armed Forces, and internally across different FMV directorates.

3.3.2 Intermediate producers

Netherlands

Overview

Dutch government policy on the defence industry was laid out in the report *De Nederlandse Defensie-industrie* published in November 1990 by the Ministry of Economic Affairs, and in Ministry of Defence White Papers published in 1989 and 1991. The Netherlands government interest in defence-industrial matters emerges from industrial development considerations rather than any security concerns. It is therefore the Ministry of Economic Affairs, through its Commissariat for Military Production and Government Procurement, which is involved in stimulating the technological development of a limited number of defence-related sectors. The Netherlands attaches maximum importance to European co-operation, and special efforts are made to find project partners on a bilateral basis within the EU (Ministry of Defence of the Netherlands 1992).

Structure

Equipment procurement decisions are the responsibility of the Directorate-General for Materiel at the Ministry of Defence and the Directorates of Materiel for the three services. The Directorate-General formulates the general procurement criteria, and checks that this policy is applied correctly. The actual procurement is carried out by the Directorates of the three services, with the exception of real estate, which is procured and maintained centrally by the Directorate General.

Contracts for major projects are processed by a Defence Contract Review Board, to ensure consistency with commercial practices. Major projects must also receive the approval of the Secretary of State at every main stage of the procurement process.

Contracting and project management principles

Defence materiel policy stresses competition, with the main criteria for awarding a contract being price, quality and delivery time. Another concern is to ensure that Dutch industry is involved as much as possible. However, domestic industrial participation is the concern of the Ministry of Economic Affairs, not the Ministry of Defence. Domestic participation is linked to international co-operation, which is preferred because its positive effects on standardisation and interchangability of materiel, and on unit costs.

The procurement of defence materiel with an estimated value over 5 million guilders follows a specific Defence Materiel Selection Process (DMP). The process, which will be reassessed in the year 2000, starts once the armed forces (Chief of Defence Staff) have established an operational requirement. This is followed by a four-stage process leading to the selection of system and supplier. For larger weapons platforms, the process is centralised with the Minister or the State Secretary taking responsibility for decisions. Smaller projects are conducted by the services. Every year the projects are announced to Parliament.

At an early stage in this process, the Ministry of Economic Affairs will discuss with the domestic industry the possibilities for domestic supply, and it may decide to assist domestic firms so they can present an attractive bid to the MoD. Any company that wishes to do defence business in the Netherlands has to be included in an index of suppliers at one or more of the contracting authorities. To ensure consistency with commercial processes contracts for major projects are reviewed by a Defence Contract Review Board (Dirksen 1996).

The Netherlands demands offsets when large defence orders (over 5 million Dutch guilders) are placed abroad. The Ministry of Economic Affairs, in consultation with the Ministry of Defence, determines the type of offsets to be obtained and negotiates and administers them.

Procurement reform

Major changes in procurement policy and procedures are not expected. However, the Netherlands has started work on the introduction of Electronic Commerce in defence purchases. Some pilot applications are being tested and it is expected that by the year 2000 new systems will be implemented, with a direct effect on the present procurement procedures.

Spain

Overview

After years of relative neglect, the Spanish government developed the elements of a defence-industrial policy during the 1980s. The use of defence demand to support domestic defence-industrial concerns was seen as a means to develop high-technology capabilities. To this end, the main responsibility for the development of defence procurement policies fell in an office of the Ministry of Defence - the Directorate General for Arms and Materiel (DGAM). It was acknowledged that domestic industrial capabilities felt short of providing the necessary range of skills to supply a modern armed force, and the new approach to defence industrial policy was accompanied by a attempt to participate in large numbers of international (mainly European) arms development and production programmes.

Budgetary limitations thwarted many of the expectations that the new defence industrial policies had created, and procurement policy during the 1990s has been more subdued in its objectives. However, the main policy elements set up in the past decade have endured. The concentration of responsibility for procurement policy within the Ministry of Defence, and the preference for domestic suppliers combined with the support for Spanish participation in international programmes continue to be main elements of Spanish defence procurement policy. Lower level administrative and project management practices have evolved more slowly; despite a legal framework supporting open competition and efficient management, competition is limited and project management still conducted mainly on an *ad-hoc* basis.

Structure

The Minister of Defence is ultimately responsible for all new contracts, but delegates most of this responsibility to other Ministry and Armed Forces officials. Contracts over a specified amount must be approved by the Council of Ministers, and the Minister retains control over important materiel purchases, specially when involving the acquisition of new large defence systems. Overall responsibility for procurement policy falls on DGAM; this directorate prepares, proposes, develops and co-ordinates defence procurement policy, and has also responsibility for executing some procurement and research programmes, as well as holding general responsibility for standardisation and certification tasks.

Contracting and project management principles
In principle, Spanish defence contracts are regulated by the same law applicable to all State contracts. A new regulation (Contratos de las Administraciones Públicas) came into law in 1995, with the main objective of streamlining procedures. From 1986 onward, Spanish public procurement legislation has complied with EU regulations.

However, the exclusion allowed by Article 223 has been interpreted in a generous manner. Spanish officials understand that the list of products covered by this Article is not exhaustive, and consider other unlisted products as exempted war materiel (Miranda 1987). In practice, the Spanish Ministry of Defence has exerted much control on whether a contract will or will not be subjected to European competitive tendering.

There are several different kinds of contract procedures in use by the Ministry of Defence. In principle, public tendering is mandatory and calls for bids must be published. Yet, there is a possibility also to award 'Direct Contracts' (Contratación Directa). This is an 'exceptional' procedure in which there is no public notification, the customer directly approaching the supplier and negotiating the terms of contract. There is also a procedure that allows limited competition - direct contracts with requests for proposals (contratación directa con promoción de ofertas). Present regulations foresee several circumstances under which direct contracts can be allowed, including security considerations, foreign purchases, etc. Direct contracting is still the main procedure through which defence contracts are awarded.

Formally, contracting procedures in Spain use fixed price contracts, although a degree of flexibility is introduced by the specific contracting rules. First, long-term contracts may include clauses for price revision, in which complex formulas are applied to align contract prices with the broad evolution of general prices and costs. Also, the contract can be modified to introduce changes in both specifications and prices. Within certain limits, the contracts that have not yet been performed can be subjected to revision. In the past, cost overruns have been absorbed through such changes in the initial contracts (Molas-Gallart 1992, pp. 123-125). In relation to the drafting and monitoring of project specification, the responsibility on the client side falls traditionally on with the purchasing Service, usually at Staff Headquarters, even when the contractual responsibility for the project falls on Ministry of Defence departments.

Norway

Overview
Norway is the main European NATO member that is not part of the EU. Significantly, it is also an associated member of the WEU, the organisation tasked with elaborating and implementing Union decisions with defence implications. This associated membership enables Norway to participate in WEU-EU discussions. Also, it brings Norway into the activities of WEAG, the main body responsible for European defence-industrial co-operation within the WEU. Also, Norwegian forces have long co-operated with those of other EU countries, and its industry is active in many European defence industry projects. We have therefore considered it appropriate to include a description of Norwegian defence procurement policies in this report.

Structure
The largest defence programmes (about 30) require parliamentary approval, not only for their initiation, but also for any changes in the overall level of funding required. The management of contracts on the customer side falls to different offices depending on the nature of the project.

Equipment contracts are concluded and managed by the Material Commands of the branches, or by the Norwegian Defence Communications and Data Services Administration.[13] Contracts are also placed at other levels of the organisation, from Defence Headquarters, to district commands, and even individual units.

Contracting and project management principles
The Norwegian Ministry of Defence states that "Norway's defence investment must, as far as possible, be designed to promote Norwegian industry and the advancement of technology through R&D" (Royal Norwegian Ministry of Defence 1997). Because of the increased complexity of weapons systems and the limited capabilities of the Norwegian defence-related industries, the Ministry of Defence recognises the need to place defence contracts with foreign companies, but stresses that it will continue to require offsets in the case of major contracts. Norwegian defence customers can also reserve the right to approve individual subcontractors, or to place contracts for sub-systems and components independently from the main system contract; all to promote the participation of Norwegian subcontractors when a large contract has been placed with a foreign company.

Usually the main contractor is responsible for the management of the whole project, including the relationship with subcontractors (with the possible exceptions mentioned above). There is however a Norwegian Standard (NS 3431) defining "overall contracts" for building and construction, in which the contracting authority may also manage subcontractors. However, "overall contracts" of this nature are seldom used.

The general rule is that contractors are placed on a competitive basis and they are publicised through different avenues. Like other WEAG members, Norway publishes details in a monthly bulletin of forthcoming defence contracts over ECU 1 million.

In general defence purchases are ruled by the general "Regulations Concerning Government Procurements" (REFSA, k-0502). The regulations permit three alternative purchasing methods:

- competitive tendering;
- negotiated purchasing;
- direct purchasing.

The conditions to use these methods are laid out in the regulations, although the general rule is that competitive tendering should be used. A further set of regulations, "Provisions Concerning Procurements for the Armed Forces" (BAF), based on the general government procurement regulations, contain more detailed provisions for the procurement to the Armed Forces.

Regulations for public sector procurement have been harmonised with those of the EU since the European Economic Area (EEA) Agreement came into effect in January 1994. However, article 123 of the EEA, reproduces the exclusions for defence products allowed under Article 223 of the Treaty of Rome.

13 For contracts over NoK 50 million, Ministry of Defence approval is needed both for the tender and for the placement of the contract.

Procurement reform

Procurement procedures may be affected as a result of project LOGSTRAT, a wide initiative aimed at developing new materiel management strategies to reduce life-cycle costs. There have also been formal statements on the need "to co-ordinate the development of expertise in the defence industry with the efforts being made to promote levels of expertise throughout the civil industrial sector" (Royal Norwegian Ministry of Defence 1997).

3.3.3 Minor producers

As Ireland and Luxembourg have no significant indigenous defence industries, and as that of Portugal is very small, the discussion in this section has been limited to Austria, Belgium, Denmark, Finland, and Greece.

Austria

Structure

Procurement responsibilities are not centralised. After military requirements and specifications have been drafted, a technical department manages the purchasing process, including writing the call, processing the offers and selecting the best bid.

Contracting and project management principles

Since joining Europe in 1994, Austria has had to adapt its public procurement procedures to EU legislation. However, only about 15% of total defence procurement expenditure is disbursed through contracts ruled by this general legislation. The law regulating federal purchases permits exceptions for contracts under a certain threshold level and for goods essential for the protection of national security interests. This "exception" is applied to a large proportion of Austrian defence purchases, which are instead ruled by an Austrian "Önorm" standard established in 1957 (Corrieri 1996).

Contracts are awarded on a competitive basis through open or restricted tenders. In some cases a direct negotiation with a potential supplier, without previous competition, is allowed.

Belgium

Overview

Although the Belgian defence-related industry is very small in size and controlled by foreign industrial groups, a substantial share of the equipment purchased by the Ministry of National Defence (MND) is produced domestically.

Structure

Regional ministries, and the Federal Ministry of Economic Affairs have noticeable influence on the contracts placed by the MND, mainly as a consequence of a complex system of economic and technological schemes tied to military sales (De Vestel 1997).

Procurement reform

There is an increasing trend in Belgium procurement practice to favour commercial off-the-shelf products in procurement decisions.

Denmark

Overview

Danish defence procurement practice is to look for "best value for money". When a foreign supplier is selected, and for contracts over a value of DKK 25 million, the Ministry of Business and Industry will negotiate offsets in the form of industrial co-operation agreements.

Structure

Denmark does not have a central defence procurement organisation. The contracting authorities for defence acquisition are the different "Materiel Commands" of the armed services branches. General policy matters concerning defence procurement are dealt with by the Materiel Division, an office of the Defence Staff.

The Ministry of Business and Industry deals with industrial offsets, which are often required when buying foreign materiel.

Contracting and project management principles

Most defence contracts are awarded on a fixed price basis; although in projects of long duration price revisions may be allowed. Calls for tenders are usually issued to a limited number of companies.

Danish defence materiel acquisition policy states that systems should be selected, as far as possible, from already developed systems that are already in production. It is preferred that the systems have already been introduced in other NATO countries. With the exception of warships, it is Danish policy not to develop equipment that is specific to Denmark.

On the basis of a set of "basic military requirements" establishing performance characteristics, the Materiel Commands will carry a market survey and issue an invitation for bids. The contracting authority will then forward a recommendation to the Chief of Defence containing details of the bids received. Operational contracts are then authorised. In the case of procurement investments, the Chief of Defence will make a recommendation to the Ministry of Defence, who will prepare a request for funding to be negotiated with the Ministry of Finance, the Ministry of Business and Industry, the Defence Materiel Committee and the Parliament Financial Committee.

The Defence Materiel Committee is an advisory body formed by representatives from the ministries of Defence and Business and Industry, along with the Chief of Defence, the Confederation of Danish Industries and the labour unions. The Committee provides advice on Danish industrial capabilities in relation to the procurement projects under discussion. The Ministry of Finance will give approval provided the procurement fits within the existing defence budget. Once an agreement has been reached and approval obtained the Chief of Defence will instruct the contracting authority to proceed with the contract.

Military equipment that is considered subject to Article 223 of the Treaty of Rome is subjected to the rules agreed by WEAG, and calls are published in a monthly bulletin. When the contract value does not exceed the WEAG threshold (ECU 1 million) defence acquisition follows the rules set up in the Danish Procurement Regulations, a document with restricted circulation.

Finland

Overview

Historically, Finland has been a staunch follower of non-alignment policies. It is not a member of NATO and has followed a balanced East/West procurement strategy, buying both Russian and Western arms systems.

Contracting and project management principles

Finland considers that there are several key technologies and industrial capabilities that must be kept in national hands, particularly:

- electronics capabilities to maintain and develop C3I systems;
- ammunition production and R&D.

Finland is member of a collaborative agreement between Nordic countries, and as a consequence publishes a monthly bulletin of forthcoming defence procurement calls, similar to those published in the WEAG bulletin.

Greece

Overview

Defence procurement in Greece has recently been reorganised into a more centralised structure. In terms of general guidelines, the system continues to be geared to the support of fledgling defence industrial capabilities.

Structure

In the mid 1990s, the whole structure of the Greek Ministry of National Defence was reorganised. As a result, responsibility for defence procurement programmes passed from the General Staffs of the different services to a new central Armament General Directorate (AGD). The new AGD started its operations in 1996 and is described as an Agency of the Ministry responsible, *inter alia*, for:

- the implementation of armament projects of the Armed Forces;
- the development and co-ordination of the defence industries;
- the co-ordination of military R&D and technology programmes;
- the co-ordination of the procurement of defence materiel;
- the development and implementation of procurement programmes (Rogakos 1996).

The starting point for a weapons acquisition programme is the Operational Requirement set by the General Staff. The final decision on projects is taken by the responsible government authorities after a process of discussion in which the AGD participates. Once the project is started the AGD takes full responsibility for managing its implementation. The final decisions on purchases fall on the government authorities. For particularly large projects a decision by Parliament is needed.

Contracting and project management principles

The AGD aims to provide a service to the Armed Forces and maintains close contact with the General Staffs.

Participation of domestic firms, either directly or through offset contracts, remain an important consideration when selecting a supplier. Offsets are a prerequisite for any procurement contract in which foreign currency payments exceed an established value. The Ministry of Defence has issued official guidelines establishing that offsets must be at least equal to 60% of the foreign currency part of the procurement contract. In addition, a minimum of 50% of the total offset value must be in the form of industrial work in the defence field.

Portugal

Overview and structure

Portuguese defence production is limited to light equipment, munitions, and some communication equipment. Heavy equipment is always of foreign origin.

The Portuguese government recognises the need for a profound restructuring of the Portuguese defence sector. The high levels of financial support that the defence industries were receiving were seen as incompatible with rigurous budgetary policies and unjustifiable given the real strategic value of the sector.

Since December 1996 the main Portuguese defence companies were integrated into a public holding, Empresa Portuguesa de Defesa (EMPORDEF), which controls about 90% of Portuguese defence production. The formation of EMPORDEF was seen as a step to inject "enterpreneurial rationality" in the management of the defence industries. Yet, the Government is not committed to full privatisation; rather it will select the sectors that should remain in the public sector by virtue of their strategic value. Meanwhile the financial situation of the holding contnues to be very precarious.

EMPORDEF must prepare and maintain a strategic development plan with is submitted for advice to the Ministry of Defence Srategic Council, and the approved by the General Assembly. The Strategic Council is also involved in the negotiation of offsets and other aspects related to the purchase of defence equipment.

Contracting and project management principles

Portuguese public procurement regulations have been the subject of profound reform. In March 1995 a new procurement law (DL 55/95) consolidated procurement practices across different areas, streamlined processes and brought Portuguese practices into alignment with EU Procurement Directives.

In the defence area, only the types of war materiel listed under the EU exceptions covered by Article 223, are considered exempted from the general legislation. At present, only two programmes are being carried out outside the general legislation: a purchase of light helicopters for the Army, and a programme to procure submarines for the Navy. The Portuguese Ministry of Defence is studying a new law to cover procurement procedures for such exempted materiel.

Procurement reform

Since 1993 military procurement takes place within the framework of 5-year Military Investment Plans. The plans are reviewed every two years, and provide the framework within which the yearly budgets are established.

3.4 Conclusions: trends and general characteristics

The harmonisation of defence programmes and procurement practices has been a long held objective of WEAG and its predecessor the IEPG. In November 1988 a meeting of the IEPG ministers agreed, among other measures, to align bidding and contract procedures across member-nations. It was this meeting that led to the establishment of the cross-border competition arrangements, leading for instance to the publication of the defence contracts bulletins described above. Despite these efforts the description of national defence procurement procedures presented above reveals a substantial diversity of policies and organisational procedures.

On the surface, public contracting structures are similar across the European Union. All Member States espouse the principles of fair competition, and employ similar types of public contracts (open tender, restricted tender, negotiation). Also, they generally interpret Article 223 very generously - taking it to mean that all defence materiel is exempt from EU rules. Countries normally express an official preference for domestic suppliers and some have established compulsory offset rules when dealing with foreign suppliers.

However, there are four important differences in the organisational structure of defence procurement, and in the ways individual Member States apply procurement principles.

1. *Preference for national suppliers is expressed and implemented with different degrees of vigour*. In the 1980s, for example, the UK engaged in a process to open its defence market to foreign competitors and has retained a more receptive stance towards the supply of defence materiel by foreign suppliers. The Netherlands has also maintained a relative open position justifying the support of domestic suppliers for industrial rather than security reasons. Finland has selected a number of sectors where national capabilities must be maintained. Others (like France and Norway) regard the maintenance of a broader defence-industrial base as one of the core aims of the defence procurement policy

2. *The structures of the defence procurement agencies and organisations vary considerably*. In most countries major procurement responsibilities are centralised in a ministerial department or a specialised agency; but in a substantial number of EU Member States the different armed services retain responsibility for weapons procurement, although usually with some sort of central coordination. The remits of most defence procurement agencies in the EU do not extend beyond procurement tasks as such. However, the responsibilities of the Swedish FMV and the French DGA extend to defence-industrial policy, defence R&D, and testing and evaluation. Because of their multiple responsibilities, these agencies have developed a tight network of relationships with domestic defence suppliers that go beyond purely contractual arrangements.

3. *Partly as a consequence of organisational variance, defence procurement procedures are also diverse*. The stages of a procurement process and the requirements to enter it differ from country to country. For instance, some countries require suppliers to be inscribed in a list (therefore imposing a vetting system as a pre-condition for access to the market), whereas others do not require this formality.

4. *The principles of procurement reform vary considerably from country to country, along with the extent to which reform is being undertaken*. Major defence producers like

4

SITUATION REPORT: DEFENCE STANDARDISATION

4 Situation report: defence standardisation

The above discussion has outlined the main trends in defence procurement. Most EU Member States are engaged in a process of procurement reform, although the maturity and scope of the measures they have taken varies. A common objective underlying all procurement reform policies is to make defence acquisition more flexible by increasing access to civilian sources of technology wherever possible.

There is much debate about the extent to which cost savings promised by the comparatively lower prices of civilian products will be realised. Some argue that short-term savings will be offset by long-term costs incurred as the long life-cycle of most defence systems confronts the rapid obsolescence of civilian components (more below). Long-term 'supportability' may be compromised by the too rapid adoption of cheaper commercial components.

Whatever the outcome of this debate, the resulting policies will have to be implemented through changes in the ways defence systems are specified and purchased. It is against this policy background that the present interest in the reform of military standards and specifications must be understood. The following sections describe how defence standards are defined, both by international organisations and within different EU Member States, and how defence standardisation philosophies and procedures are changing.

4.1 Defence standards: international organisations

4.1.1 The role of NATO

NATO is the main international organisation with a substantial involvement in defence standardisation. It is through NATO that most of the EU Member States become involved in the transatlantic dialogue on all defence issues, including standardisation. Since the late 1950s, NATO has promoted armaments cooperation among its members through agreed standardisation procedures.

NATO engages in standardisation activities on two fronts:

1. ***Operational and administrative*** - These standards are 'doctrinal' in nature, and govern the actual conduct of joint battlefield operations involving forces from different NATO countries.

2. ***Armaments and other materiel*** - In terms of form and function, these are the rough military equivalents of civil industry-wide standards.

Although the objectives underlying both types of standards are related, 'operational' standards are not concerned with technology as such, but rather with procedures, command structures and so forth. This Report is concerned mainly with standards in the second category, but the organisational structure of NATO standardisation activities must be seen in terms of both sets of objectives.

When NATO started to promote co-production schemes in the late 1950s, the emphasis lay on the military benefits of standardisation, mostly as expressed in terms of interoperability (Matthews 1992). NATO interest in standardisation was triggered in the first instance by the operational objective of ensuring that there was compatibility between key battlefield components and systems as produced by different members of the alliance, and that systems could operate in the same theatre without interfering with each other. The economic costs of duplication in production, maintenance and support facilities soon became additional considerations.

Currently, NATO recognises that there are four levels of standardisation, from lowest to highest these are:

1. *compatibility* - whereby two or more systems, components or procedures can function in the same system or environment without mutual interference;
2. *interoperability* - whereby different systems, components and procedures can be operated together in order to deliver a specific functionality;
3. *interchangeability* - whereby the functional and physical characteristics of selected components and procedures are equivalent in terms of performance such that one can be exchanged one for another without alteration or adjustment;
4. *commonality* – whereby systems, components and procedures are identical.

The primary NATO objective is to evolve towards interoperability between multinational forces. This requires action on all four levels of standardisation, although it should be noted that commonality is chiefly directed to procedures and doctrine. The NATO defence ministers set up in their Ministerial Guidance DPC-D(97)9 (Revised) of 11 June 1997 the following standardisation priorities:

a) commonality of concepts and doctrine (combined and joint operations, joint taks fores);
b) commonality of procedures and communication and information systems interoperability;
c) interoperability of relevant Alliance equipment;
d) interchangeability of combat supplies;

In the 1960s, when the US defence industry was absolutely dominant within NATO, standardisation came to be seen as little more than the adoption of US equipment by NATO allies (Matthews 1992). The imbalance in defence trade between Europe and the US soon became a concern in NATO, particularly among its European members. From the 1970s onwards, attempts to redress this imbalance were made both inside and outside NATO. Nevertheless, the perception of US dominance in NATO standardisation activities has endured in many quarters until today.

During the 1980s, NATO introduced a broad series of initiatives to pursue greater commonality in equipment and doctrine. In 1985, the NATO Standardization Group was created with the objective, *inter alia*, of defining a 'NATO Standardization Base' in order to identify and correct shortfalls in NATO standardisation efforts. This was the first of a series of initiatives aiming at improving the management of what had become a large activity within NATO. The following sections will describe briefly the nature of these activities, and outline the latest attempts at internal reorganisation.

NATO as a standards-setting organisation
It is NATO policy to encourage development and implementation of standardised concepts, procedures, criteria, and designs. The main principle ruling NATO standardisation activities is not dissimilar from that of national and international standardisation bodies as outlined earlier in this Report.

NATO maintains that unique NATO standards should only be developed when the requirements are not covered by existing international civilian or military standards. Civilian standards are regularly adopted for use within NATO, preferably without modifications. When selecting civilian standards, NATO applies an order of preference that is identical in most respects to that used in a European Union context:

- International standards produced by ISO, IEC, ITU or any PAS formally adopted for NATO use;
- Regional standards;
- National standards;
- PAS not otherwise specifically adopted by NATO;
- proprietary standards;

Where standards requirements cannot be met with civil standards, NATO operates its own standardisation regime and publishes standards in two main categories:

1. ***Standardisation Agreements (STANAG)***. A STANAG is formally defined as a "record of an agreement among several or all the member nations to adopt like or similar military equipment, ammunition, supplies and stores; and operational, logistic and administrative procedures". NATO members ratify and implement STANAGs on a voluntary basis. A STANAG has no authority until it is implemented by member nations. This is done by incorporating it into a national document - i.e. by referring to or reproducing a STANAG in the national catalogue of defence standards.

2. ***Allied Publications (AP)***. An AP is also an official NATO standardisation document that is adopted by NATO members for common implementation purposes. Unlike the STANAG, an AP does not need to be referred to or published in a national document. Instead, they are used 'directly' as required. APs refer to different areas of activity; for instance, the Allied Administrative Publication (AAP), and the Allied Quality Assurance Publication (AQAP).

These documents can be applied in all of the contexts outlined above - operational, administrative[14] and armaments/materiel. Depending on the context, however, different NATO bodies will be involved in the standardisation process.

Responsibility for operational standardisation falls on NATO'S Military Agency for Standardization (MAS), reporting directly to the Military Committee. MAS is also responsible for the promulgation of all NATO standards. There are at present over forty MAS committees working on operational standards, but its role in the definition and maintenance of equipment standards is small.

14 Administrative standards refer primarily to terminology.

Proposals for new STANAGs can come from any national NATO nation. The NATO group with responsibility for the technical development of standards in the relevant area would then become the sponsor and custodian of the new initiative. There is no central body within NATO with exclusive rights to approve STANAGs, although promulgation is a MAS responsibility. Approval occurs by consensus of interested countries, and, in theory, a small country could veto the promulgation of a STANAG.

Once a STANAG has been approved in its sponsoring committee, it is sent for ratification by individual NATO nations. Once sufficient ratifications have been received for a particular STANAG it is promulgated by MAS. Nations have different procedures for ratification and implementation and it is difficult to know the actual implementation status of any STANAG at any given time.

One of the principles of the STANAG regime is that STANAGs should be retained only if it can be demonstrated that they are in actual use. However, the revision, replacement and/or upgrading of existing STANAGs is a continuous task with responsibilities distributed among member countries and across different NATO committees. The problem is compounded because of limited feedback on the state of national implementation at any given time.

Reforming NATO's Standardisation Processes

This report is mainly concerned with what NATO would call "materiel standards". Most NATO materiel standardisation work is carried out under the auspices of the Conference of National Armaments Directors (CNAD) and the NATO C3 Board (NC3B). Under CNAD there are three main armaments groups[15], five Cadre Groups and a number of other specialist groups, which can identify areas in need of standardisation and launch standardisation initiatives. They are supported by specialist Sub-Groups, Working Groups, Panels, etc. made up of national experts.[16]

An example of a CNAD group playing a role within NATO's standardisation structure is the Senior Cadre Group on Standardisation of Materiel and Engineering Practices (AC/301). AC/301 was set up by CNAD to develop an effective policy and implementation programme within NATO for the standardisation of Materiel and Engineering Practices (M&EP).

There are several other committees involved in standardisation activities. In the field of Quality Assurance for instance, the NATO Group of National Directors for Quality Assurance (AC/250) develops NATO AQAPs (more below). Other NATO offices are also involved in standardisation processes, like for instance the NATO CALS Office, which is engaged in the development of common standards for the management and exchange of complex product data in electronic formats.

The complex structure of standardisation activities in NATO has led to reform initiatives, with the result of a new structure of offices, boards and committees being superimposed to the old standards-related committees. In 1991, the NATO council endorsed a new policy for standardisation, which was due to be updated in 1998. The policy aimed to clarify the responsibilities of the different NATO bodies and agencies involved in standardisation.

15 The NATO Naval Armaments Group, NATO Air Force Armaments Group, and the NATO Army Armaments Group.

16 For instance, the NC3B has eight specialist Sub-Committees.

Following a review process started in 1992, a new NATO's Standardisation Organisation (NSO) was approved on 18 January 1995. NSO comprises the following:

- AC/321- NATO Committee for Standardisation (NCS), which reports to the North Atlantic Council;
- The NATO Standardisation Liaison Board (NSLB) is an internal co-ordinating body of resident staff in NATO Headquarters representing all bodies and committees with standardisation responsibilities;
- The Office of NATO Standardisation (ONS) provides staff support to the NLSB and the NCS. The ONS mission is to be the focal point for NATO Standardisation, but it has only a staff of four. This office comprises military and civilian staff officers from both the International Staff and the International Military Staff.

It is noticeable that MAS falls outside the NSO. An attempt to create a NATO Standardisation Agency that would unite MAS and NSO was unsuccessful because of problems in bringing staff from both the military and civilian branches of NATO together into a single organisation. The possibility that International Staff (at CNAD Groups for instance) might have had to report to the Military Staff of MAS, turned out to be politically unacceptable. In consequence, the ONS role is significant in that it brings together officers from both the International Staff and the International Military Staff. Yet the influence that ONS will be able to exercise on the overall NATO Standardisation processes is yet unclear.

The overall objectives for the NSO were defined as:

- harmonisation of standardisation policies, planning and procedures;
- preparation of the NATO Standardisation Programme, updating the Programme, and monitoring its implementation;
- harmonisation of applicable standardisation matters (e.g. the Partnership for Peace programme);
- collaboration on standardisation matters with political/military organisations outside NATO;
- collaboration with civil standards organisations.

Harmonisation objectives play a central role in these objectives. Of particular importance is the development in 1997 of an overall NATO Standardisation Programme (NSP) that will provide NATO with a tool to highlight the most urgent standardisation needs. The NSP combines new top-down approaches with the traditional bottom-up processes. Proposals emerging from NATO Commanders, member countries and the standardisation bodies described above are processed in the NSP, according to clearly stated goals and objectives.

The implementation of the NSP faces many difficulties. The strengthening of top-down processes for standardisation management will not be easy to implement and may generate resistance in some quarters. So far, the success of reform initiatives has been mixed, with more progress achieved in the areas of operations and procedures than in materiel. There are several factors slowing down the process of reform:

- the complexity of the NATO standardisation processes;
- the difficulty of combining top-down with bottom-up approaches;
- the problems of dealing with different national standardisation cultures;

- the institutional inertia in a big organisation with large and long-standing standardisation activities.

All of these problems are in most respects similar to those faced by reform initiatives in the civil arena. There is broad consensus, however, that change is necessary to increase the efficiency of NATO standardisation processes, particularly as large and influential members like the United States are involved in comprehensive defence standardisation reforms at the national level. For the time being, however, NATO's approach to standardisation remains chiefly 'bottom-up' in terms of sources of inputs. This has been coupled with a complex organisational structure and great diversity in member country requirements and attitudes with respect to standards. Co-ordination problems are inevitable. Processes have been fragmented, control difficult in many places, and there has been no authoritative priority-setting process.

4.1.2 Other international organisations

ABCA

ABCA is an acronym formed by the title letters of the four member countries - America, Britain, Canada and Australia. It was created in the post-war period to develop common tactical concepts and doctrines and for the standardisation of materiel. It is split into three independent organisations, one for each armed service, each responsible only for standardisation functions relevant to its particular service.

There are considerable variations in the individual programme objectives, with the result that the three organisations have different titles and methods of operation. They publish standardisation agreements on a wide variety of topics. Some may be based on NATO STANAGs, and others may provide the basis for new NATO STANAGs. There is also a degree of informal cooperation between NATO and ABCA. ABCA provides an avenue for Australia (and New Zealand, which is represented through Australia) to respond and even have indirect input in the standardisation activities of NATO.

FINABEL

FINABEL is an international Land Service organisation headed by a committee of the Army Chiefs of Staff of France, Italy, Netherlands, Germany, Belgium, Luxembourg and the UK. The organisation was founded in 1953, and its purpose (not governed by a treaty) is to establish close contacts between armies in order to harmonise as far as possible their tactics, logistics and training. In addition, military characteristics of armaments are studied, while joint developments and trials may be proposed.

FINABEL has no authority to negotiate with a government. However, its proposals and recommendations may be communicated to a government by that government's own FINABEL representative.

Military Usage And Harmonisation Advisory Group (MUAHAG)

MUAHAG is a military user group within the CENELEC Electronic Components Committee (CECC). CECC provides harmonised European standards for electronic components and an assessment and approval service for electronic component suppliers and users. MUAHAG's Main Group comprises national representatives from the defence standardisation agencies of Denmark, France, Germany, Italy, Norway, Sweden, and the UK. The system is centrally managed from Brussels and implemented nationally by member countries in accordance with common procedures.

MUAHAG promotes the use of the CECC system for the procurement of electronic components for military applications by:

- formulating acceptable procedures for the choice and procurement of electronic components;
- receiving reports from national military procurement agencies on their experience of implementation of the CECC System in their individual countries;
- reporting to the CECC on the progress made, thus providing feedback to the appropriate working groups on any shortcomings observed in CECC Specifications, or in the national or international implementation of the CECC System;
- preparing lists of preferred electronic components for military usage.

The preferred lists draw on the CECC Register of Approvals (CECC 00 200) to the maximum possible extent, but may include other components included in European military standardisation programmes, for which MUAHAG wishes to encourage manufacturers to obtain CECC certification.

4.2 Defence standards: national standardisation procedures in Europe

4.2.1 The UK

For many years the British Ministry of Defence has followed a policy of using civil standards whenever possible. This approach was formally established when the 1982 Government White Paper 'Standards Quality and International Competitiveness' (Command 8621) committed UK Government departments, including the MoD, to support BSI in the production and implementation of British Standards. In this respect, it could be said that most of the basic reforms in military standardisation that have been sought in the United States over the past six or seven years, have been normal practice in the UK for the better part of fifteen years.

In its public procurement practice the UK explicitly takes note of the guidance on the application of Standards in contracts laid out in the European Union's Public Supplies Directive (93/36/EEC). Although this Directive could be ignored for specific military contracts under Article 223, the UK MoD considers European Standards to be the first choice for defence procurement. This is reflected in the MoD's officially declared hierarchy for the selection of standards in defence procurement (Table 4-1).[17]

[17] This hierarchy is at present under review for minor changes.

Table 4-1 The Order of Preference and Hierarchy for the Selection of Standards for UK MoD Procurement

Order of Preference	Type of Document
1	British Standards implementing European Standards of common technical specifications (eg European Standards approved by CEN, CENELEC)
2	British Standards implementing International Standards
3	Other British Standards
4	Defence Standards (including STANAGs and QSTAGs)
5	Defence Specification, Defence List, Defence Guide, or extant Standardisation Memorandum
6	MoD Departmental Standards of specifications
7	Standard prepared by other Government Departments
8	Recognised industry/partnership/consortium standards

Source: UK Ministry of Defence (1991). *Defence Standard 00-00 (Part 1)/Issue 2. Standards for Defence. Part 1: Principles and Organizational Structure.*

The UK MoD does not develop defence standards as a first option. Before it is even possible to propose a new defence-specific standard, a *standardisation validation certificate* must be prepared declaring that research has been conducted, and that no possible alternative is available. It is MoD policy to ensure that "as many British standards as possible are acceptable without qualification for Defence use" (UK Ministry of Defence 1991, p.30). As noted, the MoD nominates representatives to sit in BSI committees, and is one of most important customers for BSI standards. Also, defence standards which are considered to have a more general application are submitted to BSI for publication as British Standards.

The Directorate of Standardization (DStan), part of the Procurement Executive, is the focal point for all MoD materiel standardisation matters. Among other matters, DStan:

- advises on the formulation and implementation of MoD standardisation policy;
- provides the linkage between MoD and BSI and DTI, submits MoD comments on draft British Standards and selects MoD representatives to BSI committees;
- initiates and encourages the preparation of standards for defence purposes, either in the form of British Standards, or Defence Standards when the former are not feasible;
- publishes and distributes Defence Standards.

When a need emerges within the Armed Forces for a new standard, the potential user will approach DStan, which is then responsible for validating the need. If the need is established, the task will be assigned to one of over 20 sub-committees, organised under the Defence Materiel Standardization Development and Management Committee (DMSDMC). These committees have a co-ordinating role for the implementation of standardisation policy, and report to the Defence Materiel Standardisation Committee (DMSC). DMSC is chaired by the Director of Standardization and formed by representatives from all services. It is responsible for advising on the formulation of policies on "all aspects of materiel standardisation, metrication and rationalisation of technical procedures for monitoring its implementation" (Def-Stan 00-00). One of DMSC's main goals is to reduce the variety of standards and specifications produced within the MoD, encouraging greater use of British Standards, and the re-evaluation of MoD specifications to try to make them more compatible with British Standards. The total UK portfolio of defence standards totalled 1921 at the beginning of 1996, of which 30% have since been cancelled or declared obsolescent. D Stan itself is becoming more a facilitator and publication authority, than an organisation devoted to the development of standards.

These practices have had two major implications for British standard-setting organisations:

1. The MoD has dramatically cut down its direct input into standards making. In the 1970s UK MoD had a large staff of about 100 involved in standardisation activities; this number has fallen to 35. The number of specific defence standards has fallen from 1,921 to 1430.

2. The MoD has become one of the most important contributors to BSI work. In the past, the participation in BSI committees of defence personnel was funded by DStan, and often undertaken by experts from the British defence research establishments (now DERA). The responsibility to develop standards firmly moved to project managers after DStan's budget was slashed by 80% in a cost review exercise. The main implication of this change was that DStan was not capable any longer of providing substantial technical support to standardisation initiatives. The financial burden of standards development shifted to the defence client/sponsor. Nevertheless MoD supports BSI work with 172 part-time representatives contributing to the work of 378 (out of a total of 3222) BSI committees.

The cost of standards development to MoD sponsors and users has further increased as a result of the fact that many of the standardisation activities in which BSI is involved are now international in nature. At present, only 8% of BSI standards are purely national; and MoD customers interested in developing of new standards must now meet the added costs of participation in regional and international committees. Not only is this more costly, but the process becomes more difficult to influence as there are typically more interests to reconcile in international committees than in national ones.

4.2.2 France

The standardisation policies of the French Ministry of Defence were subjected to significant reform in late 1995. A new directive on the standardisation policies for arms programes was issued on December 21st 1995 (No. 100009 DEF/DGA/D). The directive's objective is to establish the conditions under which a defence programme will use existing standards or develop its own.

The directive represents a departure from previous practice. The French MoD had traditionally adopted sets of specific military standards with the objective of guaranteeing the quality and *independence* of French defence systems.[18] Changes in the international political situation, and in the economic and technological environments brought about a reassessment of this approach. The reduction in defence budgets has forced the French defence production system

18 The total number of French defence standards (GAM, MIN DEF) is however relatively low: around 2500.

to increase its efforts in the international arena. In order to distribute fixed R&D costs over a wider customer base, France is seeking more international cooperation and becoming more export-oriented. As the Directive explicitly recognises, this objective requires the a new approach to defence standardisation characterised by:

- the elimination of unique French standards, unfamiliar to foreign partners, in favour of standards broadly used by potential foreign customers and partners;
- "taking into account the present evolution of US defence standards"
- the use whenever possible of "institutional and sectoral standard families"
- the "respect of the specific standards developed by the Ministry of Defence"
- "taking into account the organisation of standardisation activities in the Ministry of Defence.

The approach to the selection of standards laid out in the directive is however noticeably more complex than in other European countries. First, the Directive establishes a hierarchy of preferred standards sources, divided into three "domains" within which there is an order of preference. Second, this approach establishes a generic typology of standards, and for each one of the classes a preferred source of standards is defined (Table 4-2).

Table 4-2 General Order of Preference for the Selection of Standards

Order of Preference	Type of Document
International Defence Standards	
1	NATO Standards ratified by France
2	NATO Standards not yet ratified by France
3	US defence standards
International civil standards	
Order of Preference	**Type of Document**
1	International Standards (ISO, UN/EDIFACT, CCITT...)
2	European Standards (CEN, CENELEC, ETSI; AECMA)
3	US Standards (ANSI; ASTM, API, etc.)
National standards (civil and defence)	
Order of Preference	**Type of Document**
1	French standards (NF/C, NF/L, . . .)
2	Sectoral recommendations (UTE, RG Aéro, . . .)
3	Ministry of Defence standards (GAM, DGA sectoral norms, . . .)

Source: *Directive sur la politique de normalisation defense pour les programmes d'armament.* No. 100009 DEF/DGA/D. 21 December 1995.

Table 4-3 Preferred sources of standards by standards type

Basic standards (metrology, terminology, etc.)	Institutional standards[19] (ISO, CEN AFNOR, etc.), with the broadest acceptance
Technological standards (industrial supplies)	Sectoral and institutional standards, including civil French standards and international civil standards
"System standards" defining system requirements, including performance and interoperability	International defence standards as in Table 4-2
Organisational standards (programme management, ILS, quality)	Institutional and sectoral standards, including AQAPs based on ISO 9000, whenever they are coherent with the French guiding norms DGA/AQ 902 and RG Aéro 00040.
Organisational standards (technical and commercial data exchange)	Civil standards as defined in Table ** above.

Source: *Directive sur la politique de normalisation defense pour les programmes d'armament.* No. 100009 DEF/DGA/D. 21 December 1995.

19Institutional standards are defined as those generated by a standards organisation, either national, regional or international.

In this framework, the Ministry of Defence is only involved in the development of "system" and organisational standards, and only when there are no other adequate standards in the existing national and international catalogues. Whenever a new defence standard is introduced, its development should be clearly justified. Besides existing defence standards will be abolished when other adequate standards are published elsewhere.

The organisational structure of French defence standardisation is complex. The main authority for defence standardisation within the Ministry of Defence is the *Responsable Ministériel pour la Normalisation* (RMN). The RMN is in charge of promoting and executing "technical, industrial, and logistic" standardisation within the Ministry of Defence and heads the Committee for Standardisation Policy and Programming (COPNORM). COPNORM defines the main standardisation policy guidelines.

Each service and directorate has its own "sectoral" head of standardisation (RSN), to coordinate standardisation policy within their departments and express their standardisation requirements. There are also a number of "Inter-branch standardisation Committees (CIN- *Commissions Interarmées de Normalisation*), that together with the RSNs form Inter-branch Standardisation Committee (CINORM). CINORM plays the role of "executive committee" of Frence defence standardisation policies. Finally, under the joint authority of RMN and the DGA's responsible for quality we the Inter-branch Office for Standardisation (BINORM) provides the secretariat for CINORM and COPNORM and coordinates the different CINs and other standardisation committees within the Ministry. It is also in charge of maintaining a directory and repository of all defence standards and to provide to all *ministerial* users a library of internal and external standards.

4.2.3 Germany

In Germany, civil standards from DIN and military NATO STANAGs standards are preferred for military procurement. Specific military standards are developed only when appropriate DIN standards or STANAGs are not available.

There is no single policy-making body dealing with defence standardisation issues. The different services, the general Armed Forces Staff, the Medical Staff (Surgeon General) and the Armaments Directorate, all have responsibilities in relation to defence standardisation. Subdivision III of the department of Technical Affairs at the BWB is responsible for standardisation in the armament sector, together with other issues related to property rights, patenting and licensing, logistic procedures, etc. However, defence standards - known as VG norms - are developed and published only within BWB. VG norms are only developed in exceptional cases, and their total number is relatively low (about 1000). They often refer ISO standards, ENs, and STANAGs.

Based on NATO standardisation policy, Germany establishes a standardisation concept for the Bundeswehr which is published by the Generalinspekteur. This serves as a framework for military standardisation for the various armed forces, outlining the applicable legislation and rules, along with procedures for the development, preparation, production, updating and revision of NATO STANAGs and Allied Publications.

4.2.4 Italy

Traditionally, defence standardisation in Italy has fallen under the responsibility of the different services. In 1996 the Italian Defence General Staff launched a feasibility study to establish a centralised standardisation office. The study led to a complete reorganisation of Italian defence standardisation procedures and offices. The old standardisation structures have been dismantled but the new organisation is not yet in place. Defence standardisation policies are therefore in a state of flux.

It is common practice in Italian defence procurement procedures to refer to STANAGs or variants of them. More recently, international civilian standards, particularly from ISO, have been given formal priority. Detailed technical specifications are often requested by the defence customers (Defence General Staff). Although they often reflect standards commonly used in the defence industries, there appears to be a need for further harmonisation. Italy has no explicit policy to reduce references to military specification and standards whenever possible. Small changes requiring costly modifications of alternative commercially available technology are introduced often by the defence.

4.2.5 Sweden

Most of the defence standardisation responsibilities in Sweden lie with the FMV. FMV has a standardisation department within the Army Materiel Logistics Directorate. The department co-ordinates defence standardisation activities, working on assignments from the Armed Forces and from other FMV divisions. The department is small, and responsible for:

- the Swedish defence standard system (FSD);
- co-ordinating standardisation activity within FMV, and between FMV and the Armed Forces;
- co-ordinating activities with NATO;
- providing information and advice on current standards and standards development;
- participating in the definition of standards to be applied to new weapons programmes;
- library function and delivery of standards to the FMV and the Armed Forces.

The department contracts technical assistance externally, and also internally from other FMV departments.

The new Public Procurement Act establishes a hierarchy of preferred standards for all public procurement, with European standards being the first preference, followed by Swedish standards based on accepted international standards, and domestic Swedish standards (not accepted internationally). Only when none of these are applicabe are defence standards such as STANAGs, MILSTNDs, Def-Stan, and FSD used.

Although it does not have any direct responsibilities for standardisation, the Association of Swedish Defence Industries (FiF), which brings together the fifteen largest Swedish defence industrial companies, provides industrial representatives to a number of *ad hoc* standardisation working groups.

4.2.6 Special circumstances in selected intermediate and minor producer countries

For the most part, the defence standardisation systems in the intermediate and minor producer countries emulate features of the systems in the major producer countries as outlined above. In some cases, however, there are specific national circumstances in defence standardisation policies and procedures that are important for consideration in a European defence procurement context. These can be exemplified by looking at five countries.

Spain

The Spanish catalogue of Military Norms (MN) lists well over 1000 specific Spanish defence standards. MNs are defined in terms of 'technical specifications' as devised by the standardisation bodies of the Ministry of Defence, and they are mandatory for application in one or more of the branches of the Spanish defence forces.

However, Spanish defence agencies can adopt standards and norms generated elsewhere. There are two main types of other standards formally adopted for use by the Spanish defence bodies:

- Spanish civilian norms approved by the Ministry of Industry or the Spanish agencies authorised to issue standards; these are known as 'UNE' standards (*Una Norma Española*).
- Foreign military norms, which includes STANAGs ratified and implemented by Spain, and a small number (22) of US military standards.

Significantly, European standards (from CEN, CENELEC and ETSI) are rarely formally required by the Spanish defence customers.

The development process for Spanish defence standards is bottom-up. Standardisation organisations in each of the defence branches develop their own Annual Standardisation Plans, and submit proposals to the Sub-directorate General for Normalisation and Cataloguing in the Ministry of Defence. If the standard is given the go-ahead, responsibility for writing and maintaining it will fall on the branch that proposed it, although it may be used by one or more of the branches. There is a total of 50 offices that can propose and develop standards, and there is weak systematic co-ordination between the branches.

Belgium

Belgium lacks systems capability in many areas, the procurement of large defence system is done through imports or international co-operation projects, and therefore the capacity to influence the selection of standards is very limited. The Air Force for instance has no direct contacts with organisations involved in civilian standards, nor does it develop any standards of its own, although it is represented in NATO standardisation working groups.

As in most EU countries with limited defence production capability, the approach to defence standardisation in Belgium has revolved around NATO policies and standards. The standards most commonly used by the Belgium defence forces are NATO STANAGs, US MILSPECS and ISO standards. In cases where the Belgian defence customers are in a position to define the standards, international standards are preferred over national ones, and civilian standards over military ones. Military standards and specifications are only allowed when there are no alternative civilian standards.

Greece
Within the organisational structure of the General Staffs, Special Services have been established to formulate and select technical standards for military applications. Therefore each individual Service is responsible for standards policy, and for coordination with the other services if it considers this to be necessary. Although a substantial part of the standardisation activities revolve around the application of STANAGs, there is no single body to discuss and define national policies and procedures with respect to STANAG ratification and implementation.

As illustrated in Table 4-4, the general order of preference for selecting standards for defence application in Greece is substantially different to the hierarchy used in major producer countries like the UK.

Table 4-4 General Order of Preference for the Selection of Standards: Norwegian Ministry of Defence

Order of Preference	Type of Document
1	Standards developed by Greek government departments
2	National Defence Standards as issued by defence/departments agencies
3	NATO Standards
4	National Standards implementing International Standards (ISO, IEC, etc.)
5	National Standards implementing European Standards (EN) or common technical specifications
6	Other National Standards (EAOT etc.)
7	Publicly available specifications as developed by companies and industry consortia

Source: Adapted from a personal communication with the Codification Section of the Support Material Procurement Directorate, Armaments General Directorate, Ministry of Defence, Greece.

Portugal
The Portuguese case illustrates how constructing national defence standardisation priorities arround NATO activities can result in standards preferences that are not synchronised with the policies that have emerged or are emerging in the major defence producer countries.

Table 4-5 reflects the order of preference for the selection of standards applied by the Portuguese Ministry of National Defence.

Table 4-5 General Order of Preference for the Selection of Standards: Portuguese Ministry of National Defence

Order of Preference	Type of Document
1	NATO Standards
2	Portuguese Standards implementing International Standards
3	Other Portuguese Standards
4	Portuguese standards implementing European standards or common technical specifications
5	Portuguese defence standards as issued by defence departments/agencies
6	PAS as issued by companies and industrial consortia
7	Standards prepared by other Government Departments
8	Other standards

Source: Personal communication, Deputy National Armaments Director

In this case, the main objective of defence standardisation is to enable Portuguese forces to operate effectively in multinational environments. However, a comparison with Table 4-1 which lists the UK order of preference shows that this objective can result in far less emphasis being placed on European regional standards, except where these are basically international standards transposed to the regional level.

Norway

Norway provides an important example in this context in that it is very closely allied with the EU while not being a member. This translates also into a direct interest in European standards.

As is the case in most EU countries, defence standards are developed in Norway only where there is no other alternative. Thus the Standardisation Branch of the Norwegian Ministry of Defence spends considerable time investigating Norwegian and international standards. Its primary sources of standards in addition to Norwegian Standards are ISO, IEC, CEN, CENELEC and ETSI,and DIN. Nevertheless, the national catalogue of defence standards is large - there are some 850 Norwegian Defence Standards. These are published on CD-ROM and are available on the Internet.

As illustrated in Table 4-6, the general order of preference for selecting standards for defence application in Norway is very similar to the hierarchy used in major producer countries like the UK.

Table 4-6 General Order of Preference for the Selection of Standards: Norwegian Ministry of Defence

Order of Preference	Type of Document
1	NATO Standards
2	Norwegian Standards implementing international and European regional standards
3	Other Norwegian Standards
4	Norwegian defence standards as issued by defence agencies
5	Standards developed by other national government departments
6	PAS issued by companies and industrial consortia

Source: Adapted from a personal communication with the Head of Standardization Branch, HQ Defence Command, Norway

5

THE EUROPEAN DIMENSION: A SURVEY

5 The European Dimension: a survey

5.1 Approaches to the inquiry

The previous sections have presented the background to our analysis of the defence standardisation systems used in Europe and the US and of the policy requirements in this field. The description of European defence procurement and defence standardisation procedures has shown the diversity of national approaches and the fragmentation of markets along national lines. The initial exposition of general standardisation regimes and mechanisms reveals a complex and changing situation as regards standardisation at both national and international levels.

Against this background, this chapter will analyse how some of the main stakeholders in European defence standardisation perceive the situation, and what kind of policy actions they deem necessary in the present environment. The chapter focuses on the findings of the formal interview programme that provided most of the data used in our overall analysis. Wherever possible, we illustrate the general presentation of our European survey results with specific examples drawn from the interviews. Examples were drawn also from informal interviews carried out by the researchers from time to time during the course of the study.

Regarding the formal interview programme, it was decided at the outset, in agreement with DG III, that the investigation on the European side should be made by interviews on the basis of a common questionnaire. Potential respondents in three main categories - policy-makers, trade associations, and defence manufacturers - were to be identified, and the selection of respondents was intended where possible to cover the requirements of the three armed services, air, land and sea forces.

For logistical reasons, it was impractical to administer the formal interview questionnaire in all fifteen Member States, and country selection involved making judgements about the significance of defence production and procurement in various Member States. The formal survey was thus carried out in nine Member States: UK, France, Germany, Italy, Sweden, Netherlands, Belgium, Spain and Portugal. This selection includes all of the major defence producer countries and a representative selection of countries that are minor producers and/or primarily purchasers of defence equipment.

The Member States that were not included in the selection for formal interview were nevertheless contacted by the research team, and asked to contribute information to the study. These communications were primarily directed at national defence agencies, several of which responded with valuable information. In our opinion, the necessity to focus the formal interview programme on a selection of Member States has not unduly prejudiced the conduct, findings or conclusions of the study as a whole.

Where policy makers and trade associations were concerned, it was possible in each case to identify persons who could reply to the questionnaire in a representative capacity. Among industrialists, however, particularly where very large firms were concerned, the choice of respondents presented logistical and conceptual difficulties. Without undertaking an inordinate number of interviews, it would have been impossible to cover all sectors and departments in the largest firms, and also to take any account of the often quite distinct problems of SMEs. Therefore, the investigators in each of the nine countries adopted the general principle of the high-level approach; inviting senior officials in companies to select the persons most suited to respond to the questionnaire. This addressed the logistical problem and to some extent the conceptual problem of representativity. It was possible to apply this approach successfully in eight of the countries selected for interview. In the case of France, a response on behalf of all government policy-makers and the majority of industrialists was co-ordinated by the Defence Ministry. This process diminished the natural variety of opinion, but it also gave greater weight of authority to the response.

The first two parts of the questionnaire invited a description of the current situation in Europe with respect to standards in defence procurement. Part 3 of the questionnaire concentrated on the US initiative, and was aimed at exploring possible consequences for European interests. The questionnaire was administered to more than eighty individuals between March and October 1998.[20] Interviews varied in length, ranging from one to two hours. The majority of responses were oral - either face to face or conducted by telephone - but some organisations preferred to respond in written form.

Three methodological points should be made:

1. Written responses tended to give the views of the co-ordinating authority where matters of opinion on policy were concerned. This contrasts with some oral replies, where the interaction between respondent and interviewer tended to elicit more nuanced opinion. Nevertheless, there was a broad agreement on the key issues of the urgent need for change, the impact of American competition and globalisation of defence equipment markets, and the possibilities for action on the European standards-setting scale.
2. The interviews necessarily avoided the mass of factual details presented in the initial sections of this report. The first two parts of the questionnaire invited some detail but rather more opinion, e.g. on the current practice and value of standard-setting bodies or trade associations, and the efficiency of linkages between them.
3. In the analysis that follows, national governments in general and MoDs and procurement bodies in particular are assumed to be congruent where policy-making is concerned, in formal terms at least. Informally, there will naturally be differences between them, and among the various government departments and also within MoD and procurement bodies. At government level, the main line of cleavage will lie first, between Treasury departments and spending departments including defence agencies. Second, it will lie between industry departments (concerned with the overall position of industry and employment) and defence ministries and their procurement bodies. There will often be a third level of cleavage, within defence agencies around the questions of cost-cutting versus military requirements of reliability and performance, and the use of civil versus military standards. But for the purposes of this enquiry and its recommendations, the informal side - though significant for the study of policy-making - can be ignored.

Only in the case of larger countries, with defence industries producing for all three armed services, was it feasible to maintain the balance between air force, navy, and army procurement issues. Equally, it proved difficult to do more than sketch in the views of SMEs or subcontractors, not least because of the principal trend in Europe towards final customer

20 An annotated version of the questionnaire is given in "Appendix B: Questionnaire formats".

reliance on the prime contractor to select processes or products which meet performance criteria. All main suppliers and subcontractors then conform to the prime contractor's requirements. It is quite clear that in defence, as elsewhere, SMEs and subcontractors often lack both bargaining power and alternative market outlets.

Finally, it is important to note that where interview sources are cited by country of origin - e.g. as British, French or German sources - this does not imply that these responses represent the homogeneous view of the countries in which the sources are situated - merely of individual respondents in these countries.

5.2 The need and context for change

Virtually all interviewees agreed that some measure of change is necessary in the European approach to standardisation in the defence context. There was no significant variation on this point between countries, governments or producers, or any of the armed services branches.

Nevertheless, there were three main kinds of concerns:

1. Many large defence manufacturers are uneasy about assuming increased responsibility as a result of the shift by defence agencies from military specifications and standards applied to materials, design or products, towards performance standards.
2. SMEs that supply defence related goods and services are concerned about the consequences of concentrating more-and-more market power and agenda-setting initiative to prime contractors.
3. There is general concern about the increasing problems of co-ordinating products with long life-cycles - ships, vehicles or aircraft platforms - with products having increasingly short life-cycles, particularly electronic equipment.

A sense of urgency has developed in the European defence arena since 1989 and the end of the Cold War about the need fundamentally to re-think the strategic roles of armed forces and defence equipment. This is amplified by the contingent needs of managing national defence budgets, and responding to the new sorts of tasks imposed on NATO and the EU by regional and sub-regional crises such as the Gulf War, Bosnia, or Kosovo.

Rethinking national and alliance strategy in terms of rapid reaction forces or trans-national co-operation has consequences for standards setting, notably in communications, systems integration, and front line equipment interoperability. At the same time, the consequences of technological development and increasing complexity in fields like electronics, materials, hardening processes and systems integration, along with the escalating costs of R&D have already led to rationalisation and restructuring across all the defence industries. American companies are far ahead in the process of mergers and rationalisation, particularly in the field of aerospace. In Europe, rationalisation remains painfully slow despite urgings by European governments. Nearly all the MoDs and defence manufacturers interviewed believed that improved standardisation practices would help to create a more competitive environment in Europe, and a more level playing field for European companies in export markets.

With few exceptions, the great majority of defence-related corporations are also involved in producing for civilian markets. The balance shifts steadily towards the latter year by year.

Moreover, as MoDs and procurement agencies have reassessed their status as customers whose military orders amount to much smaller amounts of manufacturers' total production, the established military-industrial lobbies have lost much - though not all - of their political influence. The move towards increased use of commercial technologies, as expressed in US policy, has thus acquired two-fold validity. It is what many major producers are already doing and wish to continue to do, and it contains the possibility of substantial cost savings (up to 50% in some cases, see below). However unwelcome in the short term, this move to commercial technologies may also help free manufacturers from the sort of long term reliance on MoD customers which in the past isolated them, their technology, and the their work force skills from the civilian market place. This should in theory enhance their overall global competitiveness.

These expectations and assumptions are explicitly embodied in the reform prescriptions of various national MoDs, notably in Germany, France and Sweden, and in the UK where the 1998 Strategic Defence Review embodied the 'smart procurement' concept. Generally speaking, all stakeholders agree that standards and standardisation processes should be an integral part of the rationalisation process, or a natural consequence facilitating further change. Nevertheless, policies and practices in this respect vary from country to country because different governments have different priorities as to how change should be achieved and how to assess its consequences for military and civilian producers as well as for general matters like employment, competitiveness, national security, industrial development and the environment.

The survey has confirmed that changes in the overall context of defence manufacturing currently affect standardisation in several ways:

- increasing use of civilian standards, with military standards restricted to military products with no possible civilian equivalent;
- increasing use of regional/NATO and international rather than national standards;
- increasing use of "commercial off-the-shelf technologies" (COTS);
- increasing use of performance criteria rather than specifications;
- assigning a wider role to prime contractors and restricting the role of the defence agency to that of a customer;
- focusing on interfaces and interoperability;
- focusing on open architecture in long-life structures allowing for replacement of electronic and other equipment;
- intrusion of 'civilian issues': safety, health, environment, insurance liability.

5.3 The savings from defence standards reform

That there will be savings in costs as a result of a transition towards increasing use of civil standards is scarcely doubted by the respondents. This is stated as a cardinal assumption in the 1995 French Directive 100009 DEF/DGA/D, for example. Yet, estimates on actual cost saving varied widely among interviewees, depending on the respondent's function and standpoint. As there is as yet no authoritative methodology for assessing these savings, inevitably a measure of political self-interest intrudes. Higher figures (in the 20-50% range) tend to come from officials in Industry or Treasury departments. MoDs give lower estimates and in many cases argue that given all the complexities of calculation and off-setting other cost increases, estimates over five to ten years are bound to be unreliable. Purchasing bodies (who have the most experience with assessment of this kind) suggest that cost savings will come mainly from devolving responsibilities to prime contractors, rather than from reform of the standardisation system as such.

It is noticeable however that no interviewee stated that the reform would result in *higher* costs. Most agreed that there were savings to be made, with the largest estimates (of up to 50%) coming from aerospace, missiles, and defence electronics sectors, and the smallest (15-30%) from traditional army and naval manufacturers. The following are examples of the range of opinion:

- A large electronics firm estimated the saving in the defence sector to be in the order of 50%; and another argued that "should civilian standards not be used, materiel would become 3-5 times more expensive."
- An avionics division of a defence firm stated that by using civil standards and testing procedures, cost reductions between 30% and 200% (sic) could be achieved. In contrast, a specialised avionics manufacturer believed savings to be "not substantial."
- A defence shipbuilder estimated the savings to be between 20% and 30%, with another one giving a wider bracket (15%-50%).
- Also in shipbuilding, a producer whose main area of activity was in the civilian sector, estimated that the reform of military standards and specifications could eventually bring prices down in the defence sector by as much as 50%.
- A submarine builder estimated that the savings would be in the order of 40% for electronics components and sub-systems, and 20-30% for hardware.
- A defence vehicle engine manufacturer estimated the savings from using commercial rather than MILSPECs to be 30%.
- A company involved in space technology cited the case of a NATO purchase where not specifying MILSTDs /MILSPECs led to a saving of 50% in the cost of the product.
- One Swedish defence ministry official claimed that there would be savings probably between 10-20%, while another Swedish official estimated the savings to be around 50%.

In all cases these were figures emerging from personal impressions, and in no case did we found data that was backed up by a systematic cost analysis.[21] Indeed, respondents identified four main difficulties that, in their view, inhibit precision:

- Costing the balance between savings related to the design and production process, and to longer term maintenance and replacement costs. The relationship between short-term purchase costs and long-term maintenance costs is unclear; some respondents in the defence electronics industry pointed out that the move to off-the-shelf purchases would lower the price of components at the cost of higher long-term maintenance expenditures.
- Costing the balance between dependency on external procurement (licensing and use of foreign standards) and dependency on civilian standards (being restricted, for example, to what general stockists hold).
- Costing the processes of testing by military authorities and certification by civilian bodies.

[21] In 1996 the SBAC Engineering Standards Working Party Report on the Cost/Benefits of Standardisation identified savings, as a result of standardisation, over a project period of 20 years as £27 million in design costs alone. This calculation refers to the use of standards in general in aerospace projects, rather than to the process of substitution of one set of standards for another. In fact this study pointed rather to the savings to be obtained from a relatively rigid standards environment within a specific project; for these savings to be realised clear standardisation guidelines should be in place at *the outset* of a programme. The industrial respondent discussing this case argued that similar cost savings could not be made through the introduction of a new approach to standardisation half-way through a programme.

- Cost savings may be put at risk if the new procedures give a dominant position to an industry or manufacturer, or if they are achieved at the price of attenuating strategic planning and personnel (a view stressed by French and German sources).

Interestingly, some interviewees took a different perspective when addressing this question. Instead of addressing the impact of military specification reform on total product costs, they assessed the costs *to them* as developers and producers. A defence electronics manufacturer stated that technical specifications and standards save much effort in the development phase of a specific product: about 80% of any new product development effort is invested in solving routine problems, which could be defined *a priori* through specifications and standards. Therefore, a reduction in the number of detailed specifications and standards in the procurement of defence systems would shift development costs from the defence client to the manufacturer. The same company however, estimated that the application of commercial components of adequate performance would result in final products costing 35%-50% less than present prices.

In a similar vein, some respondents, particularly in France and the UK, pointed to a danger inherent in defence customers resorting to MILSPEC reform as a way to save money. They indicated that cost cutting by defence procurement or defence research agencies may threaten their capacity to continue to evolve necessary military standards, and even to play an adequate role in the civil as well as military standardisation processes. Consequently, the withdrawal of defence agencies from the definition of procurement specifications can work to the industry's detriment. As an example UK officials pointed out to the loss of government laboratory capabilities in the field of oils and fuels for marine engines. Government failure to fund this capability leaves funding to industry, or, alternatively, leads to the adoption of US standards. Other government officials disagreed on this specific example pointing out that there was no need to define special fuel oils for UK marine engines.

Finally, there is some scepticism about the effects of cost-cutting on competitiveness on a European scale (as opposed to achieving purely national competitive advantage) in default of progress towards a more coherent European defence procurement policy. At present, the socio-economic consequences of cost-cutting, rationalisation and restructuring (redundancies above all) constitute a major political obstacle to what all parties agree are desirable reforms.

5.4 The US Example: different European perceptions

The survey enquired in detail about European positions and opinions in relation to the US policy of defence procurement and MILSPEC reform (the US initiatives are analysed in detail in chapter 6 below). US reforms can act as a point of reference because of their current depth, scale and scope and because they have been widely documented and benchmarked. The way in which European policy makers and industrialists interpret the evolution of US policies provides a good initial approximation to the ways in which they perceive the challenges and opportunities posed by the reform of the defence standardisation regime. It was therefore not surprising that that the applicability of the US model rates third among all the topics addressed in the survey in terms of the frequency and volume of discussion it generated, and second in terms of positive polarity (i.e. the level of agreement among respondents about the importance of this topic), exceeded only by awareness of the need for change.

However, there was no single European perception and several different views of the US coexist. Analysis is necessarily undertaken within a group of national contexts shaped by very diverse post-war histories, political cultures, concepts of the state and its role in national defence, as well as by differences in military technology, defence export markets and memberships of alliances.[22] Many of the practical and policy questions discussed below tend to be associated with national boundaries and identities.

Defence manufacturers in some countries are much more familiar with American practice than others, either because they purchase American supplies, or because they compete with American companies in foreign markets (as with Britain, France, Germany). Others become familiar because they work with American companies through offset agreements and other collaborative arrangements (Netherlands, Spain). European companies with less experience of these kinds tend not to know the details of the US reform and are often unfamiliar with the substances of general defence procurement reform initiatives.

Diversity is compounded by different nuances that apply when key concepts are discussed. Despite being very widely understood in Europe, even the Perry Memorandum (see below) or the concept of dual-use, take on distinct inflections. Some European observers maintain that there is no categorical or unified 'US model' of standardisation in the defence industry field. Others stress that the US model is not original, even considering the Perry Memorandum.[23] It is argued that British, French and Swedish models predate this, and find formal expression in distinct ways such as the 1995 French Directive (No. 100009 DEF/DGA/D), the 1982 Government White Paper Command 8621 in the UK, and the evolution of the unique partnership between MoD and FVI in Sweden.

The British MoD has shown a particularly keen interest in the US reform process. There have been formal visits and exchanges between the UK Assistant Director of Standardisation and the US Director of Acquisition Practices to discuss issues associated with acquisition reform and how it was developing. These discussion have proved fruitful for both parties and it was agreed that they should continue (probably on an annual basis, and possibly under the auspices of a NATO Committee) to enable other NATO countries to be involved.

The British D Stan administration is also tracking two projects to assess the likely impact of US procurement reform on MoD programmes. One is the TRACER project, a programme to replace the ageing Combat Vehicle Reconnaissance, and to which end the UK entered talks with the US. According to D Stan officials, it became obvious during these talks that the UK approach to project specification differs from that of the US. This was largely due to the Perry initiative, whereby US defence requirements need to be stated by referring to civil standards. The task of analysing and determining whether a civil standard is suitable for all aspects of the military application is far from trivial, but indications that there is general awareness of this problem in Europe did not emerge spontaneously from responses received during our interview programme in other countries.

The second project being tracked by British defence officials is the Multi Launch Rocket System (MLRS), an example of a system that has been in service for some time, and which used a large number of US specifications and standards, many of which were affected by the

22 Of the nine countries in this study, one, Sweden, is not a member of NATO.
23 For details on the Perry memorandum see below, Chapter 6.

reform. Developed in the US, the system had been manufactured in Europe by an industrial consortia involving German, Italian and French firms. Because the production phase had already been completed, the system was at the time experiencing very few problems with US standards. However, it must be noted that a respondent from outside the UK identified the MLRS as an example of a problematic system for which the standards used where not complete or clear enough, requiring European manufacturers to acquire additional information from the US at great expense.

Although no respondent doubted the importance of the US reform for the European defence industries, or that the main reasons for US reform (cost-cutting and better use of recent technology) are equally valid for Europe, the applicability of the US approach to reform in the European context was often contested. European military sources cited a number of reasons for this view.

First, respondents from the French and German MoDs pointed out the great difference in scope between the defence standardisation system in the US and those in their own countries. The US had more than 45,000 documents defining military standards and specifications, whereas the defence standardisation effort in European countries was much less extensive (about 1000 defence standards/specifications in Germany, 1340 in the UK, and 2500 in France).[24]

Second, the French Ministry of Defence drew attention to the fact that US MILSPECs and MIL-STDs were obligatory for use within DoD markets. This was not the case for French defence standards in French defence procurement. Furthermore, while most US defence standardisation documents defined in detailed product characteristics, French practice has long been to express requirements in terms of performance specifications - a practice taken up by the US only through the reforms of recent years. In consequence, the French Ministry of Defence stresses that the US model of MILSPEC reform is not directly applicable to their situation, and that the methods used in France to reform the defence standardisation system will be different. The Ministry also notes, however, that US military standards will continue to be used in a number of defence programmes in France and other countries, even when they may be subjected to cancellation or other changes as part of the reform initiatives implemented in the US.

Third, many respondents stressed that European standards-setting bodies and practices are necessarily different from those in the USA, because the Pentagon's political weight and its capacity to influence the pace of change are radically greater than the purely national weight and capacity of European Ministries of Defence. A respondent from the Italian Ministry of Defence argued that the US model is too liberal to work in the political reality of continental Europe unless and until a common European defence policy emerges. Also, German and British respondents pointed out that the US DoD works more closely with US industry from much earlier stages of product development than is the practice in Europe.

A number of respondents concerned about the international competition implications of US reforms, were wary of their effects on the European defence industrial base. French officials, for instance, stated that the main factor in this process of change is the increasing

[24] It has to be noted however that it is the goal of the US reform process to bring down the number of US MILSPECs and MILSTDs to a total of 960, that is, a number below the present level of defence standards in the main European countries.

competitiveness of American defence suppliers in global markets. European defence manufacturers need to know how the US system works, in order to be able to meet interoperability requirements and remain competitive in world markets. Similar views were expressed by Italian and Swedish respondents. A Dutch respondent from industry pointed out further that the already heavy competitive pressure from the American defence industry acquires extra leverage from the US DoD's defence procurement reform.

Such apprehensions were reinforced by the problems that European industrialists found when trying to deal with the US system. Problems for European companies are often ascribed to the opaqueness or incompleteness of US standards, and to the introduction of procedural standards without due consideration of their impact outside the United States (e.g. the US Fastener Quality Act which would have made compliance difficult for European exporters). A British respondent stressed that, whatever it is said to be, the US system is in reality a mixed political economy where company standards predominate (especially in aerospace) with much variation and lack of transparency.

The lack of information about the usage of standards at some levels in the United States imposes costs on European firms. The decentralised nature of the US standardisation system and the fact that relatively few standards are promulgated by ANSI can lead to confusion about the status and use of particular standards outside of the US. Many standards developed in US trade associations' are largely unknown outside the US, yet they are treated by the DoD as if they were international. The problem is compounded in that US defence manufacturers may use standards long declared redundant by DoD. Some European governments see this as an instance of barriers to trade, in contrast to European policies designed to harmonise standards. A British industrialist went even further emphasising American commercial ruthlessness, believing that American companies and government would contest the evolution of European standards if that were seen to work to American disadvantage.

Other respondents were less concerned about the possible threats of the evolving US system and more concerned to stress the opportunities and challenges involved in constructing a pragmatic response. Portuguese and Spanish respondents viewed the US model as indispensable in cutting costs, promoting dual use and encouraging transatlantic co-operation. A Swedish official stressed that the US model is the most significant example of comprehensive dual use reform, and key in establishing the principle that military standards should be a last resort. A German respondent stressed that US standards and the US reform process are dominant in NATO, and will inevitably trickle down to all NATO members. British and French respondents agreed that the US model is very successful and worthy of emulation, even if it can not be applied directly or entirely to the situation in Europe.

Besides, for some British, Spanish and Dutch respondents from industry, the reality of American competitiveness is such that it may appear preferable to join in transatlantic joint ventures than to strive after rationalisation in Europe; and what applies to arms programmes, applies also to standards.

These differences between a positive outlook on US reform and wariness of its effects on European firms have more than abstract importance. First, they largely determine how the responsible authorities in each country will monitor and assess progress in improving the standardisation procedures which apply to their defence industries. Second, differences like these condition responses as to what the future relationship with US defence suppliers will be - whether competition will intensify or decline.

Whatever national variations of perception might exist, the US example has been and continues to be influential though not necessarily in an originating sense. What may be called its 'derivatives' have already permeated the strategies of all governments, agencies and industrial players contacted in the course of this study. Respondents define and prioritise these derivatives in different ways, but each acknowledges that the following dynamics are present already in most European defence markets:

- increasing use of civil standards
- reducing the number of military standards to the minimum
- off-the-shelf purchase of equipment
- greater co-operation between military-end users and defence manufacturers
- greater co-operation between standards-setting bodies
- increasing use of performance criteria in preference to materials design and construction specifications
- an increasing role for the prime contractor in the choice of specifications and standards
- a general move from national to international/regional standards.

5.5 Institutional set-up

5.5.1 Where should standards-setting activity be centred?

There was wide consensus among respondents from all countries on the necessity to move towards greater use of international and EU regional standards in preference to national ones. This need was identified as being more in areas like electronics components, and in aerospace products and procedures.

For many military respondents, the need to move towards international standards meant a focus on the standardisation activities of NATO (see below). For instance, the German Army states that it is through membership of NATO (and the development of multinational co-operation) that standards in the defence field can evolve towards further integration. All agree that remaining purely military standards should be in the hands of national MoDs, while civilian bodies should increase their scope wherever possible, subject to security classification.

For the French MoD, However, the key is not where, but how standards-setting should be organised to achieve key aims. These basic aims are seen in terms of performance and competitiveness, and the requirements of interoperability in national and allied forces.

There is agreement among larger European countries that the manufacturers' input into standards-making should be harnessed at a centralised European level, and that the standards mechanism should not give advantage to any individual supplier, group, national industry or sector. The case of ECSS is cited by Italian sources in the aerospace sector as a model for associating industrialists and agencies in establishing standards.

When standardisation is being carried out at the European level, respondents favour additional methods to override the delays caused by bureaucracy, language problems and the need for consensus voting. This view was pressed most strongly by German respondents who felt that this would help also to resolve disputes with the US over product certification and manufacturers' approval. However, few respondents could offer detailed suggestions on how these objectives should be achieved. Some Swedish respondents recommended an information strategy for standards rather than a development strategy as such. This would involve compiling an international summary of all *de facto* and interim standards, particularly those that are applied mostly at national levels.

The recourse to US standards and the US-European relationship
We found that respondents in smaller countries seemed much less concerned about the need to develop a regional system of standards used in the defence industries than their counterparts in larger countries. For instance, a Dutch defence electronics manufacturer stated that their main institutional source of standards was the US DoD, both for procedural and product standards. This firm noted that the US DoD makes some of its acquisition standards, practices and procedures available free of charge on its Internet site and that, consequently, the need for co-ordination was slowly vanishing. The same company found the US DoD acquisition practices and process very useful in co-operating with its co-developers and subcontractors. In Portugal we found that the procurement agencies and the domestic defence industries used mainly STANAGs and US military standards, and again this was not considered to pose any particular problem. A preference for US defence standards was also expressed by a smaller subcontractor to the British shipbuilding and aerospace industry. This company argued that export customers preferred US MILSTANDs or MILSPECs because they were freely available; in contrast, the majority of their export customers did not have access to similar British standards (particularly NES1004 and DEF STAN 59-41 in this instance) because of their restricted classification. Indeed, the majority of specifications required by foreign customers were based on US defence standards.

Other industrial representatives in larger countries also pointed to the value and extensive use of DoD standards in areas like shipbuilding. UK industrial representatives indicated areas where US defence standards had helped in the absence of British standards (for example, data protocols for the fire control computer in the Challenger tank), and argued that to be competitive in the global defence market, it is often necessary to follow US specifications and standards and that, therefore "there is no future for EU standards as such".

In the aerospace sector also, we found many examples of industry using US defence standards out of choice and not because it was mandated by customers. Some European aerospace manufacturers use for instance US military standards and specifications on materials like alloy steel sheets and plates (MIL-S-18729), alloy steel tubes (MIL-T-6736), tungsten powder alloys (MIL-T-21014D), rivets, protecting covers, electrical terminals, etc. In the broader area of project management, US military standards on Configuration Management (MIL-STD-973) were used by an aerospace firm as the basis to develop an in-house standard to support the management of the EH-101 international helicopter joint venture.

However, following US military standards and specifications can cause difficulties as well. A long standing data bus standard in the military field (MIL-STD-1553) mainly addresses the transfer of data between avionics systems and is now being used in most space, fixed- and rotary-wing military applications. MIL-STD-1553 is widely applied in the EU and in the rest of the world. Although the standard is being retained in the US, however, some European respondents were afraid that this was one of the standards that the US DoD does not wish to maintain. In fact, an almost identical version of the military standard has now been issued as a

US commercial standard (SAE AS15531). While these changes and debates were taking place in the US, European users felt that they were outsiders unable to influence the process. As one respondent pointed out, even if the representation of European interests in these US standardisation processes is possible, it is usually an expensive proposition.

Another concern was expressed by British Government officials and relates to the blurred distinction between PAS and proprietary technology. They argue that US firms have been masters in taking advantage of 'incomplete' standards (referring to PAS that do not reveal all the necessary information to implement the specification). The example given concerns Boeing test gear, the available information on which is not complete, and the necessary additional data is expensive and difficult to obtain.

The role of joint projects in standardisation

Given the difficulties in developing and establishing formal international standards, many have seen in the organisation of international development and production projects an avenue to develop common standards and specifications, at least at a European level. International standards can be introduced through international projects, and these are often heralded as examples of how international defence standards can spread. A German electronics firm referred in this respect to the role of the Panavia consortium in successfully developing special standards for the Tornado aircraft. The Harrier jet was mentioned as another example of how joint projects can lead to the mutual acceptance of standards from the participating countries. The Harrier evolved into a US-UK co-development and was designed with parts complying with either US or UK standards, as the participating companies agreed to accept each other's standards. As a result of this arrangement, the UK Royal Air Force admitted US wiring standards into its standards regime. These would not likely have been accepted had they been specified in a purely national UK development programme.

However, respondents also identified several problems that can be encountered in the international project-based approach to standards harmonisation. First, the transition between 'project standards' generated within the context of an international collaborative programme, and international publicly available formal standards is not an easy one. A British official noted that there is no agency or mechanisms for such project standards to become European standards, and that the only existing military route to formal promulgation as a standard would be NATO.

Second, project-based standards can lead a company away from harmonisation and towards accumulation of different sets of standards as used in different projects. For example, we interviewed one manufacturer who had produced US systems under licence, participated in two collaborative European programmes, and had another joint venture with a US firm. This firm ended up working with four separate Standards Parts Manuals (two specified in Metric and two specified in Imperial measures). Each different international project was associated with different sets of standards that were aligned with national rather than international standards systems even though the programmes were collaborative international projects.

Third, management of the standards used in a international joint project often becomes a complex task, which does not necessarily result in harmonisation and rationalisation. A manager from the armoured vehicle industry argued, for instance, that "the MRAV programme has fifty standards in the first few pages, with eight or nine designations, some only in national languages which need translation; all this produces extra costs and wastes time."[25]

The work that is necessary to harmonise and rationalise standards in the framework of international programmes is also exemplified by the tri-partite Horizon frigate project. In this programme the French, British, and Italian partners have had to set up a "standard identification task" with the objective of examining and reforming some 800 standards. The 'task' had to verify the conformity between standards and the contract specifications, determine which were the lowest-cost standards available to attain the performance levels defined in the specifications and to use international commercial standards as much as possible.

However, some industrial participants and representatives from naval industry associations stressed the many problems that the Horizon programme has encountered, many of which will be familiar to the observer of international collaborative projects. These problems affect not only the design of the ship but also the standards applied. For instance, Italy requested more space for crew accommodation arguing that, otherwise, the design would not conform with Italian standards on conditions of work (the final design had to accommodate this requirement and resulted in a bigger ship than initially planned). These types of problems led a respondent to argue in favour of European institutions to drive the standardisation process over a sustained long period, instead of relying on a project by project approach.

5.5.2 Effectiveness of co-ordination between national, European and international standards bodies

In general respondents were reasonably satisfied with the ways in which different SDOs co-ordinated their activities. Table 5-1 shows the specific ratings on this question group (not all respondents gave a rating). Nevertheless, very few respondents considered the situation to be 'very satisfactory' and a substantial number of respondents found much at fault with SDO system.

Table 5-1 European survey: effectiveness of coordination between European, international and national standards bodies

	Very satisfactory	Satisfactory	Unsatisfactory
Belgian		1	
French		5	
German	2	6	2
Italian		4	
Dutch		1	5
Portuguese		3	2
Spanish	1	1	
Swedish	1	5	3
UK		1	2

[25] MRAV is an international European programme to develop and produce an armoured vehicle. The United Kingdom, Germany and France are the initial partners, the programme being known as the MRAV Multi Role Armoured Vehicle (MRAV) in the UK, Vehicule Blinde de Combat d'Infanterie (VBCI) in France and the Gepanzertes-TransportKraftfahrzeug (GTK) in Germany. It is being managed by OCCAR, and it has been presented as a modular-design vehicle selected to give the maximum flexibility for multi-purpose operation, incorporating a high level of standardisation and use of commercially proven automotive components for availability and cost reduction.

However, not all respondents were concerned about inefficiencies in the same manner. It is noticeable that defence ministries and defence procurement agencies seem much more satisfied with the present institutional arrangements than industry. Representatives from the German BWB stated that co-ordination between the military and civilian standards institutions was secured by the engineers and technicians representing their nations in the different working groups within civil SDOs and comparable working groups in NATO; they judged this situation to be satisfactory and that there was no need for change. It was clear that for most respondents, answers depended on specific experience, and for some it was difficult to say whether participation in the various levels of committees was or was not efficient.

In terms of transatlantic co-operation some respondents pointed to instances of satisfactory dialogue. An interesting example is the work of the AECMA and the US Aerospace Industries Association (AIA) to develop jointly a set of writing rules and specific vocabulary known as Simplified English to simplify and standardise the language used in technical maintenance manuals. An industrial respondent stated that the Guide to Simplified English was one of AECMA's most successful ventures, being used across the world in all sectors of the aircraft industry. In contrast, some industrial respondents pointed to evidence of European national voices being ignored in the US unless defence manufacturers maintain a semi-permanent presence there. There are also some fears that NATO procedures tend to become 'nationalised' by the defence agencies of the larger European countries.

An industrial respondent noted that co-ordination was getting better in those areas where defence agencies where withdrawing from standardisation activities. Yet, in those defence areas where civil standards are not available (e.g. ammunition) co-ordination in the standards field was still very troublesome, leading to delays in joint projects.

Requirements for change

Criticism centres mainly on slow procedures; overlapping institutional work; dangers of proliferation; lack of general standards databases; and a risk of creating artificial technical barriers by compromising on essentials. Respondents to the survey stressed that they would like to see:

- changes in procedures for decision (virtual meetings) and shortening process time
- faster delivery of standards to users
- general adoption of the Perry memorandum approach in the military sphere
- need for greater control to prevent different standards requirements from different countries

However, a general caveat must be added with respect to all of the comment received concerning the workings of SDOs and requirements for change in the standardisation system. Taken as a whole, the interviews did not indicate a particularly high level of understanding on the part of many respondents of the characteristics of the civil standardisation system, either internationally or in Europe. Understandably to some extent, this was more pronounced in national defence agencies and in firms that have more intensive defence than civil orientations. Nevertheless, we encountered frequent advocacy of changes in the civil SDO system that had already been made (for example, one respondent in a major defence firm advocated forming a Europe-wide civil standards agency, seemingly unaware of the existence of CEN/CENELEC), or arguments favouring the use of civil standards bodies in defence contexts that displayed little or no knowledge of how civil standards-making was resourced or managed.

5.5.3 The role of NATO

There was broad consensus that those areas of standardisation remaining within the military domain should, when possible, be covered by STANAGs, and at the same time incorporate an industrial input. The bulk of interviews from Belgium, France, Germany, Italy, Portugal, Spain, Sweden and the UK that expressed opinion on this point were united in this view. On the military side, there was general agreement that NATO should be the driving force during the process of transition, pressing whenever possible for the highest levels of standards harmonisation, and ensuring the basic interoperability of NATO forces.

This was even more the case in smaller countries with no advanced defence standardisation activities of their own. In Spain, a respondent from the Ministry of Defence stated that they were basically using STANAGs. Although they had latitude to use and reference other standards, they did not see any need for this option.[26] In Italy, representatives from the Ministry of Defence stated that the Italian defence standards policy is the same as NATO policy. In Germany, an official from the Ministry of Defence stated that the standardisation concept for the Bundeswehr published by the Generalinspekteur is based on NATO's standardisation policy. This concept defines the standardisation framework for all the branches of the German Armed Forces, including the procedures to prepare, produce, and update STANAGs, AQAPs, service regulations for the Armed Forces etc. Although Germany has produced a substantial number of national defence standards, this type of response places the German approach to defence standardisation firmly within the framework of NATO policies and procedures.

Despite the central role many respondents attributed to NATO regarding defence standardisation, there was widespread dissatisfaction with the way in which NATO interacts with other standards-setting organisations. Many respondents distinguish between a prolonged period of poor co-operation that occurred before 1995 and the improvements subsequent to the setting up of the NATO Standardisation Office with responsibility for NATO Standardisation Policy. Nevertheless, this latter judgement is still heavily qualified. Respondents point, for instance, to the influence of specific industries and the lack of general databases. AFNOR told us that co-operation with the civil SDOs appears to be most effective in the case of specific projects where there is strong political backing (as with CALS, for example). In some cases there has been active NATO collaboration in civil standards development -for example, NATO is in charge of preparing one of the application protocols of the STEP initiative within ISO, and participates in the development of ISO product data management standards. The collaboration between NATO and AECMA was also rated highly by respondents. Yet, these examples remain exceptions to the generally weak links between NATO and standards-setting organisations operating in the civil arena.

Co-ordination between NATO and national MoDs rates higher than collaboration with civilian SDOs. It must be noted however that the ministries themselves often place top priority to the co-operation with NATO and its standards-making structure, witness for instance the case of

[26] The view from the firms in the same country was slightly different however. A Spanish firm reported to be rigorous in following NATO standards because these were imposed by its foreign customers.

the German Bundeswehr discussed above on page 112.[27] Also, not all opinions are equally positive about the NATO relationship with national defence procurement and standardisation agencies. The French MoD along with other respondents rated them as clearly unsatisfactory. There were also concerns with the slow acceptance of STANAGs by some national defence procurement bodies. Finally, the Swedish approach is different: being a non-member, Sweden cannot access NATO classified standards.

Requirements for change
Respondents in many countries (Belgium, France, Germany, Italy, Portugal, Sweden, UK) wish an increase in co-operation between European civil standards bodies and NATO, and conversion of NATO standards into European ones. Many respondents also seek more transparency in the creation of NATO STANAGs, especially in favour of industry, where security permits. They also seek more transparency where state industries are involved, in order to prevent national governments from promoting national interests. In general, respondents were asking for better communications, procedural improvements such as virtual meetings, more co-ordination between producers and users (e.g. on interfaces), and speeding up of existing procedures. Although NATO generates standards that most regard to be of good technical quality, some high-ranking defence officials pointed out that the process is meticulous and very slow (up to four years may be needed to establish a STANAG).

Regarding the NATO relationship with civilian SDOs, the French MoD, for instance argues that NATO's "non-military needs" should be taken into account by international and European regional SDOs without first having to go through national bodies. It is therefore necessary, the argument continues, for these SDOs to recognise NATO. AFNOR expressed regret that there is no general agreement between NATO and ISO on an "internationalisation" of the "Perry Directive."

5.5.4 The role of national defence procurement bodies in developing standards, specifications and procurement practices

Countries may have general regulations or guidelines defining the main parameters for the development and use of standards in defence procurement. For all countries where information was available these have been described in chapter 4 above. We have seen that in Britain, D Stan 00-00 presents the general framework for defence standardisation, while in France the Directive No. 100009 DEF/DGA/D establishes the conditions under which a defence programme will use existing standards or develop its own. Although these formal documents provide an indication of changes in practice and policy at specific points in time, not all of the dynamics of change are necessarily reflected in the formal standardisation guidelines.

Interestingly, the ways in which procurement agencies reference specifications and use standards often raised little concern among national suppliers. This is probably due to the fact that in many countries defence procurement agencies and defence suppliers (the main focus of our survey programme) form a closely-knit community. The response of the Spanish defence-related industry was illustrative in this respect; its state-owned nature and proximity to national customers in the defence agencies has led to a purely reactive mode. Product

[27] The German Bundeswehr sees the NATO standardisation process as an immediate point of reference for its standardisation activities, before dealing bilaterally with allies or other friendly countries.

specification was never a problem, in that the producers would respond directly to defence client requests and set prices accordingly. Consequently, Spanish firms found the role of defence procurement bodies in relation to procurement practices and standards development to be very satisfactory.

Difficulties in such arrangements start to appear where foreign suppliers are concerned, and in this case experience with procurement agencies is mixed. In one case, a German electronics company stated that it received assistance from its own defence procurement agency (BWB) when dealing with international tenders. However, as Table 5-2 shows there is still some dissatisfaction among (mainly industrial) respondents about the role of the defence procurement agencies. This usually relates to how they specify their requirements and how they maintain relationships with their suppliers.

Table 5-2 European survey: role of defence procurement bodies in relation to standards development and procurement practices (numbers of respondents replying)

	Very satisfactory	Satisfactory	Unsatisfactory
Belgium		1	
France		4	
Germany	3	8	1
Italy		2	3
Netherlands		1	3
Portugal		2	
Spain	2	1	
Sweden	3	2	3
UK	1	3	4

Table 5-2 presents the general range of opinion expressed by respondents concerning the role of defence procurement agencies in developing new procurement practices and ways of using standards. Interpretation of these results must be tempered by consideration of national factors. Defence procurement agencies in small countries are not involved in the development of standards to the same extent as those in large countries with large defence budgets (like France and the UK). For instance, industrial respondents in the Netherlands rated as "negligible" the role of national defence procurement bodies in the development of standards. Some respondents in Britain and the Netherlands stated that standards should not in principle be mandated by defence customers, and in all nine countries in the interview group the view was shared that the responsibility for standards specification should increasingly be transferred to prime contractors.

Table 5-3 European survey: provision of standards guidance and advice by defence procurement agencies (numbers of respondents replying)

	Very satisfactory	Satisfactory	Unsatisfactory
Belgium	1		
France	2	2	1
Germany	2	9	1
Italy		3	3
Netherlands			1
Portugal			
Spain		2	
Sweden	4	1	3
UK	2	3	3

A related issue is the way in which the defence agencies provide guidance to their suppliers and prospective suppliers on the standards they require. Although there are clear differences across countries, clear patterns are difficult to discern. Unsurprisingly, in countries like France where the collaboration between industry and a powerful defence procurement agency has long been established, domestic agents tend to be more content with the services provided by the procurement agencies. The situation is more complex in countries like Britain, where despite important efforts at providing information on standards and an open information policy, the relationship between procurement agencies and many (although not all) of their suppliers is more distant. Finally, it is interesting to note that a Dutch respondent singled out the US DoD as the procurement body that provided most of the direct guidance to his organisation in the field of standards, specifications and practices.

5.5.5 Changes in defence procurement

Our survey enquired whether respondents perceived national defence customers in Europe to be changing the ways in which they specify systems and request standards. Virtually all of the respondents perceived that such changes were taking place in several important ways:

- International and national civil standards were being used on a much wider scale, except in cases where there were highly specific military needs.
- Increased use of performance specifications rather than precise instructions on production;
- Increasing use of 'off-the-shelf' procurement (COTS) in which the contractor selects the most appropriate component to meet performance requirements;
- Greater equivalence is being introduced between defence and civil standards in many areas;
- Greater attention is being paid to the development of European standards (ENs) and pre-standards (ENVs).

Examples of all of these changes are now found throughout the European defence sector. The French Service des Programmes Navales (DGA) has recently launched an initiative fuelled by a keen interest in reducing the use specific defence norms and opening up to international civilian standards. In 1995, the UK MoD changed its electronic components selection policy from one in which the choices were vetted by the MoD to one where the contractor is required to select the most appropriate components based on MoD specified performance and logistic requirements (Def Stan 59-36 Issue 5). In aerospace, the increasing equivalence of many civil and defence standards can allow substitution of parts in some instances (e.g. UK Def Stan 00-970 "Design and Airworthiness Requirements for Service Aircraft" still requires the use of Def Stan parts, but it allows at times the use of parts complying with BSI, AECMA or other civilian standards).

Respondents generally pointed to two main sources of resistance to these changes. The first is the problem of legacy systems. Sunk investment in older, though still operational, generations of military systems still encourages defence procurement agencies to demand specific military parts and components. Interoperability requirements often act to transpose this tendency on to newer systems. For instance, the British MoD requested components for the new Warrior armoured vehicle that were based on existing military-specifications in order to ensure that the vehicle could share stores and supplies with older systems still in operation.

However, there appears still to exist a cult of 'exceptionalism' within most national MoDs that encourages the survival of strong national interests and producer interests. Where high-technology front line systems (aircraft and tanks) are concerned, performance still takes priority over cost. Some British and German respondents argued that this is diminishing under the forces of external competition and domestic cost-cutting. Viewing the matter from another angle, however, French respondents argued that in the absence of a common European defence policy the primary client for defence goods will remain the 'nation state'. As a result, there will necessarily be divergences between state and industry agendas on specifications and standards (which have been replicated in NATO since the Perry memorandum).

5.5.6 Are defence procurement agency requirements congruent with those of other government procurement bodies?

This question drew out very few responses. Our attempt was to elicit the view of the respondents on the existence (or not) of marked differences between the procurement procedures and standards used in the defence markets, and those used in other defence markets. The few responses we received pointed however to the existence of clear disparities. In the UK, we were told that procurement practices in other government departments were noticeably different, particularly because of the concern among non-defence bodies about regulatory issues, such as health and safety, which were treated differently in the defence area.[28] In Sweden, respondents also identified differences, particularly because of FMV's punctilious adherence to public procurement regulations. It is interesting to note that issues that have attracted considerable attention from analysts, particularly in the US, like the "overspecification" of defence products or the complexity of administrative procedures in the defence markets, were not stressed by our interviewees in the European did defence industries and agencies.

5.5.7 Impact and value of trade associations

As Table 5-4 shows, respondents were mostly satisfied with the service provided by various trade associations to which they referred (the question was mainly oriented to industrial

[28] Although the general approach to the use of standards in public procurement was harmonised across departments.

interests). At the European level, the work done by AECMA, EDIG, Eurocae, and ICC was welcomed, together with the links developed between them and the larger national trade associations (for example SBAC-AECMA and BNAE-AECMA) and international associations (for example, the AECMA-SAE link).

Table 5-4 European survey: value of trade associations (numbers of respondents replying)

	Very satisfactory		Satisfactory		Unsatisfactory	
	Information	Standard setting	Information	Standard setting	information	standard setting
European bodies						
AECMA	6	5	2	2		
Eurocae	4	4	1	1		
ECSS	1	1				
EDIG			1			
ICC (International CALS Council)	1					
National bodies						
Belgian: CIP/SAAMI	2	1				
France: GIFAS/BNAE*	1	1	1	1		
Germany: BDI			1	1	1	
BDLI			2	2		
Italy: AIAD	1		3	1	1	
Netherlands: NDNA/NIID	1	1				
Portugal: AIP			1			
Sweden FIF~	1		2		1	
UK: DMA	1		1	1		
SBAC	1		2	1		
FEEI			1			
BICEMA			1	1		

*This is the only French case: otherwise trade associations have no role.
~ A very high level of participation (e.g. CALS) but not in standard setting.

Both industry and government respondents pointed out two main areas where trade associations can and often do make valuable contributions. One is in the co-ordination of industry inputs into standards-making bodies and in liaison with defence ministries and procurement agencies. The other is in providing guidance and advice to their members.

In general, however, the industry view regarding the role of trade associations in standards-making in a defence context is much more complex than indicated in the table. Most of the 'satisfaction' indicated in the table concerns the proactive standardisation profile of AECMA at the European and international levels, and the activities of a select handful of national trade associations. Respondents did not argue that trade associations generally should perforce take more active roles in standards making, especially at national levels.

Respondents noted also that many trade associations are often too small and underfunded to mobilise the views of their members effectively in standards-making. Particularly in small countries, the role of national trade associations was seen as minimal (for example, Netherlands respondents did not see the NDMA as a major force on the national or international stage). A French respondent went further, arguing that national trade associations should not be involved in standardisation - that trade associations should not risk being confused with standards-making bodies. In contrast, British MoD respondents argued that trade associations may be able to intervene if the civil standards bodies are too slow, although in principle they should work through national standards bodies such as BSI (reflecting British practice described in Chapter 2).

However, it was noted that in some cases trade associations have taken an active role in the process of defence standards reform, even if they were not directly involved in standards-making as such. In France for instance, industrial respondents pointed to the participation of trade associations (and their members) in the pilot activities sponsored by the DGA to introduce international standards instead of French defence standards. Industrialists, and trade associations, have shown particular interest in these initiatives as they perceive that they will help open international defence markets and reduce prices.

5.6 Policy goals

5.6.1 General objectives: the need for rationalisation and harmonisation

There was general agreement among respondents that, in principle, the defence standardisation system requires rationalisation and reduction of duplication. Respondents from all countries pointed out to the need for greater interchange between governments/defence agencies and the defence industries. German, Italian Portuguese and British respondents stressed the need for greater cross-border co-operation, restructuring, and reduction of barriers to change. While there were differences of opinion on how far market forces would drive this process, all agreed on the need for governments to act in a facilitating role.

It was also pointed out that a harmonised standards system could help promote technological advance and defence industry competitiveness particularly in export markets. Interviewees identified several areas where the lack of European/international standards was posing particular difficulties to their operations and increasing costs. The following four examples indicate the kinds of problems involved in this context that in the opinion of our industry respondents could be addressed by policies to stimulate progress towards broadly accepted international standards.

Software. A large German electronics firm identified difficulties in the software engineering area in that different European governments demand different specific procedures and special documents, and many have their own standards in this field. A British industry respondent referred to the particular requirements posed on software designers supplying the British national market by the strict rules laid out in the UK Def Stan 00-55 (requirements for safety-related software) and Def Stan 00-56 (safety management requirements). The same respondent noted that because of the differences between national and NATO standards, his company was often forced needlessly to re-engineer the same products in order to satisfy the standards used by different clients.

Electronic components and Information Systems. A respondent from the avionics industry pointed out difficulties experienced with quality standards for electronic components. In this area, suppliers of components for defence systems tend to base their own quality regimes on civil standards in the first place (and therefore the move towards civil standards in this specific field has less potential to yield new cost savings). The respondent stressed that this is a field in which it is becoming more difficult to establish standards, both because they have to be based on the harmonisation of a wider range of quality requirements and because of the widening range of commercial interests (see Profile 15 - Electronic Components – in chapter 7). With respect to Information Systems, German Bundeswehr representatives confirmed that the 'hardening' issue still presents major problems as different countries continue to insist on different hardening standards for Information Systems hardware.

Aerospace. The space division of a large aerospace company pointed out that they were operating with different standards in the civil aeronautic, military aeronautic, and space sectors, and that there was a need in the future to harmonise the standards for all product categories that fall within the same levels of technological complexity. Other respondents in the sector mentioned materials specifications as a primary target for rationalisation (in this area SBAC and AECMA have already launched an important initiative), and pointed out to fasteners as an area where problems existed.

Shipbuilding. Interviewees identified areas like steel plate and hydraulic fluid systems where international standards were needed and should be possible. They are lacking primarily because of the intransigence of national maritime and defence authorities rather than for compelling technical reasons.

Each of the above cases indicates a situation (of which there are many more than could be related here) where, in the opinion of our industrial respondents, more action is required on the policy front than on the technical front. These are considered to be the most appropriate kinds of opportunities for public sector intervention.

Another area about which several industrial respondents voiced policy concern, is the degree of international access to standards documents. The ease with which US standards documents can be accessed have made them a common reference in many foreign (non-US) contracts, and some industrialists demand that similar documents by European defence agencies are made more freely accessible to the rest of the world.

Although certification is not strictly a standardisation issue (but rather a problem involving standards -see Chapter 8), it elicited many concerned responses. Although the acceptance of civil testing results by other countries is being fostered by Mutual Recognition Agreements under EU auspices, many respondents believed that the problems of testing and certification need to be addressed more extensively to minimise overlap, and to overcome cross-border mistrust of other national standards. Some respondents stated that either this should be a common task, given over to a 'trusted' common or international body, or that interested observers should be admitted to national testing processes.

It must be noted, however, that not everybody perceives the same need for policy-led reform initiatives.

- Different perceptions of the need for an active approach to standardisation reform were apparent across different countries. Smaller countries appeared less concerned about the shortcomings of the present defence standardisation system. For instance, a representative of the NDMA suggested that standardisation systems and their shortcomings were not a primary source of concern for the Dutch defence industry (only for a small portion of the 148 active NDMA members were defence sales substantial sources of revenue).

- Differences were noted also between main systems assemblers and their suppliers. A foundry and mechanical engineering group supplying large defence contractors did not see the standardisation system as a concern. As subcontractors for major defence projects they were producing to somebody else's specifications and they were not concerned about who was ultimately responsible for these specifications.

- Another respondent from an industry association saw the entire reform process as being led by the US initiative and driven technologically by the electronics and computer industry. As this sector was no longer prone to respond to specific demands from defence customers, the change in standardisation approaches would take place anyway without the need for specific European initiatives.

There was also some degree of scepticism about the way in which harmonisation and collaboration was taking place in practice. A British industrial respondent gave the example of the way in which standards used in international collaborative helicopter programmes were being defined. In 1990, AECMA published a report on "Proposed Standards for Future Helicopter Projects" (AECMA/CN-16692). The report contained national, programme and company standards used on the then current co-operative programmes and was intended to provide a reference for the selection of standards in future international projects. According to the British respondent, the list was predominantly of French and German standards used in the Franco-German Tiger programme with a few from the British-Italian EH-101. The document stated that the listed Tiger components would be used on the new NH90, implying that EH101 standards would not be used even if converted to AECMA (and therefore EN) standards. The respondent presented this case as an example of a situation in which national considerations and the market share requirements of specific consortia were precluding real standardisation efforts at an European level.

5.6.2 Types of standards

Apart from specific technological areas in need of harmonisation and standardisation, our survey also questioned respondents as to actions that might be required on specific types of standards. In general, all respondents agreed that standards used in defence procurement should define interfaces and interoperability criteria rather than product characteristics, and that they should define performance criteria rather than set out overly-detailed technical specifications. It was generally perceived that these principles should guide all standards documentation in a defence procurement context.

Reflecting the emphasis on performance over prescription the main problem area identified by our respondents concerned the types of standards most usually associated with industrial and management processes than with technical description as such. Referring to the nine formal classification used by the US Navy (as given in Chapter 1), these concerns focus primarily on management standards, manufacturing process standards and codes of practice, and secondarily on related data acquisition/interchange standards and maintenance standards. In one way or another, most of these standards traverse or are tangential to Quality Assurance subjects.

As process standards are gaining in profile, it is not surprising that they were frequently singled out as an area in need of improvement. This was particularly true in areas like aerospace and related sectors where many processes in many industries and firms must be integrated into a complex final product with a relatively long intended life-cycle. An aerospace manufacturer in a smaller EU country referred to "Total Quality" and "statistical control of the manufacturing process" as areas in which the aerospace industry should focus and adopt standards common to civilian and military operations.

Furthermore, an aerospace industry association stressed the importance of establishing process standards in the electronics sector as a prerequisite to tackling the ever-present obsolescence problem.[29] As the life-cycle of commercial electronics components keeps getting shorter, a new component has to be certified every time an existing component becomes obsolete. To avoid the need for constant re-certification in an environment of rapid technological obsolescence, there is a need to move towards standard design procedures.

5.6.3 Standardisation levels

Respondents were generally familiar with the NATO definitions of standardisation levels (as given above in section 4.1.1) and responses tended to be framed around these definitions. To review them briefly, NATO defines 'compatibility' in terms of the capability for systems to be operated side-by-side without interfering with each other, 'interchangeability' in terms of being able to move selected components from one system to another (e.g. ammunition), 'interoperability' in terms of enabling one system to work directly with another (e.g. telecommunication systems), and 'commonality' as the complete standardisation of all components and sub-systems.

Many respondents were of the view that basic compatibility was now an insufficient standardisation level for most of the current requirements of cross-border co-operation and rapid reaction forces. Nevertheless, the pragmatic view shared by most respondents was that achieving higher goals like interchangeability, interoperability and commonality would depend very much on the context. As such, commonality was seen generally as attainable mainly at the levels of concepts and doctrines, and potentially through the implementation of common programmes such as Eurofighter. British sources cited commonality as an appropriate goal for environment and safety standards. As noted already (in section 2.1.5) military strategists can regard commonality as a strategic disadvantage if taken to too great an extreme.

[29] The obsolescence issue is addressed in more detail in section 3.1.5 A caveat: does obsolescence justify the maintenance of military specifications?. It must be noted that difficulties in this area did not appear to be unique to the electronics sector. An example was given by an interviewee of a supplier of aircraft tail lights that changed the design of this component causing a serious difficulty for one of its system assembler clients. This difficulty may not necessarily be solved by using formally established standards. Another aerospace industry respondent pointed to the fasteners standards used in the Lynx and EH101 helicopters as well as Tornado and Hawk aircraft; these were selected in line with the, then current, ISO recommendations. Unfortunately as the ISO standards evolved they were subjected to changes that made the new standards not interchangeable with the series in use in these aircraft.

Of the different levels of standardisation discussed by respondents, interoperability and/or interchangeability emerge repeatedly as the main objectives towards which equipment standardisation should be targeted. This was reinforced by the official response from the French Ministry of Defence, which stated that rationalisation and harmonisation were required at the level of system interoperability, particularly with NATO countries. Generally speaking, the French position was that standardisation efforts should focus on:

- functional requirements described in terms of verifiable performance requirements and/or of results expected from the main system (or major sub-systems) and its support systems
- interoperability requirements among systems and with those of the allied forces, and of interchangeability of materials to satisfy the common needs of logistics support and conditions of use (specially ergonomics)

In general, the survey indicated that interoperability goals were paramount in areas like software, communications systems, and avionics. For instance, German Bundeswehr documentation states that, following NATO's approach, interoperability should be the general objective for Information Systems, and should apply to areas like the exchange of formatted written messages, and the interoperability of simulation systems used for training. A similar approach was echoed in the response received from the Portuguese General Directorate for Armament and Defence Equipment. In their view, standards activity should be centred in the field of communications interoperability, data transmission and processing, information systems, simulations, etc.

However, citing the areas of data security and encryption, a Swedish respondent stressed that even for communication systems, achieving interoperability is seldom straightforward. As noted in Chapter 3, encryption is an area that national governments are keen to control as a key element of national security. This conflict between the goals of interoperability and security can create problems for contractors. A respondent from a space technology company noted that in order to obtain interoperability in EHF band satellite communications with US satellites, it was necessary to purchase classified US materials, and that the same would occur with applications using classified codification or TRANSEC protection.[30]

Respondents in Belgium, France, Germany, Netherlands and the UK equated the objective of interoperability with the need to define interfaces. Standards should define interfaces that enable operational compatibility and the interchangeability of key components, all with the aim of achieving defined levels of interoperability. The German procurement agency (BWB) considers that standardisation of interfaces is the precondition to enable interoperability, which in this case is defined as the possibility to provide mutual support and launch joint military operations. A British aerospace manufacturer argued the case for limiting standardisation activity to the definition of key interfaces and functions in order to encourage an open and dynamic design environment and production infrastructure. The analogy of the mobile telephone was invoked to illustrate how concentration on standardising the interface allowed designers progressive freedom to develop new systems in which individual components could be changed and upgraded without threatening the functionality of the system as a whole.

[30] Transmission Security (TRANSEC) is defined as the portion of communications security resulting from all measures designed to protect transmissions from interception and exploitation by means other than cryptoanalysis.

The German Bundeswehr stressed that for items like munitions and selected spare parts, interchangeability would be the most appropriate goal. However, munitions manufacturers noted that commonality within NATO countries was almost complete as far as conventional munitions was concerned. Howitzers, field guns, AA guns, etc. have exactly the same calibre, the same expansion chamber volumes, etc. A munitions manufacturer stated that because of this commonality the conventional cannon and its munitions had become virtually a commodity, and that standardisation in this field was no longer an important issue.[31] On the other hand, munitions safety presents a very different issue. A technical manager for a British defence company stated that there were 24 different standards for munitions safety grouped under 7 different designations (STANAGs, MIL-STDs, Def-Stan, etc.). In other words, the possible advantages of virtual commonality in the design and manufacture of munitions can be thwarted by a proliferation of standards concerning factors like storage, handling, training etc..

For the most part, however, respondents viewed commonality issues more in terms of standardised concepts and doctrines than of technology as such. 'Procedures' was another area where some respondents thought further commonality might be desirable. For example, respondents in the German BWB stressed the importance of achieving greater commonality for procurement practices by establishing standardised procurement procedures across European countries. These could support European collaboration from the early stages of programme definition and planning, and ultimately support the harmonisation of defence procurement planning in the Member States.

5.6.4 How far should the transition from military to civilian standards go?

There was general agreement among respondents that the transition from military to civil standards should be accelerated wherever military exigencies permit. Respondents from all countries agreed that greater use of civil standards and COTS products should be made in preference to military specifications and standards. However, the pivotal issue is how to define those specific areas where military exigencies do not permit the transition to civilian standards. It is here that we found differences among respondents. The extent to which considerations of national military strategy and procurement may set a limit to the use of civilian standards varies depending on the policies of individual governments and their views on the nature and determinants of national security.

Many respondents still referred to the traditional arguments concerning differences between military and civilian technology requirements

- *performance* - military users may seek higher performance parameters at a cost of efficiency and reliability;
- *hardening* - military systems must be capable of operating in extreme environmental conditions and in situations of extreme hazard that do not routinely occur in civil applications;
- *security* - military installations and information systems require extraordinary levels of security protection.

[31] This is not the case for the new high technology munition arming new systems like "smart bombs" and guided missiles. Here the munition is so closely integrated with the entire weapon system (both hardware and software) that some traditional munition producers have been unable to capture a role in this evolving market.

These arguments are embedded, for example, in the official response received from the French Ministry of Defence which distinguishes two main domains in military standardisation:

- an area identical to the civil domain, subjected to the same requirements and constraints (for instance, security -air security, transport of dangerous materials- and environmental regulations)
- an area with specific military requirements, where the required performance is higher than in the civilian field or where the operational environment is much harsher (stealth, hardening, NBC protection).

This communication goes on to define nuclear technology (security, hardening), information exchange (security, data formatting), arms and munitions (security, etc.), and the military environment (condition of use, stealth, etc.) as representing fields with clear military specificity:

However, most respondents recognised that the quantity of genuine military exceptions is falling in practice. The difficulty then shifts to defining the *extent* to which these remaining specific military requirements call for distinct military standards. In the official and informal statements received through our interview programme we found little evidence that wholly coherent (much less common) criteria were being formulated or followed by industry or governments in this grey area of standardisation activity.

A positive approach to the problem was suggested by AFNOR in a written response provided to the research team. AFNOR defines the general areas in which it considers military specificity to be justified or not justified (see Table 5-5). The argument behind this definition is that it is only with respect to the definition of performance levels, product specifications, and codes of practice that the military clients may demand the use of different standards. In the case of codes of practice the objective is the application of a concept or a standard to a particular military environment. As such, a code of practice is aimed primarily at a specific group of users. Therefore, it can be justifiable to target codes of practice to particular military users. By contrast, test methods do not have to be differentiated for different user groups. For example, although military users of some materials may require proof of higher levels of resistance to environmental hazards than civil users, there is no reason that the test methods employed to measure these resistance levels should be different.

In general, most of the common justifications for retaining specialised defence standards were not backed up by the evidence or opinions expressed by the interviewees. It was acknowledged that in many areas, civil technology standardisation practices deliver both superior performance and potential cost savings. For instance, in reference to the problem of obsolescence in electronic components and sub-systems (see above section 3.1.5), interviewees in France, Germany, Italy, Netherlands, UK agreed that the civil concept of open architecture design was the most likely solution electronics systems renewal and replacement problems in both civil and military applications.

Table 5-5 Where are specific defence standards justifiable? A view from AFNOR

General standards categories	justifiable	not justifiable
1. Compatibility		
Interfaces	questionable	√
Data modelling		√
2. Processes		
Testing methods		√
Management		√
Production Processes		In general, they should not be specified through standards
Codes of practice	√	
Maintenance		√
3. Product specifications		
Performance	√	
Detailed product definition		In general, they should not be specified through standards

Source: Personal communication, Pascal Poupet and Jean Hyenne (for AFNOR).

In other areas, the performance of commercial products has exceeded that of equivalent military products, and commercial standards are therefore increasingly adequate for military use. According to a defence vehicle engine manufacturer, for example, the civil quality grades for engine lubricants are now higher than military grades, and NATO countries largely have abandoned the latter in favour of commercial products.

However, a helicopter manufacturer pointed out that there were still differences between the needs and requirements of its military and civilian clients. Civil clients required more exacting reliability and efficiency levels, whereas military customers normally place more emphasis on technology performance requirements. This example seem to be confirmed by an Italian Ministry of Industry official who argued that the civilian standard for helicopter turbines was, in some respects more demanding than for military engines. Because of fire risks, the burning chamber of civilian helicopter turbines has to be made of steel, while the same turbine for a military helicopter is made of aluminium and chrome. This results in an engine that is more powerful but much more prone to fire hazards.

Our survey uncovered anecdotal evidence that some firms with minimal or no current presence in defence markets were being virtually locked out of these markets by current defence industry standards and practices could virtually lock them out of these markets. In some cases, moreover, these problems persist even after a civilian standard appears to have been adopted. In the crucial field of quality standards (a leading area in the reform of US military standards, see belowsection 6.3.6) the adoption of ISO 9000 in military procurement was often referred to by respondents as an example of successful transition. However, the ISO standards used in the military field are then 'versioned' to suit particular defence applications. For example, NATO AQAPs based on the ISO 9000 quality standards series (see below section 7.3.1), introduce modifications of the original ISO standards. A German electronics firm complained that the ISO9001 standard as versioned in NATO AQAPs included further important requirements like the establishment of specific configuration and risk management techniques within the firm. An official from an international organisation pointed out further that firms from different countries were differently positioned in the transition to civilian quality standards. For instance, while most British defence firms are already ISO9000-certified, their French counterparts are comparatively behind in the process, with some large military firms still in the process of obtaining corporation-wide ISO9000 certification.

Our interviews revealed several additional examples of areas where civilian standards should be adopted by defence manufacturers, or, alternatively, where military requirements were different enough to warrant the use of different military standards.

An executive of a large defence shipbuilder remarked that there were many areas in military shipbuilding in which the sources of standards had been "non-military by tradition". Areas that have traditionally used civilian standards include the technical construction of hull and infrastructure (welding, riveting, steering gear, etc) engines, hydraulics, electrical engineering, fire hazards, safety systems (water-tight compartments) and so forth. Yet, a British manufacturer asserted that even though civil and military structural standards were converging (the British Navy was looking at using Lloyds standards for warship design), specific defence standards were still being specified. According to another British interviewee HMS Ocean will be the first case in which the UK Navy has accepted merchant navy standards for specification of the characteristics of a warship hull.

Other areas pointed out by respondents where civilian standards are increasingly used (or should be used) in warships include fittings, accommodation, and structural design. Yet in other areas (mainly those related to protection against environmental conditions) respondents agreed that military requirements are different. A minesweeper requires different forms of resistance to external shocks than does a merchant ship, and the military will continue to require NBC protection that it is not needed in civilian environments. In the UK, the experience of the Falklands War has led to a tightening of specifications in areas were the vulnerability of ship design was exposed: for instance, aluminium superstructures (which were found to melt under the heat from an Exocet missile explosion) and electrical cable insulation.

An example of a formal strategy being developed by a military shipbuilder to move from defence to civilian specifications can be found in the French DCN shipbuilding enterprise. DCN is at present developing a new internal set of technical reference documents based on international civilian standards to be included in its specifications to suppliers. The DCN expects to reduce the cost of the products it buys-in by increasing competition through the introduction of COTS products.

A similar rage of experiences and examples were cited by industrialists in other sectors. An avionics manufacturer drew attention to ICAO standards for air navigation security which the firm was voluntarily introducing in their military equipment portfolio. Another interviewee remarked that civil requirements for immunity from radio interference in aircraft are higher than military ones. By contrast, respondents in several countries agreed that the exchange of secure information should remain in the reserved military sphere. A manufacturer of engines for military vehicles pointed out that a large number of civilian sources of standards were already routinely used (especially from ISO and SAE).

In some areas, however, questions were raised about the benefits of using standards in the military arena that were designed originally around problems defined in the civil arena. An example offered by an armoured vehicle producer concerned the civil environmental standards for engine emissions which were now becoming mandatory for highly specialised military vehicles. In this case, the standards were designed to control the pollution caused by a problem of scale - i.e. the existence of hundreds of millions of cars and trucks. By not exempting the small number of specialised military vehicles (typically no more than a few hundred in any given country), the costs of producing engines for these vehicles is greatly increased relative to their minuscule contribution to overall levels of air pollution.

5.7 A role for the Commission?

There are important differences among respondents in the way they see the role of the Commission in the area of defence standards reform. The French Ministry of Defence, for instance, sees the EU role to be conditional upon the agreement of the Member States to open their defence markets. Its official response to our enquiries states that "if the Member States wish effectively to proceed to open their national public defence markets, it appears to be sensible to undertake parallel actions at the EU level to lead standardisation in the arms sector towards convergence, while avoiding any overlap with the standardisation activities of NATO" (French Ministry of Defence, personal communication, 28 May 1998). To this end, and within the framework of cooperation between the WEU and the EU foreseen by the Treaty of Amsterdam the French MoD envisages the development of a role for WEAG to establish a collection of standards in the form of a handbook of general technical specifications to be used within the EU for all calls of tender from the Member States. This co-operation agreement would state explicitly that civil standards would be used whenever possible, and STANAGs when necessary. With agreement from the NATO Council, European SDOs could then participate in NATO standardisation work.

Not all the responses received contain the same level of detail on preferred courses of action, but some point out that co-operation between NATO and WEU on the increasing use of civil standards and STANAGs could be encouraged under the Amsterdam Treaty. However, most respondents (particularly those in the defence procurement agencies and in many defence manufacturers) emphasised the role of NATO.

For the present, and as the CFSP develops slowly, the emphasis put by respondents on the NATO role appears to preclude any leading role by the Commission. This was argued specifically by German, Swedish and British sources. British government officials outside the MoD stated, for instance, that the British government does not recognise an EU role in defence procurement. Spanish opinions put the point even more firmly, arguing that Article 223 of the Treaty of Rome forbade Commission involvement in defence matters. The Spanish view was that NATO, not the EU, should be the nexus of international co-operation on standards, citing the example of CALS as a model for co-operation between NATO and international SDOs. Those respondents who did advocate a greater EU role, focused on the EU-NATO relationship. A German respondent proposed a joint EU-NATO commission on technical harmonisation, whereas Italian and Portuguese respondents opted for the expansion of the kind of co-operation models established by OCCAR and ECSS.

In most of our interviews, much of the discussion moved naturally to the issue of forming a single European defence market, but no obvious consensus emerged on the course of action best suited to bring about such a goal. Some German respondents advocated an administrative solution, and urged the formation of a single European procurement agency. Some British respondents preferred a more technical approach, focussing on the development of a European procurement policy based on the concept of 'smart procurement', backed by a single market initiative in defence equipment. The assumption in this case was that harmonisation of civil and military standards would follow the initiative. Dutch respondents argued for a gradual political approach at the upstream end for co-ordination difficulties that are essentially political, whilst leaving the down stream technical issues to respond to market forces. In relation to narrower standards policy issues, Spanish opinion favoured only NATO as an initiator, and favoured European standards as a preliminary step to transatlantic negotiations over global standards. Some Belgian, Portuguese and British views echoed this opinion.

A purely facilitating role for the Commission, however, elicited a rather different set of responses. Given the Commission's historic role in industrial policy, rationalisation and competitiveness together with competition policy, from the various comments we received, we can differentiate four main types of proposed action:

1. that the Commission should encourage and facilitate the reforms in standards and standards-setting on which national governments are in agreement, especially where there is a possibility of bridging the military/civilian gap (e.g. in harmonising European norms and NATO STANAGs) or encouraging the movement from military to civilian standard;
2. that the Commission should encourage defence industries to meet the US competitive challenge, in ways complementary to standards reform which include mergers, rationalisation and restructuring;
3. that it should encourage the integration of European civilian standards under the umbrella of ISO through joint working groups;
4. that where necessary, in the Commission's opinion, Community financial assistance should be provided to help fulfil these aims.

5.8 Policy approaches: final remarks

5.8.1 Different requirements and perceptions

The survey has revealed a fragmented situation regarding both perceptions and policy requirements regarding defence standardisation matters. We can define four main areas in which differences exist.

First, our survey confirmed the juxtaposition of different national interests and political cultures, and the different approaches to defence standardisation issues they have generated.

The view articulated most clearly by French sources is that the international political system works inefficiently and slowly -witness the stunted evolution of the European CFSP- and that ultimate decision-making power for defence matters must still lie with the nation state. In particular, the nation state should hold sole responsibility for defining the exceptional areas where military standards should prevail, with the corollary that the military authorities should participate in the evolution also of civil standards. Also, in this view, the nation state is responsible for mobilising industrial opinion - that is, gaining the knowledge, skills and confidence of industry without conceding to defence manufacturers any right of interference or leverage over the definition and development of what are purely national interests defined by the state.

German MoD officials agree with the French view on the way to mobilise industrial forces, and argue that the current system defining defence requirements works well, despite its complexity, and therefore needs little change at national level. Respondents in Spain and Portugal stressed that although the very centralised and largely state-owned defence production systems operating in their countries need to be privatised, this must not impair the state role in defining purely military requirements.

In contrast, Dutch, Swedish and British views stress that resorting to civil standards need not impair the state prerogative to insist on special requirements for equipment designed only for battlefield conditions. In this view, reform is a political process, but change has an economic dimension as well and should be driven primarily by market forces. The role of government is to facilitate and speed up the reform process, and arguments for exceptions should be made on a case-by-case basis.

Second, important differences exist depending on the type of product. General standardisation problems and requirements vary from sector to sector. In some areas fast-changing technology, the establishment of *de facto* or interim standards overtakes the formal standardisation process, leading to the phenomenon of competing product designs being embedded in proprietary standards. Manufacturers will not wish to participate in the standards-making process if it means loss of competitive advantage.

Third, respondents often pointed to policy issues that affected standards, but extended far beyond standardisation questions as such. It is not always clear from respondent statements whether standardisation is viewed primarily as a driver or as a consequence of broader procurement reforms and defence sector rationalisation. However, two broad patterns are discerable: (a) respondents concerned primarily with *industrial policy* tend to believe that standards-setting reforms can influence the reform process as a whole, and (b) respondents concerned primarily with *defence policy* believe them to be a contingent factor.

5.8.2 Government vs. industry perceptions

The survey uncovered some important differences between defence customers and prime contractors over how to reform standardisation systems. These differences have their genisis in the transformation that has occurred in the relationship between buyers and seller for many defence-related products. The regime in which the state as customer exercised a dominant position in key industrial sectors, thereby enabling it to define detailed product and service specifications, has given way to one where defence customers account for a smaller and declining share of total markets, and must resort increasingly to the use of commercial technology and standards.

The issues emerging from this transformation concern where in the new framework responsibility for product design, certification, performance and maintenance will lie. Specifically, they concern the question of who will pay the costs of standards-making and standards compliance. Prime contractors may or may not wish to assume all of these costs and responsibilities and may see disadvantages for them if states relinquish overall responsibility for setting specifications except in a narrowing field of purely military applications. In contrast, defence ministries tend to argue that the areas of highest risk for prime contractors are still covered by military specifications, and that there are substantial compensating factors for prime contractors, who in any case can pass much of the risk on to their subcontractors.

There are also differences regarding who should motivate the process of defence standards reform. While the role of NATO is emphasised strongly by European defence agencies and contractors, Europe lacks a 'prime mover' comparable to the US DoD. The possible role of Eu institutions is contentious - even at advisory or facilitating levels. French and Belgian government sources emphasise the importance of the 'prime mover' role' in stimulating progress towards a truly pan-European Common Foreign and Security Policy. In contrast, throughout our investigations, industrial respondents focused on approaches that did not appear to be so contingent on progress in the political front. Industry mainly emphasised the need for pragmatism. Some firms advocated the greater use of international standards, but many were in favour of accepting a US-based military standards regime which was already established in export markets.

5.8.3 Areas of agreement

Although the survey has exposed substantial differences in opinions and perceptions between industry and government, there were some general points on which we found a consensus wide enough to provide some foundation for targeted policy action.

We noted general agreement between governments, defence ministries and procurement agencies on the need for defence standards and procurement reforms and on what these reforms are expected to achieve: reduction in costs, greater interoperability, defence co-operation, competitiveness especially in export markets, and facilitate the exploitation of dual-use technologies. These goals are set out in various published documents ranging from the French 1995 Directive to the recent Strategic Defence Review in Britain,[32] and include the briefs given by the Swedish government to the FMV and by the German Federal Government to the BWB. Exceptions relate to details. The same consensus was true of the three armed services, apart from disagreements arising from their requirements for specific categories of military equipment.

Finally, manufacturers and trade associations at all levels believe that standardisation reforms will undergo wider change in any case, for good economic as well as military reasons. The US example has of course been facilitated by natural advantages: a single agency in the Pentagon with a distinct capacity to impose technical specifications and characteristics on contractors, a single set of armed forces, a coherent national defence policy and a single federal territory. As none of these conditions exist in Europe, the US experience will provide less a map, and more a traveller's handbook to European policy-makers.[33]

32 Principal recommendations of the SDR are: modern commercial management techniques in the Defence Agency; use of integrated project teams including MoD and industrial representatives; concentrations of reserves in early stages of defence projects to obtain better definition before development and production; streamlined approval process focused at the initiation and main investment stages; clear identification of customer within MoD structure; separation of acquisition method (low risk/minor project/major project); improved project management over the average 20.5 year timespan. These are often summed up in the phrase "smart procurement".

33 For instance, regarding the effective capacity to define product specifications, the responsible for standardisation in a medium-sized German defence manufacturer stressed the influence that the European industry has in defining the technical specifications of defence systems and, ultimately, the standards themselves. He argued that it is industry that often determines procedures and standards partly acting on behalf of the defence procurement agencies. This influence results, the argument continues, in the adoption of a large number of "single-source" technical solutions that may "lock-in" the defence customer to the specific supplier. Therefore, the standardisation framework in Europe would, according to this interpretation, already be largely dominated by the main European defence corporations.

6

STUDY OF MILSPEC REFORM IN THE UNITED STATES

6 Study of MILSPEC reform in the United States

6.1 Overview

Standardisation drives within the defence industry in the United States have taken place in the context of broader acquisition reform initiatives. Policy initiatives by the US Department of Defense (DoD) have focused on reducing the number and variety of what both government and industry have come to view as onerous military specifications and military standards (milspecs/milstds). These initiatives have emphasised the transition to commercial standards and specifications in order to reduce weapons systems costs, increase industrial flexibility and improve industrial efficiency. In the long term, it is hoped that these efforts will set the stage for greater integration of the military and commercial industrial bases in the United States. Standardisation has been a concern in these efforts, but the focus has been on reducing milspecs/milstds in order to allow introduction of common (preferably commercial) practices across programs and throughout individual facilities. DoD and industry both believe that greater standardisation could be achieved if rigid, DoD-mandated standards are eliminated in certain cases to allow defence contractors to apply single processes across multiple programs. An example is in the area of soldering, where contractors have been required to satisfy multiple and often conflicting milspecs/milstds for several different programs, even though production took place within common facilities. As a result, multiple soldering methods have been required where a single, standard process could be utilised in order to improve efficiency and reduce costs.

This section examines defence industry standardisation trends in the context of current acquisition reform initiatives in the US defence industries. To undertake this assignment we have coordinated a network of US defence manufacturers, government contacts and applied the TASC corporate defence resources necessary to address the field of defence procurement reform in the US defence industry. TASC has worked closely with SPRU analysts to provide the US component of the study.

This section provides:

- a "situation report" of the changes in the US approach to military standardisation;
- an analysis of the military acquisition reform environment and major areas of focus;
- an analysis of the migration from defence to commercial practices;
- an analysis of the leading sector indicators and adoption of "best practices" to reduce cost and increase competitiveness;
- an analysis of an industry survey conducted with leading industry and government executives concerning the impact of acquisition reform;
- a detailed sector assessment of companies that are leading in acquisition reform related initiatives.

A key element in this report is the use of data collected from the Single Process Initiative (SPI) program, an effort by DoD to introduce common commercial standards and practices throughout contractor facilities in the United States. TASC developed a customised database of SPI information to assess changes by industry sector and standards areas. This data and analysis also permitted corroboration of more subjective responses by industry and government officials collected through surveys and individual interviews.

Collectively, the information and analysis provide an overview of both general and specific reform and standardisation trends in US defence sectors. In general, the following observations can be made about current trends:

- Acquisition reforms have been implemented across a broad range of sectors and standards areas in a relatively short time period. Unlike previous rounds of "reforms," these changes do appear to have potential for more lasting and perhaps permanent transformation of the US defence industry.
- Industry has responded to policy challenges by initiating numerous changes within current production programs through the Single Process Initiative (other changes also are under way, but SPI provides the only source of consistent data to measure industry responses to these changes).
- The reforms introduced to date may reflect areas that relatively are easier to change than others. The most likely explanation for this situation is that changes being made are in areas subject to discretionary authority under the Department of Defense rather than areas governed by more rigid legislative statutes.
- Some government officials believe that acquisition reform already may have gone too far and seek means to assure consistency and standardisation in critical areas such as software. The tempo of reform may be slowing, but DoD is attempting to sustain activity through new initiatives and working groups. Barring an unforeseen event that could reverse trends, acquisition reform and the transition to commercial practices is likely to continuing for the foreseeable future.
- From an industry perspective, industry consolidation may have a more profound impact on business operations than acquisition reform. However, both industry and government officials believe that a closer working relationship may be developing between contractors and procurement agencies than existed prior to the introduction of reform initiatives. Acquisition reform and standardisation through increased use of commercial practices remains a dynamic area. This report addresses activities of major prime contractors, but little is known of subcontractor activities. The competitive impacts for US industry also remain unclear, offering both potential benefits but also short-term gains that are likely to be negotiated out of future procurement contracts. Finally, obstacles remain that could minimise the positive aspects of acquisition reform for both government and the defence industry. DoD is not likely, however, to retrench in its reform drives, making it necessary to understand these trends and their implications for the future.

6.2 Background and key issues

The end of the Cold War brought about a significant change in the force structure and financial backing for the Department of Defense (DoD) and its industrial partners. US Government leadership turned its attention to reducing the deficit and improving the operational efficiency of government agencies. As defence dollars were reduced, DoD was faced with extending the life of ageing weapon systems, a flat line budget, and little discretionary funding available for weapon systems re-capitalisation and technology insertion.

These shrinking resources posed a formable challenge to maintaining the effectiveness of US weapon systems. The DoD committed to making revolutionary improvements that would reallocate infrastructure costs and establish DoD as a "world class" organisation. It was envisioned these efficiency improvements, smarter buying and streamlined support practices would enable "better, faster and cheaper" operations for both the US military and its industrial base. The resulting savings would support future military investment plans in revitalising ageing weapons and provide US industries with a leaner, more competitive stance in global military markets.

DoD has identified a need for an additional $30 billion in procurement over the coming decade to support key modernisation programs. However, it has indicated that new funding cannot be expected in these resource constrained times. As a result, funding essentially must be derived from savings achieved through reform efforts.

Rather than imposing single industrial standards across defence companies, DoD has chosen to achieve efficiencies in business and manufacturing processes through its acquisition reform efforts. Key elements in this strategy are the reduction of military specifications (MILSPECs) and military standards (milstds) and greater reliance on contractor capabilities and initiatives to achieve savings in production programs.

6.2.1 US Government reform initiatives

Department of Defense efforts have taken place in the context of both budgetary constraints and broader initiatives within the US Government to reform internal and external operations. Reforming government to reduce cost and improve operations has been a major theme throughout the 1990s. In 1993, for example, President Clinton launched a campaign to reinvent government and improve all aspects of government operations. These initiatives were designed to improve the quality of government services, support government deficit reduction efforts, and maximise the value of government spending. In addition, several legislative measures approved by the US Congress have mandated broad changes and have provided the legal basis for department secretaries to introduce changes such as those directed by recent secretaries of Defense. These include:

- The Government Performance Reform Act of 1993 (GPRA): GPRA required federal agencies to set multiyear strategic goals and corresponding annual goals. Agencies measure performance toward achieving these goals and report to Congress on their progress. Future year budget decisions use GPRA results to assist in the budget allocation process.
- The Federal Acquisition Streamlining Act of 1994 (FASA): FASA provided broad authority to all government agencies to purchase commercial items. It eliminated certain statutory restrictions when buying commercial items, streamlined most contract actions, and raised the simplified Acquisition Threshold—the ceiling value at which individual procurement officers can make discretionary purchases without resorting to public procurement competitions—to $100,000. This final point in particular has enabled more efficient small purchase operations. FASA may be the most important of the legislative changes listed here from a DoD perspective due to the introduction of streamlined purchasing practices.
- The Federal Acquisition Reform Act of 1995 (FARA): FARA built upon FASA to further improve government-wide procurement processes by simplifying competition requirements in the award process, raising thresholds for sole-source procurements and further simplifying the purchase of commercial items.

- The Information Technology Management Reform Act of 1995 (ITMRA or Clinger-Cohen Act): Clinger-Cohen, so called after the principal members of Congress who sponsored the legislation, required all federal agencies to link their technology plans and information technology use to the agency missions and goals. Among other things, it required agencies to designate a Chief Information Officer and establish integrated plans whereby applicable technologies are procured and agency performance improvements are measured. It should be noted that the "Cohen" of Clinger-Cohen was then Senator and now Secretary of Defense William Cohen.
- The Paperwork Reduction Act of 1980, as amended in 1995 (Implemented by Office of Management and Budget Circular No. A-130): This legislation unified Federal information policies and strategies including information management policy relating to information dissemination, records management, and cooperation with State and local governments. Its objective was to reduce the burdens and costs of data gathering.

6.2.2 New procurement practices and the changing role of military standards and specifications

Over decades various requirements, specifications, standards and procurement practices evolved to support military acquisition process. These processes were designed to:

- Support the development and production of complex, state-of-the-art weapons systems able to operate in demanding environments envisioned by military users.
- Guarantee that long-term logistic requirements could be met for complex weapons systems.
- Provide consistency in the implementation of complex programs.
- Guarantee integrity in government contracting while assuring reasonable profitability for its defence contractors.
- Maintain public accountability and prevent contractor abuses.

Yet given these design constraints, the operation of defence programs continued to be criticised for decades by both internal government review panels as well as outside review boards comprised of industry and defence contracting specialists. As shown in Figure 6-1 and Table 6-1, numerous initiatives attempted to draw attention to reform within the Department. In general, these studies focused on simplifying acquisition processes and improving management of weapons programs rather than on industrial standardisation. Panels typically contended the military methods were excessively costly and impacted on the ability of US military industries to compete in world markets. For example, the Perry study[34] concluded that on average, compliance costs resulted in an 18 percent cost penalty for the procurement programs examined.[35] The study concluded that the degree to which commercial and defence production was segregated was more than might be expected, underscoring the fact that more

34 TASC Inc. and Coopers and Lybrand, "The DoD Regulatory Cost Premium: A Quantitative Assessment," December 1994 (commonly referred to as the Perry Study).

35 Other assessments have varied in the precise calculation of costs, but generally reached similar conclusions. The Center for Strategic and International Studies estimated in 1990 that 18 percent labour savings would be possible by reducing MILSPECs. Two years later, the Carnegie Commission attributed 30 to 40 percent of total contractor costs to compliance with regulatory requirements, while the American Defense Preparedness Association (a US defence industry association) raised this figure to 30 to 50 percent of total product costs. A 1993 study by the Defense Science Board concluded DoD could achieve 20 percent savings within five years in weapons procurement costs by adopting commercial practices and reducing cumbersome regulatory requirements.

complete integration of commercial and military industrial capabilities is driven by artificial military requirements.

Despite the number of studies and initiatives, however, changes were limited until recent years. For example, the Packard Commission report was instrumental in establishing a senior political position for acquisition within the Defense Department, but it had little impact on reducing the number and variety of military standards and specifications that were viewed by this study and others as the sources of DoD inefficiencies.

Figure 6-1 DoD Acquisition Improvement Studies and Initiatives

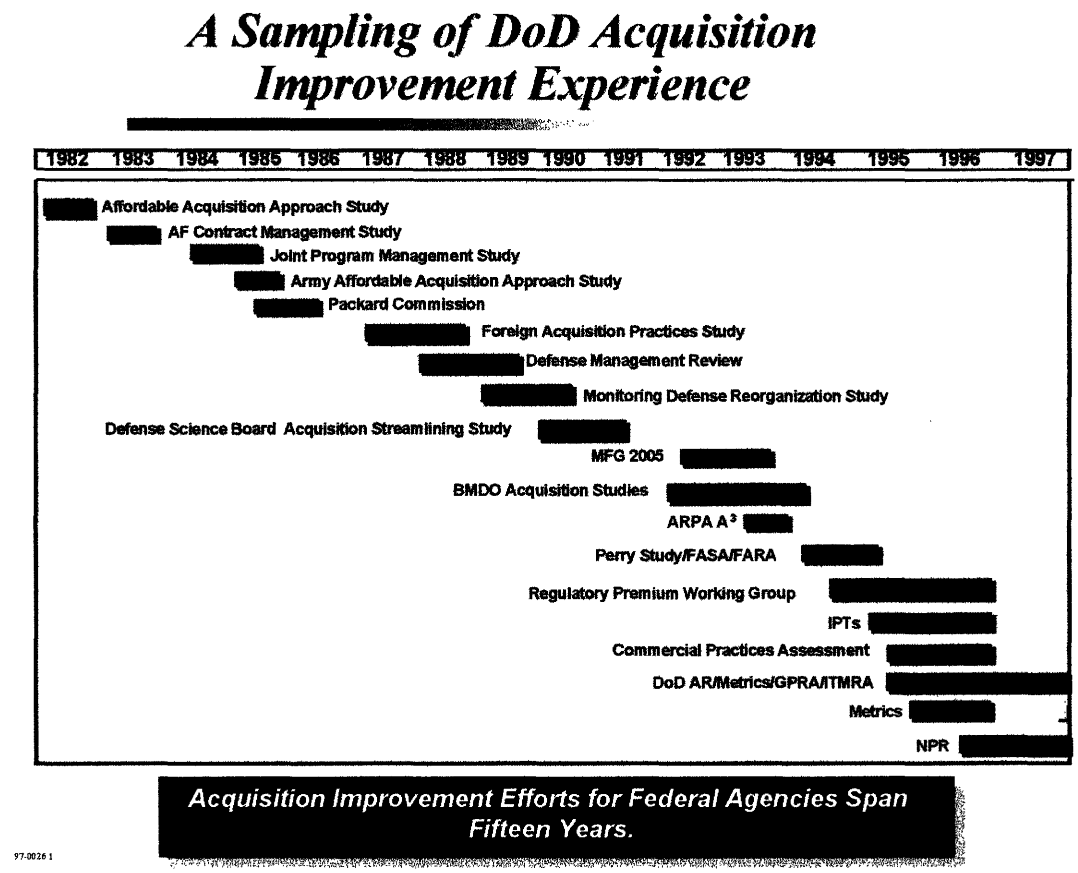


Table 6-1 Major Studies Summary

Study	Year	Focus and Recommendations				
		Immature Technology	Cost Realism	Budget/ Requirements Instability	Inexperienced Personnel	Burdensome Process
Carlucci	1981	✓	✓	✓		✓
AFSC A^3	1983	✓	✓			
Army A^3	1984	✓		✓	✓	✓
Packard	1986	✓	✓	✓	✓	✓
DSB ASTF	1990	✓		✓	✓	✓
Perry Study	1994					✓

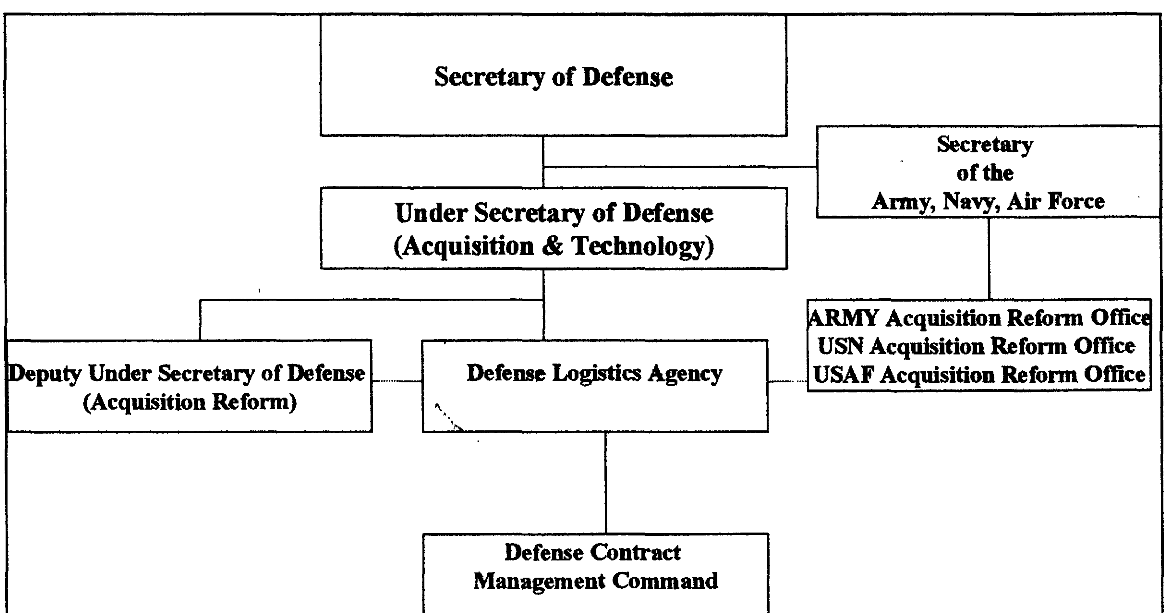
The need for reformed acquisition and business practices became apparent as defence budgets decreased. FASA's enactment and then-Secretary of Defense William Perry's June 1994 directive set in motion a comprehensive acquisition reform process. Secretary Perry's directive was particularly important. It specified that the use of MILSPECs in DoD procurements would require special justification and commercial practices would be preferred in DoD programs. Prior to the directive, the use of commercial standards instead of MILSPECs required time-consuming justification.

Secretary Perry's directive shifted DoD's emphasis from tailor-made requirements (including standards, specifications and practices) to the utilisation of commercial counterparts whenever possible. The use of commercial practices attempts to shift responsibility to industry, thereby reducing government oversight and reporting requirements while increasing emphasis on process control in lieu of inspection, industry product liability and warranties. Implementation, however, has been problematic.

6.2.3 Implementing acquisition reform

DoD established a network of reform proponents —shown in Figure 6-2— to execute lasting acquisition reform. As the leader of DoD, the Secretary of Defense mandated change in acquisition practices and became the spokesman to the United States Congress on legislative reform initiatives. Within DoD, the responsibility was directed to the Under Secretary of Defense for Acquisition and Technology (USD(A&T)) and the Military Services for execution. To facilitate and coordinate a unified approach, each Service as well as the Deputy Under Secretary of Defense for Acquisition Reform (DUSD(AR)) and the Defense Contract Management Command (DCMC) established acquisition reform offices. The sole mission of these offices is to identify and eliminate the barriers that impede acquisition reform. The Office of the Secretary of Defense (OSD) maintained a policy formulation and industry interface role, while the Services focused on re-educating the workforce and adopting improved acquisition procedures. DCMC is responsible for on-site contract oversight for military contracts at defence contractor facilities. DCMC's close proximity to manufacturing facilities and key contractor personnel provided an ideal industry interface for acquisition reform initiatives. DoD's organisational implementation strategy provided both a top-level policy oversight and a hands-on execution mechanism to implement acquisition reform across all levels of DoD.

Figure 6-2 DoD Acquisition Reform Organisation



To measure the effectiveness of acquisition reform, DoD established several key metrics programmes. These programs included:

- OSD Acquisition Reform Benchmarking Group
- "DoD Regulatory Cost Premium" Working Group
- Acquisition Reform Senior Steering Group Working Group
- Pilot Programs Consulting Group
- OSD National Performance Review (NPR) "DoD Acquisition" Reinvention Impact Center (RIC).

A short overview of each program is provided below. Programs are summarised in Table 6-2.

Table 6-2 Selected Acquisition Reform Working Groups

Group	Formation Date	Duration	Objectives	Major Accomplishments	Current Status
Acquisition Reform Benchmarking Group (ARBG)	September 1995	Ad hoc	Develop methodology for measuring the gains in efficiency associated with acquisition reform	Developed 12 metrics now in application	Active
"DoD Regulatory Cost Premium" Working Group	1994	Ad hoc	Assess cost premiums associated with milspecs/milstds. Develop action plans to eliminate DoD reform barriers	Identified / Eliminated most major cost drivers ("Perry study")	Dissolved 1995
Acquisition Reform Senior Steering Group Working Group (ARSSG WG)	March 1995	Ad hoc	Coordinate "action plans" for reducing cost drivers identified in "Perry study"	Plans for top 24 cost drivers implemented	Monitoring implementation of cost reduction programs
Pilot Programs Consulting Group	March 1994	Ad hoc	Advise, assess, report on metrics and baseline issues of Defense Acquisition Pilot Programs (DAPPs)	Four annual progress reports	Active
National Performance Review (NPR) "DoD Acquisition" Reinvention Impact Center (RIC)	July 1997	Permanent	Act as model for other US Government departments and agencies in reforming internal reinvention, fostering partnership and customer service processes.	Major goals forwarded; progress now being assessed	Active

<u>OSD Acquisition Reform Benchmarking Group (ARBG)</u>—The Deputy Under Secretary of Defense (Acquisition Reform) chartered the Acquisition Reform Benchmarking Group (ARBG) in September 1995 to develop a comprehensive methodology for measuring the gains in efficiency associated with acquisition reform. ARBG developed a multifaceted methodology that captures efficiency gains along three dimensions (cycle time, cost, acquisition process performance) and across three levels (enterprise, process, and program). The methodology embodies approximately 12 metrics culled from prior DoD, Service, and industry efforts. Specific ARBG tasks include:

- Assess and refine proposed and interim strategic outcome metrics.
- Develop or refine additional metrics arising from ongoing DoD initiatives.
- Research and analyse other government and commercial benchmarks to be used to develop objective DoD goals.
- Identify additional DoD implementation actions that are required to achieve benchmark (or goal) performance.
- Estimate potential acquisition reform efficiencies based upon reported metrics and benchmarks.

- Collect and maintain reported metrics and benchmarks in an open, interactive, relational database.[36]

OSD "DoD Regulatory Cost Premium" Working Group—This working group supervised and assessed a contracted study of cost premiums associated with DoD practices (the Perry study). The survey identified 130 regulations and standards that contributed to DoD paying an average cost premium of 18 percent for goods and services as determined from analysis of ten contractor facilities. The cost premium resulted from government-unique practices (compared to best commercial practices) that are imposed on industry through DoD specifications, standards, and regulations. Of the 130 cost drivers, the top 24 accounted for 75 percent of the cost premiums and the top 59 account for 100 percent of the quantifiable cost premiums.

The Acquisition Reform Senior Steering Group Working Group (ARSSG WG) was formed to identify and coordinate efforts by the Department to address the top cost drivers. The Working Group, chaired by DUSD(AR), finalised a DoD action plan on March 31, 1995, initially assigning responsibility for the top 24 cost drivers to specific Offices of Primary Responsibility (OPRs). Progress continues to be monitored and revised action plans are implemented as appropriate to reduce perceived regulatory cost premiums.

OSD Pilot Programs Consulting Group. The Pilot Programs Consulting Group (PPCG) was chartered on 4 March 1994 by the DUSD(AR) to advise, assess, and report on metrics and baseline issues of the Defense Acquisition Pilot Programs (DAPPs). Since its inception, PPCG has issued four annual reports. Successive annual reports focused on:

1. Documentation of methodological efforts and progress in developing appropriate metrics.
2. Summarising program reported data against agreed upon metrics.
3. Updating DAPP-reported data and documentation of PPCG's initial analyses of that data.
4. Integration of PPCG's analyses of DAPP successes and lessons learned with the results of other programs to identify a future course for continuous process improvement.

The 1997 report documented PPCG's analyses of the data reported by DAPPs and places DAPP results into the broader context of acquisition reform. This broader context is critically important since the DAPPs serve as vanguards for implementing acquisition reform. The 1997 report also documented the progress of DAPPs in implementing acquisition streamlining in areas such as specification and standards, data requirements, and integrated product teams, specifically:

- The use of innovative commercial practices and the implication of those practices for the broader acquisition community.
- Gains in acquisition efficiency that are reported by the DAPPs in terms of contract cost, cycle time, and program office staffing.
- Contributions of innovative practices to reducing the total ownership costs of DAPP systems.
- Results of subsequent DoD programs that built upon DAPP experience

The PPCG is chaired by the Director, International and Commercial Systems Acquisition, within the office of the DUSD(AR). It consists of members from the offices of the DoD

36 See http://www.acq.osd.mil/ar/arms/arms00a.htm or a listing of the metrics.

Comptroller, DoD Inspector General, Defense Contract Audit Agency (DCAA), DCMC, the Defense Systems Management College (DSMC), and an independent consultant. The Group is supplemented with other representatives from the OSD and Defense Agencies, as deemed appropriate.

OSD National Performance Review (NPR) "DoD Acquisition" Reinvention Impact Center (RIC). The Department of Defense was designated a National Performance Review Reinvention Impact Center by Vice President Gore. Twelve 12 NPR "DoD Acquisition" RIC goals were forwarded to the Vice President by the Secretary of Defense on July 9, 1997 and constitute the hallmark of what DoD hopes to achieve by the year 2000. The Department asserts that it is taking timely and effective actions under the leadership of the USD(A&T) to employ acquisition and logistics process improvements in the quest to achieve these goals. The focal point for the DoD Acquisition Reinvention Impact Center is the Director, International and Commercial Systems Acquisition, Office of the Deputy Under Secretary of Defense (Acquisition Reform). The Director is responsible for coordinating DoD plans and periodic status reports with the goal proponents to be reviewed quarterly by USD(A&T) and semi-annually by the Vice President.[37] The initiative is meant primarily to publicise DoD advances for application, where appropriate, throughout the US Government.

These various programs established early "lessons learned" and valuable insights into the barriers of changing DoD acquisition environment. Metrics captured from these programs were used in the development of outyear budget goals and savings estimates. As a result of these programs, DoD was able to baseline its current operations, obtain valuable lessons learned from pilot programs, and apply metrics to validate the success it sees today.

6.2.4 Estimating savings

The identification of cost drivers, and the impact assessment of reform measures are important elements of the work described in the previous section. However, the studies and data available fall short of offering an indisputable measure of the economic effects of MILSPEC reform. As we have already discussed in the previous chapter (see page 102), the systematic evaluation of the economic impact of MILSPEC reforms is faced with many difficulties inhibiting precision. Besides, the evidence collected by the US efforts refers mainly to specific programmes and addresses not only the effects of the reform of military standards and specifications, but also of other defence procurement reform measures like the reduction of customer (DoD) oversight and the introduction of commercial billing methods

From a quantitative standpoint the most relevant study remains the 1994 TASC/Coopers&Lybrand report on the "DoD Regulatory Cost Premium" (sometimes referred to as the "Perry Study"). It is the main published cross-sectoral, systematic attempt at quantifying the extra-cost attributable to specific requirements (administrative, technical, standards) demanded by the US defence procurement agencies. The study was based on a diverse sample of 10 industrial facilities involved in defence work, and carried out a detailed analysis of their administrative and manufacturing processes, the regulations and oversight conditions with which they had to comply, their impact on the firms' prevailing processes, and the additional costs (cost premium) they created. The study found an average DoD regulatory cost premium of 18% of value added costs, with the highest compliance costs found in the

37 For progress claimed by DoD toward these goals, see www.acq.osd.mil/nprhia/default.htm.

electronics/communications industry and the key cost drivers deriving from requirements affecting development, production and administrative processes (quality assurance, configuration management, costing and accounting systems, etc.) (TASC 1994).

The TASC/Coopers&Lybrand study was the culmination of a series of more partial analysis, based either on case studies or panel assessments. These studies had varied in the precise calculation of costs, but all reached estimates of savings that were very high. The Center for Strategic and International Studies estimated in 1990 that an 18% labour savings would be possible by reducing milspecs. Two years later, the Carnegie Commission attributed 30% to 40% of total contractor costs to compliance with regulatory requirements, while the American Defense Preparedness Association (a U.S. defense industry association) raised this figure to 30% to 50% of total product costs. A 1993 study by the Defense Science Board concluded DoD could achieve 20% savings within five years in weapons procurement costs by adopting commercial practices and reducing cumbersome regulatory requirements.

Table 6-3 Cost impact of defence procurement regulations: US studies

Study	Approach	Estimated Cost Impact/Potential Savings	Comments
TASC/C&L, 1994	Analyses of 10 contractors	18% of contractor's Value Added Costs	Empirical approach: 3rd party data collection
DSB Task Force, 1993	Government/Industry Panel	20% DoD Budget Savings 5 years	Macro-level analysis-case study extrapolation
Carnegie Commission, 1992	Industry Panel	30-40% of contractor's costs	Macro-level analysis – no new data collection
ADPA, 1992	Questionnaires/Internal Studies	30-50% of product costs	No consistent approach; no data validation
CSIS, 1990	Internal case study	18% savings in labour costs	Focus on barriers to integration – not regulatory costs
IBM, 1990	Internal case study	26% of product costs	Includes material costs; value-added savings: 6-9%
Honeywell, 1986	Internal case study of 20 programmes	13 of contractor's costs	Closest to TASC/C&L approach

Source: TASC 1994.

As the US reform progressed the initiatives mentioned in the previous section started to produce some new data on the *results* of MILSPEC reform. These were not systematic attempts at aggregate analysis, but rather studies of (mainly successful) examples of reform. The 1997 PPCG Report (see above page 138) presents details of several programmes in which MILSPEC reform has been already applied and miscellaneous data on the savings achieved. From this report, we have extracted three examples of programmes for which detailed data is available.

First, the Commercial Derivative Engine (CDE) is a programme to supply a privately-developed variant of a commercial engine[38] to equip the C-17 military transport aircraft. C-17 aircraft performance requirements were met by using commercial specifications and the

[38] The military variant (F117-PAW-100) is based upon the PW2037/2040 engine used on Boeing 757 aircraft.

supplier (Pratt & Whitney) also provided spare engines and logistics support to the user following commercial practice. This approach to use commercial specifications in defence procurement led to the following savings (Pilot Program Consulting Group 1997, pp. 3-1 and 3-2):

- The choice of an existing commercial engine, thereby broadening the contractor's business base saved $775 million in development costs (the contractor also absorbed the cost of some of the military-unique changes by demonstrating their commercial value);
- Introducing the commercial practice of multi-year contract agreements, resulted in further savings of $175 million were achieved)
- Finally, the introduction of commercial logistics support practices saved $35 million

The report provides relative data for the Fire Support Combined Arms Tactical Trainer - FSCATT- programme for the development and production of a training system for the US Army. The PPCG estimated that the savings of changing contractual requirements (affecting for instance quality assurance, manufacturing processes, software development processes, etc.) amounted to 13.5% of the total cost had traditional contracting requirements been used; and the savings of eliminating product specifications accounted for 2.8% savings (Pilot Program Consulting Group 1997, p. 4-3). Particularly important in this programme were the savings in manufacturing costs achieved through the waiver of military standards and requirements related to fabrication, test, quality control and shipment (4.6% savings). Using commercial rather than MILSPEC parts brought about 3.4% savings. The waiver of software development tasks required by military standards resulted in 1.3% savings.

The final example we have selected is the Joint Direct Attach Munition (JDAM) programme to develop and procure a guidance kit to attach to "dumb" bombs. In this programme, the PPCG concludes that a 50% reduction in unit costs (compared to the baseline estimate developed using traditional defence approaches) was achieved through the introduction of commercial components. This programme used commercial suppliers extensively (70% of the components were commercial), and this was clearly a cause of the high savings achieved. The PPCG noted that the comparatively lower savings in other programmes may be due to the source selection methods by prime contractors hindering access by commercial "sub-tier suppliers".

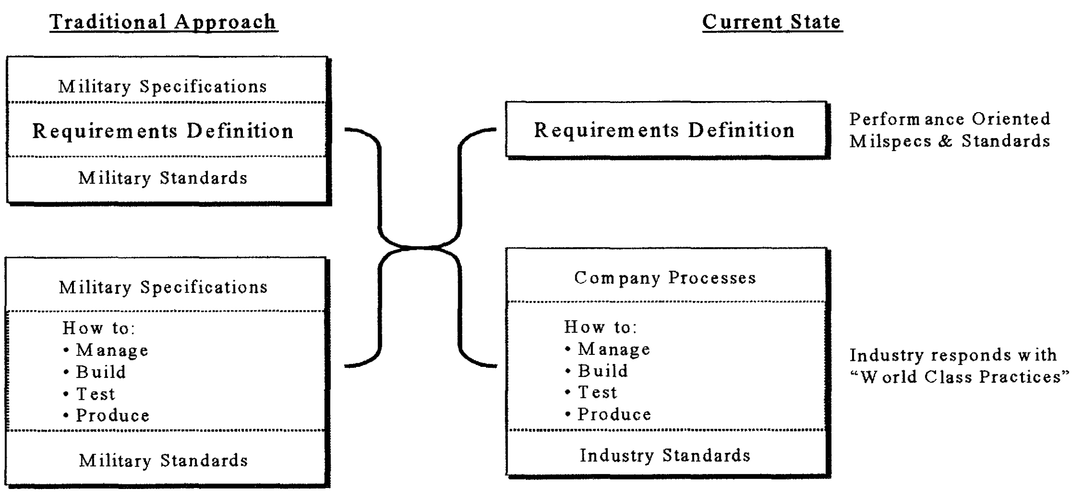
Another US initiative that has yielded data on the savings achieved through reform measures is the SPI initiative. SPI is discussed in detail below and the precise measures of cost savings that have been documented are presented in Table 6-6. The PPCG report discusses some specific examples. For instance, at a Texas Instruments plan the introduction of new commercial processes for the use of paint and primer materials in the metals fabrication process resulted in the reduction of environmental emissions by 40-80%, and in another plants several modifications of assembly process will result in future "cost avoidance" in excess of $40 million. At Raytheon, cost avoidance is expected to be $20 million per year for all DoD contracts.

All the *ex-ante* and *ex-post* estimates discussed in this section coincide in providing appraisals of substantial cost savings. It must be noted however that, in general, the savings expected by individuals and expressed for instance through questionnaires and panel studies are somewhat larger than those presented in detailed analysis and ex-post estimates of specific projects. On the other hand, some initial sceptical opinions on the results of the "Perry study" as those expressed by a GAO report (NSIAD-96-106) that pointed out the small 1% savings achieved in early pilot programmes are not supported by the more recent data discussed here. Although savings may often fall short of the 18% average cost premium estimated in 1994, available figures suggest very substantial savings achieved through procurement reform measures.

6.2.5 The transition from MILSPECs to performance-based specifications

Traditional military acquisition programs relied heavily upon military specifications and standards to describe the management processes and procedures used in the development and manufacturing of military systems. As depicted in Figure 6-3, acquisition reform has fundamentally changed the way in which the government acquires systems. Traditionally, military specifications provided very specific "how to" guidance for the development and production of military items. Since acquisition reform, these specifications are being replaced with "performance-based" specifications. The following sections describe the types of standards and specifications addressed in this effort as well as the process used to move toward performance-based specifications.

Figure 6-3 Transformation to performance specifications



Types of standards

Standard classifications of specifications are utilised throughout DoD. These include:

- **Interface**: Documents specifying the physical or functional interface characteristics of systems, subsystems, equipment, assemblies, components, items or parts, to permit interchangeability, interconnection, interoperability, compatibility, or communications. They express performance criteria in terms of form, fit and function.
- **Design or selection criteria**: Documents requiring the use of certain materials, parts or components.
- **Test method**: Documents providing a procedure to measure and evaluate qualities, characteristics, and properties of a product or process.
- **Management**: Documents mandating common approaches for controlling and directing overall operations, performance, work division, accounting, paperwork, and other business and engineering control elements, including configuration management, and quality management.
- **Manufacturing process**: Documents requiring a series of actions or operations connected with the manufacture of a product (plating, heat treatment, casting,...).

- **Codes of practice**: Documents laying out procedures on how to conduct tasks, functions or operations not related to manufacturing or maintenance (e.g. standards for handling and transportation, marking, etc.).
- **Maintenance**: Documents laying out procedures to conduct maintenance tasks, functions and operations related to system repair and maintenance.
- **Data acquisition**: Documents specifying how to acquire, data and the data formats used (technical data, reports, manuals, drawings, etc.)
- **Reference**: Documents describing systematic classifications of materials, products and processes, definitions, abbreviations, acronyms, symbols, and other terminology.

These classifications apply to both military specifications and standards that have been the focus of the transition to performance-based specifications. The official classifications of military standards and specifications used in European countries do not necessarily match the taxonomy presented here. It is significant, however, that at this level of aggregation there is sufficient correspondence between military and commercial standard types to allow migration from the former to the latter.

Specification transition process

The Department of Defense undertook a major specification improvement effort to transform to a performance orientation. Specifications within the DoD inventory were ranked according to their utility, and a determination was made by the Services as to disposition of all specifications and standards. The specifications were either cancelled, replaced or converted into performance specifications. Other documents were combined and converted into reference documents, such as "Guidespecs" or "Handbooks," to be used as guides for future system acquisitions.

Perry study results guided the conversion process. The OSD DoD Regulatory Cost Premium Working Group reviewed and made disposition on the top 62 cost drivers within the Department of Defense as identified in the Perry study. Using this effort as a catalyst, the Services campaigned to move to performance-based specifications and educate their workforce on the techniques of performance-based acquisition. An overview of major cost drivers and specifications that have been eliminated is provided in Appendix D.

DoD authorised automation of military specifications as a result of the specification reform guidance and the need for an effective process to update specifications. This new system applied information technology to disseminate information and provide real time updates to the changing specification world. The program consisted of two phases:

- Phase I - Functional Document Repository
- Phase II - Expansion of Communication/Interface Functionality

Phase I created the Acquisition Streamlining and Standardization Information System (ASSIST), a digital library of 48,600 active Military Specifications, Standards, and Standardization.[39] Installation and Beta testing of this system began July 7, 1997. A fully digital operation was established, and the Navy Print on Demand System (NPODS) was shut down on September 30, 1997. The ASSIST system features:

39 Online service for a Single Stock Point for Military Specifications, Standards and Related Publication (http://www.dodssp.daps.mil/dodssp.htm).

- Storage and retrieval of Documents in Portable Document Format (PDF) format.
- Cross-reference indexing of the Digital Library.
- Installation of customer service workstations.
- Connection for high-speed output printing.
- Updated classified index.
- Creation of a Data Item Descriptions (DIDs) interface.
- Installation of a File Transfer Protocol (FTP) server for document transfer.
- An Internet website for future ASSIST/ASSIST DOC interface (ASSIST-WEB).

Phase II of this program focuses on the Expansion of Communication/Interface Functionality. The proposed system improvements will provide enhancements that include:

- Expansion of the Digital Library to include all inactive documents (approximately 30,000, or a total of about 80,000 digital documents).
- Installation of a Bulletin Board System (BBS).
- On-line ordering for Federal Supply Code (FSC) or document bundle orders via the BBS.
- On-line capability to order, pay for, and download documents via the internet.
- Creation of an ASSIST database interface on the internet (ASSIST-WEB).
- Upgrades to communication lines to enhance performance.

The application of information technology to enhance specification process is just one example of how the Department continues to drive to adopt best practices and improve both its internal and external operating efficiencies. It also has enabled US contractors to access the most recent DoD changes in specifications and standards. This information system has been a critical element in communicating acquisition reform to industry.

Specification reform efforts are now nearing completion. DoD policy calls for greater integration of defence contractors with commercial industries (Civil Military Integration—CMI). To achieve a truly integrated military industrial operation, reform efforts are addressing policy, practices, and operational barriers that currently inhibit effective integration of military and industrial operations. CMI assumes that integration efforts will result in reduced weapon system development time and infrastructure cost required for the military operations through dual-use R&D, concurrent production lines and maximum use of commercial products. DoD guidance outlining this strategy includes the Defense Reform Initiative and the National Performance Review. Summaries of these initiatives are included in Appendix C.

6.2.6 Quality: a case study of military vs. commercial practices

Evidence of some migration to commercial practices is evident in the US military industrial base. To date, the most frequently proposed conversions relate to quality management. This section provides an illustrative example of the systemic impact of utilising commercial vs. military specifications and practices.[40]

The DoD has reconsidered the all-encompassing Quality Program approach based on MIL-Q-9858 (Quality Program), and commercial companies are increasingly restructuring

40 A more detailed cost and operational analysis is presented in "Cost Reduction Initiatives Research for the F/A-18 E/F and V-22 Programs," TASC Report TR-7718-73-01, dated February 28, 1997.

their quality programs as well. Both prime and subcontractor's direct and indirect labour will be affected. The objective of this shift is to make improvements in scrap, rework, repair processes and cycle times.

Quality practices

The Department of Defense and its suppliers traditionally depended on a DoD-unique set of standards and specifications to define the quality assurance systems for purchased hardware and software. These standards included MIL-Q-9858, MIL-STD-785 (Reliability Program), MIL-STD-965 (Parts Control Program), and MIL-STD-882 (Engineering Management). Together, they provided models for quality systems in which the DCMC and other DoD agencies played a major role with DoD's suppliers in ensuring product quality and performance.

However, two trends led DoD to reconsider its strategy for ensuring product quality and performance. The first was the growth in importance to US military contractors and DoD of Foreign Military Sales (FMS). As more foreign governments bought a larger percentage of US military systems, they questioned the need for US-unique quality standards. Responding to specific pressure from its NATO partners, DoD decided in August 1989 to adopt the internationally recognised ISO 9000 standards for quality systems. This advocacy of a migration to the ISO 9000 standards was not wholehearted, however. For example, DoD did not specify a deadline for suppliers to convert to the ISO standards, nor did it require suppliers to officially register their quality systems.

The second trend was the pressure on DoD to streamline its acquisition procedures and practices. MIL-Q quality systems using government inspectors was seen as having contributed to a large, costly military acquisition bureaucracy. Facing declining defence budgets, DoD chose to streamline its acquisition procedures and practices. In February 1994 Secretary of Defense Perry called for a:

> ...shift from a management philosophy that attempts to achieve high quality and performance through after-the-fact inspections, to one that prevents defects through controlling its processes, and reviewing the process controls of its contractors (focus on process control rather than hands-on inspections).[41]

Secretary Perry directed the Secretaries of the Military Departments and the Directors of the Defense Agencies to reduce direct government oversight through the substitution of process controls and non-government standards. Many suppliers, both prime contractors and their subcontractors, responded to Perry's directive by proposing modification of their existing quality assurance systems to make them consistent with the ISO 9000 standards.

The ISO 9000 series of quality standards represents an international consensus on the general features of a quality system. The ISO 9000 series was first published by ISO in 1987. Today, more than 80 countries, including the US, have adopted the ISO 9000 series as national standards. The American Society for Quality Control (ASQC) and the American National Standards Institute (ANSI) play major roles in defining ISO 9000 standards and in their adoption by American industry.

41 Acquisition Reform: A Mandate For Change, Secretary Perry's White paper, February 9, 1994.

The quality models described in the MIL-Q and ISO 9000 standards are conceptually very similar.[42] For example, both address the need for process controls as well as product controls. Within DoD, however, implementation of the two sets of standards has resulted in very different quality systems. DoD suppliers' quality systems were derived from the MIL-Q based quality models and emphasised product control. They featured elaborate inspection and testing procedures performed by a cadre of supplier and government quality assurance specialists whose responsibility was to ensure that product quality was "inspected in." By contrast, implementation of ISO 9000-based systems has tended to focus on control of the underlying production processes, documentation of those processes and maintenance of suitable records. Quality assurance staffs work with line employees to define and document processes and procedures. The assumption is that if well-defined processes are adhered to during production, product related errors will be eliminated and fewer end product inspections will be required. The long-term benefits, according to ISO advocates, are greater product quality, consistency and reduced cost associated with product rework.

Transition to ISO 9000-based quality systems will incur up-front, nonrecurring costs of changing from a MIL-Q environment to an ISO 9000 system. Depending upon previously in-place quality systems, movement to ISO practices may increase or decrease the cost of products. For companies with sophisticated MIL-Q based systems in place and commercial ISO practices operational, the conversion should reduce operational cost and the processes merge to a single system. For companies that currently are not ISO registered, an investment and training cost is required to move to the more flexible ISO practices. As an end result, it is expected that the philosophy of preventing versus detecting problems should improve products and reduce life cycle costs.

6.3 Single Process Initiative (SPIs)

> Replacement of multiple Government-unique management and manufacturing systems with common facility-wide systems should, in the long run, reduce the costs to both our contractors and DoD.
>
> - Dr. Paul Kaminski, 8 December 1995.

The previous section addressed legislation and cabinet orders that began implementation of acquisition reform in the Department of Defense. Acquisition reform is intended to reduce procurement costs and complexity through streamlined procurement processes, greater autonomy in decision making at lower levels of government, reduced reliance on military standards and specifications and greater -utilisation of commercial standards and business practices. Another goal of acquisition reform has been to bring about more commonality in production programs by eliminating DoD-specific requirements in the management of those programs. DoD has instituted through the Single Process Initiative (SPI) a means for defence contractors to apply consistent practices across programs with common facility-wide systems on existing and future contracts. Revised acquisition policies are now being implemented on all new defence procurements. Tracking SPI initiatives allows insights into the nature and extent of those changes.

42 Lamprecht, 1992: p. 54.

This chapter analyses SPI data to determine industry responses to acquisition reform measures, industry priorities in implementing more efficient processes within facilities and across programs, and industry sectors most active in implementing new, simplified processes and procedures. *SPI data is critical in assessing these trends, since it provides the only quantifiable measure of industry's migration away from existing military contract requirements to best commercial practices.* Furthermore, since specific proposals originate in industry, *SPI data also indicates industry interests and priorities for achieving more efficient and profitable defence production.*

6.3.1 Background: SPI origins and objectives

In order to identify the major cost premiums associated with military procurements, then-Deputy Secretary of Defense Dr. William J. Perry chartered a study under the USD(A&T) to conduct an empirically based estimate of the cost associated with DoD regulation and oversight. "The DoD Regulatory Cost Premium: A Quantitative Assessment" (the "Perry study") was conducted from March to October 1994 and a final report was issued in December 1994.

The study was conducted to obtain a general perspective of the industry cost associated with DoD's regulatory environment. The project addressed:

1. Industry cost impacts of DoD acquisition regulations and oversight.
2. A sample group of 10 contractor facilities. The sample group represented a diverse range of facilities with respect to size, region, industry sector, tier position, commercial market segment.

The results of this study focused attention on DoD cost premiums. A subsequent series of government/industry working groups helped create the Single Process Initiative (SPI). The SPI was instituted by the Secretary of Defense (SECDEF), who assigned oversight responsibility to the USD(A&T) in December 1995 to facilitate plant-wide (versus contract by contract) conversion to "best practices." The SPI program is coordinated by the DCMC on behalf of USD(A&T). SPI invites concept papers and proposals from industry directed towards achieving "best practices" through the elimination of regulatory, contractual, specification barriers and the replacement of multiple Government-unique management and manufacturing systems with common facility-wide systems.

Prior to the SPI program's inception, the Defense Logistics Agency (DLA) initiated Pilot Programs with selected contractors designated as "Reinvention Laboratories." Through joint government/industry teams, these laboratories experimented, evaluated and demonstrated the feasibility of the SPI program. These early laboratories assisted in establishing implementation procedures for consolidating multiple related requirements facility-wide into a single process.

To facilitate the transformation process, DCMC established a review process by which industry could submit transformation ideas and receive a government position and contract modification within 120 days. These streamlined review processes were designed to replace multiple government-unique management and manufacturing systems with common, facility-wide systems in a timely manner.

The SPI concepts are generated by industry at plant manufacturing facilities, submitted to the local DCMC government agent who coordinates the concept paper through a tri-service (Army, Navy, Air Force) management council. Military customer technical inputs are solicited and incorporated where applicable. Upon reaching government consensus, technical approval is granted. The Administrative Contracting Officer executes a "Block Change Modification" that modifies all affected government contracts at the facility. Modifications allow industry to move from previously government dictated "how to" processes to "World Class" commercially driven processes for the production of military items. A more thorough description of this process is detailed in Appendix C.

6.3.2 Measuring SPI impact and trends: our methodology

In order to manage and monitor the transformation activity, DCMC developed the Single Process Initiative System (SPIS) database comprising individual reports from contractors and programme managers. This database was developed to automate the SPI reporting process and provide timely status reports to the USD(A&T). Although evolutionary in nature, the database is populated from each facility location as concept papers are submitted. The database is a management information system designed to track proposals but not to provide the technical detail information related to each proposal. Generally, the SPIS provides information related to identifying and tracking each proposal (i.e., company name, location, process type, text fields describing requirements to be eliminated and proposed commercial alternatives, tracking information and government and industry contact information). SPIS information is supplied to the government via a secure network with industry information posted on the Internet at the DCMC SPI homepage.[43] Table 6-3 provides a listing of the process types used to categorise all SPI concept papers in the SPIS database.

43 Single Process Initiative Status provided by Defense Logistic Agency Defense Contract Management Command "Single Process Initiative (SPI)" homepage (http://www.dcmc.hq.dla.mil/Spi/Index.htm).

Table 6-4 SPI Concept Paper Tracking Categories - Process Types

Process Types	
Business-Cost Data Reporting	Logistics-General
Business-Direct Billing	Logistics-Marking
Business-Earned Value Mgmt System	Logistics-Packaging
Business-FARA/FASA	Logistics-Parts/Material Mgmt
Business-General	Manufacturing-Electronic Fabrication
Business-Gov't Property	Manufacturing-ESD Protection
Business-Patent Reporting	Manufacturing-General
Business-Reps & Certs	Manufacturing-Management
Business-Small Disadvantaged	Manufacturing-Painting/Coating
Business-Subcontracting	Manufacturing-Soldering/Welding
Business-Subcontracting-ACO Consent	Manufacturing-Wiring
Business-Subcontracting-Enabling	Quality System
Business-TINA	Quality-Calibration
Engineering-Audits	Quality-General/Multiple Processes
Engineering-Configuration Mgmt	Quality-Inspection
Engineering-Drawings	Quality-Non Conforming Material/MRB
Engineering-General	Quality-Supplier
Engineering-Management	Safety
Environmental-AP2I-JGAPP	Software
Environmental-SPI	Testing

Recognising the utility of information contained in SPI reports as a quantifiable measure of industry's move away from military requirements to commercial practices as well as standardisation trends resulting from acquisition reform, TASC converted SPIS report information into a more flexible database to allow industry-, company- and sector-wide analyses. TASC did so by accessing individual SPI reports, separating data contained in each report into individual data fields, and reconstructing the information in a relational database to allow in-depth analyses. TASC also used these reports as one means of identifying potential respondents to its industry survey (the results of which are summarised below). This is the first comprehensive analysis of data that can be derived from SPIS reports. Although the Department of Defense records and stores individual reports, it has not yet analyzed the information contained in those reports in this fashion.

The DCMC SPIS database as currently structured aggregates all SPI statistics to provide top level DoD trending information. Unfortunately, there are no current DoD metrics tracking which sectors of the military industrial base are making the most progress and which remain entrenched in traditional approaches. The analysis in this chapter attempts to capture competitiveness improvements resulting from acquisition reform by measuring industry movement from military requirements to commercial best practices. Acquisition reform offers broad policies that impact all acquisitions. These reforms solicit commodity-specific responses tailored to the competitive nature of each manufacturing sector. The analysis applies a commodity-based manufacturing approach to the US defence industrial base. The methodology:

1. Applies sector identifications to participating SPI contractors
2. Provides sector analysis & trends
3. Identifies sector manufacturing leaders

TASC's approach utilised the reconstructed DCMC SPI database coupled with industry information available in recognised corporate databases and industry directories. DCMC' SPI database provides status information on SPI proposals. The text based entries monitor each proposal submitted by industry. Key information is maintained for each proposal, including contractor name and manufacturing facility. To derive the industry sector and commodity group relationship, the text-based entries were captured and converted into databases from which analysis of the relevant information could be performed. Drawing from our expertise in DoD industrial analysis, we applied three DoD recognised standards — *Dunn & Bradstreet Marketplace*, *CorpTech Explore Database* and *Haystack Online Directory* — to assist in sector identification. Utilising *Dunn & Bradstreet Marketplace*, the 8-digit Standard Industrial Classification (SIC) code identifying manufacturing orientation was applied to known manufacturing facility locations to identify sector affiliations. This information was augmented with the *CorpTech Explore Database of Technology Companies*, which is updated quarterly and contains significant, detailed information about the products produced at a particular location. As a final resource prior to sector identification, we consulted the *Haystack Online Directory* from Information Handling Services.[44]

All 308 contractor sites participating in SPI were matched based on their location (city, state, zipcode+4). Where possible, the location's Contractor and Government Entity (CAGE) code was referenced in order to confirm that facilities in the same zip code were involved in government contracts. From there, the manufacturing facilities were assigned a primary sector based upon the product mix that was cited in the database. For example, if Lockheed Martin Missiles and Space produced both missiles and satellite launch equipment at a single facility, the primary sector was determined by the number of parts produced by the plant that were in the respective Federal Supply Class (FSC). The FSC data was obtained through the Haystack database. In some instance, major suppliers transcend several commodity groups. Proposals, which crossed commodity groups, were assigned to all relevant sectors for trend analysis. Several small contractors could not be identified to particular sector affiliation and were categorised as "unknown."

Appendix F provides the complete results of the commodity group analysis and classification used for this analysis. This chapter summarises key trends.

Sector Analysis: US Sectoral Definitions

In the US study, the fidelity of the data did not lend itself to the exact classifications as originally proposed (see Appendix G: Notes on Sectoral Definitions). Therefore, in order to supply sectoral details as required in the Invitation to Tender, the study analysed the standard systems for the defence industries in each of the sectors listed above and was slightly modified (see Table 6-4) to address the US industrial base, with associated ties to the planned analysis.

44 More information about these products is available through the following web sites: http://www.corptech.com, http://www.mktplace.com and http://www.ihsgroup.com.

Table 6-5 US Sector Analysis Categories

Avionics/EW	Ships	Weapons (Troop related)
C3I Electronics	Missiles	Vehicles
Helicopters	Satellite	Other/Services
Tactical Aircraft	Ordnance/ PGM	
Transport Aircraft	Engines	

6.3.3 SPI: Overview of major trends and achievements

Analysis of SPI data indicate that revised acquisition policy is currently being implemented on all new defence procurements. Both DoD buying commands and most major DoD contractors are engaged in acquisition reform efforts. In general, industry trends indicate the easiest and/or most beneficial improvements relate to Quality, Manufacturing, Property Management, Soldering, Configuration Control, and Business Practicés. On the other hand, Property Management, Software, Testing and General Business Practices have generated industry interest but also have been met with the most government resistance. This is indicated by the relatively long time periods required to gain approval of industry proposals by the government (that is, on average greater than 120 days in the review process).

SPI established an industry foothold with a few DoD contractors in the spring of 1996. Since then, industry participation has greatly increased with a broad range of SPI candidate concepts being generated. Figure 6-4 to Figure 6-6 provide a summary of all SPI categories submitted by industry. Industry progress and government resistance can be measured by comparing the number of proposals submitted, against the combined number of proposals approved and those that are taking greater than 120 days to process.

Figure 6-4 Top 15 SPI categories identified by DCMC

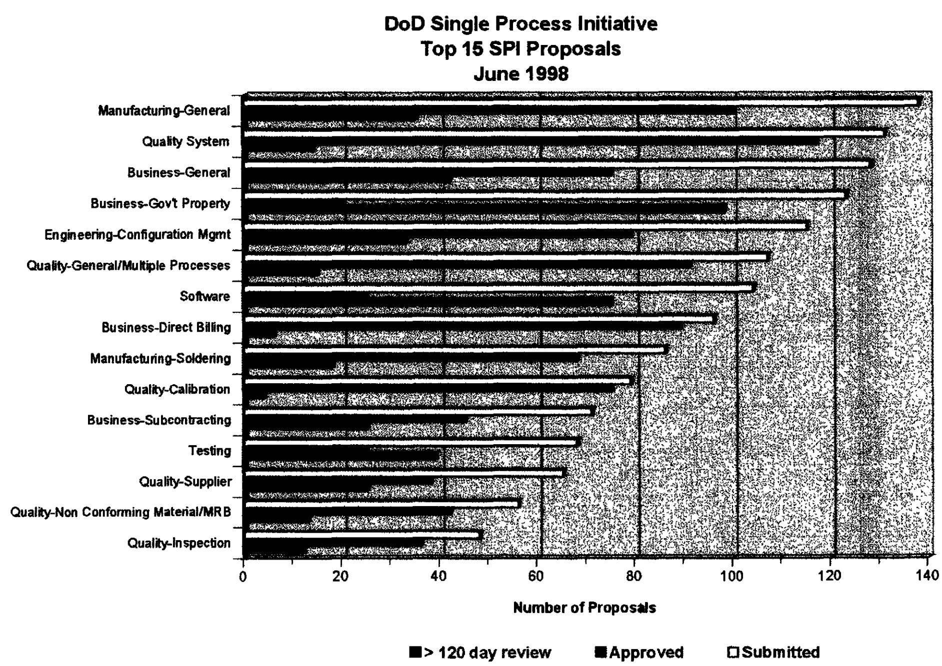


Figure 6-5 DoD Single Process Initiative Middle 15 SPI Proposals

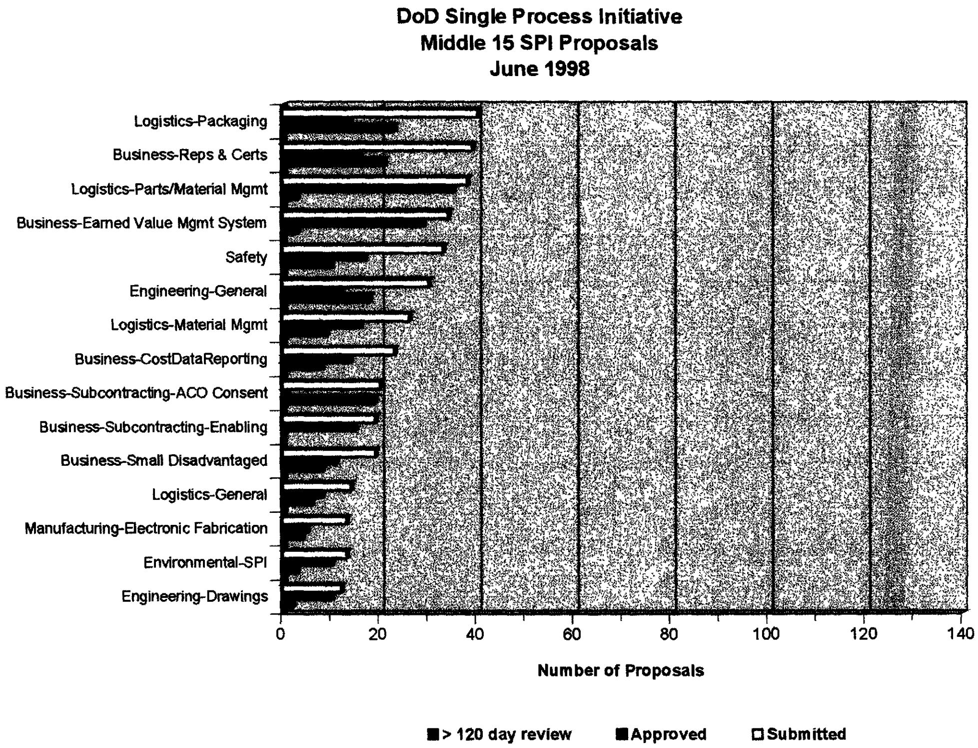
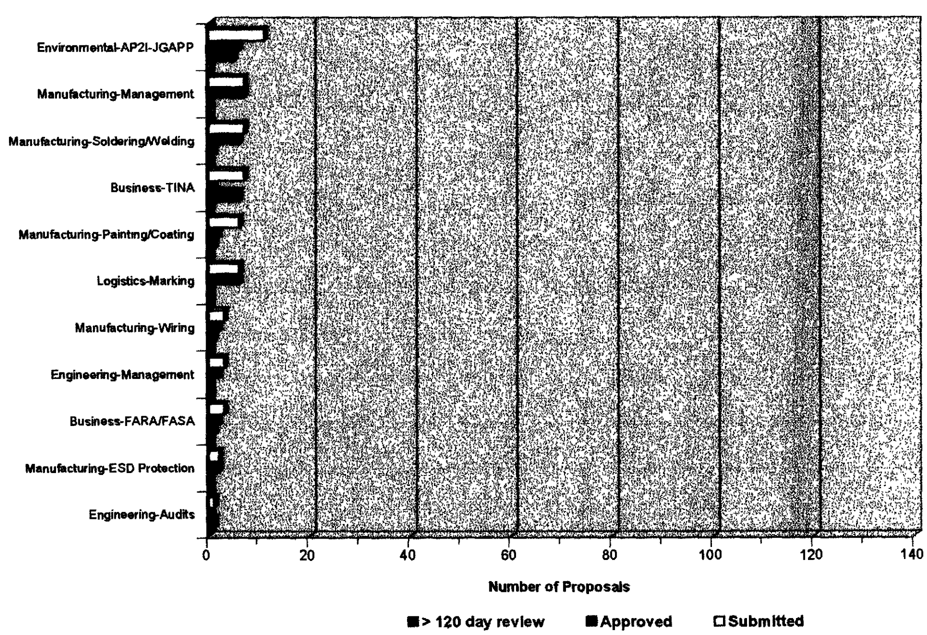


Figure 6-6 DoD Single Process Initiative: bottom SPI proposal



As of June 30, 1998, 308 contractor facilities submitted 1871 proposed process changes with 765 resulting in block change modifications being executed. Of the process changes that have been proposed or implemented, over 580 are directed towards the top 10 cost drivers identified in the Perry study.

US industry and government counterparts have made significant gains in the use of information technology to support electronic billing. Additional gains have also been made in the areas of quality, manufacturing, engineering management and soldering processes. Most approved proposals involve adopting internationally recognised standards such as ISO 9000. The US Government continues to resist changes in the treatment of government owned property and software development.

The end goal of the SPI program is to reduce weapon system cost through the adoption of world class processes. Although not all SPI proposals document savings or cost avoidance, Table 6.5 captures the top ten process types and savings recorded by DCMC. These early results suggest that acquisition reform and the SPI are reducing costs to the US Government.

Table 6-6 Top 10 Cost Reducing Processes Types and Savings[45]

Process Type	No. of Processes Reporting Cost Data	Combined Cost Avoidance and Negotiated Savings
Quality Systems	45	$51M
Testing	16	$42M
Engineering-Configuration Management	43	$38M
Business-General*	29	$34M
Logistics – Parts/Material Management	16	$25M
Manufacturing – Soldering/Welding	35	$24M
Quality – Multiple Processes	38	$19M
Business-Earned Value Management System	13	$16M
Quality-Nonconforming Material/MRB	13	$15M
Quality-Inspection	14	$11M

** Business-General includes processes not categorized under any other specific business process type.*

SPI participation has been extensive. Based on DoD sales, 21 of the top 25 contractors are actively involved in the SPI process (see Table 6-6). These contractors represent over 71 percent of the sales for the top 200 contractors.[46] Appendix E provides a more complete listing of the top 200 government contractors, and top 100 DoD contractors.

45 Extracted from DCMC Single Process Initiative FY-98 second quarter report dated May 1998.

46 Top 200 Government Contractors 1-200 TOTAL PURCHASES: $178,367,569,000,Government Executive Magazine 1996 CONTRACT FISCAL AWARDS ($000s) August 1997..

Table 6-7 Top 25 DoD Contractors Based upon FY 96 Sales

Parent Company	Total $	DoD $	Civilian $	DoD Rank	Civilian Rank	Active in SPI ? Y=Yes N=No	% OF Top 200 FY96 Contractor Sales
Lockheed Martin Corp	19,758,033	14,009,181	5,748,852	1	1	Y	17.17
McDonnell Douglas Corp.	12,524,380	12,150,097	374,283	2	21	Y	14.89
Northrop Grumman Corp.	3,505,503	3,387,099	118,404	3	47	Y	4.15
Raytheon Co.	3,712,625	3,306,320	406,305	4	14	Y	4.05
General Motors Corp.	3,930,388	3,284,226	646,162	5	10	Y	4.02
United Technologies Corp.	2,851,022	2,491,335	359,687	6	22	Y	3.05
Boeing Co.	4,223,364	2,317,834	1,905,530	7	4	Y	2.84
Litton Industries Inc.	2,363,589	2,264,560	99,029	8	57	Y	2.77
General Dynamics Corp.	2,123,307	2,092,427	30,880	9	200	Y	2.56
Rockwell International Corp.	2,597,199	1,347,787	1,249,412	10	6	Y	1.65
General Electric Co.	1,563,602	1,321,890	241,712	11	30	Y	1.62
FMC Corp.	1,093,224	1,093,224	0	12	--	Y	1.34
Computer Sciences Corp.	1,381,849	978,149	403,700	13	15	N	1.20
Westinghouse Electric Corp.	3,482,004	918,106	2,563,898	14	2	N	1.12
Textron Inc.	851,234	843,590	7,644	15	733	Y	1.03
TRW Inc.	1,505,632	799,254	706,378	16	8	Y	0.98
Tracor Inc.	736,257	713,980	22,277	17	271	Y	0.87
Bath Holding Corp.	702,368	702,368	0	18	--	Y	0.86
ITT Corp.	718,775	674,728	44,047	19	144	Y	0.83
Texas Instruments Inc.	655,287	652,819	2,468	20	--	Y	0.80
AT&T	976,682	643,546	333,136	21	23	N	0.79
GTE Corp.	633,628	609,214	24,414	22	245	Y	0.75
Science and Applied Technology	710,767	586,558	124,209	23	46	N	0.72
Halliburton Co.	636,133	576,708	59,425	24	104	N	0.71
Allied-Signal Inc.	1,188,492	541,852	646,640	25	9	Y	0.66

DCMC Observations on SPI Effectiveness[47]

As custodian of the SPI, DCMC reports on the progress of SPI to senior DoD leadership. DCMC observations of trends are significant for their broader implications for the transition to commercial standards and practices. Observations contained in recent reports have highlighted the following issues:

- The tendency to date in specific SPI proposals has been for industry to focus on the most easily implemented changes without necessarily having regard to potential cost savings. This tendency to "pick-off the low hanging fruit" implies a need, in the view of DCMC, to address more substantive changes.

- Activities have centred around prime contractors to date, with far less involvement by subcontractors. As industry assumes more responsibility for determination of appropriate commercial standards and practices in research, development and production programs, subcontractors are likely to face more demands on their capabilities. This trend has been evident in other major industries such as the automotive sector, where subcontractors are assuming more research, development and design requirements in new product development. DCMC believes that the US Government should emphasise to prime contractors involved in the SPI the need for increasing subcontractor involvement and thus contribute to SPI effectiveness.

- DCMC has identified several potential obstacles to timely implementation of SPI proposals. These include a lack of timely government and legal review and resolution of

47 General observations included in government perceptions published in the Single Process Initiative (SPI) Quarterly Report, October 1 – December 31, 1997 published January 20, 1998.

escalated block change proposals where there are significant government concerns. DCMC has called for resolution of these issues.

- In many cases, the government is unable to identify short-term savings that might result from SPI proposals. In those cases, approvals often have been delayed as these cost savings issues were addressed. DCMC believes the inability to identify instant contract savings should not be an impediment to SPI approvals.

- In specific areas, DCMC asserts that packaging offers significant opportunities for cost savings if the government takes a less risk-averse approach to packaging requirements. In this context, DCMC raises an issue that is a concern throughout government and industry offices involved in implementing acquisition reforms: the need for cultural and organisational change to allow innovative and flexible approaches to problems. In this specific instance, DCMC asserts that the military packaging community needs to believe in change in order to achieve future cost savings.

DCMC's observations anticipate and mirror many of the themes and comments raised in TASC's industry survey addressing industry consolidation and acquisition reform. The observations indicate that while SPI may have achieved limited successes to date, far more improvements are required in the view of its organisers to implement more comprehensive, lasting improvements.

6.3.4 Industrial sector analysis

There are over 308 contractor facilities currently participating in the SPI program. These manufactures represent a cross section of the DoD industrial base composed of large, medium and small manufacturers. Higher technology related industries tended to have a greater participation level than those of low technology commodities. All identified sectors are currently represented with the leading contractors including 32 percent of the contractors representing electronically intensive commodities (Avionics & C^3I), 18 percent representing aviation related commodities (tactical, helicopters, transport), 9 percent engine manufacturers with smaller participation from other commodity segments.

In an analysis of 1844 proposals[48] submitted by industry, one would expect a strong correlation (on a percent basis) to exist between the number of proposals and the number of sector participants. Figure 6-8 provides the distribution of proposal by sector. A comparison between Figure 6-7 and Figure 6-8 reveals a direct correlation does not hold true for all sectors. To determine the leading sectors, a simple SPI productivity index was developed by multiplying the percent share SPI proposals by the percent of DoD contractors involved in each sector. An SPI productivity ranking is provided in Table 6-8.

48 The 1844 Proposal count includes duplicate entries, to account for proposals submitted from contractors whose production facility location serves more than one commodity group. (See Appendix G.)

Figure 6-7 SPI Sector Distribution by Contractors

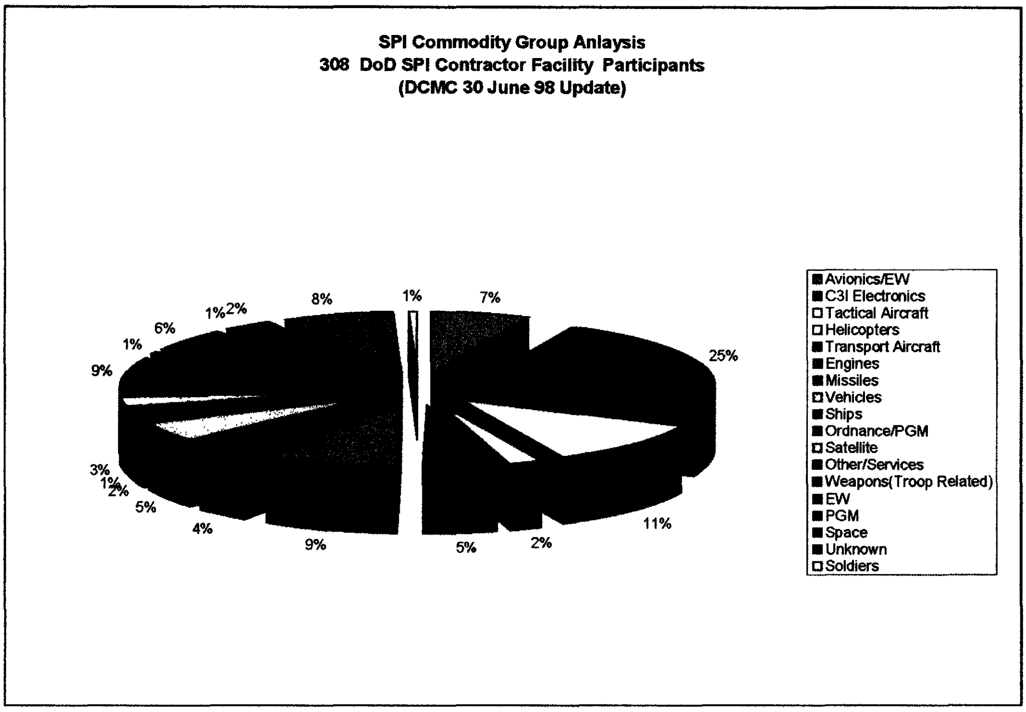


Figure 6-8 SPI sector distribution by proposal

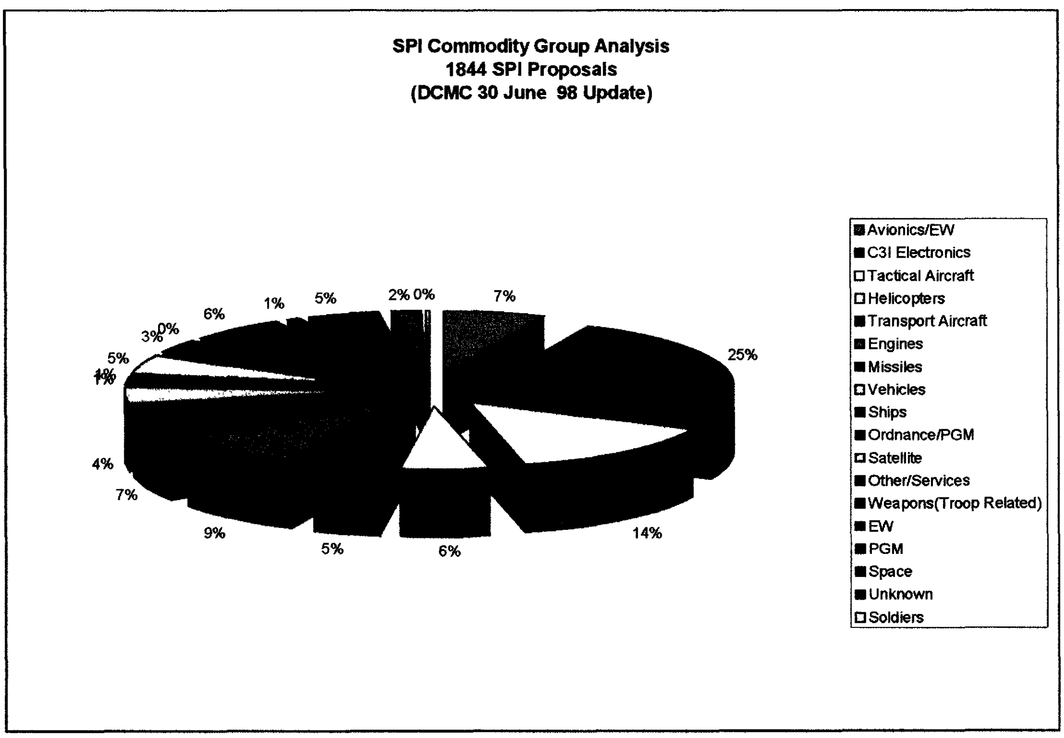


Table 6-8 Sector SPI Productivity Index

	% Contractors Involved in SPI	% SPI Proposals	Productivity Indices
C3I Electronics	25.0	25.3	631.8
Tactical Aircraft	11.1	14.3	158.9
Engines	9.2	8.8	81.2
Avionics	6.8	6.7	45.7
EW	5.7	6.5	36.8
Other/Services	8.7	2.9	25.5
Missiles	3.8	6.5	24.8
Transport Aircraft	4.9	4.6	22.3
Vehicles	4.9	4.1	20.2
Helicopters	2.4	5.9	14.3
Unknown	7.6	1.8	13.6
Satellite	2.7	5.0	13.6
Space	1.9	4.9	9.4
Ships	1.6	1.0	1.7
Ordnance	1.4	0.5	0.7
PGM	1.1	0.6	0.6
Weapons(Troop Related)	0.5	0.3	0.2
Soldiers	0.5	0.3	0.2

6.3.5 General sector observations

Several broad trends are evident in SPI data by sector and business process types. The following sections provide short observations for each area.

At the highest aggregate level of analysis, the following generalisations can be made:

- C^3I & tactical aircraft lead all sectors in SPI productivity and commercial military integration initiatives. The leadership role of both these sectors may be attributed to the early role each played in reinvention centres and early SPI policy formulation.
- Avionics, EW, and Engines are making incremental progress.
- Ships, Weapons and Ordnance manufacturers are not actively engaged in SPI.

Intuitively, these trends underscore commonly held perceptions concerning the competitiveness of the respective sectors in the United States. These differences become more pronounced when sector activity relative to SPI participation are formatted in terms of their relative productivity. Multiplying the number of proposals submitted times the percentage of contractors engaged in SPI proposals provides an activity index that makes the lead roles of such key sectors as C^3I/electronics and tactical aircraft even more pronounced (Table 3.5).

To gain greater insight into sector trends and leading indicators, a sector by sector analysis was conducted. Section 6.3.6 provides the results of DCMC process type categorisation for each sector and Section 6.3.7 includes a discussion of the:

- Top ten contractors participating in the SPI process.

- Leading processes proposed for replacement.
- General observations of sector progress.

6.3.6 Sector analysis of leading business process types

As discussed earlier, DCMC categorizes business process types and aggregates the data to provide overall business process trending. Little insight is provided into trend differences associated with sectors. The following section applies sector information to the top 10 process types. Table 6-8 and Table 6-9 identify the salient specifications and sector applications. Table 6-8 lists the most frequently cited requirements and specifications in SPI proposals by business process type. Note the number of process types dealing with government property and quality. Table 6-9 correlates SPI proposals with the most frequently modified specification or requirement. The table demonstrates again the importance to industry of MIL-Q-9858 (quality standards) and MIL-I-45208 (inspection requirements). These two areas cut across almost all sectors. The range of aerospace (including aircraft) and electronic sector interests also can be seen from the table.

The following sections provide insights into the sector distribution participation for the top 10 SPI business process types proposed for modification. The format for each sector discussion is the same, providing a graphic visualisation of proposals submitted and approved by sector, followed by a set of general observations on the significance of those trends.

Table 6-9 Most Frequently Cited Requirements and Specifications by Business Process Type

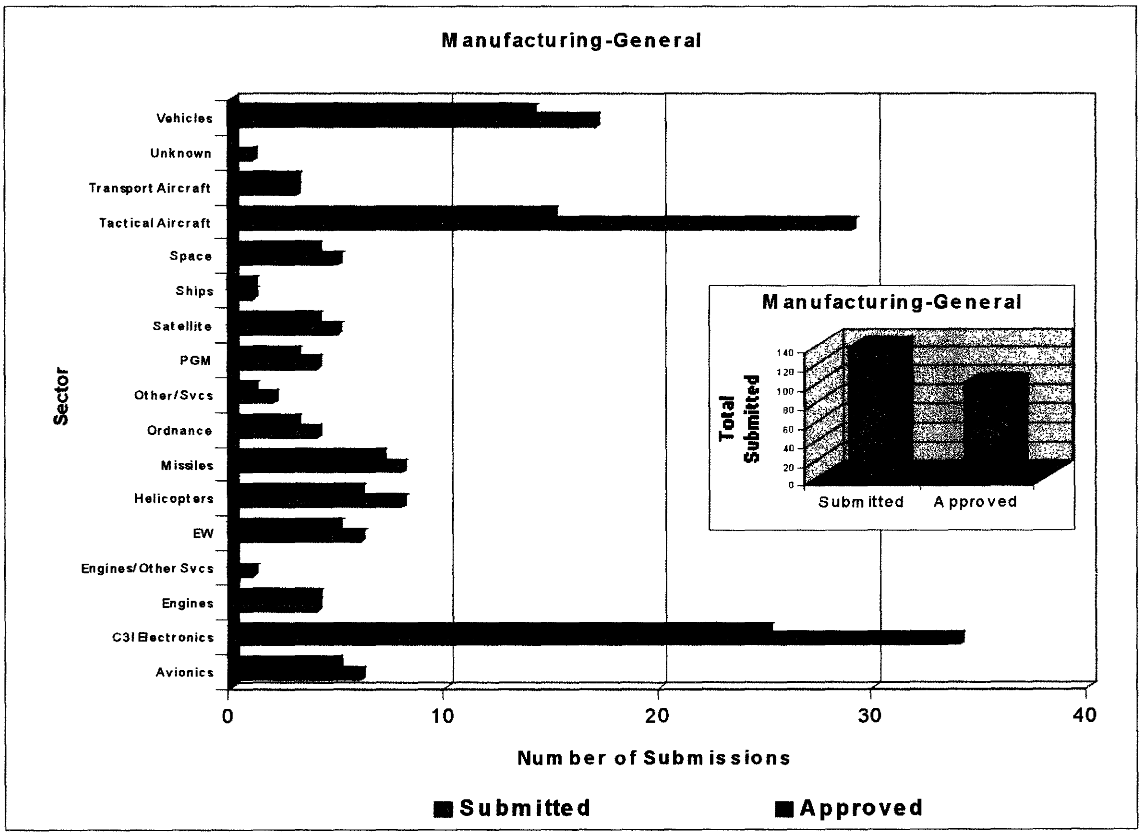
DCMC PROCESS TYPE CLASSIFICATION	Requirement or Specification Most frequently Modified	General Description
Business-Earned Value Mgmt System	DFAR 252.242-7005	
Business- Direct Billing	DFARS 242.803	Contractor Billing Requirements
Business-Earned Value Mgmt System	DFARS 252.234-7000/1	
Quality-Inspection	DoD-STD-105	Quality Inspection Sampling Procedures
Business-Gov't Property	FAR 45	Government Property
Business-Gov't Property	FAR 45.6	Reporting, Redistribution, And Disposal Of Contractor Inventory
Business-Reps & Certs	FAR 52.203	Improper Business Practices And Personal Conflicts Of Interest.
Business-Small Disadvantaged	FAR 52.219-16	
Business-Subcontracting-ACO Consent	FAR 52.244	Subcontracting Policies And Procedures.
Business-Gov't Property	FAR 52.245	Government Property
Quality-Calibration	MIL-C-45662	Calibration Systems Requirements
Quality System	MIL-I-45208	Inspection System Requirements (No S/S Document)
Quality System	MIL-Q-9858	Quality Program Requirements (No S/S Document)
Manufacturing-Soldering/Welding	MIL-S-45743	Soldering, Manual Type, High Reliability Electrical And Electronic Equipment (S/S By Mil-Std-2000)
Engineering-Configuration Mgmt	MIL-STD-100	Engineering Drawing Practices
Quality-Inspection	MIL-STD-105	Sampling Procedures
Quality-Non Conforming Material/MRB	MIL-STD-1520	Corrective Action And Disposition System For Nonconforming Material
Quality-Supplier	MIL-STD-1535	Supplier Quality Assurance Program Requirements
Logistics-Material Mgmt	MIL-STD-1546	Parts, Materials & Processes, Control Program For Space & Launch Vehicles
Engineering-General	MIL-STD-1785	System Security Engineering Program Management Requirements (S/S By Mil-Hdbk-1785)
	MIL-STD-1949	Inspection, Magnetic Particle
Manufacturing-Soldering/Welding	MIL-STD-2000	(DoD-STD-2000) Soldering Technology, High Quality And High Reliability
Logistics-Packaging	MIL-STD-2073	DoD Materiel, Procedures For Development And Application Of Packaging Requirements (S/S By Mil-Std-2073-1a)
Software	MIL-STD-2167	(DoD-Std-2167) Defense System Software Development
Software	MIL-STD-2168	(DoD-Std-2168) Defense System Software Quality Program
	MIL-STD-454	Standard General Requirements For Electronic Equipment (S/S By Mil-Hdbk-454)
Quality-Calibration Engineering-Configuration Mgmt	MIL-STD-45662	Calibration Systems Requirements (Refer To Iso-10012-1 And Ansi-Z540-1 Or Comparable Standard
Engineering-Configuration Mgmt	MIL-STD-480	Configuration Control - Engineering Changes, Deviations And Waivers
Engineering-Configuration Mgmt	MIL-STD-483	Configuration Management Practices For Systems, Equipment, Munitions, And Computer Programs
Engineering-Management	MIL-STD-499	Engineering Management
	MIL-STD-9100	
Logistics-Material Mgmt	MIL-STD-965	Parts Control Program (S/S By Mil-Hdbk-965)
Engineering-Configuration Mgmt	MIL-STD-973	Configuration Management

Table 6-10 Sector Application of Most Commonly Modified Requirements

Requirement or Specification Most Frequently Modified	Satellite	Space	Avionics	C3I Electronics	Ships	Tactical Aircraft	Transport Aircraft	Helicopters	EW	Missiles	Engines	Vehicles	Soldier	PGM / Ordnance	Total Sectors Impacted
MIL-Q-9858	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
MIL-I-45208	1	1	1	1	1	1	1		1	1	1	1	1		12
MIL-STD-45663			1	1	1	1	1		1		1		1		8
MIL-STD-1520			1	1		1			1		1	1	1		7
MIL-STD-2000			1	1	1	1			1	1		1			7
DFARS 242.803			1	1			1		1				1	1	6
FAR 45	1	1					1	1		1		1			6
FAR 52.245	1	1	1	1					1	1					6
FAR 52.244	1	1						1		1	1				5
MIL-STD-100	1	1			1			1				1			5
MIL-STD-1535			1	1			1		1		1				5
DFAR 252.234	1	1							1	1					4
MIL-STD-2073					1	1					1	1			4
MIL-STD-454			1	1	1				1						4
MIL-STD-973				1		1	1	1							4
MIL-STD-2167	1	1						1							3
MIL-STD-965			1							1	1				3
CDRL								1				1			2
FAR 52.219								1						1	2
MIL-STD-480						1					1				2
NHB 5300.4	1	1													2
FAR 44.3					1										1
FAR 52.203				1											1
FAR 52.214														1	1
FAR 52.219-16					1										1
FAR 52.222							1								1
MIL-M-38769					1										1
MIL-P-5510										1					1
MIL-STD-1949														1	1
MIL-STD-2168														1	1
TT-C-490														1	1

Manufacturing-General

Figure 6-9 Sector Participation in Manufacturing General

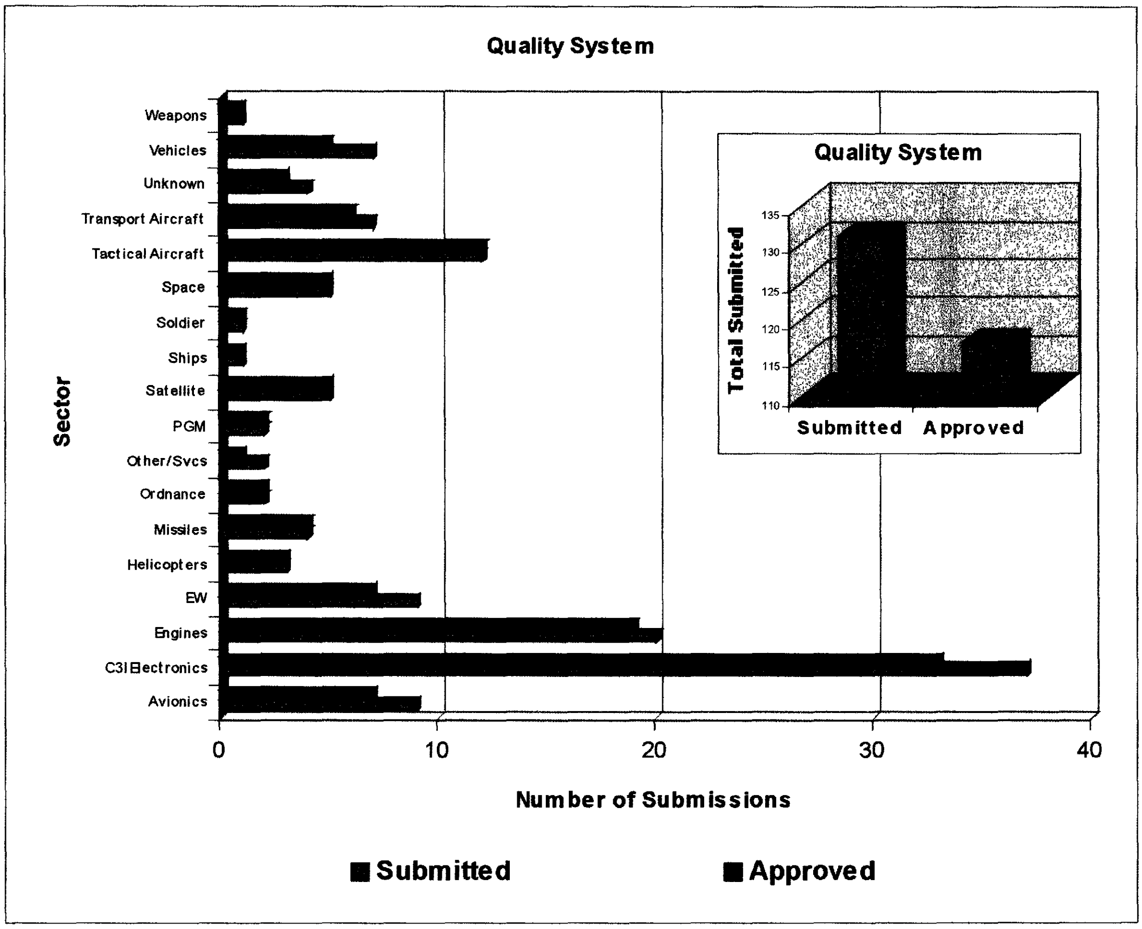


Observations:

- This area represents one of the leading business process types submitted for modification in SPI.
- All sectors are participating and gaining government acceptance of commercial manufacturing practices. The relatively high percentage of government approvals for industry submitted proposals is notable. This can be interpreted as an indication of government support for improved manufacturing efficiency.
- Proposals represent true progress in movement from traditional "how to" military specifications and standards to performance-based requirements.
- "Low technology" segments such as vehicles are well represented, signifying freedom for all types of manufacturing process.

Quality Systems

Figure 6-10 Sector Participation in Quality Systems

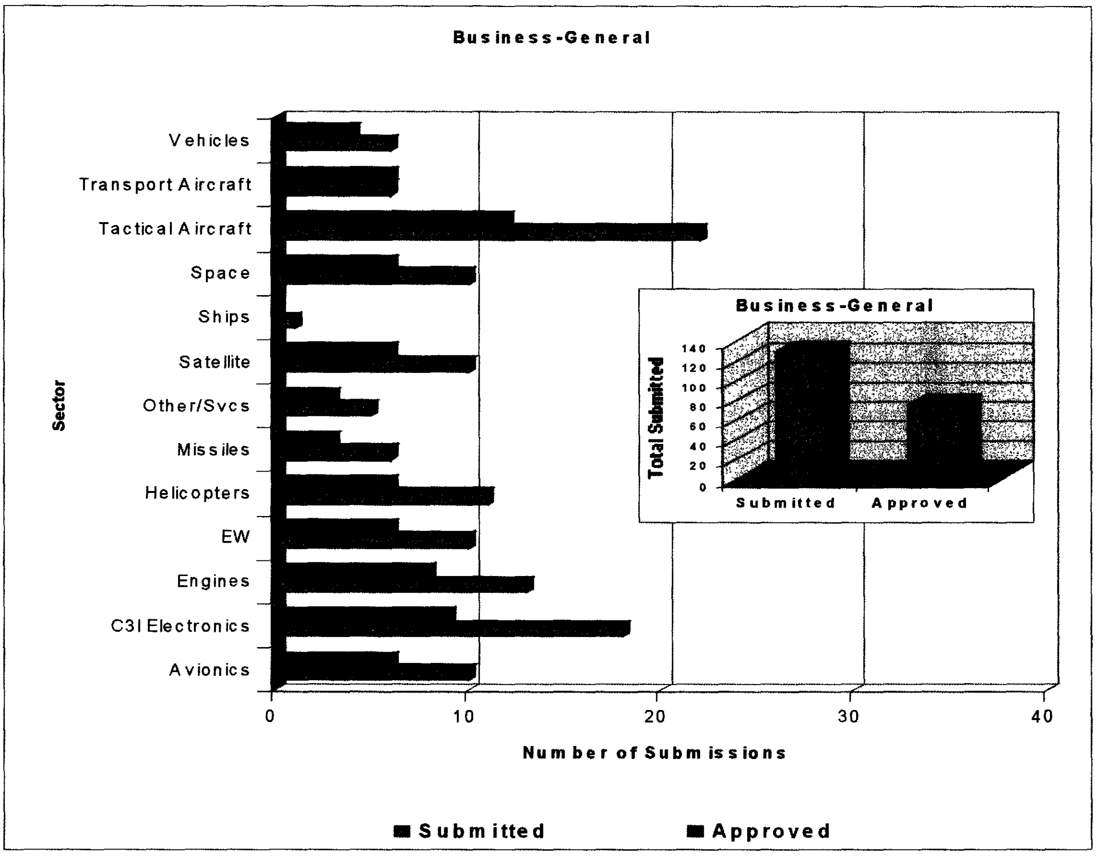


Observations:

- The quality category represents the second highest category of submission among all business process types. The relatively high rate of approval—almost 90 percent of all submissions—is notable since it affects industry's ability to move rapidly toward use of international quality standards through all production programs.
- Sectors with large international exports show significant movement to ISO 9000 quality standards.

Business General

Figure 6-11 Sector Participation in Business General



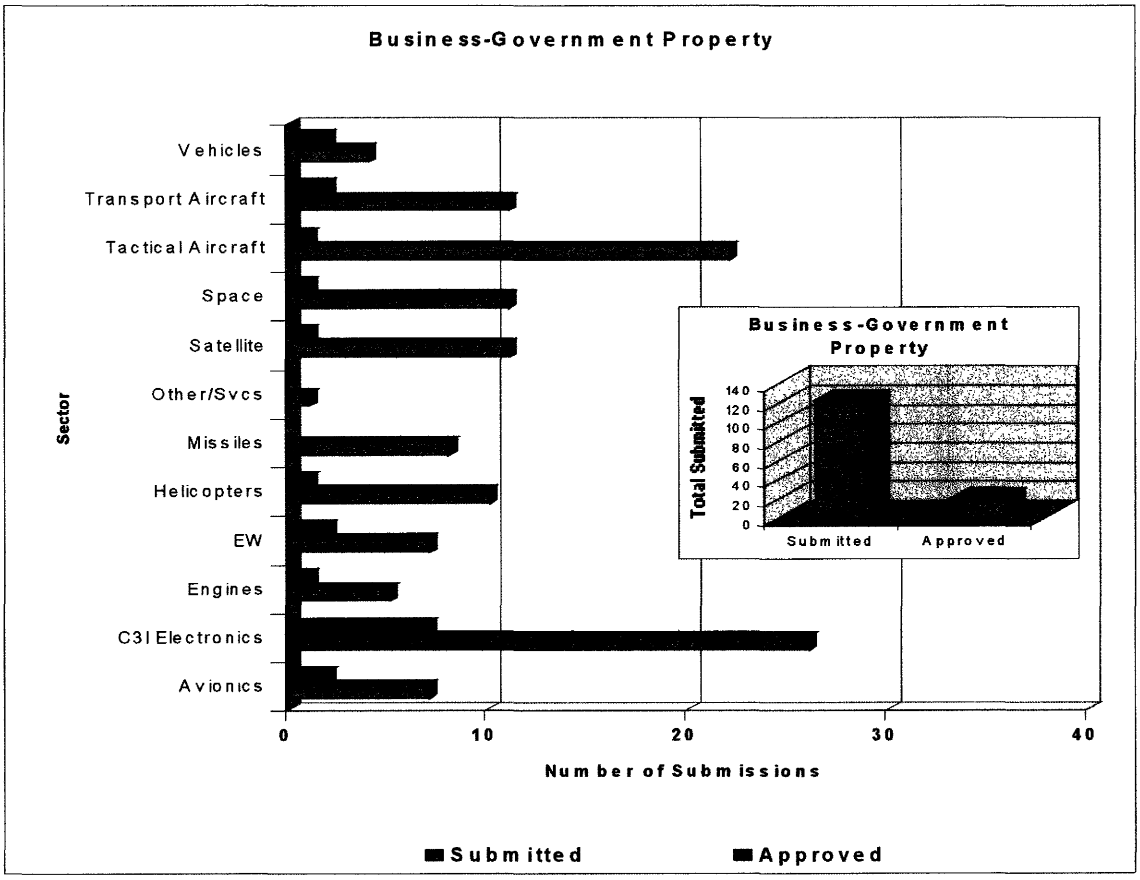
Observations:

- General business practices applicable in government contracting for all sectors are being addressed by most sectors. The practices comprising this area were among the most frequently cited by industry respondents in the "Perry study." Industry views them as non-value added requirements affecting profitability.

- Approval rates lag behind that of manufacturing and quality areas. Policy and administrative barriers are still being addressed. These trends underscore DCMC's concerns about rapid implementation of milspec/milstd reform. Slow responses in approving changes involving general business practices could reflect deep-seated reluctance within DoD at lower levels to undergo a cultural change.

Business Government Property

Figure 6-12 Sector participation in Business Government Property

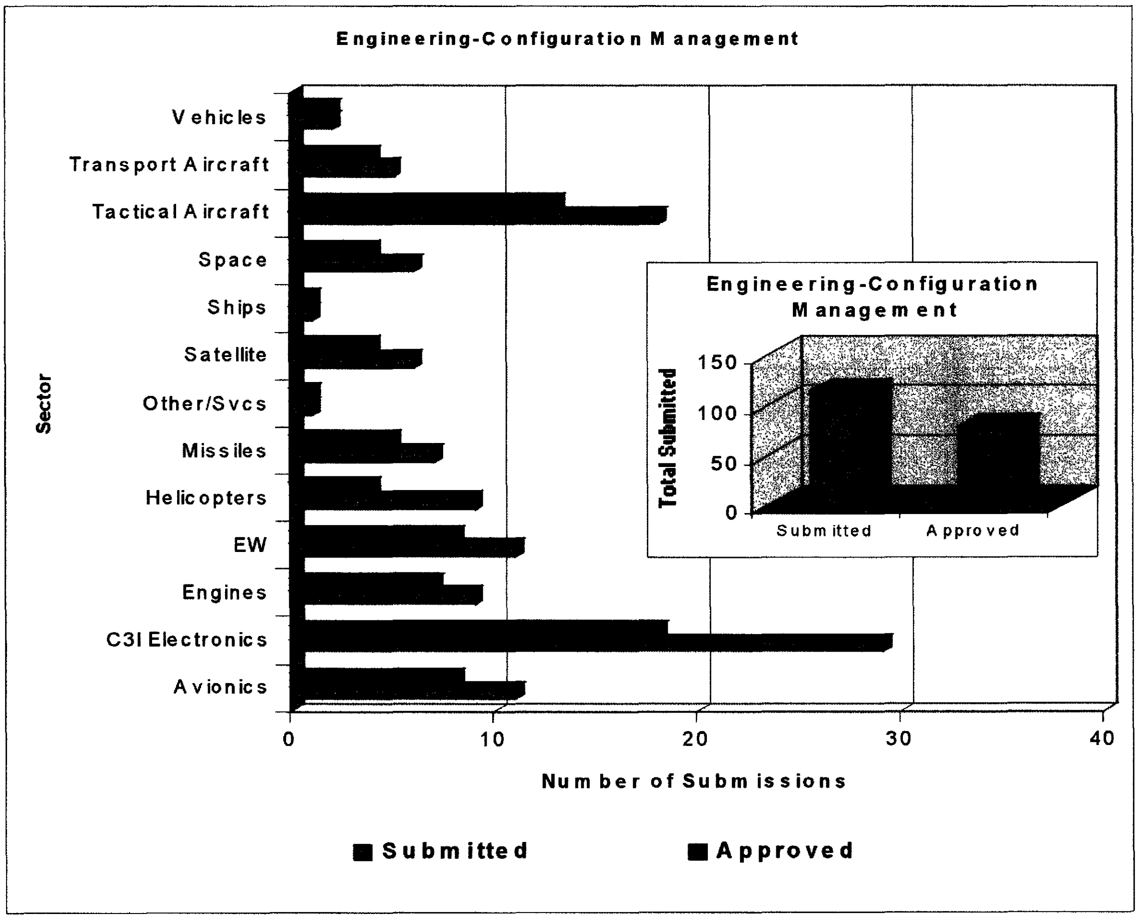


Observations:

- This is one of the key areas of government resistance. Submissions have been submitted by most sectors but the low approval rate is notable. Under 20 percent of all submissions have been approved. Statutory and regulatory interpretations could be limiting approvals.
- Government Property has been identified as a reform focus area for 1998-1999 time frame.

Engineering-Configuration Management

Figure 6-13 Sector Participation in Configuration Management



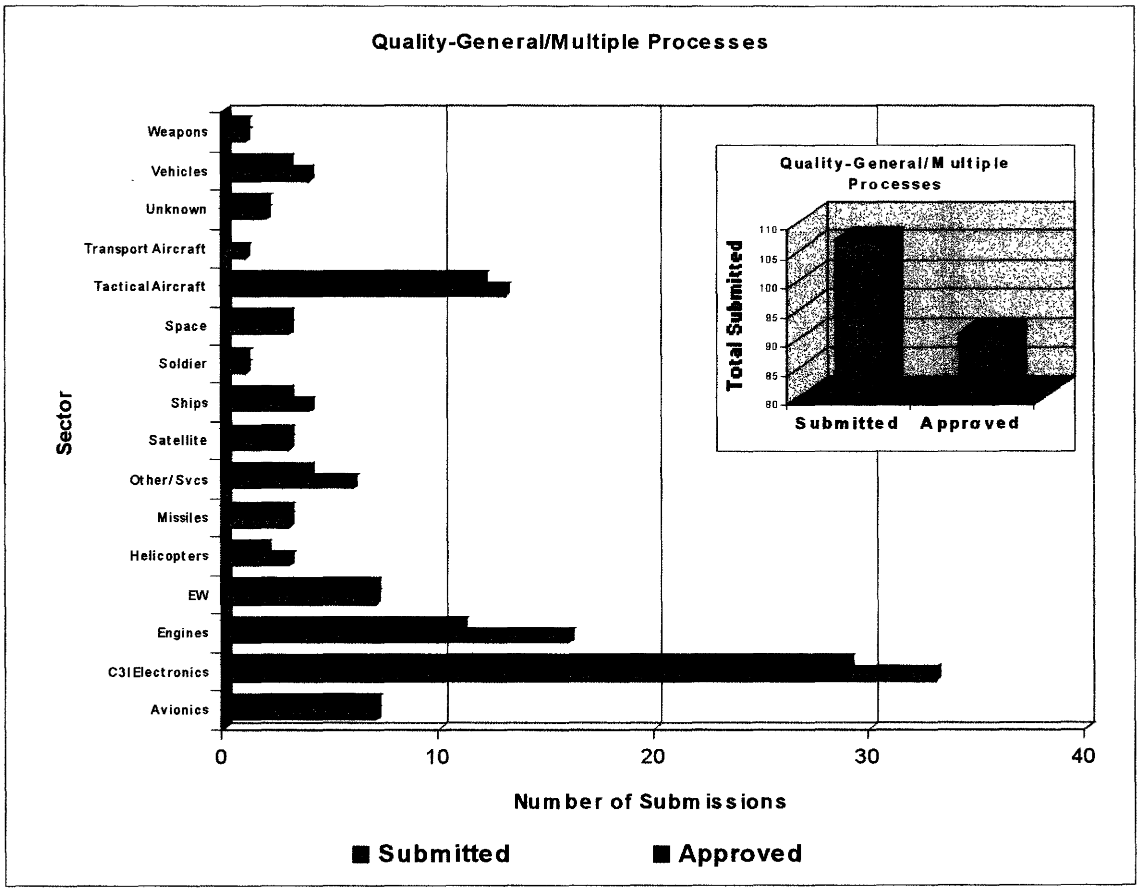
Observations:

- Industry is actively engaged in removing what it views as restrictive government configuration control constraints. Industry as a whole is actively pursuing and obtaining approval to use internal configuration processes.

- Configuration Management combined with Quality process types represent the fundamental reform focus of making industry more accountable in production programs. The data suggest that both industry and government are willing to shift greater authority and responsibility for programs to contractors.

Quality General/Multiple Processes

Figure 6-14 Sector Participation in Quality General/Multiple Processes

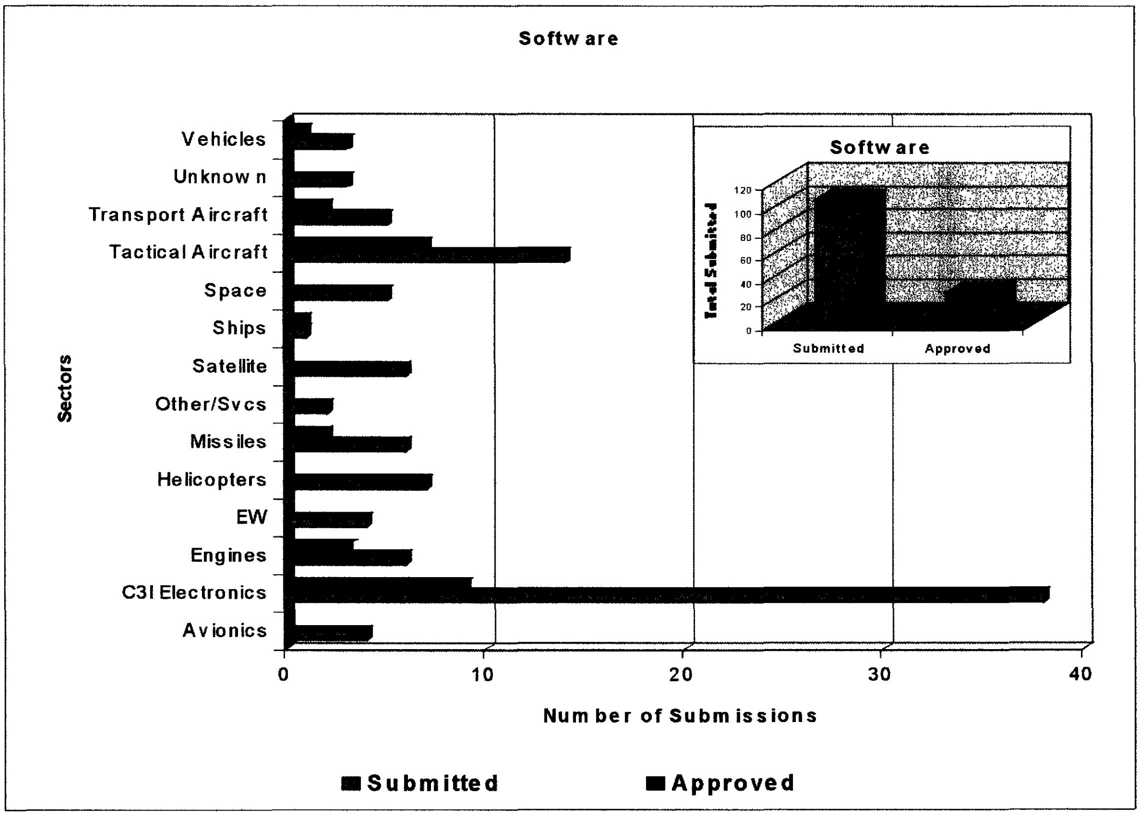


Observations:

- This area is similar to Quality system process type. Industry as a whole is seeking and obtaining approval for use of international standards (i.e., ISO 9000).
- The high approval rate—approximately 85 percent—parallels trends in other quality SPI areas.

Software

Figure 6-15 Sector Participation in Software Process Category

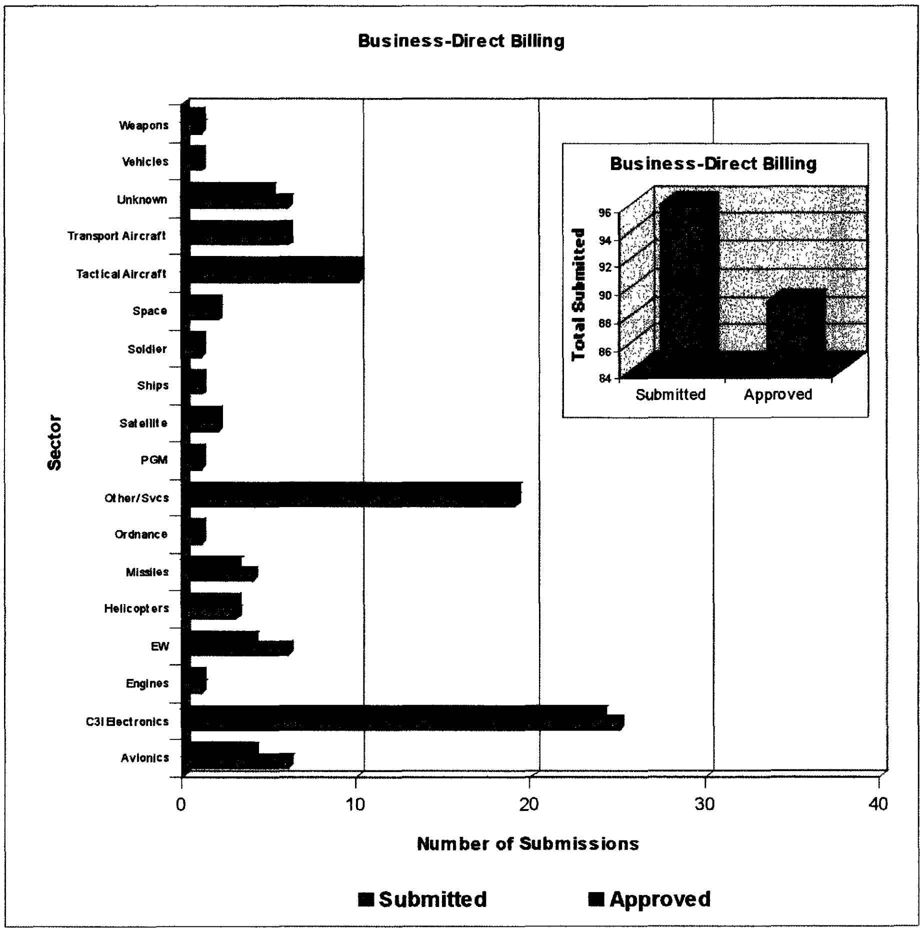


Observations:

- Early SPI leaders are driving software development to contractor controlled software development technique. "In-house" methods and use of ANSI-J-STD-106 are the most common alternative proposals.
- Software intensive sectors lead proposal efforts.
- The slow approval rate is noticeable. Although no explanation is immediately at hand, it certainly reflects DoD caution involving standardised software development and verification processes, as well as its concern over maintaining consistent code and quality standards in custom software products. This area was specifically identified in interviews with government personnel as one major concern with regard to standardisation.

Business Direct Billing

Figure 6-16 Sector Participation in Business Direct Billing Process Category

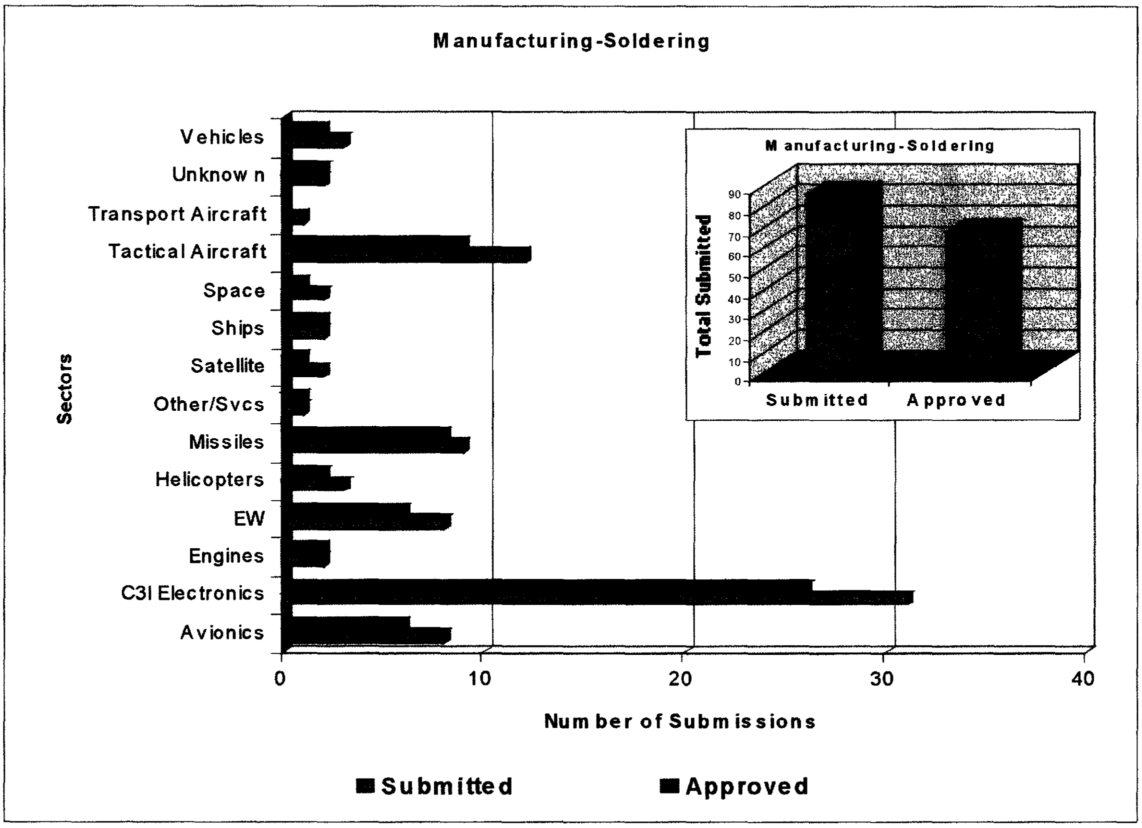


Observations:

- All sectors are pursuing alternative Direct Billing business processes. Many of these requests are driven by a desire to utilise electronic commerce & improve cash flow through interim progress payments.
- This trend quantifies anecdotal evidence and statements by leading corporate officials that they are looking toward improved business operations/efficiency for higher profitability.
- C^3I sector submissions may be attributed to the overall importance of cash flow and the largest number of contractors participants of all sectors.

Manufacturing- Soldering

Figure 6-17 Sector Participation in Manufacturing-Soldering Process Category



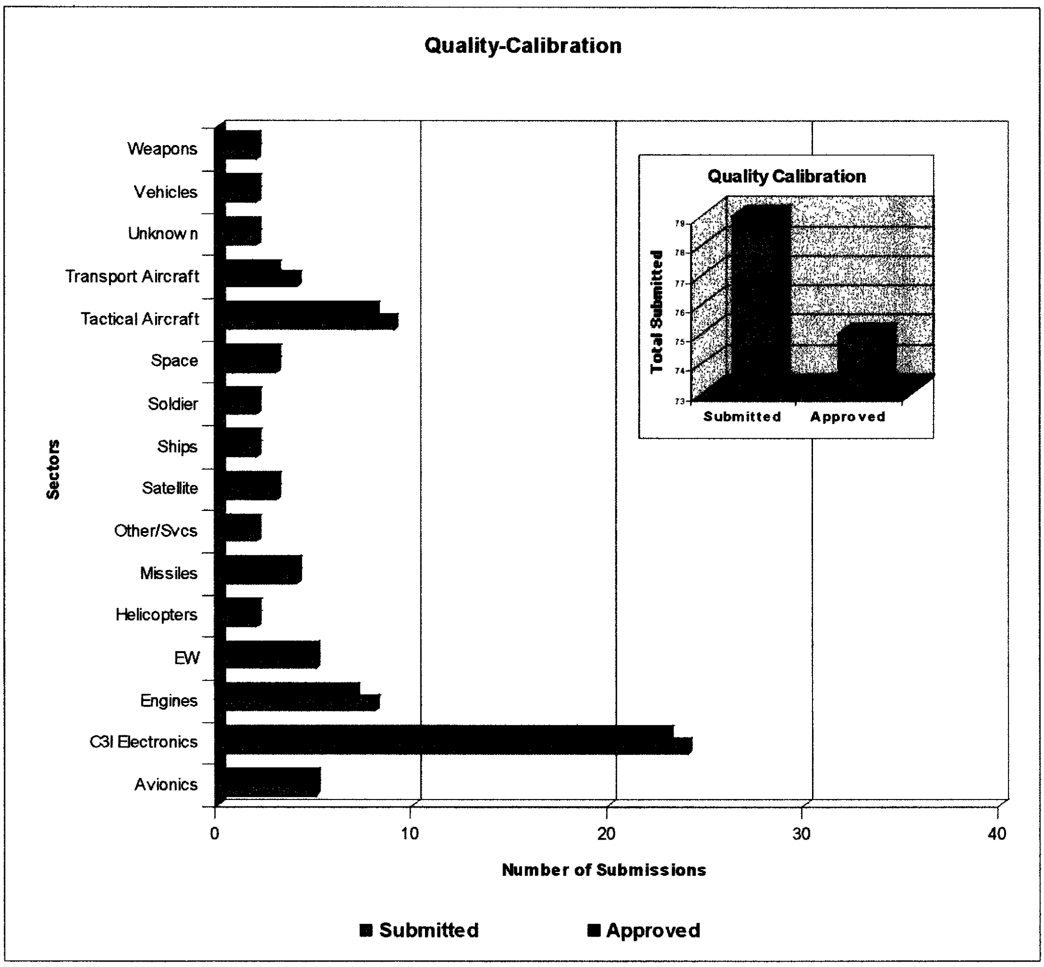
Observations:

- Soldering Process is common to most commodity groups. High technology, electronics-intensive industries are actively pursing simplification of multiple government soldering requirements.

- Soldering was an early "Reinvention Lab" topic. The government and industry went through extensive review of soldering requirements. Jointly they have agreed upon requirements and continue to conduct extensive training in acquisition forums.

Quality – Calibration

Figure 6-18 Sector Participation in Quality Calibration Process Category



Observations:

- Early DoD policy and direction authorising ISO 9000 series as a suitable substitute generated an overwhelming response in all quality areas.

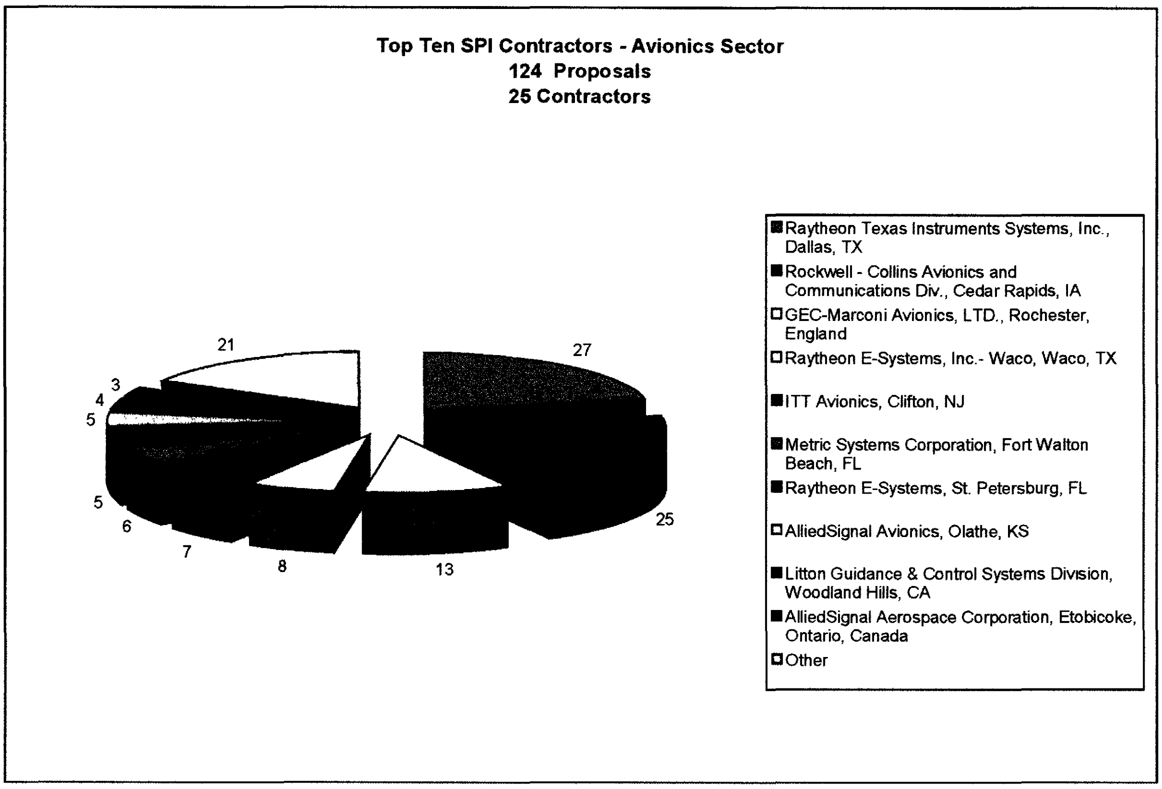
- Quality processes are being pursued in all sectors. C^3I leadership may be attributed to number of contractors participating.

6.3.7 Sector analysis: progress of leading defence contractors

The following sections examine each identified sector in greater detail. First we examine SPI proposals from the viewpoint of proposal activity levels, and then the number and types of proposals by sector. This analysis identifies the SPI proposal activity level, major contractors in each sector as well as the key processes identified for replacement within each sector. Where appropriate, key observations will note significant findings that may impact the EC members. The format for each section follows a standard format, graphically portraying leading contractor activity in each sector, followed by a table of the most frequently modified requirements or specifications and concluding with observations on trends in each sector.

Avionics Sector

Figure 6-19 Top ten SPI contractors - Avionics



Avionics Requirement Or Specification Most Frequently Modified

Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Avionics	MIL-Q-9858	Quality Program Requirements (No S/S Document)	16
Avionics	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	10
Avionics	MIL-STD-2000	(DoD-STD-2000) Soldering Technology, High quality and high Reliability	10
Avionics	MIL-I-45208	Contractor Billing Requirements	8
Avionics	MIL-STD-1535	Supplier Quality Assurance Program Requirements	8
Avionics	MIL-STD-45662	Calibration Systems Requirements	8
Avionics	MIL-STD-454	Standard General Requirements for Electronic Equipment (S/S by Mil-Hdbk-454)	5
Avionics	DFAR 242.803	Contractor Billing Requirements	4
Avionics	FAR 52.245	Government Property	4
Avionics	MIL-STD-965	Parts Control Program	4

Observations:

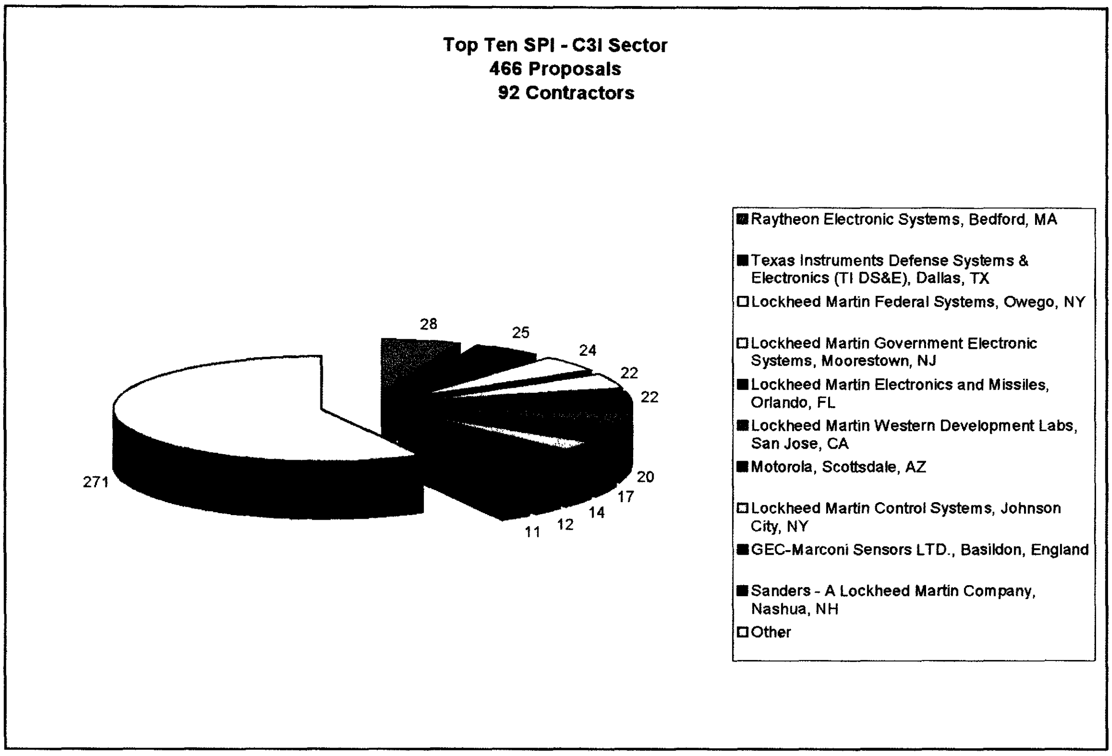
- GEC-Marconi represents foreign ownership. Globalisation is an important element of acquisition reform for DoD. Participation by overseas firms in SPI suggests potential for internal transfers of commercial practices.

- Efforts are dominated by major manufacturers; vendors are not currently participating in this sector.

- Quality procedures and practices dominate this sector.

C³I Sector

Figure 6-20 Top ten SPI contractors – C³I



C³I Electronics Requirement Or Specification Most Frequently Modified

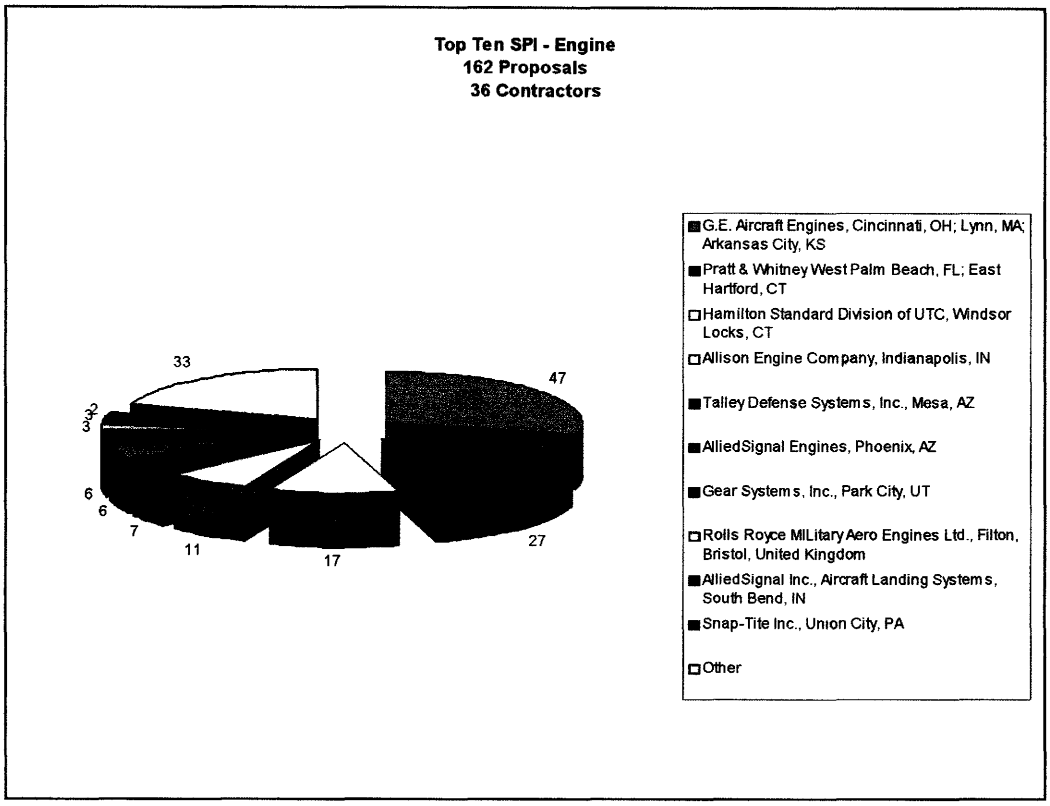
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
C³I Electronics	MIL-Q-9858	Quality Program Requirements (No S/S Document)	58
C³I Electronics	MIL-STD-2000	(DoD-STD-2000) Soldering Technology, High quality and high Reliability	47
C³I Electronics	MIL-STD-45662	Calibration Systems Requirements	34
C³I Electronics	MIL-I-45208	Inspection System Requirements (No S/S Document)	30
C³I Electronics	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	28
C³I Electronics	MIL-STD-454	Standard General Requirements for Electronic Equipment (S/S by Mil-Hdbk-454)	25
C³I Electronics	DFAR 242.803	Contractor Billing Requirements	23
C³I Electronics	MIL-STD-973	Configuration Management	23
C³I Electronics	MIL-STD-1535	Supplier Quality Assurance Program Requirements	20
C³I Electronics	FAR 52.245	Government Property	16

Observations:

- Lockheed Martin accounts for over 25 percent of all activity.
- Raytheon, Lockheed, Texas Instruments and Northrop Grumman played an early role in SPI program development.
- The electronics industry as a whole has broad participation in SPI. Proposals have been generated from both Prime and Sub-vendor suppliers with over 84 contractors. This is one of the few sectors in which there is evidence of strong subcontractor involvement.
- Corporately, Lockheed is effectively transferring SPI process & procedures among its various facilities.
- The C^3I sector is aggressively pursing the movement to commercial manufacturing processes.

Engine Sector

Figure 6-21 Top ten SPI contractors - Engines



Engines Requirement Or Specification Most Frequently Modified

Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Engines	MIL-Q-9858	Quality Program Requirements (No S/S Document)	22
Engines	MIL-I-45208	Inspection System Requirements (No S/S Document)	21
Engines	MIL-STD-2073	DoD Materiel, Procedures for Development and Application of Packaging Requirements (S/S by Mil-Std-2073-1a)	12
Engines	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	9
Engines	FAR 52.244	Subcontracting Policies and Procedures	7
Engines	MIL-STD-45662	Calibration Systems Requirements	7
Engines	MIL-STD-1535	Supplier Quality Assurance Program Requirements	6
Engines	MIL-STD-480	Configuration Control-Engineering Changes, Deviations and Waivers	6
Engines	FAR 52.203		5
Engines	MIL-STD-2167	(DoD-STD-2167) Defense System Software Development	5

Observations

- General Electric dominates SPI proposals. Its leadership role is attributable to its senior management's involvement in early SPI policy formulation. Unlike other sectors, GE is engaging its supplier base in the SPI process.

- Inspection requirements, property management and quality control are focus areas for both primes and subvendors.

EW Sector

EW Requirement Or Specification Most Frequently Modified

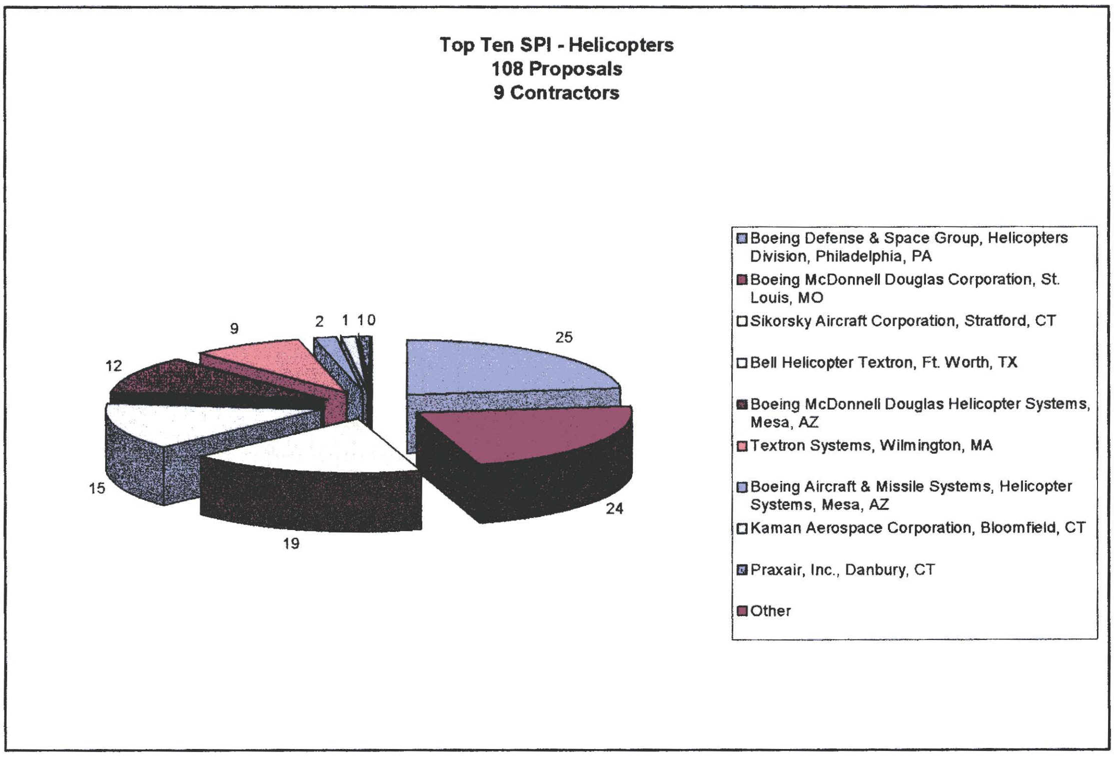
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
EW	MIL-Q-9858	Quality Program Requirements (No S/S Document)	16
EW	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	9
EW	MIL-STD-2000	(DoD-STD-2000) Soldering Technology, High quality and high Reliability	9
EW	MIL-STD-1535	Supplier Quality Assurance Program Requirements	8
EW	MIL-STD-45662	Calibration Systems Requirements	8
EW	MIL-I-45208	Inspection System Requirements (No S/S Document)	7
EW	MIL-STD-454	Standard General Requirements for Electronic Equipment (S/S by Mil-Hdbk-454)	5
EW	DFAR 242.803	Contractor Billing Requirements	4
EW	FAR 52.245	Government Property	4
EW	MIL-STD-965	Parts Control Program	4

Observations

- Quality inspection requirements are driving forces for this sector.
- Leadership is held by major prime contractors (Raytheon, TI, and Rockwell Collins) who participated in early acquisition “reinvention laboratories.”
- Proposals focus on manufacturing related areas such as soldering and inspection calibration.

Helicopters Sector

Figure 6-22 Top ten SPI contractors - Helicopters



Helicopters Requirement Or Specification Most Frequently Modified

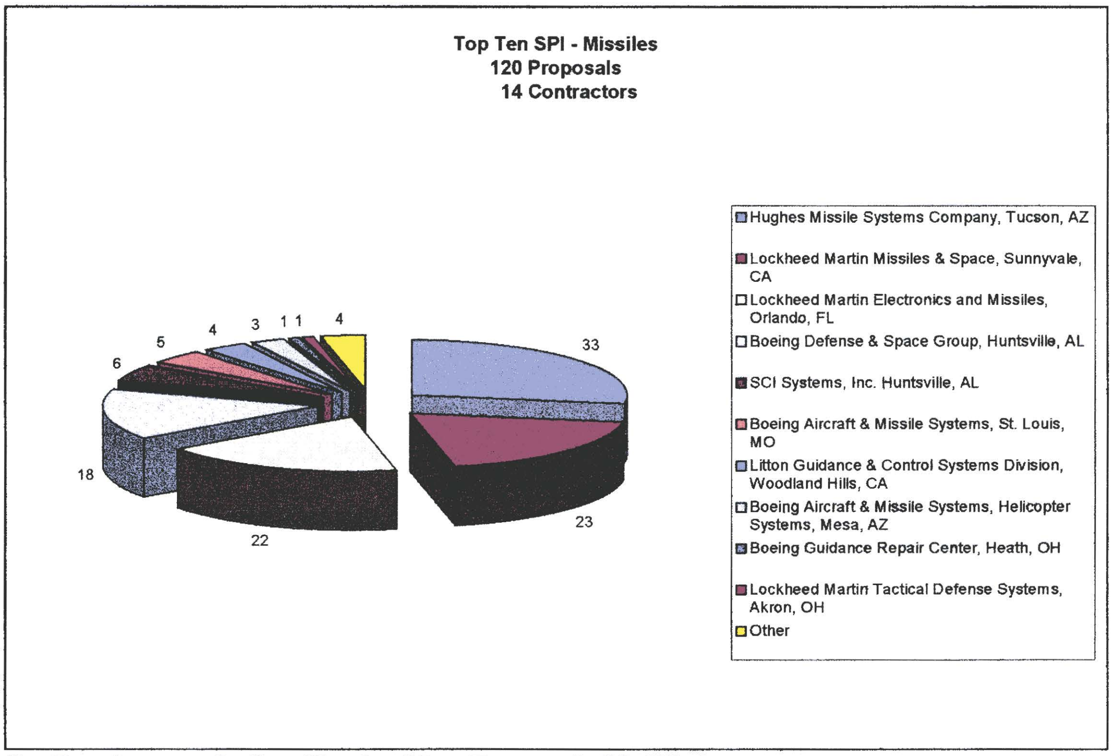
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Helicopters	DFAR 252.234		11
Helicopters	FAR 52-219		8
Helicopters	MIL-Q-9858	Quality Program Requirements (No S/S Document)	7
Helicopters	MIL-STD-973	Configuration Management	6
Helicopters	DFAR 252.242		5
Helicopters	FAR 45	Reporting, Redistribution, and Disposal of Contractor Inventory	5
Helicopters	FAR 52.244	Subcontracting Policies and Procedures	5
Helicopters	CDRLs		4
Helicopters	MIL-STD-100	Engineering Drawing Practices	4
Helicopters	MIL-STD-2167	(DoD-STD-2167) Defense System Software Development	4

Observations

- Boeing leads the sector with over 50 percent of proposals.
- Interest areas for Boeing are apparent in most major manufacturing facilities. This might indicate that Boeing's internal network is effectively sharing gains from SPI. This company wide approach may represent true competitive improvement potential with implications for its commercial and military production.

Missiles Sector

Figure 6-23 Top ten SPI contractors - Missiles



Missiles Requirement Or Specification Most Frequently Modified

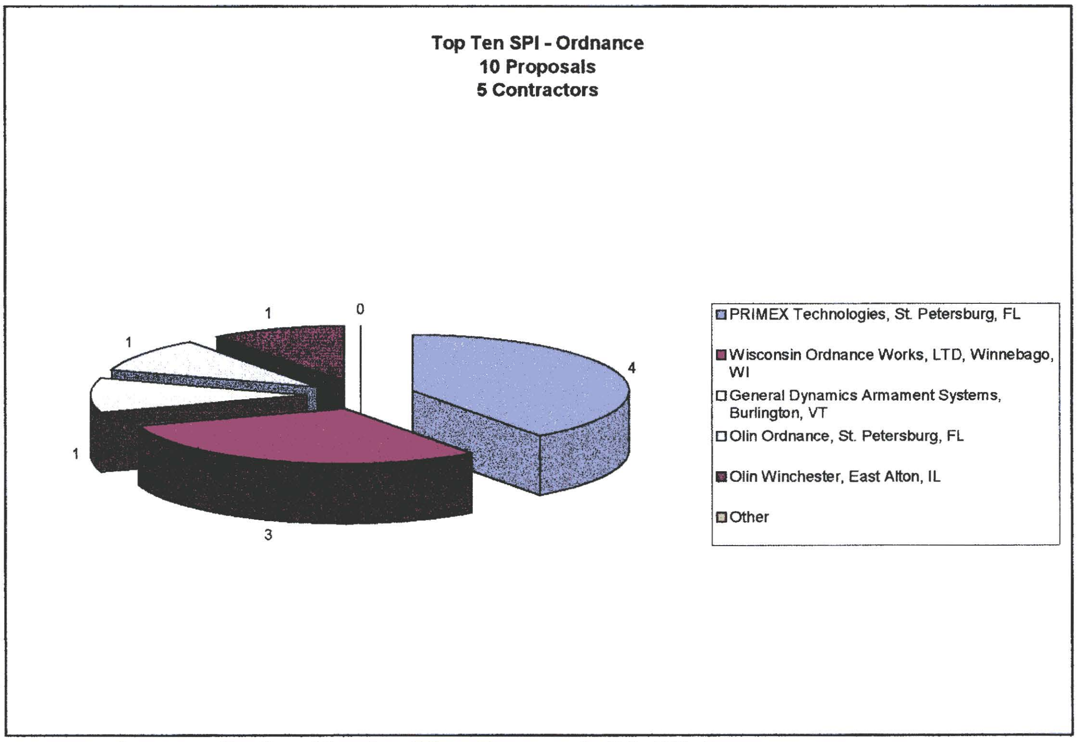
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Missiles	MIL-Q-9858	Quality Program Requirements (No S/S Document)	9
Missiles	MIL-STD-2000	Supplier Quality Assurance Program Requirements	9
Missiles	FAR 52.244	Subcontracting Policies and Procedures	6
Missiles	MIL-STD-965	Parts Control Program	5
Missiles	DFAR 252.234		4
Missiles	FAR 45	Government Property	4
Missiles	FAR 52*		4
Missiles	MIL-I-45208	Inspection System Requirements (No S/S Document)	4
Missiles	MIL-P-55110		4
Missiles	MIL-SPECs		4

Observations

- Lockheed, Boeing and Hughes dominate SPI activity.
- There is little or no subcontractor involvement in this sector.
- The leading area of modification is in Business Process supplier relations.
- Boeing's integrated corporate approach is evident through the participation of all its major facilities in this sector.

Ordnance/PGM Sector

Figure 6-24 Top ten SPI contractors – Ordnance/PGM



Ordnance Requirement Or Specification Most Frequently Modified

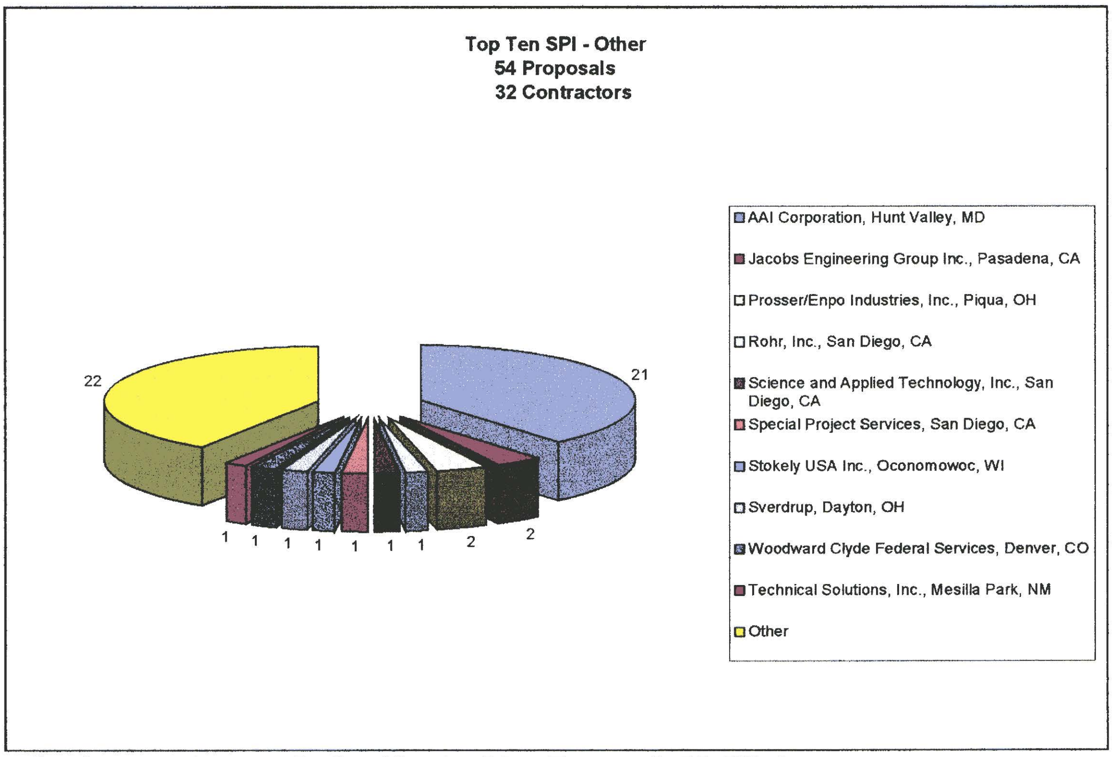
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Ordnance	CDRLs	Contract Deliverable Reports	4
Ordnance	FAR 52.219		4
Ordnance	MIL-Q-9858	Quality Program Requirements (No S/S Document)	4
Ordnance	DFAR 242.803	Contractor Billing Requirements	2
Ordnance	Discontinuities ranging from 1/8" to 2"		2
Ordnance	FAR 52.214		2
Ordnance	MIL-STD-1949	Inspection, Magnetic Particle	2
Ordnance	TT-C-490		2

Observations

- Few contractors and proposals are evident in this sector.
- Low technology dominates this sector. There is no major interest developed in migrating from traditional military processes used in the development of ordnance.

Other Services Sector

Figure 6-25 Top ten SPI contractors – Other services



Other Services Requirement Or Specification Most Frequently Modified

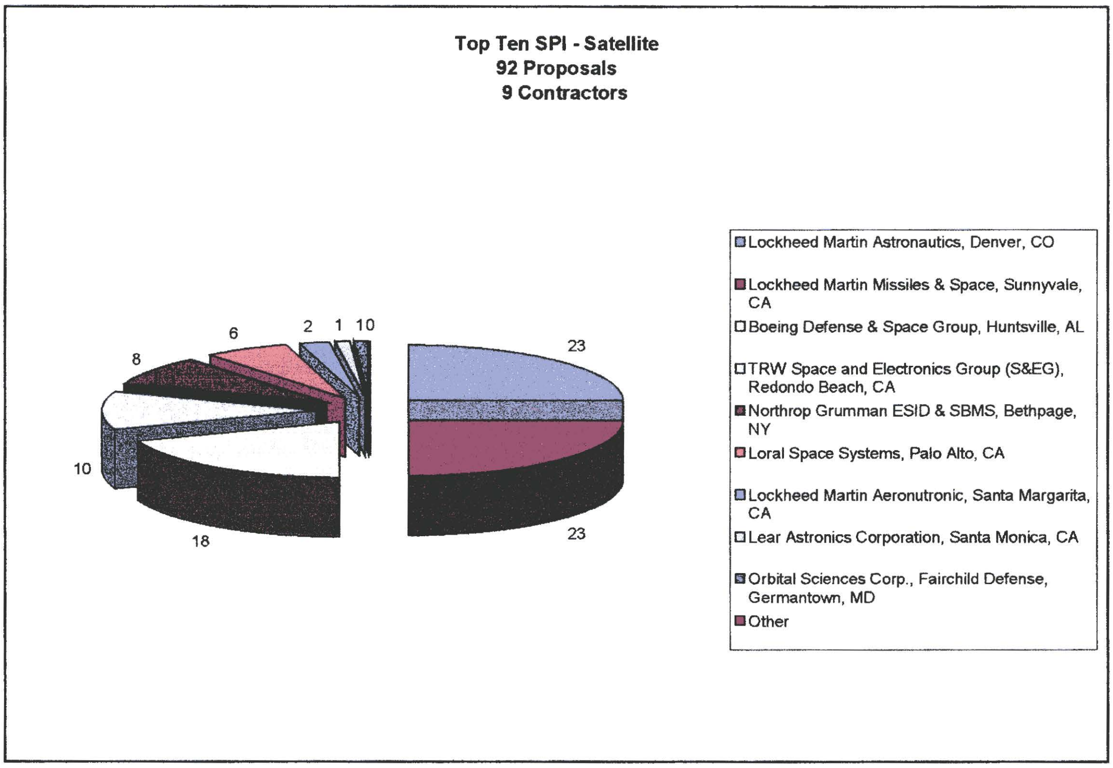
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Other/Svcs	DFAR 242.803	Contractor Billing Requirements	21
Other/Svcs	MIL-I-45208	Contractor Billing Requirements	5
Other/Svcs	MIL-Q-9858	Quality Program Requirements (No S/S Document)	5
Other/Svcs	MIL-STD-45662	Calibration Systems Requirements	4
Other/Svcs	MIL-STD-100	Engineering Drawing Practices	3
Other/Svcs	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	3
Other/Svcs	DD-250		2
Other/Svcs	MIL-STD-1535	Supplier Quality Assurance Program Requirements	2
Other/Svcs	MIL-STD-2168		2
Other/Svcs	CFR 21 Subchapter J		1

Observations

- AAI is leading in the service sector. AAI is one of the first midsize companies ($180M/yr sales) to actively engage in SPI. AAI has taken the position that SPI will reduce the cost of doing business and will increase its competitiveness.
- A large number of manufacturing centres representing the subtier supplier base also are evident in this sector. Proposals in this sector are dominated by two firms, but there nevertheless is broad participation by subcontractors as well.

Satellite/Space Sector

Figure 6-26 Top ten SPI contractors – Satellite/Space



Satellite/Space Requirement Or Specification Most Frequently Modified

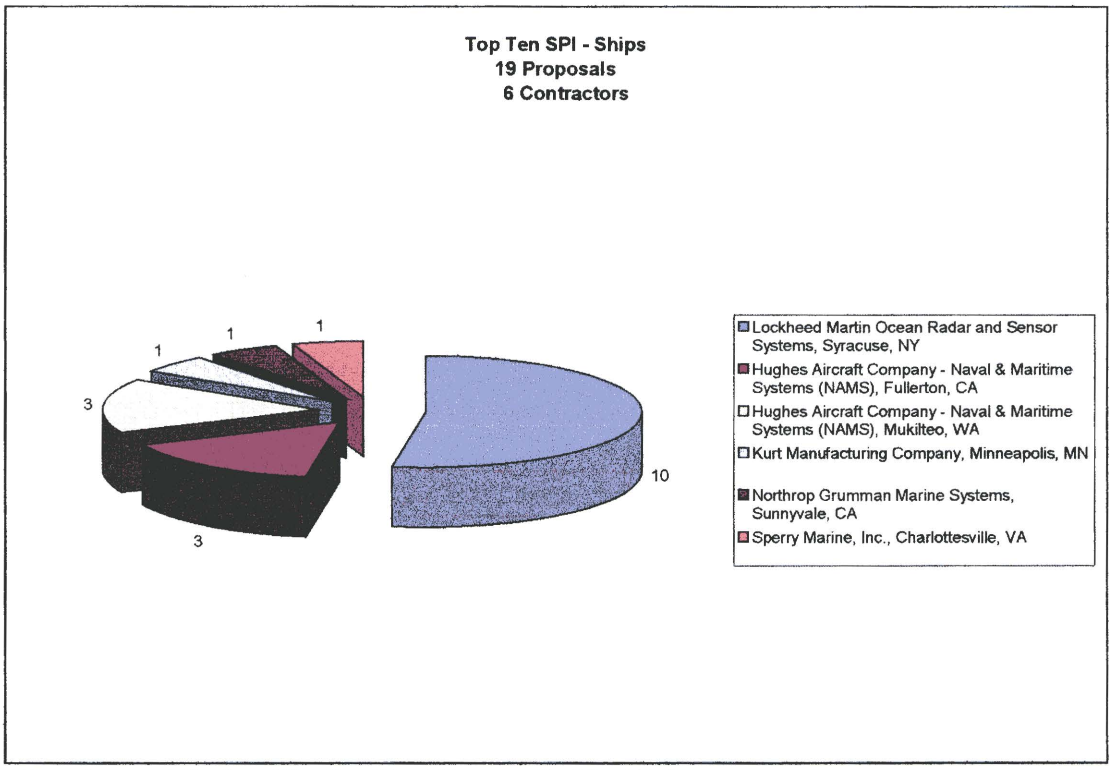
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Satellite	MIL-Q-9858	Quality Program Requirements (No S/S Document)	11
Satellite	NHB 5300.4		9
Satellite	MIL-I-45208	Contractor Billing Requirements	7
Satellite	FAR 45	Government Property	6
Satellite	FAR 52.245	Government Property	5
Satellite	DFAR 252.234		4
Satellite	FAR 52.244	Subcontractor Polices and Procedures	4
Satellite	MIL-STD-2167	(DoD-STD-2167) Defense System Software Development	4
Satellite	FAR 52		3
Satellite	MIL-STD-100	Engineering Drawing Practices	3

Observations

- Prime contractors dominate activity in this sector. Lockheed Martin's activity is particularly noticeable.
- The major emphasis of change proposals is on billing, quality and inspection procedures. These all have potential for immediate impact on companies' profitability, although quality and inspection are likely to have a greater impact over the long term.
- The large commercial application of satellites may limit the need to participate in SPI program.

Ships Sector

Figure 6-27 Top ten SPI contractors - Ships



Ships Requirement Or Specification Most Frequently Modified

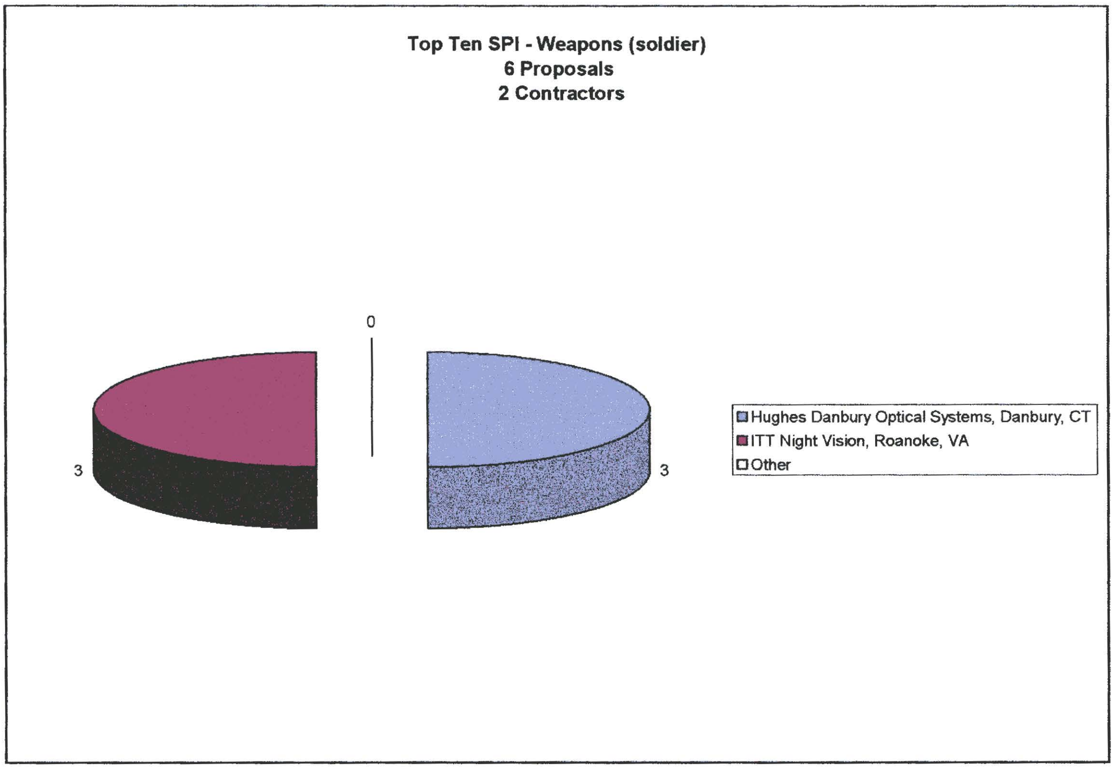
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Ships	MIL-I-45208	Inspection System Requirements (No S/S Document)	4
Ships	MIL-STD-2000	(DoD-STD-2000) Soldering Technology, High quality and high Reliability	4
Ships	MIL-Q-9858	Quality Program Requirements (No S/S Document)	2
Ships	MIL-STD-100	Engineering Drawing Practices	2
Ships	MIL-STD-2073	DoD Materiel, Procedures for Development and Application of Packaging Requirements (S/S by Mil-Std-2073-1a)	2
Ships	MIL-STD-454	Standard General Requirements for Electronic Equipment (S/S by Mil-Hdbk-454)	2
Ships	MIL-STD-45662	Calibration Systems Requirements	2
Ships	FAR 44.3		1
Ships	FAR 52.219		1
Ships	MIL-M-38769		1

Observations

- Overall, the participation of this sector in SPI is limited.
- Industry continues to work to traditional practices. Early hull manufacturer participants indicated that SPI offered only marginal gains to their businesses.
- SPI activity is focused on electronically oriented vendors within the shipbuilding sector. This underscores lack of involvement by hull manufacturers – the "traditional" shipbuilding industry – and actually serves to supplement advances made by electronics manufacturers in other SPI areas.
- SPI proposals address inspection/calibration, soldering and general drawing practices.

Soldier

Figure 6-28 Top ten SPI contractors - Soldier



Soldier Requirement Or Specification Most Frequently Modified

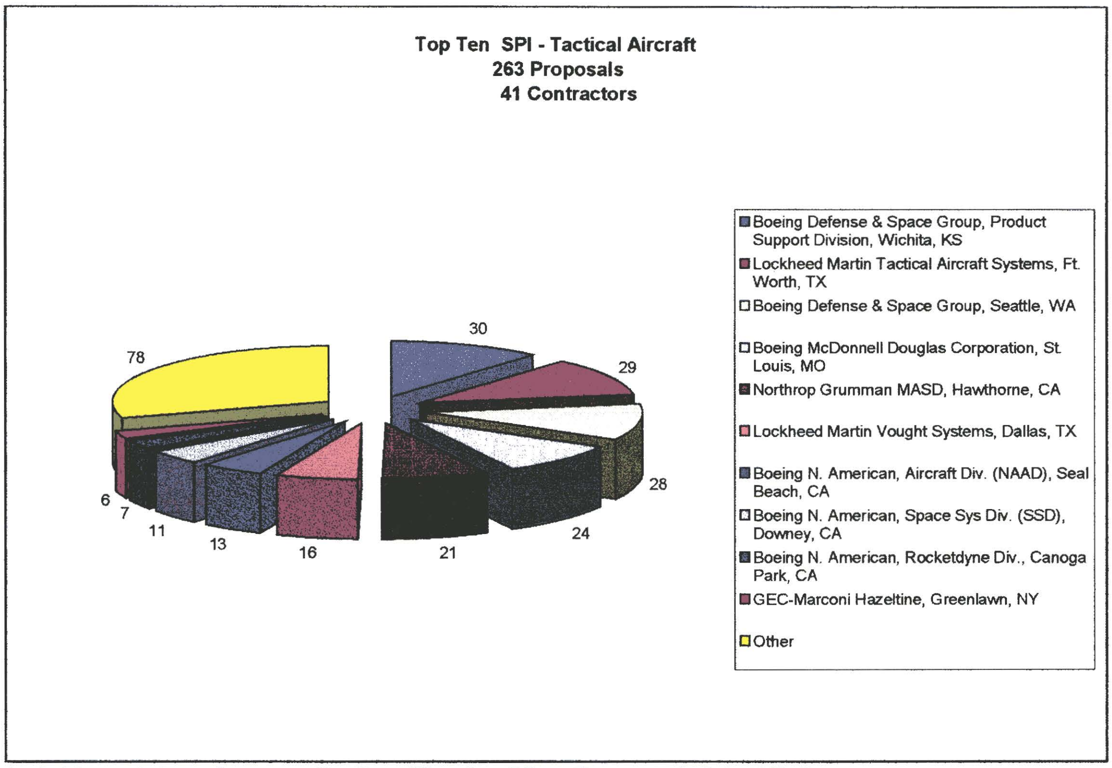
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Soldier	MIL-I-45208	Contractor Billing Requirements	2
Soldier	MIL-Q-9858	Quality Program Requirements (No S/S Document)	2
Soldier	DFAR 242.803	Contractor Billing Requirements	1
Soldier	MIL-C-45662	Calibration Systems Requirements	2
Soldier	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	1

Observations

- Respondents are limited to night vision device manufacturers. Proposals deal with billing practices to improve cash flow, calibration and material disposition.

Tactical Aircraft Sector

Figure 6-29 Top ten SPI contractors – Tactical aircraft



Tactical Aircraft Requirement Or Specification Most Frequently Modified

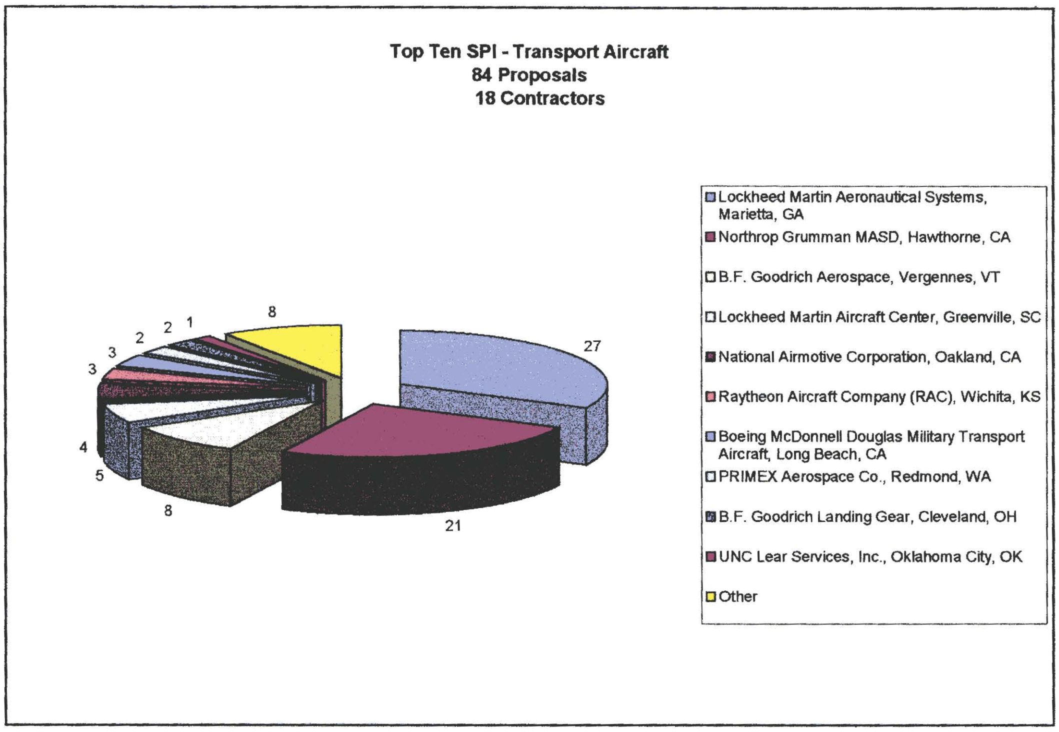
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Tactical Aircraft	MIL-Q-9858	Quality Program Requirements (No S/S Document)	23
Tactical Aircraft	MIL-I-45208	Contractor Billing Requirements	17
Tactical Aircraft	DFAR 252.234		16
Tactical Aircraft	MIL-STD-2000	(DoD-STD-2000) Soldering Technology, High quality and high Reliability	16
Tactical Aircraft	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	12
Tactical Aircraft	MIL-STD-1535	Supplier Quality Assurance Program Requirements	12
Tactical Aircraft	MIL-STD-973	Configuration Management	12
Tactical Aircraft	MIL-STD-45662	Calibration System Requirements	11
Tactical Aircraft	MIL-STD-480	Configuration Control-Engineering Changes, Deviations and Waivers	11
Tactical Aircraft	MIL-STD-2073	DoD Materiel, Procedures for Development and Application of Packaging Requirements (S/S by Mil-Std-2073-1a)	10

Observations

- Major OEMs and their vendors are present. However, 90 percent of the proposals in this sector are prime vendor related.
- This is the leading sector in SPI proposals. It influences other sectors in a leadership role. The sector as a whole is a leader in the transition of manufacturing processes.
- The number of participants and proposals suggests that companies in this sector are pursuing commercial practices aggressively.
- SPI focus areas cross both manufacturing and business operations.
- Given the importance of this sector to DoD and the economy as a whole, SPI activity must be viewed with particular importance.

Transport Aircraft Sector

Figure 6-30 Top ten SPI contractors – Transport aircraft



Transport Aircraft Requirement Or Specification Most Frequently Modified

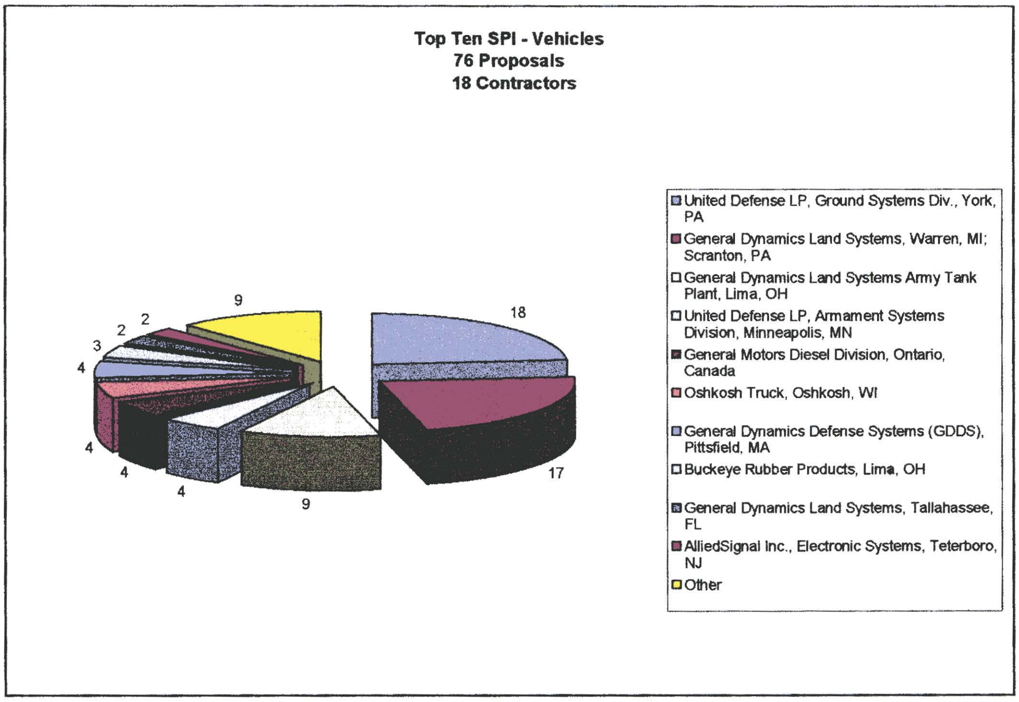
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Transport Aircraft	MIL-Q-9858	Quality Program Requirements (No S/S Document)	10
Transport Aircraft	MIL-I-45208	Contractor Billing Requirements	8
Transport Aircraft	DFAR 242.803	Contractor Billing Requirements	7
Transport Aircraft	FAR 45	Government Property	5
Transport Aircraft	MIL-STD-45662	Calibration Systems Requirements	5
Transport Aircraft	MIL-STD-1535	Supplier Quality Assurance Program Requirements	4
Transport Aircraft	MIL-STD-973	Configuration Management	4
Transport Aircraft	FAR 52.222		3
Transport Aircraft	MIL-STD-100	Engineering Drawing Practices	3
Transport Aircraft	MIL-STD-965	Parts Control Program	3

Observations

- Prime and subvendor involvement is evident in this sector.
- Quality, inspection and billing are the focus areas for conversion.

Vehicles Sector

Figure 6-31 Top ten SPI contractors - Vehicles



Vehicles Requirement Or Specification Most Frequently Modified

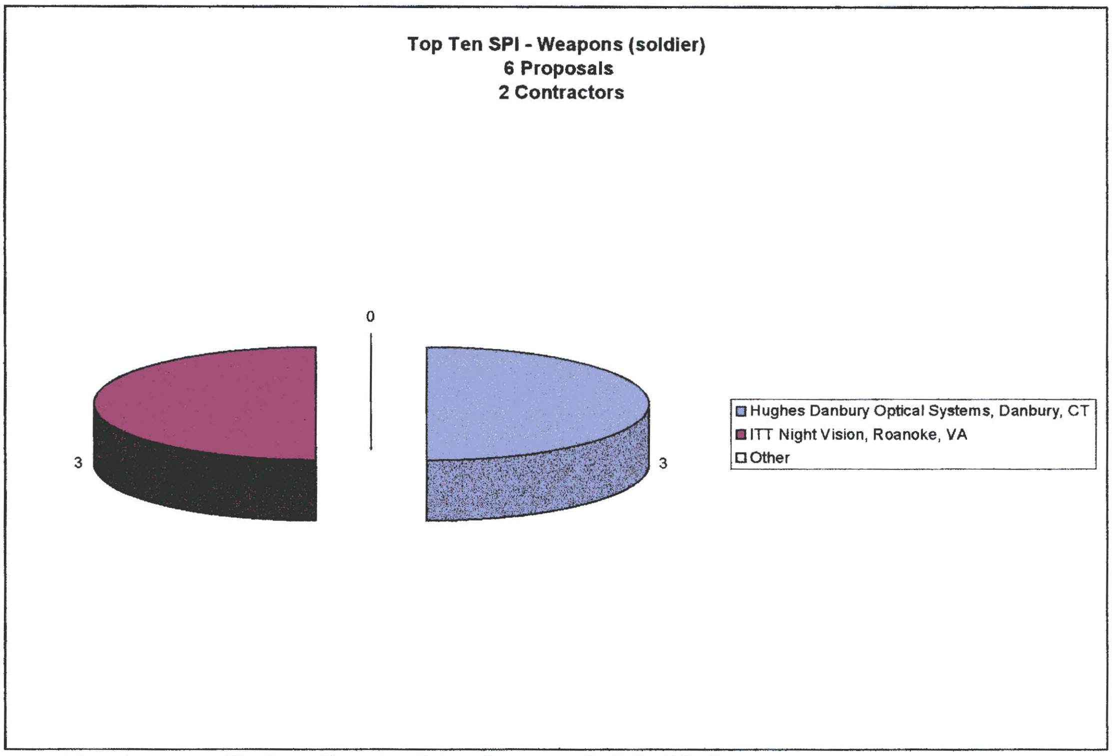
Sector ID	Requirement or Specification Most Frequently Modified	General Description	Qty of Request
Vehicles	MIL-I-45208	Contractor Billing Requirements	11
Vehicles	MIL-Q-9858	Quality Program Requirements (No S/S Document)	6
Vehicles	MIL-STD-2000	Supplier Quality Assurance Program Requirements	5
Vehicles	FAR 45*		4
Vehicles	MIL-STD-100C*	Engineering Drawing Practices	4
Vehicles	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	4
Vehicles	Contract Requirements		3
Vehicles	MIL-STD-200A*		3
Vehicles	MIL-STD-2073	DoD Materiel, Procedures for Development and Application of Packaging Requirements (S/S by Mil-Std-2073-1a)	3
Vehicles	CDRLs		2

Observations

- Both prime contractors and major vendors are involved.
- It has the third highest manufacturing focus of all sectors.

Weapons Sector

Figure 6-32 Top ten SPI contractors - Weapons



Weapons Requirement Or Specification Most Frequently Modified

Sector ID	Requirement or Specification Most frequently Modified	General Description	Qty of Request
Weapons	MIL-I-45208	Inspection System Requirements (No S/S Document)	2
Weapons	MIL-Q-9858	Quality Program Requirements (No S/S Document)	2
Weapons	DFAR 242.803	Contractor Billing Requirements	1
Weapons	MIL-C-45662		1
Weapons	MIL-STD-1520	Corrective Action And Disposition System for Nonconforming Material	1
Weapons	MIL-STD-45662	Calibration Systems Requirements	1

Observations

- The limited number of vendors makes reform less critical to company survival.
- Despite this situation, companies are proposing reforms that are consistent with trends in other sectors.

6.4 Industry and Government perceptions of acquisition reform

The previous chapter examined data that indicates industry actions regarding acquisition reform. The Single Process Initiative (SPI) is the only source of data that quantifies industry, company and sectoral priorities in terms of improved competitiveness, profitability and business practices. Most major prime contractors and industry sectors are represented in SPI proposals and activities. While they are active in these areas and their proposals do represent important priorities to individual companies, the relative importance to individual firms of government initiatives, industry proposals and other external trends such as defence industry consolidation are not necessary reflected in this data. Other measures are required to gage the relative importance of these trends to individual companies and the defence industry as a whole.

To address this problem, TASC began an industry survey in April 1998 to assess industry perceptions of acquisition reform and the Single Process Initiative program. A full accounting of the survey is provided in Appendix H.

Mailing lists were compiled from industry representatives on appropriate technical committees of major industry associations. Industry participants in SPI initiatives were identified in data contained in SPI reports included in the DCMC SPIS database. The survey was sent to 59 individuals at 39 organisations via e-mail and to an additional 106 individuals at 63 organisations via regular mail. In addition, approximately 15 personal interviews were conducted with industry members. There was no overlap in individual names, although there was some overlap in organisational affiliations. Recipients of the survey included major prime contractors, industry associations and well-known consultants with significant Defense Department experience. Prime contractors represented the full range of industries reflected in the SPI data. As of October 23, 1998, 50 responses had been received.

The survey was structured to provide an industry assessment of the impact of reduced DoD procurement budgets on defence acquisitions evident in two areas:

- DoD acquisition reform
- Consolidation of the US defence industry.

The survey was intended to measure the effect of these two developments on the business of US defence contractors. It did not ask for quantitative information, but rather sought qualitative assessments of where companies now find themselves in relation to doing business with DoD, as well as opportunities in other defence markets.

6.4.1 DoD acquisition reform

Shrinking defence dollars have forced senior military leadership to employ new and innovative techniques to reduce infrastructure cost and maximise the resources available for military equipment. Acquisition reform has been underway for some time. Nine of 17 survey questions were structured to assess the impact of these reform initiatives. The following section discusses industries' key observations of DoD acquisition reform initiatives as indicated in survey results.

From a US defence industry perspective, there has been no immediate (positive) impact on costs or profits, but there has been a perceived increase in the opening of competition for non-traditional DoD contractors. Over 60 percent of survey respondents indicated that their costs have not been affected significantly by reductions in MILSPECs. A comparable percentage had similar views in terms of improved profitability. For the defence industry as a whole, however, respondents were more optimistic: almost half of the survey respondents felt that MILSPEC reduction would have a favourable impact on industry as a whole over the long term.

While survey respondents felt their own companies were not benefiting significantly from MILSPEC reforms, they did see an increasingly competitive environment as a result. In particular, greater emphasis on the use of commercial, off-the-shelf (COTS) solutions provides greater market entry for new commercial competition. Reduction of military specifications and conversion to commercial and performance-based specifications contributes to this situation. Thus, respondents saw significant potential for previously unseen competitors to enter into their markets.

The increased use of commercial practices was viewed as having a beneficial impact on individual businesses and the industry as a whole. Almost 80 percent of respondents felt that the use of increased commercial practices is having a direct or indirect impact on the defence industry as a whole, and over 60 percent saw a positive effect on their own company operations. Acquisition reform initiatives are seen in industry as improving the DoD buying process, while performance-based acquisitions are forcing greater customer focus and attention to front-end planning and requirement setting. Acceptance of commercial configuration management and quality practices through the government's Single Process Initiative has provided the most benefit to industry participants. Solicitation processes were areas identified by survey respondents where incremental gains have been made. Government-to-industry interchanges have resulted in meaningful dialogues and improvements to the process. (These dialogues, however, are not seen routinely throughout the Defense Department.) Industry relationships have improved in terms of program management; industry sees DoD as managing risk rather than relying on the rigid instructions of military specifications.

However, respondents viewed this situation with mixed emotions. The trend is favourable for DoD but increases risks for industry. As noted later, many government officials share this perception. In both cases, it reflects a new element of tension between buyers and sellers in US defence markets. Government empathy with industry's dilemma, however, offers hope for a more cooperative relationship in the future.

A consistent theme noticed by industry is that government officials and bureaucracies must undergo a significant change in culture before the full benefits of acquisition reform can be realised for both industry and the taxpayers. These transformations require a long-term commitment. Industry apparently does see signs of positive change in terms of greater trust and openness: roughly one-third of respondents believed that company relationships with DoD acquisition officials have improved, although without benefiting their efficiency. Significantly, senior level officials are viewed as more cooperative, accessible and trusting. Employees at the working level are seen as retaining a "business as usual" approach, suggesting that a cultural change has not fully penetrated the workforce. Furthermore, the ability to maintain this long-term perspective given upcoming changes in administration within the Department raises significant doubts to its future success.

The question of cultural change brought more industry comments in the survey than any other question (see Appendix H). "Cooperation rather than confrontation" was a theme repeated in several forms in those comments, but officials appeared to believe for the most part that significant change had yet to take place at lower levels of the bureaucracy. In addition, respondents indicated that higher leadership levels of DoD may be unaware of the lack of change at lower levels due to the shear size of the DoD bureaucracy. As one respondent noted, "I see much intent from high level officials but little real change [at the] execution level."

Interviews with industry officials and results from the industry survey revealed the perception that acquisition reform offers no competitive advantage for domestic markets. SPI proposals, for example, benefit all competitors are equally, minimising the positive competitive impact for individual firms. Nor is acquisition reform seen as having a positive impact on individual firms' competitiveness in international markets in the future. (Responses where slightly more favourable in terms of the international impact than for domestic competitive impact.) Survey respondents in particular felt that industry consolidation and government administration of such areas as export control laws have a far greater impact on international competitiveness than acquisition reform.

6.4.2 Industry consolidation

Shrinking defence budgets have triggered an industry wide consolidation of defence manufacturers. Six survey questions were structured to assess the impact of industry consolidations. In general, the survey results suggest that industry consolidation has greater impact on individual firms and the defence industry as a whole in several respects than does acquisition reform.

Industry survey participants indicated that to date, there have been moderate gains in accessing resources through industry consolidation. Respondents see consolidation as having a far more important impact on their competitiveness, although perceptible improvements in costs or profitability have not yet been seen. The most important change has been in the area of an improved market position within the domestic defence market: 58 percent of the survey respondents indicated a substantially or slightly improved competitive position as a result of industry consolidation. Firms also saw improved opportunities in foreign and commercial markets due to industry consolidation rather than through acquisition reform efforts. Mergers are believed to have enhanced the long-term competitiveness of the companies in both the domestic and foreign markets and will lead to enhanced market opportunities.

Based on the survey results, it appears that industry views acquisition reform and industry consolidation—although both stimulated by decreasing defence dollars—as independent of one another. Over 75 percent of survey respondents agree that these initiatives are responding to different external environments. Acquisition reform can be characterised as a buyer phenomenon while industry consolidation is a seller phenomenon. Both from a company and industry perspective, 49 percent of the responses believe industry consolidation has a greater impact on competitiveness of the US defence industry, while 18 percent believe acquisition reform has the greater impact, with the remaining 33 percent unable to differentiate.

6.4.3 Acquisition reform and industry consolidation: government views

Not surprisingly, interviews with government officials for this project reveal somewhat different attitudes toward current trends regarding acquisition reform and industry standardisation. The divergence and intersection of these views with perspectives identified in the industry survey are important for their potential implications on the future of acquisition reform and standardisation activities. The most important difference is the degree to which military standards and specifications have been replaced by commercial standards. Government acquisition officials, pointing to a lack of consistency and excessive complexity in many commercial standards, believe this movement already may have gone too far.

Military standards and specifications have one important advantage from an industrial standpoint: the practices and procedures for everything ranging from the report template for reporting program progress to the specific manufacturing processes used for producing equipment items are consistent across companies and even across international borders. This has given US industry and government consistent standards to measure performance. Government officials and some industry personnel believe that these standards may also have given US industry a competitive advantage in overseas sales, since these standards are known universally to all potential customers. Milspecs are seen as having provided US firms the ability to assure overseas customers of product and standard uniformity. Finally, milspecs/milstds have provided US allied governments with similar assurances. Although perfect interoperability is unrealistic, Milspecs can be credited with bringing a degree of interoperability to common systems. From a policy standpoint, this is critical to the Department of Defense. From a more practical industrial viewpoint, it means that allied governments will be assured of having potential access to all non-sensitive items that are available to US forces.

A counter view was evident in our interviews with government officials. Some officials we interviewed believed that US competitiveness in overseas markets was attributable due to their ability to field advanced products more rapidly than their overseas competitors. They believe that acquisition reform, the shift to commercial standards and more rapid product development times will enable US defence firms to maintain this lead in critical sectors.

Some government officials nevertheless believe that the advantages of Milspecs may be lost to US industry and the government with the continued move toward commercial standards and practices. One government official characterises the present environment as a move toward "outsourcing everything," with DoD simply "providing the bodies" for an otherwise all-commercial military infrastructure. Officials with similar perspectives emphasise the following points as fundamental misinterpretations of acquisition reform that have potential negative consequences for DoD:

- Milspec reform does not translate directly into "commercial practices." Milspec and acquisition reform do suggest a far greater reliance on performance specifications and contractor capabilities. This does not, however, suggest a blind replacement of all military specifications and standards with commercial alternatives.
- Commercial standards and specifications may be insufficient in meeting all DoD needs. Reliance on contractor capabilities and DoD program managers to develop performance-based specifications is an important element in overall reform efforts. However, since there are no "commercial standards" for many DoD needs, this approach must be applied to

appropriate products and processes. For example, commercial standards for many lethal systems clearly do not exist. Replacing military specifications with commercial alternatives, therefore, is unrealistic.

- Milspec reform and use of standards have become confused. The reduction of military specifications does not connote elimination of standardisation efforts. In the view of many government officials, however, this is exactly the situation that is emerging, complicating the ability of DoD program managers to perform their jobs effectively and threatening the possibility that future systems increasingly will be incompatible with one another. Some government officials believe that the original Perry directive to reduce milspecs was misinterpreted as meaning that all standards should be eliminated. This is not the case. Service acquisition officers have implemented rigid "no milspec" requirements in programs. However, standardisation remains critical to DoD. Current trends threaten to complicate the need to standardise while relying more on contractor capabilities and commercial standards and specifications.

Examples of the potentially negative ramifications for DoD in these scenarios are abundant. One important example is in the area of government furnished equipment and tooling for programs. Under older practices, this tooling tended to be compatible if not identical with tooling from other programs overlapping multiple services. This provided potential cost savings to DoD while offering certain advantages to contractors as well, most notably in the area of reduced training requirements. Under current practices, tooling and equipment decisions are left to individual contractors. As a result, there is less coordination among services as well as reduced oversight, which leads to concerns over assuring quality standards as well. Finally, the more general technical reports replacing the military specifications of these older approaches and systems have the potential for favouring particular contractors. Even technical reports written by government program officers may benefit from "industry support" coming from a single contractor. In these and other cases, the perspectives of the individual contractor are likely to be dominant. Even if these views are entirely objective, they understandably could favour that one contractor, reducing possible options to the Defense Department as a result.

Government officials note that early MILSPEC reform efforts were selective and controlled. This, in their view, was key to achieving identifiable benefits for DoD. Moving rapidly from a controlled environment to one that is more "fly by the seat of your pants" risks loss of these benefits.

Government officials do note that positive results have been derived from military specification reform efforts. Underscoring a recurring theme in the industry survey, these results often have come after government officials have adapted their internal culture and have improved their capabilities through greater experience and training. For example, acquisition officials interviewed for this project indicate that they believe government officials have become more sophisticated in developing and writing verifiable performance requirements due to greater experience in this new environment.

Officials remain undecided on the potential benefits, but they do note that considerable risk has been shifted to contractors in this new environment. They note that this risk can and is being reduced through such means as Integrated Product Teams (IPTs), where government program managers, customers and suppliers all work together earlier in product development phases to define performance specifications, program management approaches, logistics issues and other concerns in advance. (This also illustrates the importance of changing the totality of DoD's acquisition structure and not simply isolated elements of it.) Many government officials are unsure of the potential cost benefits of these changes, but they do seem to believe that the increased flexibility available to contractors will result in potential savings for DoD. One example offered by an official interviewed for this project was in the area of use of common assembly lines for both commercial and defence systems. This flexibility could offset the potential negative effects of reduced government furnished equipment outlined above.

Interviews of government officials indicated a perceived mutual need for changing operating environments and cultures. Government officials noted that contractors can be as rigid in their willingness to change as their government counterparts. One explanation of different participation levels in Single Process Initiatives, for example, could be that the willingness and ability of some contractors to adapt to new conditions is limited. One acquisition official we interviewed complained that businesses he dealt with were unfamiliar with new contracting procedures and were unwilling to adapt to them. The result was a move by that official to new commercial vendors who he viewed as being far more responsive and flexible in meeting DoD's identified needs. While anecdotal, this does indicate an isolated instance in which the overall objective of acquisition reform was in fact achieved. DoD was able to exercise greater authority and flexibility at a lower level of authority to meet its stated needs with quicker turnaround times, while a new commercial vendor was able to obtain sales in an area that it may previously have been unable to meet due to rigid DoD rules and regulations.

Interviews suggest that government officials believe they are facing a transition point in milspec/milstd and broader acquisition reform. They believe that the initial phase of reducing military specifications is completed, reduced largely to a "document exercise" to quantify and validate changes. Officials we interviewed, however, believe that the next area of focus for DoD should be in recapturing the benefits from standardisation. Despite the potentially negative images raised by the term, they believe that unguided reform efforts will undermine they benefits of reduced military specifications and standards. In general, broad criteria for making sound standardisation decisions are available. They include:

- Business-based decision factors (lower costs through greater quantities).
- Operational factors (interoperability, compatibility).
- Safety considerations.

Note that none of these criteria necessarily suggests a requirement to write a new government military standard or specification. They all involve more flexible, business-based and performance-based considerations. According to the officials interviewed for the project, safety is particularly important and an emerging area of concern. It is an area worth monitoring in the future for its impact on reform and standardisation efforts.

An example of government officials refusing to eliminate MILSPECs entirely is in the Joint Technical Architecture (JTA—a mechanism governing DoD acquisition and development efforts in command, control, communications, computers and intelligence—C^4I.). In resisting the trend to replace MILSPECs with commercial specifications and standards, JTA has mandated a set of 400 MILSPECs to retain consistency and common configurations in information technologies (hardware and software) as well as to control costs even while emphasising preference for COTS solutions. Waivers of the MILSPECs require high level approvals.

Government officials are not convinced universally that the migration to commercial specifications has led necessarily to reduced costs as much as shifting costs. Reliance on commercial specifications has contributed to a trend of shifting research and design work to contractors, raising their costs. This could reduced R&D requirements on the part of DoD, but companies also will seek to recover these costs through higher procurement prices. Officials admit frankly that they remain unsure of what is best for DoD from a cost perspective, recognising the short-term benefits and long-term uncertainties in this situation.

To allow maximum flexibility to contractors, DoD procurement officials are attempting to avoid what they call "hard suppression"—that is, arbitrary and absolute designation of a commercial specification for a military specification. Instead, they prefer outlining performance objectives for contractors, who are left to their own resources to determine the best specification alternatives. These flexible replacements, however, raise liability issues for both the government and contractors—still another aspect of how both parties are feeling their ways through acquisition and MILSPEC reform. (The government officials we interviewed, however, indicated that liability has not yet emerged as an issue despite the potential concerns by industry and DoD.)

Officials note that MILSPECs *per se* have not necessarily been a problem for industry or government. In their view, the application of specifications and standards have been the source of DoD and industry problems by requiring excessive reporting requirements and applying specifications and standards at the wrong points in contracting cycles. Thus, they remain unconvinced in some cases that simply converting to commercial standards and specifications will lead immediately to improved procurement processes and practices.

Although somewhat outside the scope of this project, procurement officials have noted vast improvements in their operating authority with the implementation of commercial acquisition practices such as higher signature authority levels, credit card purchases and increased alternatives available to government purchasing offices. These steps, officials believe, have translated into immediate and significant savings and have expanded the number of firms willing to sell to DoD.

Government officials already have identified areas of concern for the long term in this more flexible contracting environment. There is a lack of contingency planning on the part of DoD, for example, for replacing supply sources when firms go out of business. This is particularly worrisome to logistics officials, who see more of their responsibilities being outsourced to the private sector (this remains an intense political issue in Washington). Stability of supplies is an emerging concern as well as developing criteria for determining "core" and "non-core" personnel and capabilities to guide outsourcing decisions.

Significantly, government officials repeated the theme of cultural change that emerged from the industry survey. They recognise the necessity to change their internal culture to adapt to this more competitive environment and service their respective customers. Supporters of acquisition and MILSPEC reform within DoD feel that a significant number of visible advocates for continued implementation of these programs. Further implementation is essential to change DoD's internal culture permanently, they feel. However, this will require generations to achieve, not simply the 2- to 4-year life span of a political appointee. They are concerned that when the present set of advocates within DoD leave the government, momentum could stall and further change could be difficult if not impossible. This is particularly worrisome since further changes increasingly could require congressional approval of legislative changes. An external event such as a procurement scandal also could easily reverse progress made to date, especially as reform advocates leave the government and initiatives move further away in time from the original Perry mandates for reduced reliance on MILSPECs.

Finally, officials involved in international programs interviewed for this project appeared optimistic that acquisition reform will make US defence contractors better potential partners for European firms in future cooperative programs, ranging from research and development to production and logistics support. These officials apparently believe that the move to commercial and particularly internationally recognised standards will make US firms more flexible and global. They also suggest that as a result, they expect firms to take increased initiative in identifying new opportunities with European partners. The same cannot be said of cooperative efforts with Japanese firms, however, due to a combination of trends. These include Japan's shrinking defence budgets and a reluctance by Japanese defence contractors to embrace the objectives and methods of acquisition reform. Significantly, we noted more concern among international program officials about the "bureaucratisation" of US acquisition reforms than from any other pocket of DoD. Some officials were concerned that acquisition reform offices and efforts increasingly are becoming formalised and more rigid, reducing their value and effectiveness to DoD and industry as a whole.

6.5 Assessment: Acquisition reform, SPI and defence industry standardisation

Previous sections in this chapter have examined:

- The context of acquisition reform in the United States.
- Industry responses and priorities to acquisition reform through Single Process Initiative (SPI) proposals for facilities and specific defence programs.
- Industry and government perspectives of these trends, compared with the statistical trends evident in SPI data.

This final chapter summarises these elements to address the broader implications of current trends on future activities. Before entering into that discussion, three fundamental premises governing the implementation of reforms should be reiterated:

- From DoD's perspective, the importance of acquisition reform rests in the potential to reduce weapons costs and improve efficiencies through the reduction of military specifications and standards, as well as through the introduction of commercial practices and standards.
- Achieving greater industry standardisation *per se* has *not* been an objective of acquisition reform. Elimination of rules, regulations, practices and standards that impeded industry's ability to apply common commercial practices across multiple programs *has* been a goal of acquisition reform. Milspecs and military standards were viewed as impediments to implementation of common practices – as opposed to introduction of common industry standards.
- Comprehensive implementation of acquisition reform will allow greater integration of the civil and military industrial bases in the United States, providing more options to DoD in

future research, development and production programs, in addition to anticipated cost savings and more rapid product development times. Acquisition reform sets the stage for more thorough integration of industrial capabilities in the United States.

It is important to keep these notions in mind since they have governed specific policies, programs and industry responses to date. They also help explain many of the implications for future trends. These implications fall into three categories:

- The full extent of acquisition reform in the United States.
- Benefits of acquisition reform for US industry.
- Implications of acquisition reform for civil-military integration (CMI).

6.5.1 Completeness of acquisition reform

Acquisition reform is changing the buyer-seller relationship in the US defence industry. Policy level reform efforts have been extensive. SPI data indicates that US industry has responded in many respects, although the full extent and impact of those changes remains to be seen. What is clear from the examination of these policy measures, specific actions taken by industry through SPI proposals and the responses gathered in the TASC industry survey is that relationships governing industry-DoD interactions are shifting. Industry is exposed to greater risk, although our interviews with government officials indicate recognition of this situation and a willingness to work with industry to reduce those risks through greater planning in the early stages of programs. From all indications, efforts are being made to change the way in which DoD and industry deal with one another.

However, the extent of that cultural transformation remains in doubt. At this stage, it appears that ***acquisition reform has directly impacted senior Defense Department leadership,(those most heavily affected by changes in political administrations) but as yet is not fully embraced by the working level officials who execute the buys (where career civil servants dominate the ranks)***. Nor has industry entirely adapted to the new environment: while company participation is extensive, the lack of industry participation in some areas of the Single Process Initiative indicates that not all firms have embraced the opportunity to transform their processes and practices in response to DoD guidance and initiatives. Higher technology, electronics-intensive sectors are most active in reform. Major company movements are characterised by the migration to internationally recognised standards such as ISO. On the other hand, industrial sectors founded in more traditional, slower evolving technologies are passive in their response to acquisition reform initiatives.

Acquisition reform tempo

SPI data can be analysed from the perspective of whether acquisition reform efforts appear to be accelerating or decelerating, based on the number and types of proposals submitted. Trend lines would have significant implications for the continuity of reform efforts by industry and government.

Figure 6-33 SPI Total Submission by Process. All US Sectors, 1996-1996

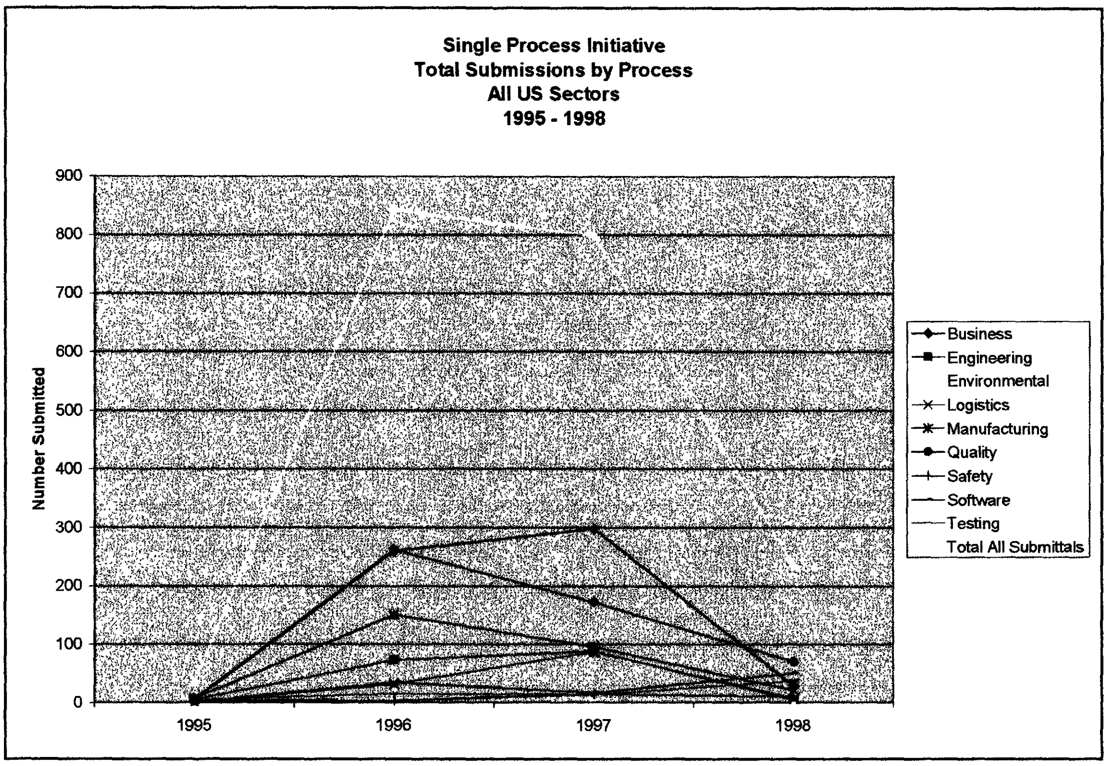


Figure 6-33 summarises the submission levels since 1995 for the ten process type categories. As illustrated, incremental gains were made in 1995 with interest peaking in 1996. Since 1996 proposal submissions have fallen off significantly. Several alternative explanations can be offered for this drop-off in activity:

- DoD's emphasis on Acquisition Reform in the 1994-1995 period drove almost all major DoD contractors to participate in the SPI program. Industry response focused on Quality Manufacturing and Business Process.
- DoD's blanket approval for the use of ISO series provided a catalyst for most major companies who were ISO certified to eliminate Military Quality requirements. A transition of manufacturing requirements was led by Soldering, with Business Processes focusing on formal reporting and tracking systems.
- Industry has concentrated on and achieved modification of less complicated processes that constrain operations. The perceived value transforming the remaining processes remains in doubt. Timing associated with further changes also is unclear. Industry survey responses coupled with interviews indicate that only marginal returns might be achieved with continued pursuit of SPIs. Furthermore, additional changes may require more time-consuming amendments of legislation that mandates certain government practices.

Although it is clear that SPI proposals have declined rapidly in number over the last year, the causes for the decline are not yet known. USD(A&T) has indicated that the SPI process will be made a permanent element of DoD management practices. However, the decline in proposals may make this move meaningless. If this decline in SPI proposals remains, then it would suggest that one element of acquisition reform either has been completed or the broader movement is coming to a halt. A government response to this trend is expected as it outlines 1999 efforts on improving commercial military-integration.

Obstacles to further reform

The most easily achieved efficiency gains have been targeted in the early rounds of the SPI program. Future success will pivot on DoD's ability to address industry requests for the execution of more difficult reforms. Unless DoD is able to remove both cultural and legislative barriers, SPI proposals could cease and only marginal gains for US industry may result. Interviews with government officials, coupled with industry surveys provided insights into the cultural issues associated with acquisition reform and their implications. The argument that cultural transformation is required to realise the full gains of acquisition reform is intuitively appealing: civil servants with long experience in certain approaches toward government contracting and interactions with industry have been conditioned by these experiences. They are reticent to change for any number of reasons, including perceived threats to their own employment situations and the inability to adapt to changing (and more competitive) environments.

There is evidence that acquisition reform is taking hold within government and industry, although years may be required to implement reforms fully. Domestic political factors such as budgetary changes, retirement of key political appointees and wholesale changes in presidential administrations are among the factors that could redirect present trends. Acquisition reform leadership and cultural acceptance by the DoD workforce are the most critical in the coming two to four years in influencing acquisition reform in the United States.

One factor that also must be addressed is the potential impact of a defence procurement scandal on acquisition reform. It will be difficult to analyse this scenario objectively, but the common perception is that numerous Federal regulations have resulted from concern over fraud and abuse in the contracting system. We assume that there is a virtual certainty that such a defence procurement scandal will take place in the future. The question arises of whether such an incident would lead to a reversal of more flexible contracting to the rigid contracting rules of the past. Government interviews support the potentially volatile impact procurement scandal will bring. To date, no major incidents have challenged the progress of acquisition reform.

6.5.2 Benefits to US industry

Potential benefits to US industry from acquisition reform in general and SPI in particular include improved profitability and access to new markets by conforming with commercial practices and standards. The industry survey suggests that company officials do not perceive any significant gains as yet in either area, although they do recognise the long-term potential for this. However, savings to industry and improved profitability could be a short-term phenomenon. Operational efficiency gains through process consolidation could derive short-term gains for US firms. However, DoD is likely to seek lower procurement prices in future programs in anticipation of these gains. These lower procurement prices will increase the competitiveness of US goods in the international arena. Furthermore, since these gains do not necessarily effect the fundamental design process, they may not have a profound impact on long term costs.

Industry has achieved gains in liability protection associated with tiering of specifications. Acquisition reform has removed the process by which any referenced requirement of a specification can be enforced and therefore weakened the prosecution argument of design deficiency. This should leave US DoD contractors with near term, marginal cost and profit improvements. However, these profits could also evaporate as future contracts are renegotiated. Thus, while industry as a whole may increase its productivity and efficiency through implementation of acquisition reform initiatives, permanent and positive impacts on profitability remain in doubt. Improvements should position companies to be more competitive for future procurement competitions, but DoD can be counted on to seek lower procurement prices as efficiency gains are made.

Potential for long-term, strategic improvements
A key barrier to civil-military integration involves the business rules that govern DoD contractors. In general, these rules have been blamed for the segregation of commercial and military business and accounting operations. These requirements were seen as contributing to increased overhead and administration costs for all contractors. In the past, DoD contractors were in essence "paid to maintain their inefficiencies." In some cases, such as in the area of cost-plus contracts, it could be argued that contractors actually had significant incentives to boost these overhead functions and costs. As seen in Figure 6-33, however, US industry has actively engaged in changing business operations from a world competitiveness stance. More permanent competitive and possibly profitability gains should be attainable if US industry is successful in changing governmental business restrictions and is able to shed the overhead cost associated with these requirements. There is potential that more cost competitive US defence products will emerge as a result.

Certain changes are unlikely to have any significant financial impact, although they may reduce the variety of requirements contractors face. One example is environmental compliance. The US government mandates numerous regulations designed to promote the overall welfare of the environment and the workplace. These requirements are represented in the area of safety and environmental process types found in Figure 6-33. Although consistent requests for proposals have been processed since 1995, US industries, as a whole, are not likely to enjoy improved profitability from modifications of these processes. Waiving of these requirements will not relieve corporations of other mandates prescribed for all US manufacturers. Instead, they will be responsive to mandates facing all commercial industries instead of DoD-specific requirements.

From a manufacturing and production viewpoint, the process type areas of Quality Manufacturing and engineering are germane. US industries were quick to adopt modifications associated with the traditional "how to" applications of military specifications. The specific process modifications, such as soldering, did enable consolidation of requirements and, in the short run, reduced oversight and tracking cost. Long-term improvements in manufacturing processes should sustain firms' flexibility in a more competitive environment.

Competitiveness emerged as an important factor in our interviews and surveys with industry. Individual firms and industry association representatives have emphasised that companies support acquisition reform in principle, but offer specific proposals with the intent of achieving a competitive advantage over domestic rivals. TASC did not examine the competitiveness of individual firms and facilities in this project, but we have attempted to identify those SPI proposals that potentially have the greatest impact from this perspective on industrial sectors. These proposals were identified above in section 6.3. The major implication of SPI data and industry surveys is that industry consolidation appears to be having a more profound effect on competitiveness than gains achieved through acquisition reform. Trends identified in analyses of SPI data cannot be discounted, however, since they are indicators of steps companies are implementing to deal with the new defence environment.

6.5.3 Implications for civil-military integration (CMI)

Firms active in SPI initiatives may be moving closer towards a more effective integration of commercial and defence production. SPI data provides insights into the industry sectors and leading contractors that are leveraging reforms to streamline their commercial and defence production and management processes.

There are distinctions between implementing commercial practices, such as electronic billing and payment, and practices that allow use of common equipment and personnel for both defence and commercial production. The SPI proposals associated with the use of government property (FAR 45) indicate that industry is actively soliciting government for major changes in how government supplied property is acquired, tracked and utilised within the production process. Reform initiatives focused on government property, allowing more flexibility on the use of government owned property can provide a key ingredient towards commercial military integration. In addition, these assets will provide US industry with an added capital advantage to support commercial operations. Other key drivers for measuring movement to commercial practices include restructuring of subcontract arrangements (FAR 52 and DFAR 252.244-7000).

All of these transformations are positive ones from the standpoint of achieving greater civil-military integration. As noted earlier, however, DoD views present programs and policies as simply laying the groundwork for future integration of commercial and military production. Additional efforts are required in DoD's view. Industry survey results also can be interpreted to suggest that industry recognises and shares this perspective.

6.5.4 Conclusions. Remaining problem areas

Calls for reforming the Defense Department's procurement system have been evident throughout the postwar period. Some changes have been implemented as a result of "blue ribbon panels" of the past, but the current reform drive is far more extensive than during any period in recent memory. Important drivers of this trend have been identified. Budgetary reductions have been consistent for several years and industry presumes that generous increases in research, development and procurement budgets cannot be expected for the foreseeable future. Direct guidance by the Department of Defense also had a powerful effect. New opportunities created through SPI and other acquisition reform initiatives are worth pursuing form industry's perspective under any circumstances, if the high initial participation rates are any indication.

Implementing acquisition reform, however, requires more than just these incentives. Budget reductions may provide financial incentive to *firms* to improve processes, but due to the nature of defence contracting, changes require the consent and cooperation of government offices at the senior as well as the working levels. To date this has not yet happened.

The extent to which process changes filter down to subcontractors will be an important indicator of the permanence and thoroughness of acquisition reform and the move toward civil-military integration through introduction of commercial practices. Assessments of the impact on subcontractors and lower-tier suppliers have not been completed by DoD to date. This impact is not well understood yet within the United States, perhaps because it is only now beginning to take place. The extent of industry integration and the impact of acquisition reform on these lower levels of the industrial base will affect future profitability, competitiveness and ease of procurement, but the precise impact is not yet well understood. This area presents important potential lessons for both domestic and international audiences.

The full competitive impact of these trends remains unclear as well. Specific firm interests have been indicated through SPI proposals, suggesting possible industry strategies and certainly indicating industries' perceptions of improvements that can be implemented easily by contractors themselves. More thorough analysis, however, remains to be performed. DoD has not completed an assessment of the competitive impact of acquisition reform changes, other than a follow-on to the Perry study that is scheduled for completion in early 1999. DoD's interest may in fact be limited, since the underlying assumption of acquisition reform initiatives is that a more competitive industry will emerge under any circumstances.

Acquisition reform trends could have beneficial results for international partnering opportunities. By bringing US firms more in line with internationally accepted standards, it stands to reason that opportunities for US firms abroad should increase. Furthermore, the combination of greater industrial compatibility with international standards and a Department of Defense that is intent on implementing best practices – including procurement regardless of origins – should also present opportunities for foreign firms in US defence markets. One question not addressed in this report is the extent to which participation by foreign-owned firms in SPI proposals enhances their positions in US markets. Answering this question could provide insights into future directions by DoD and the US defence market.

One implication emerging from this analysis is that DoD must sustain energy levels in its acquisition reform efforts to maintain the tempo of reform necessary to precipitate permanent cultural changes and lasting improvements in defence procurement processes. At the senior most levels of DoD, Integrated Product Teams comprised of both military and industry partners are working to reenergize and focus reform initiatives through new programs. OSD leadership is looking to reenergize reform through the pursuit of Civil-Military Integration, but strategies remain vague. Resources have been identified to support these emerging efforts, centring on new working groups (this approach worked well in kicking off initial acquisition reform efforts). The success of these efforts will determine if US defence reform has been accomplished.

7

ANALYSIS OF STANDARDISATION DYNAMICS AND POLICY OPTIONS

7 Analysis of standardisation dynamics and policy options

The above discussion of MILSPEC reform in the United States illustrates many of factors that are likely come into play as closer integration between civil and defence standardisation requirements proceeds in Europe. The US-oriented part of this project is essentially an evaluation of a significant reform process that has already taken place. This process is only beginning to unfold in Europe, and then mostly at national rather than EU levels. The survey of European defence interests identified many of the opportunities and challenges that will be involved in actions to emulate the US reform process at a European regional level. The US reforms have occurred wholly in a national environment: the added complexity of co-ordinating similar reforms on a regional basis adds many new dimensions.

This Chapter develops an assessment of the standardisation dynamics that will come into play as civil and military standardisation agendas in Europe converge, and links them to the kinds of policy options that may be available to the Commission to promote and facilitate linking civil and defence standardisation regimes.

7.1 Key defence technology areas and standardisation initiatives

The quantity of standards world-wide that could be relevant in the context of this study is enormous (easily in the tens of thousands), and it would be impossible to outline all of them in one report. On the other hand, it would be impossible also to describe the standardisation dynamics without reference to specific examples. Our approach to this problem was to construct a **Value-Added Inventory** that would isolate a selection of pivotal standardisation initiatives that could indicate general characteristics and trends in a variety of technological fields.

Our approach to compiling this inventory began with a **Checklist of Key Defence Technology Areas**. Each of these key areas encompasses defence technology requirements that have similar characteristics. Although some of the **Key Defence Technology Areas** we have listed below conform broadly to definitions of industry sectors as defined in the Standard Industrial Classification (SIC), the **Checklist** is arranged according to product and process categories as they relate to defence procurement regimes, rather than according to industry sectors as such.

The main purpose of the **Checklist** was to provide a framework for organising and classifying the broad array of military and civilian standards from many sources that are or could be referenced in the procurement regimes of the EU Member States. Accordingly, our selection of **Key Defence Technology Areas** synthesises the primary standardisation subject categories that are found in indexes of defence agency standards (we referred chiefly to the NATO STANAG Index, and the UK Ministry of Defence Index) and in the civil standards classification systems used by CEN and ISO.

The **Checklist** is organised according to five general categories which together encompass virtually every military technology requirement for which there is a significant degree of correspondence with civil requirements.

Table 7-1 General Organisational Categories for the Checklist

General Categories	**Category Descriptions**
A *Process Management*	Processes involved in the design specification, production, procurement and life-cycle support of defence technologies.
B *General Engineering*	Technologies related to the design and provision of military facilities, sub-systems and components.
C *Systems Platforms and Transport*	Technologies related to air-sea-land vehicles and craft, both in transport and/or weapons and supporting systems platform roles.
D *Materials and Commodities*	Technologies related to basic military stores.
E *Information and Communication Technology*	Technologies related to command, communication and control (C3) systems, and general information systems.

Each of these general categories can be disaggregated in order to describe the defence technology procurement environment in more detail. At the first level of disaggregation is the **Checklist of Key Defence Technology Areas** itself. Each **Key Area** defines a specific group of technological activities to which both military and civil standards either apply already, or are particularly likely to apply at some point.

In preparing the **Value-Added Inventory**, the **Checklist of Key Defence Technology Areas** was used

- to organise and focus our examination of standardisation activities in specific technological fields;
- to identify and classify general and sector-based institutional mechanisms for setting standards;
- to provide a framework for cross-referencing technologies and standards that may apply in more than one context.

Table 7-2 presents our selection of sixteen **Key Defence Technology Areas**, arranged according to the general categories to which they have the most direct affiliation.

Table 7-2 Key Defence Technology Areas

General Categories	Key Defence Technology Areas
A. Process Management	1. Quality control 2. Logistics and support
B. General Engineering	3. Construction and Civil Engineering 4. Electrical Engineering 5. Mechanical Engineering
C. Systems Platforms and Transport	6. Aerospace 7. Ships and marine craft 8. Land vehicles
D. Materials and commodities	9. Petro-chemical products 10. Textiles 11. Safety products
E. Information and Communication Technology (ICT)	12. Telecommunication systems 13. Computer systems 14. Software 15. Electronic components 16. ICT application areas

At the next level of disaggregation, we are concerned with individual **standardisation initiatives** for specific applications of technology. ***We define a* 'standardisation initiative' *as an organised undertaking to achieve and maintain industry and/or agency-wide consensus standardisation agreements in specific technological areas.***

This definition encompasses standards agreements made in trade and professional organisations, and industry consortia, as well as in officially recognised SDOs and defence agency standardisation authorities. We exclude from consideration only those *de facto* standards that are proprietary to single firms. However, proprietary standards are often significant factors in the instigation and/or conduct of industry-wide standardisation initiatives, and they have been highlighted individually, where appropriate, in the information profiles we have compiled of individual standardisation initiatives.

The selection of initiatives in Table 7-3 constitutes our **Value-Added Inventory**. As stated above, the inventory was not intended to be comprehensive, but rather to be indicative of the primary standardisation dynamics that apply in each **Key Defence Technology Area**.

Table 7-3 Selected Standardisation Initiatives in the Key Defence Technology Areas

General Categories	Key Defence Technology Areas	Initiatives
A. Process Management	1. Quality	• Quality Assurance
	2. Logistics and support	• CALS and Integrated Logistics Support
B. General Engineering	3. Construction and Civil Engineering	• Structural elements
	4. Electrical Engineering	• Electro-magnetic compatibility
	5. Mechanical Engineering	• Fasteners
C. Systems Platforms and Transport	6. Aerospace	• Metal alloys • Space vehicle engineering
	7. Ships and marine craft	• Structural elements
	8. Land vehicles	• Transmission, suspension and braking systems
D. Materials and Commodities	9. Petro-chemical products	• Lubricants and fluids • Aerospace fuels
	10. Textiles	• Protective materials
	11. Safety products	• Fire safety equipment
E. Information & Communication Technology (ICT)	12. Telecommunication systems	• Fixed digital network systems • Wireless (including satellite) communication systems
	13. Computer systems	• Interconnection and interoperability • Data security
	14. Software	• Software engineering and systems documentation • Programming languages
	15. Electronic components	• Component testing • Optoelectronics
	16. ICT application areas	• Avionics systems (AS) • Computer-Aided Design (CAD) • Electronic navigation systems (ENS) • Geographical Information Systems (GIS) • Multimedia and virtual reality (MM)

The selection of initiatives for the inventory was made according to five basic criteria:

Criterion 1: The selection was restricted to initiatives geared to the production of specifications that are available to any user on a non-discriminatory basis. Thus, scope is allowed to include PAS as well as formal SDO standards.

Criterion 2: The selection focuses on technologies that are highly likely to be referenced in the defence procurement regimes of all EU Member States, and that could be shared or traded in defence-related contexts between EU member and non-member states.

Criterion 3: In order to facilitate comparison between military and civil standardisation regimes at national, regional and international levels, the chosen initiatives are oriented to areas in which civil/military technology transfer is or is likely to become particularly significant economically.

Criterion 4: For each selected initiative there is evidence of significant or potentially significant mutual reference in the standards catalogues and indexes of defence and civilian agencies.

Criterion 5: The selection includes only the ***minimum*** number of initiatives necessary to present a picture of the most active features, dynamics and organisational structures of standardisation activity in each **Key Defence Technology Area**.

In most cases, most of the important overall dynamics of standardisation in a given **Key Defence Technology Area** could be illustrated by examining one major initiative, or at most two. This was largely because the initiatives we selected were situated at or near the end of standardisation chains; i.e. the initiatives were connected directly with materials, components, systems and products that were marketed directly to customers, usually in a value-added form.

Each chosen initiative was either definitive in its own field (as with Quality Assurance and CALS), or otherwise at or near the top of 'pyramids' of contributory standards as developed in supporting or related technical fields. Thus, standards for fastening and coupling technologies embody also standards for dimensions and tolerances, screw threads, advanced metallurgical technologies, machining processes, and so forth. Likewise, standards regarding electro-magnetic compatibility cut across most areas of electrical engineering (power, distribution and electronics) as well as intersecting various national and international regulatory regimes. Many of the most important linkages of these kinds are noted below in the initiative profiles.

7.1.1 ICT as a special case

Relative to the other categories, Information and Communication Technology (ICT) has been disaggregated to a somewhat disproportionate degree, especially with respect to ICT application areas, and the ICT initiative profiles are much more extensive and detailed. This reflects the generally high significance of ICT in most of the other **Key Defence Technology Areas**, and the extraordinarily high general proportion of defence technology costs that now are related directly to the deployment of ICT. In the ICT area, we have selected partly initiatives that are generic to this category (as with Key Areas 12 to 15), and partly initiatives that relate to specific applications of ICT (Key Area 16).

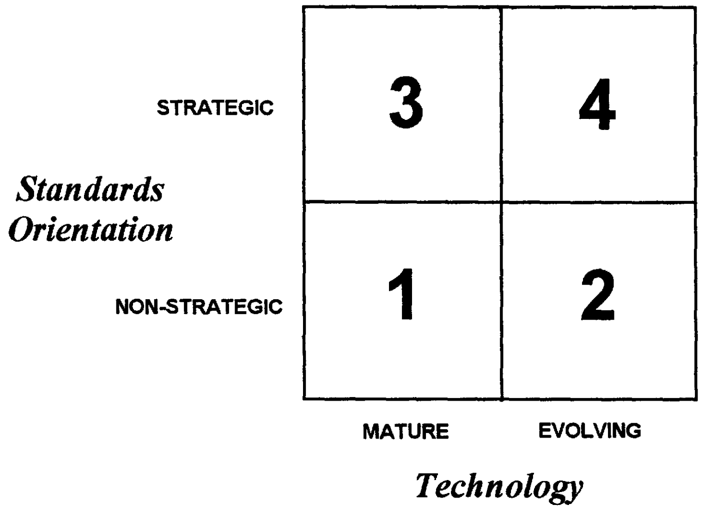
7.2 Standardisation dynamics and policy options in the Key Defence Technology Areas

For each standardisation initiative identified above, a detailed ***profile*** was constructed according to a pre-determined set of information categories. As relevant or appropriate to the initiative, each profile is based on information in the following general categories:

- institutional affiliations and links (SDO, consortia, firms, governmental and intergovernmental agencies etc.);
- core technologies and technological linkages;
- lead actors and supporters;
- rationales for pursuing the initiative;
- current state of development and implementation (including national, regional and international orientations);
- references (where applicable) in policy/regulatory/legal frameworks.

The initiatives selected to illustrate each **Key Defence Technology Area** were then were then evaluated using the **Analytical Matrix for Standardisation Strategies,** a tool that has been developed directly from extensive SPRU studies of participant rationales, outcome expectations and institutional dynamics in standardisation processes. The Matrix is illustrated in Figure 7-1.

Figure 7-1 Analytical Matrix for Standardisation Strategies



The **Matrix** axes are defined so as to show basic relationships between the state of technological development in a given area, and the principal orientations of standardisation activities in that area.

- The ***technology axis*** refers to the state of development of the technologies for which standards are required. Some technologies are 'mature' with already extensive applications in relatively stable product environments. Others are 'evolving' in that they are still subject to R&D, and the product environments are still being defined.
- The ***standards orientation axis*** refers to the primary motivations driving the standardisation activity. Some standards initiatives are strategic in that they can provide greater competitive advantages to some stakeholders than to others, whereas others are non-strategic and do not confer competitive advantages on a selective basis.

The relationships described by each quadrant in the Matrix establish four basic sets of standardisation criteria:

- ***Quadrant One*** criteria describe standardisation initiatives that apply mostly to mature, highly generic technologies. Technical change occurs in this quadrant, but it occurs either in slow increments or in co-ordinated industry-wide shifts from one generation of technology to another. Standards in this quadrant have very limited potential to advance the competitive interests of one group of stakeholders over another. The standards apply mainly to such subjects as basic dimensions, tolerances, and common physical ('plug') interfaces.
- ***Quadrant Two*** criteria describe initiatives related to technology that is still under active development, and for which the product environment is still immature, but with limited or no potential to advance the strategic business interests of individual

stakeholders. An example would be standards relating to the deployment of advanced materials, or the handling of petro-chemical products.

- ***Quadrant Three*** criteria describe situations in which already widely deployed and relatively mature technologies become subject to strategically oriented standardisation initiatives concerning their design, configuration and use. Examples include the many emerging standards relating to industrial processes and 'best practice'.
- ***Quadrant Four*** criteria describe initiatives that are primarily oriented to market creation strategies, with the objective of establishing environments for the further development of new technologies and the products and services they support. Examples are common in leading edge information and communication technologies.

This assessment scheme is very important in terms of the purposes of this study in that the quadrant criteria are related directly to

- the selection by industry actors of standardisation strategies, institutions and processes;
- the range and types of policy options available to the Commission in facilitating the use of civil standards in defence contexts.

7.3 Inventory Profiles

7.3.1 Process Management

Profile 1 – Quality

Key initiative - Quality assurance

General description

The term 'quality assurance' (QA) refers to the processes and mechanisms by which users and producers seek to guarantee that goods and services are fit for their intended use and that they satisfy stated or implied requirements. QA has long been a concern of defence manufacturers and military users. Particularly because of the safety-critical nature of many defence systems and products, and the extreme conditions in which they are used, the defence customer has had to take a direct and close interest in monitoring the quality of the supplies it receives. Consequently, the military has played a seminal role in the development of formal processes and rules to assess and control quality.

Rationale for standardisation

The rationale behind QA standardisation is the result of a complex set of factors in both civil and military arenas. Initially, QA in the defence field was based on strict inspection procedures established by the military user upon receiving products from the supplier. As major weapons systems became more complex and costly to develop and manufacture, direct product inspection by the purchaser/user ceased to be appropriate. On their own, purchaser controls could not assure product quality. Moreover, if defects were found during inspection, the costs of fixing the problems, and programme delays became increasingly unacceptable.

In response to these problems, defence QA moved towards standardised *process-oriented* controls. *Process oriented quality assurance* establishes systematic actions that are deemed necessary to provide adequate confidence that a product or service will satisfy given requirements for quality. The focus is on sets of pre-determined rules and procedures aimed at identifying and solving potential quality problems early in the production process and, in any case, *before* product delivery. Because of the process focus QA is linked to other management disciplines, approaches and procedures, like Configuration Management, Integrated Logistics Support, etc.

The development of QA standards in the civilian arena was closely allied to initiatives in the defence arena. The US DoD developed a series of specific quality standards (MIL-Q series) that were made mandatory in a wide range of defence contracts. MIL-Qs were influential in the development of QA practices among the defence producers of the US and its allies. However, several EU governments developed their own systems for Government Quality Assurance (GQA). The fragmentation along national lines of QA practices and certification procedures generated problems when defence materiel was purchased from other nations or developed through multinational projects. In response, NATO set up the Group of National Directors for Quality Assurance (AC/250) responsible for developing quality assurance documents known as Allied Quality Publications (AQAPs). AQAP implementation is supported by two STANAGS (4107 and 4108) directly governing NATO quality assurance. These STANAGs have been ratified by the NATO members.

In the civil arena, ISO has been at the centre of a vigorous QA standardisation drive, based around its ISO 9000 series of quality standards. ISO 9000 is a series of documented management practices and procedures to control quality. The first ISO 9000 standards were published in 1987, being broadly based on BS5750, the BSI quality assurance and management standard. Much of the demand for BS5750 was generated by defence supply and procurement requirements, spurred by QA developments that were occurring in the US and NATO. Today ISO 9000 represents an international consensus on the general features of a quality system: more than 80 countries have adopted the ISO 9000 series as national standards. This acceptance has made ISO the central actor in the development of quality standards.

Institutional and procedural dynamics

Although similar in concept, the application of the ISO 9000 series differs in practice from established military QA regimes. US MIL-Q practice focused on product control through product testing and inspection. The implementation of ISO standards focused from the very beginning on process control.[49]

The ISO 9000 series of standards are not specific to any sector, but are rather designed to provide general quality assurance processes. Consequently; it is common for industrial sectors to develop their own interpretations of ISO quality standards and certification procedures. These processes can at times be complex are often conducted on a national basis by national bodies. For instance in the British aerospace sector, SBAC has developed a specific Technical Specification (TS 157), as an ISO 9000 compliant certificate for aerospace-related firms. Under the accompanying Aerospace Sector Certification Scheme, TS 157 certification has to be done by an accredited Certification Body, and at least one member of the auditing team must have aerospace experience authenticated by an independent Board convened by SBAC. Similarly in France, quality certification for the aerospace and defence sectors is carried out through the QUALIFAS system, managed by the industrial association GIFAS. The

49 A more detailed description of the role of US defence agencies in the definition of quality standards and its present reform can be found in chapter 5.

documents used by QUALIFAS are the French standards RG Aéro 000 83 and RG Aéro 000 84, which in turn refer ISO 9001 and 9002 in their entirety, plus a number of additional requirements extracted from RG Aéro 000 40.

As pointed out above in Chapter 5, quality management is the area where the most active migration to commercial practices is taking place. As ISO 9000 become accepted, the US procurement reform process targeted specific military quality standards for cancellation. Firms had to keep different quality management procedures for military and civilian production thus increasing the costs of military production, while the responsible defence agencies had to support the high costs of certifying producers to military quality standards.

Hundreds of US defence contractors have now shifted to the ISO regime. The trend to certify military contractors to ISO 9000 has also extended to Europe, particularly in the UK, Netherlands and Scandinavia. In NATO, AC/250 has decided to adopt ISO documents as the base for use in defence procurement. AQAPs now include the full requirements of the respective ISO standard plus additional NATO supplements. Table 7-4 summarises the relationship between NATO AQAPS and ISO quality standards.

Table 7-4 NATO AQAPs and ISO quality standards

NATO AQAP	ISO standard referenced
AQAP-110 "NATO Quality Assurance Requirements for Design, Development and Production"	Includes ISO 9001 requirements
AQAP-120 "NATO Quality Assurance Requirements for Production"	Includes ISO 9002 requirements
AQAP-130 "NATO Quality Assurance Requirements for Inspection and Test"	Includes ISO 9003 requirements
AQAP-131 "NATO Quality Assurance Requirements for Final Inspection"	No ISO equivalent
AQAP-150 "NATO Quality Assurance Requirements for Software Development"	No ISO equivalent

Source: NATO AQAP-100 'General Guidance on Military Assurance'

The basic debate about all QA standards, but especially concerns what are perceived to be the rising costs of compliance. Certification can be an expensive undertaking, especially for smaller firms who supply components and systems to more than one supplier. In many cases, compliance with ISO 9000 must be supplemented by compliance with additional firm or sector specific QA requirements. Moreover, even though ISO 9000 compliance is voluntary, the requirement to comply can be specified in procurement contracts making certification virtually mandatory in some sectors. As a result, certification to ISO 9000 is fast becoming a major consultancy industry in its own right.

Profile 2 - Logistics and support

Key initiative - CALS and Integrated Logistics Support

General description
Integrated Logistics Support (ILS) is a disciplined management approach to optimise equipment life-cycle cost. Within the life-cycle of large complex defence or civilian system (i.e. from its development and design to its disposal), the costs incurred after procurement and delivery can vastly exceed the initial procurement costs. ILS was conceived to manage support costs and introduce support and maintenance considerations at the design and selection stages. An ILS system will have among its objectives

- to ensure that equipment is designed with a view to support and maintenance;
- to ensure that the necessary support infrastructure is put in place once the system is deployed;
- to minimise life-cycle costs.

To achieve these ends ILS will:

- define a consistent 'support environment' for deployed systems;
- define tools to monitor its application;
- determine support requirements during the design and development of a system;
- define tools to introduce support considerations in product design;
- assess support costs during its deployment.

ILS is related to a variety of equipment and process management applications. Logistics Support Analysis (LSA) is the technique used to define the support requirements of future equipment, identify likely costs and their origin, assess reliability and maintainability parameters during the design phase, identify and define the support and maintenance strategy, and so forth. LSA data is stored in a digital database referred to as a Logistics Support Analysis Record (LSAR).

An ILS system requires also the transmission of digital data among project partners, both for technical and transaction data and documents. An ILS programme must therefore be supported by a suite of ICT applications and standards, including data definitions and formats, digital document exchange formats, digital document styles and specifications, graphics and technical documents formats and database systems.

Another ILS element is 'Support and Test Equipment' (including maintenance, test and calibration equipment). The LSAR will usually detail all the required Support and Test Equipment, which should be identified in accordance with the ILS plan. Reliability and Maintainability (R&M) requirements form another ILS element.

ILS is considered to be a fundamental element in Continuous Acquisition and Life-Cycle Support (CALS). CALS originated as a US Department of Defense (DoD) programme to improve the efficiency of weapons systems procurement. It now has developed into a general philosophy for large-scale industrial project management, being applied principally in the defence industries but also in some civil projects. CALS aims to use information technology to share and exchange information with users and along the supply chain throughout the life-cycle of a product. Its proponents envisage a situation in which electronic data transfer technologies can be used as tools to integrate the activities of different firms working on the same project, and to combine electronic procurement systems with computer aided design, manufacturing and logistics systems.

Rationale for standardisation

Increasingly, ILS is being applied in industries involved in the production and operation of large complex systems, both military and civilian. The existence of different approaches and standards can generate extra-costs and reduce the efficiency with which the new business practices are being introduced; as firms may be obliged to apply slightly different processes, define data in different ways and use different software packages for different projects. Both industry suppliers and public and private customers have an interest in harmonisation. There is interest in the standardisation of data definitions and main formats for LSAR, but there is less agreement on the extent to which the ILS processes themselves should be standardised.

The main thrust for standards development in this area originates from the defence field. The high cost, long life-cycle of many defence systems has spurred defence customers to establish systems to control life-cycle costs and plan maintenance processes. Most of the thrust for international standardisation has come from the defence customer side, particularly from the defence agencies in the UK and the USA who have developed detailed standards laying out ILS processes for national application. These processes affect the ways in which industry as a whole develops its systems. For some suppliers, however, ILS is but another requirement they must meet as a 'term of contract'. Compliance often involves costs to suppliers that cannot be spread beyond the defence context. Industry has been more interested in developing standards outside of the defence context for the generation and exchange of data. These include standards for Logistics Support Data for spares management and provisioning tasks.

Institutional and procedural dynamics

The US DoD and the UK MoD have been the most active organisations in the definition of ILS standards. NATO has also attempted to play a role concerning the international harmonisation of different ILS strategies, under the umbrella of its CALS activities (ILS being one of the main CALS components). The NATO CALS Management Board (NCMB) and the NATO CALS Office (NCMB's full-time staff) were established in 1993 by the Conference, National Armaments Directors (CNAD) to guide and structure all CALS-related initiatives within NATO countries. A NATO Industry CALS Group (NICG) was set up to represent industrial interests and priorities for CALS development, and provide a single industrial interface to the NCMB.

NATO has established a CALS Policy, and NATO bodies are responsible for its implementation, including the NATO Senior Logisticians Conference, NATO Agencies and the NATO Infrastructure community. The NATO CALS Policy, while recognising the role to be played by NATO standards and other bodies in ensuring harmonisation, stopped short of establishing clear lines of responsibility among them. The policy established that NATO would act as a CALS standards 'enforcer' within the Alliance, a CALS standard 'promoter' to the individual nations and a co-ordinator of international standardisation and R&D efforts (NATO, 1994). NATO has also issued an 'orientation document' to define ILS systems in the framework of multinational projects (AC/305 (SLM) - D23). It appears however that most of these tasks fall within the NATO CALS organisation rather than its standardisation bodies.

CALS initiatives have also been addressed by civilian standardisation organisations. In 1996 ISO established a high level group to identify and address issues related to CALS and standardisation. The group reported back in May 1997 and its recommendations are now being acted on by ISO and other international bodies. In principle, NATO can contribute to ISO committees dealing with CALS issues, but most of the input, when it is made at all, comes mostly via the defence industry - particularly from actors in the aerospace sector. Private industry has also played a role in the development of ILS-related standards. In particular, AECMA has developed widely used standards among aerospace producers and users, particularly for spares management and provisioning tasks.

The UK Ministry of Defence developed Def Stan 00-60 defining ILS application from the level of principles and procedures to the definition of data definitions and formats for LSA and LSAR. The standard defines itself as "...a profile of existing, internationally recognised standards which are brought together for consistent use [profiling] standards and specifications for LSA, LSAR, ISSP and Technical Documentation creation and delivery."

Def Stan 00-60 is based on a group of pre-existing standards, which it defines as 'baseline' standards, and it also refers many other standards, among which we find:

- Def Stan 00-40 and 00-41 for the specification of R&M requirements;
- Def Stan 00-25 defining human factors requirements in the design of equipment (extending from ergonomics to the requirement to ensure the safe operation of equipment);
- Def Stan 05-91 and 05-95 defining quality systems requirements;
- SGML standards for documents as defined in ISO 8879.

The 'baseline' standards that provide the structure for many of the processes and data formats defined in 00-60 are:

- the US MIL-STD-1388 defining mainly LSA and LSAR requirements;[50]
- the support processes and data requirement defined by AECMA S2000M and applied to military aircraft;
- the specifications for technical publications using a Common Source Database defined by AECMA S1000D and used in the commercial aircraft sector.

The AECMA standards concern themselves mainly with spares management, and integrated data processing to assist the support requirement of aircraft. AECMA 2000M, addresses provisioning tasks, particularly the logistic material management of military aircraft, and defines *inter alia*:

- the procedures for initial provisioning of spares;
- the way data is presented and the formats for illustrated parts catalogues;
- the NATO codification to be used (as defined in STANAGs 3150 and 4177);
- bar-coding specifications (based on STANAG 4329);
- methods for placing orders;
- the format of electronic orders (based on ISO 9735 -EDIFACT; EN29735 and DIN 16536);

50 DEF-STAN 00-60 introduces differences in the specific LSA techniques and the data elements it mandates.

- an Electronic Data Interchange (EDI) agreement for data exchange (EDIFACT compliant).

Inasmuch as Def Stan 00-60 takes AECMA 2000M as its baseline standard, it is also supported by this same suite of underlying standards. For instance, both standards rely on NATO Stock Numbers as one of their basic elements.

AECMA 2000M was not the only pre-existing standard concerned with Logistic Material Management. In the civil aircraft industry ATA 200 established a data processing system to facilitate transactions between manufacturers and commercial aircraft operators; ATA 2000 defines procedures, data dictionaries and definitions to be used in areas related to logistics support like provisioning and procurement planning.

In the US, the main ILS standard was MIL-STD-1388 which was the main point of reference for the development of Def Stan 00-60; yet MIL-STD-1388 has recently been cancelled. MIL-STD-1388 was divided into two main parts:

1. MIL-STD-1388 1A provides the *functional* standards specifying how to conduct the LSA process and the criteria for tailoring LSA to different types of equipment. This was cancelled in May 1997 and substituted by MIL-HDBK 502, which is only a guidance document and does not impose specific processes on the supplier.

2. MIL-STD-1388 2A/B are the *data* standards specifying data definitions and output tables; 2A is for flat-file databases and 2B is designed for relational databases. This standard was cancelled in November 1996 and substituted by MIL-PRF 49506; MIL-PRF-49506 is a performance specification rather than specifying concrete output tables and data definitions.

The cancellation of MIL-STD-1388 is in line with the process of MILSPEC reform underway in the United States and analysed somewhere else in this report. Like Def Stan 00-60, MIL-STD 1388 defined in considerable precision the processes that suppliers had to engage in. The move in the US is to require performance levels in the delivery of data packages and the definition of processes, without imposing specific ways of managing, in this case, logistics support.

As a process, ILS rests on a variety of IT applications and associated processes like quality control, testing and reliability and maintainability. It is not surprising therefore that no widely accepted ILS standard has emerged. Even in the areas where standardisation efforts have been more vigorous and industry has played an active role, application has been piecemeal, and it still depends on specific projects. The Eurofighter project for instance uses and interpretation of AECMA S2000M for spares provisioning operations of Eurofighter and has based its LSA components on MIL-STD1388-2A. In both cases the management of Eurofighter has to interpret and define the specific implementations of these standards.[51]

Proprietary data formats are still in use. Although it plans to use MIL-STD 1388 and AECMA S2000M, the French firm Dassault has used proprietary data formats both for the procurement

51 The parts codes used by British Aerospace deviate, for example, from the ones defined in AECMA S2000M.

logistics, technical documentation and spares provisioning of its Rafale fighter (AECMA, 1993).

A further problem is the lack of harmonisation in data dictionaries and product codes, a problem that is apparent in collaborative projects, which account for most of today's defence development and production projects. The NATO CALS Management Board backed the development of a standard to support data exchange through the harmonisation of the data dictionaries used in ILS.

7.3.2 General Engineering

Profile 3 - Construction and Civil Engineering

Key initiative - Structural Elements

General description
The various technology areas that are of concern to civil engineers for standardisation purposes are construction materials (concrete, steel, wood etc.), internal systems (lifts, conveyors, escalators etc.), fittings and furnishings, fire safety, acoustical properties, and basic design criteria for structures employing specific materials (i.e. wood, concrete etc.). Increasingly, provisions for the use of buildings and structures by the disabled are coming also under the purview of standards developers, as are environmental concerns like energy efficiency. There are also linkages to information technology subject areas, particularly software engineering, CAD systems and product identification systems.

Standardisation for structural elements encompasses general terminology, design, manufacture and construction processes, geometric requirements for building elements and components, co-ordination of modular construction techniques, joints, tolerances and fits, and general performance rules for structures and structural elements.

Rationale for standardisation
Civil engineering is characterised by a notably slower rate of technical change than most of the other general engineering areas. Technical change tends to occur incrementally, but major generational shifts occur as well, usually around significant evolution in building materials and techniques.

Structural elements are a core area for civil engineering standardisation at national and international levels. Standards specify mainly tolerances, dimensions and performance characteristics of structural components as fabricated from various materials - from wood, concrete, iron and steel to advanced materials in some cases.

The basic rationale for setting structural element standards is to co-ordinate the production and application of these elements and to reduce costs at both the design specification and construction levels. A further rationale is to provide the technical content for various kinds of building and construction codes that are imposed on the civil engineering sector by various regimes - both legislative and professional - that enforce technical and procedural regulations. Civil engineering projects are highly standards dependent and the bodies of standards drawn upon vary with the type of structure or process concerned. A large part of the engineering process is to identify and specify the standards that will be used, or that *must* be used in that case of standards referenced in regulations.

Institutional and procedural dynamics

Standardisation in civil engineering is led primarily by the construction industry in conjunction with consultant architectural and civil engineering firms. Depending upon the characteristics of specific structural elements, there can also be varying levels of participation by national regulatory bodies, and by auxiliary interests like insurance underwriters. There is considerable input from the civil engineering profession and from national research establishments and engineering academics. In selected areas, individual firms can virtually define *de facto* national (and to some extent international) standards by virtue of recognised superior levels of competency in the design and/or testing of selected components.

Although military building and construction requirements are often very extensive, most structural elements that go into ordinary defence structures would generally conform to the civil standards that apply in the country where these structures are located. Standards that are specific to military applications tend to concentrate on requirements like the 'hardening' of structures to withstand attack, or on special assembly and portability requirements.

Most standardisation for structural civil engineering elements occurs at national levels. This is in most cases appropriate as there can be much variance in national geographical conditions, styles of construction, availability of materials etc. ISO promulgates standards in this field but much of the time ISO simply endorses standards that have been set by established industry bodies and applied extensively internationally. The US-based ASTM is a particularly important source of standards in this area and many of its outputs are virtually world standards irrespective of whether they have been endorsed by ISO or any national or regional SDO.

Historically, military engineers have made considerable contributions to the technical development of the civil engineering sector in many countries, and participation in national standards development is generally open to defence agencies. At present, there is little discernible military presence in ISO, but no reason that there could not be as ISO initiatives can be suggested by any stakeholder.

At the international level, many ISO standards are *horizontal* in that they set out basic requirements - e.g. safety requirements for type of structure, numbers of exits per size of room, types of materials, combustibility, rigidity etc. These are supplemented by standards that set out performance requirements for specific applications of structural elements, along with specific procedures for achieving these requirements. Fewer standards in the latter category emanate from international bodies than from national ones.

A standard does not have to be applicable in all countries in order to be an international standard. Standards for specific conditions tend to be driven by interests most affected by those conditions. Many of these interests are national, but many international standards are driven by needs that are perceived more in some countries than others. Examples are standards for earthquake-proofing (the Japanese lead this work for obvious reasons) and for snow load-bearing (of little concern to countries where there is no snow). Some international standards are redundant in some countries in that the construction codes of these countries have moved beyond the minima set out in the international standard. A basic standard for concrete housing is useful to developing countries, for example, but no longer required in Europe.

Civil engineering standards are referenced in some fashion or other in the building codes of all EU Member States, and several new approach Directives have direct and tangential implications for building and construction materials.

Profile 4 - Electrical Engineering

Key initiative - Electro-magnetic compatibility (EMC)

General description

The core technology areas of importance for electro-magnetic compatibility are electrical, electronic and radio components. All electrical and electronic components either produce electro-magnetic radiation that has the potential to interfere with the operation of other electronic components, or they are susceptible to interference from electro-magnetic radiation. All technologies that emit radio waves pose a similar risk. Any industrial product that employs electrical, electronic and radio technologies in either primary or secondary roles can be affected by EMC problems.

Some of the main affected technological areas are power transmission and distribution, motors, microwave and optical systems, telecommunication (both fixed and mobile systems), computer components, broadcasting systems, consumer electronics, scientific instrumentation, transport systems, navigation, and medical electronics. Aerospace is an area that is particularly problematic. Electro-magnetic interference with aircraft equipment can produce catastrophic consequences. Also, new requirements for civil aircraft to be compliant to the 'severe radio frequency environment' will have important implications on the aviation industry in terms of design requirements, test procedures, maintenance and modifications.

Rationale for standardisation

The basic rationale for standardisation is to ensure that electro-magnetic emissions from different sources do not interfere with each other. A fundamental characteristic of these emissions is that they do not discriminate in terms of which types of equipment they may affect. Thus, there is a high incentive to standardise at as high and general a level as possible.

On the electrical components side, this involves standardising various methods for limiting or managing the generation of harmonics that might cause interference, and for shielding electronic components from this interference. On the radio equipment side, this involves setting (mainly type approval) standards that set the allowed parameters for the use of radio frequency allocations - power levels, shielding, wave guides etc. In practice, as radio systems utilise electronic components, EMC problems typically involve both kinds of standards.

Institutional and procedural dynamics

Standards initiatives concerning electro-magnetic compatibility standards are led mainly by the electronics and communication industries, supported by national agencies that set technical regulations. Many electro-magnetic compatibility issues are covered in national and international technical regulations which typically specify standards as developed by recognised national and international SDOs for electrical and radio engineering.

In the defence field, the standards referenced in EMC regulations vary from country to country. For instance, the main British defence standard document dealing with EMC issues is

DEF STAN 59-41, which also sets up electrical equipment protection parameters (for example, resistance to lightning). This standard is equivalent but not identical to the applicable STANAGs. In the US, MIL STD 461 and 462 are again slightly different.

As military operations are now highly dependent upon electronic C3I systems, solving electro-magnetic compatibility problems has a high profile in the defence context. It is often difficult, however, to determine the extent to which standards in this area reflect specifically either civil or military requirements. There are differences between military specifications and civilian ones. As a consequence dual-use commercial products that could, in principle, be directly applied to military applications cannot be used without modification. However, there is a move towards aligning these different national standards more closely and using similar test techniques, and the trend it to move towards common international civilian standards whenever possible.

Standards for electro-magnetic compatibility are co-ordinated at the international level by the IEC and by the ITU-R. Although IEC has primary responsibility for electrical and electronic components, and ITU-R is the central authority for radio frequency matters, the jurisdictions of these bodies overlaps on electro-magnetic compatibility subjects.

In IEC, TC77 is the primary body dealing with the immunity of products from electromagnetic interference. In addition, IEC has an International Special Committee on Radio Interference. CISPR has participation from the broadcasting industries, the power utilities, and the telecommunication companies. The IT industry concentrates its efforts mainly on TC77. There is also an Advisory Committee on Electromagnetic Compatibility (ACEC). Among its other activities, this committee stays in close touch with military requirements and includes representation from TC77 and CISPR.

In the ITU-R, electro-magnetic compatibility issues are primarily the responsibility of SG1 (Spectrum Management). The main SG1 task concerns radio interference but it also looks also at other compatibility problems concerning industrial products, scientific instruments and so forth. ITU-R works closely with IEC/CISPR - the two bodies incorporate each other's recommendations and common procedures are being worked out.

Both IEC and ITU-R correspond with their national member bodies in terms of identifying standards requirements, and co-ordinating standards development and implementation. In the EU, IEC works closely with CENELEC and ITU-R corresponds with both ETSI and the European Radio Office in Copenhagen. There is especially frequent comparison between the CENELEC and IEC work in this area and there is no duplication of work. There are at present no formal relationships with the NATO standardisation regime, but IEC and ITU-R standards are available for use in military equipment as well as civil equipment, and where regulations apply, they apply equally to military and civil technologies.

In addition to IEC, ITU-R and their national members, there is a very broad range of other organisations involved in specific EMC issues. Most important in the context of this study are SAE standards in the automotive area, and EUROCAE and RTCA standards relating to EMC in aerospace applications.

Although there would seem generally to be a very high incentive to develop a fully harmonised set of electro-magnetic compatibility standards at an international level, certain discontinuities and frictions remain owing to national and sector practices and interests, and the above mentioned problems with discrepancies between civil and military regulations.

On the radio side, the general trend has for some time been to allow services sharing - i.e. to encourage different radio-based services to co-exist on the same bands. As a result, there now considerable transfer of military/civil technology in both directions. But the supply industry as a whole is now disinclined to build primarily to military specifications, and where they do they look immediately for a parallel civil application.

Civil needs tend to dominate the standards agenda even though much of the spectrum is reserved for military use by individual countries. The ITU Radio Regulations do not specify military frequency allocation. They specify only the types of emission than can occur in each band (AM, FM etc.) and specify certain internationally reserved allocations (i.e. amateur, CB, civil aviation etc.). Individual countries decide how much of the available spectrum bands to allocate for military use.

Military interests participate directly in the periodic ITU-R regional and global Radio Conferences behind national delegations. In the EU, military requirements are passed on to the European Radio Office in Copenhagen for co-ordination. This office can co-ordinate all EU spectrum use, but it cannot participate directly in fixing the international specifications as such. They have to make proposals to ITU-R in this respect based on a consensus of EU Member States.

On the electrical and electronic components side, a particular point of inter-industry friction involves the IEC 61.000 series of standards that specify limits for the production of harmonics. Some EU industrial interests are not enthusiastic about this initiative because they believe that that the limit-setting approach increases costs. On the US side, however, the computer networking industry has objections on the basis that the harmonics limitation approach may have negative implications for services sharing - e.g. delivering data transmission services over power lines. Much of the harmonics limitation debate arises because of different practices in the US and Europe. For example, a US power transformer typically has less than five connections, whereas a European transformer typically has about 200 connections. This potentially makes the emission problem more acute in Europe where services sharing is desired.

All EU Member States set electro-magnetic compatibility regulations under the ITU-R International Radio Regulations, and correspond with the European Radio Office. There is an EU Directive on electro-magnetic compatibility and CENELEC has an agreement with IEC to share the technical work with respect to this Directive in order to reduce the possibility of redundancy. However, the arrangements between various levels of regulation in Europe can cause problems. For example, there has been confusion as to whether demonstration of conformance to the electro-magnetic emission regulations set up by the civil aviation authorities in individual Member States are acceptable under the EU-wide regime.

Profile 5 - Mechanical Engineering

Key initiative - Fasteners

General description
The term 'fastener' covers all types of mechanical devices that are used products that are used to connect two or more structural parts such that they form either a solid or a movable joint. They include screws, nuts, washers, pins and rivets. Fastener requirements are defined roughly either in terms of general fastening devices that could be used in virtually any context - like standard nuts and bolts - or in terms of highly specialised devices. ISO separates aerospace fasteners, special screws and keys, and special fasteners for ball and roller bearings from other more general fastener types.

For any type of fastener, standardisation can apply to dimensions, tolerances, mechanical and functional properties, test methods and procedures for the acceptance of fasteners. Standards can also specify performance characteristics in terms of strength, resistance to corrosion etc. There are technological links to virtually all other mechanical engineering areas

Rationale for standardisation
Fasteners and couplings constitute the most basic kind of interface for mechanical products, and they demonstrate the probably the purest basic rationale for setting industry-wide voluntary standards. The basic rationale for standardisation is variety reduction in order to facilitate design specification processes, and to reduce production and maintenance costs. Standardisation also reduces the possibility that at some point manufacturers and customers for products that require the replacement of fasteners might become dependent on particular suppliers for essentially trivial items, thus boosting overall maintenance and obsolescence costs.

Institutional and procedural dynamics
Requests for new and/or revised standards come from across the spectrum of the mechanical and allied industries. The standardisation system for general types of fasteners is concentrated in the national and international SDOs. Indeed, the SDO system in many countries was founded for the initial purpose of standardising fastening devices, and the first ISO technical committee was set up to standardise screw threads.

Most national SDOs promulgate standards for fasteners and couplings. Some of these are specific to highly localised products and processes, but most reference ISO standards. The main bifurcation is between imperial and metric sizes. CEN TC 185 sets European standards with specific reference to ISO.

The main ISO Technical Committees in this area - TC 1 (screw threads) and TC 2 (fasteners) deal with generic issues, but other groups are more specialised. For example, TC 20 Sub-Committee 4, deals with aerospace fastener systems and has developed about 100 standards in the field; including design parameters and procurement specifications for nuts, bolts, threads, and other issues like identification and part numbering issues.

However, not all fasteners correspond to publicly available standards. Systems assemblers like Aerospatiale and BAe have developed their own types of specialist fasteners, the manufacture of which they licence to suppliers. Since 1992, AECMA has convened a technical committee (C3) to develop European standards for aerospace fasteners. Other sources of fastener standards include the US National Aerospace Standards (NAS) and MIL-STANDS, as well as the SAE Aerospace Material Specification (AMS) series. Although most fastener standards are based on ISO specifications, there have been instances (particularly in aerospace) where the evolution of basic ISO standards has resulted in incompatibilities with fastener series already in service.

Although fasteners are a very basic technology and not usually subject to rapid technical change, certification requirements can have significant implications. An example is the recent US Congress debate concerning a US Fasteners Quality Act that would require all fasteners used in the US to conform to the AMS standard. This met with opposition from domestic as well as foreign suppliers. The government proposal was to require that original documentation accompany every consignment of fasteners, irrespective of whether it was a small batch from a distributor, or a huge order from a manufacturers stockist. This would result in very much increased overheads for managing and distributing the documentation, in addition to the costs of establishing sufficient AMS certification laboratories to deal with the volume of applications.

7.3.3 Systems Platforms and Transport

Profile 6 – Aerospace

Key initiative (a) - Metal Alloys

General description

Increasingly, the source of value-added for most aerospace systems is the engineering of electronics-based systems rather than airframe and engine engineering as such. Of the non-electronic technologies, one of the most important is metal alloys. The two aerospace communities most concerned with standards in this area are airframe and engine manufacturers.

For most aerospace applications, the primary metal materials fall into the category of 'light metals and alloys' - i.e. primarily alloys based on aluminium, magnesium or titanium. There is more limited use of ferrous metals and alloys in aerospace, although gold and silver alloys feature in some non-structural applications. The primary linkages for standards purposes are with process technologies for the manufacture and performance testing of metal alloys and specific elements made from these materials. These processes are often highly 'scientific' and often cited on specialised computer-based platforms. This creates standardisation links with CAD technologies, and scientific instrumentation in connection with electronic simulation and testing of materials and components.

Rationale for standardisation

Aerospace applications require exacting performance and high reliability from metal alloys. Failure will often be 'catastrophic' (i.e. not due to cumulative wear leading to decrease performance, but due to the sudden complete failure of a part or component). Clear specification of the characteristics of alloys are required along with the means to test their 'environmental performance' (i.e. the performance of the alloy in the actual conditions of temperature, mechanical stress, humidity, etc. to which it will be subjected in use).

In the field of metal alloys the aerospace industry has proved to be very conservative. For instance, over the years only about a dozen steel, nickel and titanium alloys have been used commonly in aircraft engine manufacture. However different standardisation organisations, and the main engine manufacturers will often define slightly different environmental performance testing requirements for basically the same alloy. These different testing requirements impose added costs on the alloy or component supplier, and ultimately increase the costs for prime contractors and their customers. Standardisation of physical characteristics, performance parameters and test methods can reduce these costs.

Institutional and procedural dynamics

There is a particularly strong link in the aerospace sector between civil and military applications. Most aerospace firms supply both markets in varying degrees. In the past, there have been attempts to transfer military standards (especially) MILSPECS into ISO standards but most have failed.

Most of the design and production capability in the sector is concentrated in a small group of countries, of which the US, UK, France and Germany have the largest shares. As a result, the standards environment tends to be determined at a national or even firm level by a few large prime contractors, in accordance (where necessary) with the requirements of national civil aviation authorities. Some standards as developed by organisations like SAE and ASTM can find their way into international standards, but not all standards issues are appropriate for action at the international level. For example, there is much wider consensus on the need for international standards for fasteners than for electrical systems. Likewise, international standards with respect to alloys tend to be of a highly generic nature, subject to additional specification by contractors.

The definition of alloy specifications is mainly in the hands of the prime contractors (the airframe and aircraft engine manufacturers), who are in charge of the overall design of the systems and therefore the performance requirements for the components. Systems assemblers will require from their components and materials suppliers products complying with national/international standards and specifications, but more often, will define their own specifications.

Alloy specification is a particularly critical decision in aerospace engines. Accordingly, the main aerospace engine manufacturers have their own sets of specifications for materials. The German company MTU has defined a series of specification known as MTP and MTL. The French firm SNECMA develops its own DMD specifications. In Britain, Rolls Royce requires its own MSRR (Material Specification Rolls Royce) materials regime. In the US, GE requires suppliers to comply with its own B50 series of specifications. Most of these specifications have a close equivalent in AMS specifications and, in turn, these are often referenced in national standards catalogues (AFNOR, BSI, DIN etc.)

The diversity of specifications that suppliers have to comply with is compounded by the different standards bodies that issue specifications. Often European countries issue their own standards; and although the differences among them are typically minimal, there is a considerable degree of confusion as to the specific requirements that clients in other countries may request through reference to domestic standards. Some measures have recently been taken to address this problem. In Britain, SBAC has elaborated two documents (TS-95 and TS-96) cross-referencing different national standards in the field of aerospace alloys. ENs are also starting to be used in joint defence aerospace programme. Eurofighter has been the first defence programme making extensive use of ENs - most of the metal and alloys specifications of EF2000 are based on ENs. However, ENs in this field do not cover certification procedures.

Key initiative (b) - Space Vehicle Engineering

General description
The basic technological environment for space vehicle engineering is very similar to that of terrestrial aircraft engineering. Standards can apply to most material and mechanical elements, as well as to quality control, process management, and tolerances for the performance of space vehicles in specified environments. Besides the basic materials and mechanical elements, space vehicle engineering has to encompass aspects of thermal, structural, propulsion and pyrotechnics engineering. Co-ordination is necessary also between the design and performance parameters of launch vehicles and those of payloads.

Rationale for standardisation
Space vehicles are complex systems that are highly individual to the particular national or regional space programmes that engineered them. A key point of commonality between different space programmes that underpins many standardisation initiatives is provided by the economics of the contemporary space industry. To survive economically, a launch vehicle programme requires a steady stream of payloads. In the past, most of these were of the same programme origin as the launch vehicles themselves. In the present environment, however, payloads can come from a variety of national and commercial origins. Defence is now just one among many space vehicle applications.

The standardisation rationale in today's competitive civil launch environment is to facilitate the launch of any payload on any vehicle. Most military payloads use the same launchers as civil payloads, but the military launch market is less competitive owing to the added political and national security factors that influence the selection of launch facilities. As most launch vehicles and payloads are different, the basic objective is to have design, manufacture, and quality assurance standards that will compensate for variations in the characteristics and/or performance of space launchers, and co-ordinate the highly complex supply chains that culminate in the payload being mounted on the launcher and projected into orbit. This rationale is shared both by the payload contractors (who are now more diverse and internationally distributed) and by the launch contractors (of which there are at present only four - NASA, ESA, and the space agencies of Russia and China).

Institutional and procedural dynamics
Standards for space vehicle engineering have in the past tended to accumulate in regimes structured around specific launch vehicle programmes. Some specifications are issued by the space agencies to prime contractors, but within this framework, contractors and sub-contractors can employ standards from a variety of sources, including proprietary standards. The two main areas in ISO are space communications (SC 13) and space systems and operation (SC 14) which deals with the application of space technologies. ISO has liaisons

with the major space agencies - NASA, ESA, CSA etc. - as well as with the major aerospace industry standards bodies, including AECMA.

The balance of commercial market share for space launchers has shifted significantly in the past 10-15 years. The European Ariane programme now commands better than half of a global market formerly all but monopolised by NASA. Competition from Russia and China is becoming significant but they remain smaller players in the launch marketplace. Europe now has a major economic stake in the space industry, with several hundred contractors currently generating 8-10 bn ECU in revenues and providing in excess of 30,000 jobs.

This emerging market dominance led in 1993 to the setting up of the European Co-operation for Space Standardisation (ECSS) programme. ECSS was set up at the urging of the Eurospace trade association with the objective of harmonising CNES and ESA product assurance standards. ECSS is effectively a European counterbalance to NASA in terms of promoting technology co-ordination, although it is not exclusively a European organisation (the Canadian Space Agency is a member, for example).

ECSS is primarily concerned to build a framework for the application of existing European and international standards, or other commonly used space engineering standards. ECSS has agreements with CEN to develop draft documents in co-operation with AECMA that will be presented for consideration as EN and ENV. The CEN link is reinforced by a Commission mandate.

One of the main problems in achieving a global standardisation regime for space vehicle engineering is that relationships between ECSS and the US, Russian and Chinese space programmes have yet to be worked out. All of the world's major space programmes have followed somewhat different overall engineering approaches supported by idiosyncratic regimes of standards. Special problems are anticipated with respect to harmonising European and US standards, although it is possible that ISO could become the forum for European-US co-ordination.

However, another major obstacle to international standardisation is that space technology retains many strategic dimensions, both military and commercial. Many leading actors in North America and Europe consider that some subjects are inappropriate for standardisation in ISO because of the security implications of technology transfer to third countries. The view in many quarters is still that some space technologies should not be distributed to all countries. More-and more of the reasons for this concern are now commercial - for example, the transfer of information to China, a growing Aerospace competitor.

Profile 7 - Ships and Marine Craft

Key Initiative - Marine Vessel Structures

General description
Included in this category are all of the materials and physical components that comprise marine structures - ships, miscellaneous marine craft (including sea-bed anchored structures like petroleum exploration and production platforms), and small craft. Marine structures in this context generally include 'ship-to-shore' interfaces - i.e. docking, berthing and cargo handling facilities. Technological linkages for standardisation purposes include soldering and welding

technology, fasteners (particularly rivets and bolts), metallurgy-based technologies including founding and forging, mechanical vibration and shock, pressure vessels, piping and cargo handling equipment. As with most other general engineering areas, the design and production processes for marine engineering have become highly computer intensive, creating linkages with CAD processes, electronic simulation and testing of materials and components and with quality assurance.

Rationale for standardisation

As with the design and construction of any complex structure, a marine engineering project will employ standards from a vast array of sources, typically selected and configured on a project-by-project basis. Many of these standards will be generic and drawn from related mechanical, civil and materials engineering areas. Most of these standards are applied for reasons of co-ordination, rationalisation and variety reduction much as they would be in other engineering contexts.

Specific standards for marine structures are set for the most part in order to comply with IMO requirements for the safe operation of shipping and the protection of the marine environment. IMO requirements are supported and in many cased augmented and supplemented by national 'classification agencies' who are closely allied with the shipping underwriters.

Thus, the rationale for setting and configuring standards for marine structures is driven both by the economic interests of ship and marine platform constructors during the design, construction and maintenance stages, and by the interests of marine vessel operators and underwriters during the operational stages.

Institutional and procedural dynamics

Marine engineering is one of the few areas where individual countries can achieve very high profiles irrespective of the relative sizes of their economies. Traditionally sea-faring smaller nations like the Netherlands and the Nordic countries have long histories of being technological leaders in this field. Likewise, the dominance of Asian shipyards in the bulk carrier market has increased the profile of Asian standards. Japanese, Korean and Chinese national standards now tend to outnumber US and European standards in this field. In general, the national standards of countries with extensive maritime industries become influential in determining how IMO and classification agency requirements are established and met.

The classification agencies are co-ordinated internationally by IACS, which both sets its own standards and configures regimes of standards set by other agencies, including SDOs. Particularly influential member agencies in IACS include the American Bueau of Shipping (ABS), Bureau Veritas (BV), Det Norske Veritas (DNV), Germanischer Lloyd and Lloyd's Register of shipping (LR).

IACS activities concentrate on hull structures and shipboard engineering systems throughout the life-cycle of a marine vessel. The IACS system is basically one of quality control and certification. Vessels are classified as to how they must operate, where and what functions they can perform on the basis of third party engineering analyses and periodic verification of the integrity of structures and systems. Certification is granted on the basis of statutory national requirements and IMO international requirements. Classification of this kind is essential to underwriters in determining risks for vessel and cargo insurance purposes. To a large extent, it is risk assessment for underwriting purposes that drives the setting and application of technical as well as procedural standards.

Where voluntary standards are concerned, preferences are usually stated by IMO and IACS for ISO standards. However, ISO Marine engineering standards concentrate on areas that are mostly non-structural as such - lifesaving and fire protection, environmental protection, piping and machinery, deck machinery, bridge layout, navigation systems (magnetic and mechanical), inland navigation, and computer applications. Structural matters in ISO are at present restricted to bulk carrier applications and items like hatches and windows. To date, CEN activities have been confined mostly to incorporating ISO standards into the EN regime.

Standards for military vessels employ many of the same standards from the same sources as civil vessels. Requirements for military vessels to conform to IMO standards regimes can vary from country to country and according to the regimes concerned. The UK MoD follows IMO requirements with respect to environmental matters, for example, but it is not clear that it is a requirement in all instances for military services to conform to conventions like these.

Most naval vessels are highly specialised for military purposes and require structural features that are different or more robust than those of civil vessels. The navies of most NATO countries still maintain extensive internal standards regimes for specification and maintenance purposes, and NATO STANAGS are likewise numerous. Insofar as structures are concerned, most of these refer to the special needs of mounting military platforms (helicopter pads, weapons emplacements etc) and to battlefield 'hardening'.

There is high momentum in the shipbuilding industry to harmonise civil and military standards regimes. Particularly in Europe, contracts for new ships (both civil and military) are becoming more difficult to come by. Even though in the past some shipyards have become highly specialised in military vessels, dual capabilities are now crucial to the survivability of many of these yards. Most European naval authorities now support the principle of wider migration to civil standards. The UK Navy, for example is examining the possibility of using Lloyds Register standards for warship design. However, most of the harmonisation activity regarding structural elements is occurring at national levels rather than at European regional or international levels. Cross-border co-operation on projects like the CNGF frigate have not to date produced any significant convergence in the civil and military standards regimes.

Profile 8 - Land Vehicles

Key Initiative - Transmission, Suspension and Braking Systems

General description

Seen as a unit, transmission, suspension and braking systems comprise one of the basic mechanical subsystems of a land vehicle - the others being the power source (engines), the structural frame (encompassing the chassis and bodywork), steering systems, hydraulic systems and electrical systems. Standards for transmission, suspension and braking can apply to powered vehicles - motor cycles, motor vehicles (cars and trucks) and articulated vehicles - as well as to non-powered light and semi-trailers that can be attached to these vehicles. Transmission, suspension and braking system specifications are important factors in the design of coupling mechanisms that connect powered to non-powered vehicles and in some cases one powered vehicle to another. Most couplings are designed to operate within given suspension and braking performance parameters. Furthermore, some 'powered' couplings (e.g. lifts and swivels) involve links with transmission systems.

Transmission, suspension and braking systems are designed with reference to virtually all other elements of vehicle car design. each element must be specified in terms of the platform on which it will be mounted and the power source that will drive it. Technological areas that are closely allied to transmission, suspension and braking systems include fluids and lubricants, advanced materials, piping, screw threads, fasteners, welding and soldering, mechanical vibration and shock, hydraulics and pneumatics, springs, aerodynamics, bearings and shafts. As all but the structural elements of subsystems for land vehicles are to an ever increasing extent controlled by computer modules, there are links also to electrical systems, and in particular to EMC problems.

Rationale for standardisation

The rationale to seek industry-wide standards varies somewhat with the type of vehicle, the technology concerned, and the market characteristics. However, in all cases, standardisation of aspects of the basic mechanical interfaces - such as those involved in transmission, suspension and braking components - is driven by the fact that a great deal of component manufacture is outsourced. In principle, standards remove many of the technical barriers that lock component suppliers into supply chains aimed at specific vehicle producers, and allow producers to change suppliers more easily.

In practice, most of the standardisation that occurs is at the level of individual vehicle producer supply chains. Industry-wide standards tend to concentrate either on aspects like terminology, material tolerances, performance tests, and production and maintenance procedures, or on common generic elements like fluids and fasteners. Throughout the automotive sectors, increasing attention is being paid to standardisation in the quality assurance field.

Voluntary standards issued at the industry-wide level by SDOs tend to be focussed on the compatibility, interchangeability and safety of highly generic materials and processes, although many of these can involve advanced technology (as with materials for bearing surfaces and linings, for example). As a result, although there may be complete interchangeability of some parts and systems among several products by the same manufacturer, there is little interchangeability where the products of different manufacturers are concerned except at the most generic levels of technology. Essentially, however, similar vehicles by different manufacturers usually offer highly similar degrees of utility to the end-user.

As with land vehicles we are often dealing with products that are produced and sold in large quantities. The potential restraint of trade implications of this structure for parts and systems sub-contractors are clear. In some markets (the US and Canada for example) the problem is addressed somewhat by the system whereby generic manufacturers may acquire rights to build components to the internal standards of vehicle manufacturers. In Europe the situation is less clear, with vehicle manufacturers putting pressure on governments to curtail the generic sector in vehicle components.

The final rationale for standardisation concerns compliance with the range of national and regional regulations covering safety, performance and environmental factors, and with the requirements of insurers in determining vehicle insurance classifications. In the case of transmission, suspension and braking technology, regulations can cover a wide range of concerns including the composition of fluids and materials, the disposal of toxins, and performance requirements for safety reasons.

Institutional and procedural dynamics

The lead actors in setting standards for transmission, suspension and braking systems are the major vehicle constructors and their suppliers. As noted above, most of the available 'standards' are in effect the internal design specifications of the vehicle manufacturers themselves. In addition to supplying a wide range of standards for basic mechanical engineering applications, national SDOs issue some standards that are specific to the production and maintenance of land vehicles, but these tend to be in generic areas as outlined above. Likewise, ISO issues a relatively limited range of standards that are specific to land vehicles. IEC standards are more extensive in that they tend to refer more to the performance parameters of electrical systems rather than to the physical design of electrical components and sub-systems. CEN/CENELEC has only a minor presence in setting standards for land vehicle components and systems - its only specialised road vehicle committee (TC 301) concentrates on electric vehicles.

Probably the most important single source of voluntary standards initiatives in this field is SAE. A high proportion of US national and ISO standards are in practice SAE standards promulgated at national or international levels. Although a US-based body, in many respects SAE provides the international nexus for standardisation in the vehicle industries. Many US defence standards in the ASSIST catalogue emanate from SAE. Other major sources for standards related to transmission, suspension and braking systems are API (fuels and lubricants), and ASTM (materials and lubricants).

One possible area for greater ISO influence is quality assurance. However, most vehicle manufacturers consider the ISO 9000 framework to be too general. Most prefer to apply their own internal quality management standards. This creates added costs for materials, component and sub-systems suppliers who must often certify their processes to several proprietary quality assurance regimes.

In the defence arena, all vehicle sub-systems will be included in general guides outlining common technical requirements for military vehicles. A distinction has to be made between fighting vehicles (armoured and armed platforms extending from Infantry Fighting Vehicles, to large Main Battle Tanks), and those used in support tasks (mainly military logistic vehicles). The latter will be more similar to their civilian equivalents, but they are still subjected to a number of specific defence standardisation regimes. The UK for instance has a standard (Def Stan 23-6) providing a "guide to the common technical requirements for military logistic vehicles and towed equipment." Although the standard specifies that such vehicle "shall conform to all current legislation, the latest commercial practice" they also have to conform to individual defence technical specifications.

Military logistic vehicles usually have to operate in normal open road and therefore have to conform to general commercial rules, standards and practices. These can be set by national statutory instruments that can reference international standards (mainly ISO), and national civil standards like SAE. However, specific defence standards can apply as well, both at national and international levels (e.g. STANAGs).

ISO standards used in defence contexts range from the symbols used to designate fluid types to interchangeability standards for the mechanical coupling of towed and towing commercial vehicles. Interfaces between different vehicles have been one of the main concerns of international standardisation in both defence and civil contexts. NATO, for instance, established a series of standards on the installation and operational requirements for towing and towed vehicles (STANAGs 4019 and 4101). These date mostly from the 1950s and 1960s. STANAG 4019 was changed in 1992, but not all countries ratified the new standard (the UK did not, for example).

Standards for the coupling of trailers and towing vehicles in the military arena, are different from similar standards used in the commercial world. Consequently, a number of additional standards have had to be drafted to define adaptors to enable civilian vehicles and trailers to be attached to military vehicles and trailers (i.e. standards for braking hose assemblies, coupling adaptors for air breaking, and intervehicular systems (i.e. between towing and towed vehicles - STANAG 2604). Most other NATO standards for logistic vehicles relate to towing attachments and other interchangeabilty issues. Others NATO refer to electrical voltages, spark plugs shielding and so forth for tactical vehicles.

7.3.4 Materials and Commodities

Profile 9 - Petro-chemical Products

Key Initiative (a) - Lubricants and Fluids

General description

Although different types of lubricants and fluids are required in different applications environments (i.e. automotive, aerospace and marine), it is common nevertheless for lubricants in specific environments to be common to both military and civilian applications. For example, the same lubricant can in many cased be applied to all types of gas turbine engines, including turbo-jet, turbo-fan, turbo-prop, and helicopter engines, both for military and civil service. Moreover, some lubricants and fluids can be applied in a variety of environments - aircraft engine oils can also be used in generators, starter motors, etc.

In general terms, standardisation in this field focuses on terminology, measurement, sampling and test methods, and on setting standard classifications and specifications for petroleum and non-petroleum based lubricants and fluids. Standards can apply also to refining processes, handling and transport, and to environmental concerns (especially disposal). Allied technological areas of importance for standardisation include machine tools, engines and mechanical systems for land vehicles, aircraft and marine craft, chemical engineering, statistical methods, corrosion, fire safety, and fluid power systems.

Rationale for standardisation

All lubricants and fluids have to be tailored to specific applications. Use of the wrong product can ruin engines and other mechanical systems. This creates a high incentive for standards that will assure users as to the basic properties and performance parameters of different lubricants and fluids. At the same time, technology is advancing rapidly and petro-chemical companies often use advanced product characteristics to seek competitive advantages.

The incentive to seek industry-wide standards is highest in areas like product identification regimes and terminology, basic process technologies, test methods and quality control. It is lowest where special characteristics (like additives) come into play that may be of proprietary value to individual producers. Increasingly, the composition and handling of lubricants and fluids is coming under the purview of environmental regulations, and this can act as a further incentive for industry to set voluntary standards. For users, standards supply basic information about product characteristics thereby facilitating interchangeability of products by different suppliers.

Institutional and procedural dynamics

Manufacturers of systems requiring lubricants and fluids play a central role in defining the characteristics of products and in approving their use. In some cases, although the final product may be basically the same, different manufacturers will define slightly different testing procedures, resulting in slightly different specifications for each of their products.

ISO has also a number of Technical Committees working in this field, particularly TC28, (Petroleum products and lubricants), which deals with the standardisation of measurement methods, sampling and testing technologies, terminology and specifications for petroleum and non-petroleum based lubricants and hydraulic fluids. However, the main organisation defining standards in the field of fuels, lubricants and fluids is the US-based SAE. SAE standards are used across the world, and the organisation is at the centre of the efforts harmonise lubricant standards for aircraft engines. Some ISO standards are simply SAE standards promulgated at the international level. There is no equivalent of SAE in Europe, and there are no significant ENs in this field.

It is common for SAE standards and military specifications to be closely related (for example, SAE J1899 is based on US MIL-L-22851D, and SAE J1966 on MIL-L-6082E). There is also a codification system in NATO for engine oils linked to US MILSPECs and SAE standards. Some lubricants are commercialised only after having obtained approval against a military specification (normally a MILSPEC), and after being approved by various manufacturers of equipment to which the lubricant can be applied.

The US military has played a pivotal role, not only in the defintion of lubricant standards but also in the certification process of new products. For example, MILSPEC approval is the starting point of the approval process for a lubricant that is to be used in civilian aircraft. In order to get civilian approval a product must first comply with the relevant military specifications.

However, systems manufacturers and fuel/lubricalt producers are showing distinct preferences to move towards common military/civil specifications. In the field of lubricants for aero-engines, for instance, it has been common for several sets of defence-related standards to co-exist: the US-generated lubricant specifications as defined for instance in MIL-L-23699, MIL-L-6082e, MIL-PRF-23699F, the UK specifications as defined mainly through DefStan 91 series, and the French STM specifications. These sets of standards basically specify the same products, but there are small differences and each set defines different tests. In most cases, lubricants are cross-referenced. For instance, US specification MIL-L-22851D corresponds to SAE J1899, and to UK DEF STAN 91-92 (DERD 2450), and is coded by NATO as O-156.

Most stakeholders on both sides of the Atlantic participate in SAE Committee E-34 with the objective of defining common specifications and test methods for aircraft engine lubricants. The only major exception is the US Navy which continues to set its own specifications owing to the added severity of marine corrosion testing requirements (for example MIL-PRF-23699 C/I).

Key initiative (b) - Aerospace fuels

General description

Performance requirements for aerospace fuels and related systems are generally higher than for land vehicle and marine fuels due to the possible 'catastrophic' nature of aero engine failures both in flight and on the ground. In this field, standardisation applies to the basic composition and performance characteristics of aviation fuels, and to the various systems for fuel transport, handling and consumption.

Thus, the main body of standards refers in detail to what might be termed 'ambient' characteristics like evaporation properties and storage requirements, and to hazards like contaminants and electrostatic phenomena. Technological areas for fuel system standards include pressurisation. quantity gauging, distribution, pumping and ignition systems, and fuelling procedures. The range of allied technologies relevant in a standards context is similar to that for lubricants.

Rationale for standardisation

The standardisation rationale for fuels is similar to that for lubricants. Common specifications for engine fuels are required to ensure that engines operate correctly within the range of environmental conditions in which they are expected to function, and that fuels from different suppliers can be used in a range of aircraft engines. The other main rationale for standardisation is to facilitate uniformity of safety procedures with respect to fuels transport and handling. The latter can be subject to regulation.

Institutional and procedural dynamics

The lead actors and stakeholders in the standardisation process for fuels are basically the same as for lubricants. Different standards committees and standards will be involved in the development of fuel standards and specifications, but as the main producer firms tend to be involved in the whole range of fuels and lubricants, the actors involved will often be the same. Some fuels are used both in military and civilian aircraft, and some defence standards like UK DEF STAN 91-90 are applied in commercial aviation. For jet-engines, the kerosene-based fuel known as JP-5 is widely used in military aviation. The US military has set up specification requirements for JP-5 under MIL-PRF-5624S, and in the UK the specifications are defined under DEF STAN 91-86. There is however a difference in the extent to which the military and civil aircraft use the same fuels. For jet engines, commercial and military fuel types are often different even though they may be based on similar standards.

There will often be small differences in fuels products conforming to equivalent US and European standards. For instance, in the case of jet fuel JP-5, the maximum level of sulphur allowed in the UK specification (DEF STAN 91-86) is 0.30%, whereas 0.40% is allowed in the US specification (MIL-PRF-5624S).

Profile 10 - Textiles

Key Initiative - Protective materials

General description

Standards in this area are concerned mainly with specifying the performance characteristics and ensuring the production quality of textiles that are designed specifically to provide protection against hazards. These range from chemical and biological hazards to fire hazards, electrical hazards, thermal conditions (heat and cold) and nuclear radiation. Armour and non-woven materials are generally excluded from this category, but protective textiles can be used to guard against both harmful agents (fire, chemicals etc.) and 'mechanical' hazards (like hot or sharp objects). The protective materials area is related technologically to areas like advanced materials, chemical engineering, and textile machinery and manufacturing processes.

Rationale for standardisation

The basic rationales for standardisation in textiles relate mostly to the generic qualities of textile products as raw materials - dimensions and tolerances, pilling characteristics, abrasion resistance, seam slippage, physiological properties, corrosive characteristics, thermal properties and combustion behaviour. Allied to these standards are fabric description and labelling (including 'care' labelling) standards. Most of these standards rely heavily on the availability of standard test methods. These include the specification of standard atmospheres for the conditioning and testing of textiles, colorant testing, and fibre testing as well as tests for cleansing characteristics, finishing properties and water resistance. The rationale behind standards like these is less about reducing variety than about reducing uncertainty about the performance characteristics of textiles and textile products, thus increasing the efficiency of the design, manufacturing and procurement processes. Certifications of textile products are often relied upon in the industry as virtual warrantees.

In the case of textiles used in 'protective' roles, a similar 'uncertainty reduction' rationale applies, but it relates more directly to safety critical elements like the strength and protective qualities of textiles. In this case standardisation is aimed towards certification of the quality and performance of clothing and other equipment that may be carried on the person (e.g. carriage bags and packs) in terms specifically of hazard protection.

Institutional and procedural dynamics

There is widespread use of protective textile products in both civil and military contexts, and there is a substantial amount of civilian standardisation activity. ISO convenes committees in most technical areas related to protective textiles, and there are a substantial number of European Standards on protective clothing (chemical, fire fighting, etc.). In Europe, products of this kind are subject to the Personal Protective Equipment Directive.

There is a similarly substantial concentration of civil standardisation activity in the US. Important US organisations setting standards for protective fire fighting include the US National Fire Protection Association (NFPA), ASTM, and Occupational Health and Safety Administration (OSHA). NFPA is active setting protective clothing standards for a wide variety of hazards - it sets performance requirements for chemical suits, for example. NFPA standards are often referred by other US organisations. The FAA minimum standards for personal protection equipment (PPE) used by airport fire and rescued personnel reference mainly NFPA standards. The amount of direct involvement by military agencies in international standardisation efforts is difficult to determine, but there is substantial participation of DoD staff in a variety of NFPA technical committees.

Some military requirements in this area are similar to civil requirements and some are not. Special military requirements in this area relate mostly battlefield situations involving attack by fire, chemicals and other hazardous substances. The requirements are special in that military protective clothing must be designed to defend against attack by agents that are specially designed to defeat protective gear. However, there is a broad area of military activity in which demands may be no more exacting than civil requirements. Most of the general 'workplace' requirements for protective gear arise in both contexts.

In the past, military protective gear has tended to be over-specified such that it was bulky and inadequate for more widespread applications, including civil use. However, gear of this type is problematical in military use as well - as shown for example in combat situations in hot climates like the Persian Gulf. The current trend is to develop lighter equipment, and also develop protective garments that integrate fire and chemical protection into a single suit that can be worn instead of the standard uniform. Progress towards this goal could mean that more of the same protective materials and design configurations are used in military and civil applications, stimulating even more extensive involvement by civil SDOs.

Profile 11 - Safety Products

Key Initiative - Fire safety equipment

General description
This category includes not only fire extinguishing equipment, but also design approaches, materials and structural elements aimed at increasing fire safety and reducing fire risks. Standardisation applies not only to the design and performance characteristics of fire alarms and fire fighting equipment, but also to requirements for the provision and distribution of fire safety equipment and the routines for its use. These latter considerations can be embodied in standards for the physical layout of buildings and other structures. The main general technological categories for standardisation purposes are fire extinguishing systems, fire extinguishing media (water, gaseous, foam, solid, and carbon dioxide), and fire alarms. Some of these technologies can be applied in fixed as well as portable systems. Fire equipment extends to protective gear for fire fighters. This includes applications of protective textiles and of protective breathing equipment and head gear.

Rationale for standardisation
Fire is a threat both for buildings and structures and for all land vehicles, aircraft and marine vessels. A major part of the rationale for standards is to maintain the confidence of consumers and professionals in products that are designed to be used in emergencies. In these circumstances, normal *ex post* practices for user evaluation of product characteristics are suspended- i.e. in planning for emergency situations, purchasers of equipment need *a priori* assurance that the equipment will function within specified parameters when required. For safety equipment manufacturers, it is usually the case that commercial advantage through the development and application of new materials, systems and devices often can not be gained before these new products are incorporated into recognised standards regimes. Standards for

fire emergency equipment also establish criteria against which fire risks can be assessed and minimised and for insurance purposes.

In military contexts, the standardisation rationales are very similar. Standardised damage control procedures come hand in hand with design strategies for system survivability. Nevertheless, there are special circumstances in military environments. Fires are also a likely consequence of attack, and ordnance is often designed to provoke or increase the chance of fire. In the military area fire protection is therefore linked to other damage control and system survivability strategies that have no civil counterpart.

Institutional and procedural dynamics

The ISO Fire Safety committee (TC92) plays a central role in setting standards for Fire Safety Engineering. Other committees set standards for fire protection equipment; extinguishing systems, fire detection, fire safety and so forth. In general, however, the ISO committees often have a more general focus than national or EU regional SDO committees. For example, ISO standards for fire safety tend to concentrate on processes (e.g. evacuation procedures) whereas CEN standards tend to concentrate on the fire safety characteristics of physical components and materials.

In the US, NFPA appears as very influential, setting national standards for fire extinguishing equipment, hose systems, fire safety installations, etc. including then establishment of National Fire Codes. CEN plays a similarly important role in this respect, but co-ordination problems persist with individual EU Member States. CEN fire safety standards are mandatory in the EU, but national regulatory bodies have generally preserved the right to set the levels of safety they require.

Other organisations in the civilian field are the International Technical Committee for the Prevention and Extinction of Fire, an international organisation of fire fighters, with 43 member countries that publishes technical recommendations. The International Council for Research and Innovation in Building and Construction has a Commission working on fire safety engineering needed for performance based fire codes or regulations. The Underwriters Laboratory (UL) is a very influential US-based body linked largely to the requirements of insurers, whose standards for safety of all kinds (including fire safety) are internationally influential. Likewise, there are many ASTM standards for materials and structures that refer directly to fire hazards.

Military agencies have long been active in the development of fire protection standards and regulations that are specific to military use. However, there now appears to be a move towards preference for commercial standards. In the UK, most military standards for fire fighting and fire safety equipment have been cancelled and superseded by civilian (BS) standards. Remaining defence-specific standards in areas like fire extinguishers often do no more that provide supplementary requirements to civilian standards, usually to make them usable in more extreme conditions.

However, it is still difficult to determine the level of commitment by defence agencies to participation in civil standardisation initiatives for fire safety. As defence standardisation reform began to focus on performance requirements rather than specific approaches to managing fire protection, there were criticisms that system safety would be compromised. Independent military activity in this field continues both at national levels and in NATO. The

US Navy is developing ship survivability and standardised damage control procedures which include fire protection considerations, and compliance will be required for all ship-based platforms, shipboard interface systems and associated equipment (OPNAV Instruction 3541.2A. 7 June 1996).

In the civilian arena, the rationales for standardisation are changing rapidly. In the past, the focus was on prescriptive specifications and regulations leading to the certification of particular product characteristics. The present trend is to develop performance standards that specify the ends to be achieved and not the means. The performance-based approach demands much more from designers and certification bodies but offers greater design flexibility and opportunities for substantial savings. This framework is built upon systematic risk assessment which is emerging as the normal method to evaluate the fire safety of buildings and other structures.

7.3.5 Information and Communication Technology

The profiles for the ICT category of Key Defence Technology Initiatives require special and much more extensive treatment. In today's predominantly digital environment, virtually all ICT elements are very closely related or interdependent. This is in large part driven by the reliance of all ICT developers and users on common core digital hardware and software elements. Increasingly, highly specialised components developed for specific applications are being replaced with multifunctional components and tools that are then configured to produce and support task and/or function specific applications.

This has especially important ramifications for defence technology development and procurement. Miscellaneous published figures and industry estimates gathered for this report indicate generally that for many (perhaps most) major new defence technology systems between 60 and 80 percent of the life-cycle costs can be ICT-related. Nevertheless, it is now becoming rare for new ICT components and basic systems technologies to be designed specifically for military applications. The military is now but one of many large customer groups for a range of increasingly generic ICT products and services. Thus, for an item like an aircraft carrier, a defence agency is a sole or prime customer for little more than the physical 'ship', which could represent as little as 25 percent of the total life-cycle cost of the carrier, the rest being absorbed in ICT-based systems costs.

The vast bulk of costs incurred with all ICT systems are life-cycle costs - management, maintenance and upgrading - rather than procurement costs as such. Defence agencies have much experience with long life cycles and the problems of obsolescence management, but most of this experience was gained in systems environments that were unique to military use. The extent to which this knowledge and experience can be transferred into an ICT environment dominated largely by civil technologies remains to be seen, but facilitating this transfer is clearly one of the main goals in policies of migration to civil standards.

ICT applications are now found in virtually every other area of technology. Indeed, with the possible exception of telecommunication which remains in some respects a distinct product/service in its own right, ICT is now mostly defined in terms of the job it does rather than in terms of its own characteristics as such. Many ICT components - semiconductors being the best example - are now virtually commodities in the market. For most of the ICT industries, the most significant revenue generators are systems integration and applications development.

In order to give a realistic picture of the current structure of ICT standardisation and also of the changing expectations of participants in this structure, much of the discussion in this profile must deal with ICT standardisation in a general context. Our approach will be to present first the general rationales, principal lead actors, and overall institutional structures. This will be followed by profiles of individual Key Initiatives that highlight specific technological and institutional linkages and the current state-of-the-art for each initiative. Where appropriate, links will be drawn between ICT initiatives and related activities in other Key Defence Technology Areas.

General rationales for ICT standardisation

The rationales for ICT standardisation have changed and diversified considerably in the last decade, largely driven by changes in industry and market structure. Relatively little ICT standardisation is concerned primarily with physical components. Most ICT standards focus on architectural principles, logical interfaces and so forth, and are software rather than hardware based. That said, hardware and software elements are very closely related, and many software solutions are embedded physically in hardware components. Seen in this light, increasing points of convergence are visible between the standardisation rationales of the computing, telecommunication and related industries. As with computer networking, the elements of the public telecommunication network have become much more modular and interchangeable, thus potentially diversifying the supplier base, and increasing operator reliance on advanced systems integration capabilities.

The original rationales for ICT standardisation grew out of a structure in which telecommunication and computing markets were largely separate, each with a small number of technologically and commercially dominant actors. On the computer side, pressure for change came partly from new market entrants, but mainly from large users of mainframe computer systems who were anxious about the longer term effects of lack of choice in the market. Governments and government contractors are by far the biggest users of ICT world-wide, and the public sector provided significant motivation and/or support for most of the early attempts to open up computer markets through major international standardisation initiatives. Likewise, on the telecommunication side, overt pressures for change in the standardisation regime emerged in 'domino' fashion following the liberalisation in the early 1980s of the US telecommunication market.

In the above contexts, there were two basic rationales for standardisation that were applied in somewhat different ways to both computing and telecommunication technologies:

> **(1)** ***Interconnection*** - This refers to the basic capability of linking one system to another - i.e. ensuring physical compatibility between components and 'logical' compatibility between defined service functionalities.
>
> **(2)** ***Interoperability*** - This refers to the basic capability of enabling one system to interwork with another once interconnection has been achieved - in other words, to enable different systems actively to transfer data and perform similar operations using transferred data.

Both of these rationales had been operational in the telecommunication sector since early in the century, although in the analogue era the emphasis was on interconnection and interoperation between national networks. The internal configuration of national networks was typically determined by arrangements between (usually) monopoly operators and preferred equipment suppliers. In the digital era this began to change, and the framework of international telecommunication standards began to extend far into the national network infrastructure. Liberalisation altered the rationale further from supporting the requirements of monopoly operators to supporting the interconnection of new market entrants to the existing infrastructure and facilitating the connection of new kinds of customer-owned equipment to the public network.

Support for the first significant standards frameworks for computer systems - for example, the ISO/IEC OSI Reference Model - were based largely on the assumption that the incumbent supply industry had little incentive to standardise, and every incentive to retain proprietary facilities and service environments. Major recent changes in the rationales for standardisation are linked to rapid changes in the nature and structure of ICT markets. Following the rapid proliferation of the PC, and later on of Internet technology, the focus of the industry shifted from the provision of centralised components, systems and facilities to the provision of distributed networks. In other words, communication capabilities now add as much and possibly more value to ICT investments than do information processing capabilities as such.

In an ICT market dominated by network dynamics, the rationale for standardisation changes for many participants (particularly new entrants). For these actors, the main revenue stream flows not from the provision of the core technologies themselves, but from commercialisation of development tools and support products that are oriented to particular service environments. Thus, the incentive is to make available as cheaply as possible the basic technology that establishes these environments in the marketplace. If a large user base is accumulated quickly, the network externalities generated can be used to leverage sales of specialised tools and systems. This is the logic behind the free distribution of the Netscape browser, the Acrobat file reader and the Java programming language among many other examples.

In the computing arena, the outcome of this exercise has been widespread acceptance of *de facto* standardisation, and generally reduced confidence in SDO products except in specialised application areas. In the telecommunication area there have been knock-on effects for standardisation strategies due to the increasing importance of data traffic in generating public network revenues. Although much of the formal structure for telecommunication standardisation has been retained, even enlarged, there is increasing direct contact between telecommunication operators and suppliers and the more informal standardisation arena of the computer industries.

Problematically, the long-term effects of standards of either type are seldom actor-neutral. The owners of proprietary computer networking technologies and operating systems that become *de facto* standards can acquire considerable market power as a result of the build-up of network externalities. This can limit user choice and prevent access to the market for new technologies. Likewise, as the computing and telecommunication environments continue to converge, incumbent public telecommunication network operators can seek to retain control over key revenue-producing areas, like voice telephony and leased data transfer facilities, through the control of key interface and network management standards.

There is now a huge incentive to ensure that as many network environments as possible are compatible. Even though computer and telecommunication technologies change rapidly, a high obsolescence factor is a basic characteristic of most ICT systems. Technical standards must be preserved and often upgraded as long as the basic environment persists in which they apply. New network technologies tend to appear first as 'overlay networks' on existing facilities, gradually altering and sometimes supplanting the older technologies. This tends to join the evolutionary trajectories of existing and new technologies, making it essential to engineer a measure of forward and backward compatibility into each new system. The main question concerns the extent to which desired levels of compatibility can or will be supported by non-proprietary standards.

Lead actors in the ICT standardisation process

The range of lead actors in ICT standardisation has diversified in recent years. In telecommunication, the major change is that equipment and systems suppliers now participate in standards bodies much more independently of national telecommunication operators. Moreover, there are now many new public network operators - MCI and Sprint in the US, for example, or Energis and Colt in the UK. Some of these new entrants are divisions of conglomerates from outside the telecommunication industry as such (Energis is an electricity utility). In general, the balance of power between network operators and equipment and systems suppliers has changed, and suppliers are now taking much more proactive standardisation roles. In Europe, for example, the GSM/DECT family of wireless telephony standards were developed largely out of a technology base that was proprietary to equipment suppliers.

In the computer systems area, the lead actors in standardisation continue to be the major vendors of hardware and software, but the range and diversity of vendor firms has likewise increased dramatically, many concentrating on data communication rather than on data processing as such. Some of the largest ICT vendors in the world now have very specialised product ranges. Cisco, for example, is now one of the top ten revenue earners in the world for data communication equipment, but it sells only Internet routers.

However, as technologies converge, so do many of the market segments they support. This has resulted in increased contact between the commercial agendas of formerly discrete market segments. The development of standards for leading edge multimedia applications now involves participants from all parts of the computer and telecommunication industries. Significant participation from user communities has yet to emerge, except in very specialised areas. For example, a financial services community has formed around electronic funds transfer, and a manufacturing and distribution industries community has formed around EDI. Of the user communities that do participate widely, many are public sector agencies, and defence agencies are especially prominent.

Institutional framework for ICT Standardisation
ICT standardisation is now very systemic in nature, even though individual standards initiatives are often pursued in relatively discrete technical communities. For example, standards developed for radio telephony systems can have direct implications for fixed public networking systems, local area networks, and the compatibility of electronic components, along with direct and indirect implications for a wide spectrum of individual application areas.

Furthermore, in terms of volumes of traffic carried, the public telecommunication network is now primarily a data carrier. This has brought the computer industry directly into telecommunication standards in a major way - indeed, if we look at developments like Internet telephony, it is clear that soon it will be virtually impossible to distinguish between voice and data environments. Many huge telecommunication multinationals - like Alcatel, Siemens, Fujitsu, Hitachi and Motorola - are significant developers of computer as well as telecommunication products.

Although the technical boundaries between telecommunication and computing have become blurred, the SDO system retains an institutional bifurcation, stemming mostly from the fact that telecommunication is a regulated ICT industry with responsibilities for the provision of public network facilities. The profound changes have been in the relative levels of influence exerted by these institutions within the system as a whole, and in the ways they work with each other and with other emerging types of standards organisations.

Standards for telecommunication

On the telecommunication side, the basic institutional topography is fairly straightforward. The hub of telecommunication standardisation activities remains the ITU Standardisation Sector (ITU-T), now supplemented by three significant regional telecommunication standard bodies - ANSI 'T1' in the US, ETSI in Europe, and TTC in Japan. The ITU Radiocommunication Sector (ITU-R) makes technical and scientific input into ITU-T work in areas relating to wireless and satellite communication, but does not set telecommunication standards as such. That said, ITU-R retains control by international treaty over radio spectrum allocation and satellite orbit allocation. Multidisciplinary work is co-ordinated in key areas by Intersector Co-ordination Groups, of which at present there are two - ICG IMT-2000 dealing with third generation mobile telephony and an ICG for satellite-related matters.

As an International Organisation established by treaty within the UN system, national positions and national votes remain the basis of decision-making in the ITU. Until the early 1990s, this was mirrored in the procedures of ITU technical committees (the old CCITT and CCIR), and the entire standards-making process was essentially undertaken by the national monopoly telecommunication operators. The present ITU-T structure allows for direct membership and participation by virtually any stakeholder in any of six categories:

- Recognsied Operating Agencies
- Scientific or Industrial Organisations
- Other entities dealing with telecommunication matters
- Regional and other international organisations
- Regional telecommunications organisations
- Intergovernmental organisations operating satellite systems

Although national voting on standards is still part of the ITU regime, the ITU-T process now has a number of mechanisms that expedite the passage of standards initiatives through the system. In effect, ITU-T is an industry association that operates within an international organisation.

Of the three regional bodies, T1 and ETSI are the most significant in terms of overall technical influence in the to global standards-making system, and certainly the most important in the context of the present study. However, ETSI is the only SDO in this sector with official ties to a regional telecommunication governance structure. All other regional dynamics are informal, determined largely by historical factors or by the strategic regional positioning of dominant firms.

T1 is actually the ANSI accredited US domestic telecommunication standards committee, but it has assumed regional status owing to the historically harmonised US and Canadian networks (together accounting for most of the telecommunication traffic in the hemisphere) and the business links being developed aggressively by US and Canadian telecommunication firms in Latin America. However, T1 responsibilities cover primarily networking technologies. Standards covering the physical components of a telecommunication system - terminals, networking equipment, transmission media (i.e. cable and optical fibre), radio equipment, and wireless telephony equipment - are developed by ANSI committees convened by the Telecommunications Industry Association. TIA is affiliated with ITU-T and ITU-R, but also with IEC as its remit is related more to electrical engineering than to networking as such. Under ANSI rules, any stakeholder can participate fully in T1. This includes foreign firms, although in practice this is usually co-ordinated by US-based subsidiaries.

All of the major European telecommunication equipment manufacturers are full members of T1 and TIA as well as of ETSI. Most of the largest European telecommunication equipment and systems firms - particularly Alcatel, Ericsson, Siemens and Philips - are active in US markets to some extent. This means that they often maintain dual allegiances, developing products to both US and European standards. Nevertheless, European firms are among the largest and most important vendors of telecommunication technology, and standards of European origin compete head-to-head on world markets with US standards.

Standards-making in the computer sector

A similar hub and spoke system could be said to exist in the computer sector, with IEC/ISO JTC1 at the centre. As in the ITU, disciplinary boundaries are preserved in JTC1. An institutional split between standards relating to electronic components, and standards related to systems - the former are the exclusive domain of IEC committees. This reflects the persistence of separate institutional regimes for electrical and non-electrical subject areas in national and regional SDO systems. Although informal contact between the ITU and ISO/IEC has been extensive at various times in some subject areas, there has been remarkably little formal contact until recently. Closer contact has been facilitated in recent years by initiatives to co-ordinate work items and engage in parallel voting schemes.

However, this system is now vastly more diverse and complex than its telecommunication counterpart, and the focus of JTC1 has changed in the past decade from comprehensive standards frameworks like OSI to functional standardisation for specific application areas.

Furthermore, the institutional and to some extent technological balance at the regional level is less symmetrical in the computer sector than in telecommunication. The structural links between significant national and regional initiatives and those in JTC1 can be much less direct than between ETSI or T1 and ITU-T.

In the US, standards for computer systems come from several ANSI accredited committees, the most important convened by IEEE, and NCITS (the old ANSI X3). Other important committees are convened by EIA (for electrical and electronic components), SMPTE (for film and television systems), and by ANSI X.12 (with oversight over US EDI standards). The entire structure is co-ordinated under the ANSI Information Infrastructure Standards Panel (IISP).Virtually all of the major US ICT firms (on both the computer and telecommunication sides) are represented strongly in the IISP system. As these comprise the bulk of global expertise in systems design and integration, they exert a powerful influence internationally. This influence is reinforced in that all of the major European and Asian ICT firms participate in this structure also. The strongest European presence is maintained by the large European electronics and telecommunication multinationals.

In terms of scope and impact, there is no real counterpart in Europe to the US-based system. Before it was disbanded last year, the European Workshop on Open Systems (EWOS) provided at least an comparable institutional counterpart to US activity. However, neither EWOS nor the new Information Society Standardisation System (ISSS) - the first initiative in the CEN Workshop Agreement (CWA) programme - could ever be said to be comparable in scope and depth to the US-based system.

Moreover, both in philosophy and practice, ISSS facilitates closer contact between European firms and the US system. ISSS operates in conjunction with the European ICT Standards Board (ICTSB), a body led by CEN, CENELEC and ETSI with the objective of creating closer liaisons between European SDOs and all other developers of ICT standards, whether SDOs or not, and to manage specific collaborative projects where required. ISSS was founded on similar pragmatic principles at the end of a long learning curve during which many problems for the European computer systems industry of trying to co-ordinate their standards activities through frameworks like EWOS were encountered. Significantly, some of the founding 'partners' of ISSS were US-based consortia like the Open Group. Other liaisons are being forged with OMG and with ANSI/IISP.

In complete contrast to telecommunication, virtually all of the key international standards for computer systems are of US commercial origin. Some are codified in ANSI and/or JTC1 standards, but many others are either PAS (like many of the IEEE standards), or outright proprietary systems (like Microsoft Windows or Novel Netware).

The consortia challenge

The most significant challenge for SDOs in the ICT industries has been the spectacular rise in the number of independent industry consortia. These are independent, fee supported industry groupings that develop technical specifications usually in narrowly defined areas. Most were formed around subject areas that lay somewhere between the ITU and JTC1 orbits - the Internet, audio-visual, multimedia and so forth - or to co-ordinate (particularly) telecommunication sector interests in coping with the emerging new markets for electronic services. Most consortia use committee working methods similar to SDOs, and the principal contributors to consortia are largely the same firms who participate in SDO committees. Almost all consortia make their outputs available as PAS.

In the last ten years, the number of consortia has increased from just a handful to perhaps as many as one hundred. Figure 7-2 gives a selection of consortia that have come to exert significant influence on the international standards system as a whole.

Figure 7-2 Select group of major consortia

Name	Type
ADSL-F Asymmetric Digital Subscriber Line Forum	US-based international consortium
ATM-F Asynchronous Transfer Mode Forum	US-based international consortium
DAVIC Digital Audio Visual Council	Swiss-based international consortium
DVB Digital Video Broadcasting Project	European consortium (based in the European Broadcasting Union)
ECMA European Computer Manufacturers Association	European consortium
EMA Electronic Messaging Association	US-based international consortium
EURESCOM European Institute for Research and Strategic Studies in Telecommunications	European consortium
Frame Relay Forum	US-based international consortium
IMA Interactive Multimedia Association	US-based international consortium
IMTC International Multimedia Teleconferencing Consortium	US-based international consortium
MMCF Multimedia Communications Forum	US-based international consortium
MSAF Multimedia Services Affiliate Forum	International consortium led by AT&T
NMF Network Management Forum	US-based international consortium
OMG Object Management Group	US-based international consortium
The Open Group	US-based international consortium
TINA-C Telecommunications Information Networking Forum	US-based international consortium
UMTS Forum Universal Mobile Telecommunications System Forum	European-based International consortium
VESA Video Electronics Standards Association	US-based international consortium
W3C World Wide Web Consortium	Consortium - co-located in the US and Europe
XIWT Cross Industry Working Team	US consortium

The vast majority of consortia are US-based. The international significance of European consortia is in most cases minimal. The pattern is for European and Asian multinationals to participate in US consortia. Indeed many of the key consortia count European firms among their founding members.

The Commission has taken several actions with respect to the emerging consortia system, most notably through the Information Society Initiatives in support of Standardisation (ISIS) programme in DG III. ISIS has co-funded two consortia initiatives in the area of teleworking:

Basic Interoperability for Terminals for Telematic Services (BINTERMS), and Standards for Home Working (SHOW). These consortia are open to international participation, and formal liaison has been established between BINTERMS and ETSI.

As noted above, one of the main purposes of the ISSS is to co-ordinate consortia and SDO work. Similar initiatives exist throughout the SDO system. ITU-R has established formal recognition agreements with selected consortia, as have T1 and ETSI. JTC1 is in the process of opening up similar arrangements. IEC has been especially proactive in this direction, to the extent of distributing selected consortia products that are agreed by its members to contribute to the overall process of establishing international standards.

Profile - 12 - Telecommunication Systems

Key initiative (a)- Fixed digital telecommunication network systems

The basic characteristic of a fixed digital telecommunication network system is that digital messages are generated, controlled and transported using physical media - wires, cables, optical fibres and semiconductor-based devices. In practice, most fixed public network telecommunication infrastructures are made up in varying degrees of both wired and wireless elements. The latter are comprised primarily of microwave and satellite 'trunk' networks. The distinguishing feature of the fixed network is that it is oriented primarily to providing services to devices and terminals in fixed locations. Some of these devices can in turn provide mobile services.

Moreover, in a digital environment both environments are closely related - an advance in the mobile network normally requires a corresponding investment in the fixed network and vice versa. Thus, for some time, one of the key standardisation issues in Europe has been the integration of the ISDN environment (originally conceived as a service environment for the fixed network) and GSM. Likewise, GSM/ISDN integration is closely connected to such initiative as the Intelligent Network, a distributed systems concept for the delivery of value-added services.

Fixed network applications can exist in both public and private network configurations. Standards for network functions are usually developed in the telecommunication SDOs but standards for components and media can be developed in other SDOs. For example, European standards covering wiring and cabling, optical media, electrical power supply, safety, and electromagnetic compatibility are determined in the ITU-R/IEC/CENELEC orbit, not in the ITU-T/ETSI orbit.

Standards documents for telecommunication networks (fixed and mobile) tend to appear in two main forms. The first is the officially promulgated standard which normally requires a substantial amount of time to clear all of the technical and administrative hurdles. The second is the Technical Report which can appear much more quickly than a standard, and undergo rapid and frequent revision. Although Technical Reports have no status as standards, they are in many cases the most accurate representations of current practice, and they can in some cases function as standards.

The core technology groups associated with fixed digital networks are:

- **Transmission technologies** - comprising the both the physical media (wires, cables and fibres) and the technologies that define various methods of transmitting digital information over these media.
- **Switching technologies** - the computer-controlled devices that establish the connections, channels and routes for the exchange of digital messages.
- **Network management technologies** - the computer-based facilities that define discrete service elements and manage the delivery of basic and value-added services to users.

ITU-T, T1 and ETSI all develop standards that apply throughout the fixed and mobile networks. There is much cross-referencing of key standards, and a major part of both T1 and ETSI work is to transpose ITU-T standards into their respective regional application contexts. The ITU-T work programme covers every general area in both fixed and mobile telecommunication. Table 7-5 shows the various technical domains identified by the ITU in which standardisation could occur, and the various product and service areas to which standards could apply in each of these domains.

Table 7-5 Standardisation domains and areas

Standardisation Domains	Standardisation Areas
Generic	Generic
Terminology	Cables/network component
Terminals equipment adaptor	PSTN
Interfaces/protocols	Leased lines
Numbering	ISDN
Routing	Signalling networks
Signalling	IN (Intelligent Network)
Interworking	B-ISDN/ATM
Synchronization	Data networks
Switching	TMN (Telecommunication Network Management)
Network capabilities	Universal Personal Telecommunications
Tariff/charging/accounting	PDH (plesiosynchronous digital hierarchy)
NP/QOS	SDH (synchronous digital hierarchy)
Traffic management	FTTH/FTTC/FTTL (fibre to the home, curb & loop)
Traffic engineering	Wireless
EMC/Protection/Safety	IMT-2000/Mobile
Signals processing	Satellite
Languages for telecommunications	Software/application
Human factors	Other
Service definition	Telephone service
Bearer services	Facsimile
Teleservices	Bureau services
Supplementary services	Telex
Audiovisual/Multimedia	INTEX
Service management	PSTN based services
Fault, Configuration, Accounting, Performance and Security Management (FCAPSM)	Data services
	Videotex
Testing	Directories
Architecture	Cards
Security	Message Handling Systems
Transmission system/equipment	Audio Visual Multi Media Systems
Infrastructure	Sound & TV transmission
System management	OSI
User suitability	
Others	

The T1 programme is divided into seven areas that cover collectively most of the ITU-T domains and subjects.

- Performance & Signal Processing, Interfaces,
- Power & Protection for Networks,
- Internetwork Operations,
- Administration, Maintenance, & Provisioning (IOAM&P),
- Wireless/Mobile Services and Systems, Services,
- Architectures & Signaling,
- Digital Hierarchy & Synchronization.

The ETSI programme also covers most of the same areas as ITU-T and T1, but it is becoming much more oriented to specific products. Currently, ETSI is focussing aggressively on eight principal product areas, six of which are to some extent unique to ETSI.

- GSM - currently the European standard for cellular telephony and a leading contender to become the global standard;
- UMTS (Universal Mobile Telecommunication System) - the European counterpart to the ITU-T IMT 2000, third generation mobile telecommunications system;
- UTRA (UMTS Terrestrial Radio Access) - the ETSI sponsored candidate for selection as the Radio TransmissionTechnology (RTT) for IMT 2000.
- DECT (Digital Enhanced Cordless Telecommunication) - the ETSI standard for digital cordless terminals, cordless LANs, and wireless local loop (WLL) applications.
- TETRA (Terrestrial Trunked Radio) - a facility by which radio channels can be pooled and allocated dynamically to users for both voice and data communication;
- ISDN - the European ISDN development and implementation programme;
- IN - the European Intelligent Network development and implementation programme;
- HIPERLAN - private and business radio-based local area networks.

Clearly, the ETSI product profile is based primarily on European technological strengths in radio-based technologies. The immediate goal for all of these products is for them to be established as the standards underlying basic network facilities within the EU. Especially in the case of wireless systems, the longer term goal is to promote ETSI products as global standards.

Although the range of subject areas in T1 and ETSI is similar, the ETSI catalogue is very much larger. T1 publishes about 300 standards and about 50 Technical Reports. ETSI publishes some 2800 standards and reports. Much of this difference is accounted for by the fact that ETSI was charged with the task of harmonising the telecommunication regimes of the EU Member States. As in the US and Canada a harmonised continental architecture had been defined for many years in the Bell Operating Recommendations, it was not necessary for T1 to become engaged in a similar exercise. T1 concentrates instead on standards to ensure that all US exchange carriers could connect to the public network in the post AT&T divestiture period.

The main issue to which most major standardisation initiatives are oriented is the provision and management of increased bandwidth in the fixed network to support advanced services. This has led to a major concentration on high speed transmission technologies like ATM, and on services management facilities like Intelligent Network applications and TMN. Supporting this focus is an investment commitment to high bandwidth media - fibre optic systems, high bandwidth microwave systems and copper enhancement systems like ADSL.

However, conventional public telecommunication operators are no longer the only source of new services - independently operated cable television and satellite infrastructures are emerging as significant competitors, as are some of the major Internet service providers who depend to a much greater extent on public network facilities. Each of these competing commercial environments is supported to some extent by discrete (sometimes proprietary) standards frameworks, but also by standards pertaining to the public network infrastructure. Both incumbents and new entrants seek to capture new services markets, and both support standards that will facilitate the roll-out of new infrastructure, but incumbents seek also to maximise revenues from the existing infrastructure, and to control the pace and conditions of network evolution.

Defence agency involvement in developing standards for fixed network applications varies from country to country. In the US, there are strong historical ties between the development of the civil and military fixed communication systems in that a high percentage of normal and secure military telecommunication is carried on circuits leased from public network operators. The AT&T architecture was developed with reference to both civil and military requirements. In many countries, military telecommunication is carried using a mixture of public network facilities and parallel secure military facilities. Modern fixed battlefield communication systems often employ 'hardened' versions of 'customer premises equipment' developed initially for use in civil applications. Thus, many of the standards developed by the ITU, ETSI, T1 and other civil agencies find their way into defence communication systems, although defence sector participation in these agencies is generally indirect.

Key Initiative (b) -Wireless telecommunication systems

The basic characteristic of a wireless telecommunication network system is that messages are transported via radio signals. In practice wireless networks have a substantial fixed element. As explained above, many fixed services depend on microwave and satellite systems. However, the most active area in terms of standardisation activity is mobile communication, which is defined as delivery of telecommunication services to terminals that have no fixed location. This can be accomplished by broadcast methods, individual channel allocation methods, or cellular radio methods.

Standardisation applies to two main aspects of radio-based systems:

1. ***Type approval standards*** specify the allowed performance parameters of particular pieces of radio equipment in relation to specific radio frequency band allocations. The objective is to prevent different kinds of radio equipment from interfering with each other.

2. ***Radio systems standards*** specify the basic configurations of radio-based systems (eg. cellular systems, trunked radio systems, broadcasting systems etc.) as well as specifying the kinds of uses permitted within each individual spectrum allocation, such that no interference occurs between public broadcasting, cellular radio, civil aviation communications, military communications and so forth.

Most standards in these categories are mandatory, indeed most are embodied as national or international technical regulations. The international framework for them is worked out mainly in the ITU-R, but the actual interpretation and application of the framework is left up to national authorities. In Europe, the European Radio Office aims to co-ordinate these matters at a regional level. In legal terms, however, the international framework is administered on the basis of national interests. National security and defence requirements have always been especially prominent factors in negotiating radio communication standards in these categories. In the global ITU-R allocation framework, much of the available spectrum is reserved for military use.

Other standards development is more discretionary within the mandatory framework set out in the technical regulations. For most public and mass application radio communication systems, several sets of standards exist. Most countries will apply one set of standards for each type of system, but multiple standards can be used simultaneously in some cases. In the US market, several competing analogue and digital cellular standards are used, sometime in the same or adjacent markets. In Europe, this situation still applies for analogue cellular technology but the digital environment has been harmonised through the GSM programme.

The basic rationale for all standards in this field is management and administration of the radio spectrum resource, but many of the rationales for radio systems standards are strictly commercial. As with the fixed network, the radio communications environment is converging. Basically, the three elements in this convergence are trunked radio, cellular radio, and satellite communication systems. All three are now being perceived in terms of *personal communication* concepts - delivery of any telecommunication service to any user, at any location, via any available technology.

The generic term for services of this kind is 'third generation mobile' (the first two generations being analogue and digital systems respectively). A third generation system is a fully integrated network environment for radio access to telecommunication services. This vision is expressed to various extents at national, regional and international levels. At the international level, ITU-T and ITU-R promote an extensive programme - UMT-2000 - aimed at providing fully integrated satellite and terrestrial radio access. At the European level, ETSI promotes UMTS, an approach aimed at providing world-wide roaming capabilities for all users of equipment based on the GSM family of standards. In the ITU, ETSI is supporting adoption of its own UTRA product as the basic transmission technology for IMT 2000. Radio communication equipment and systems standards in the US are developed mainly by EIA, and TIA, with contributions on the public network interface side by T1.

To this point, the US has not articulated a nationally co-ordinated radio communication strategy comparable to that in Europe. The terrestrial radio communication system in the US remains fragmented - different trunked and cellular radio standards are used in different markets. Although GSM is the most widely used digital cellular standard world-wide, it is a TDMA system and its future in US markets depends largely on the fate of competing US-developed CDMA systems. At present. US activity is concentrated around several competing proprietary systems providing specific service environments that might at some point become part of a globally integrated services environment. The most prominent projects (like Iridium) aim to use low earth orbit (LEO) satellite technology. Both CDMA and TDMA solutions could be used to provide the user interface to these systems, but the final choices are in most cases still open.

At the present time European, US and Asian firms alike are adopting very pragmatic attitudes to standards. US-based Motorola has been a major contributor to the GSM programme, and produces millions of terminals to that standard, but it also makes equipment to other various analogue and digital standards (like AMPS and D-AMPS respectively) that are still used widely in the US. This policy is followed by most major European firms as well, some of whom (like Ericsson and Nokia) have a considerable presence in the US market. Many see the immediate future in terms of multi-standard platforms that will adapt to the technology in use in any particular area.

Other significant areas in wireless telecommunications include wireless local loop applications (WLL), for which ETSI is promoting DECT in competition with North American WLL products from Nortel and Motorola among others. They also include integrated trunked radio networks for which ETSI is developing the TETRA facility, again in the expectation of competing for recognition as a major standard for dynamic allocation of voice and data communications in a wireless environment. In general terms, it is usually conceded that European wireless technology currently has a market edge over US technology, primarily because of the sustained co-ordination of the wireless programme in the EU over a period of years, but that the contest between US and European technology and standards is intensifying as US firms seek to diversify the technology base for digital wireless communications.

There are particularly strong historical links between military and civil technologies in the wireless communications area. Both of the leading contenders to become the global multiplexing standard for cellular telephony (TDMA and CDMA) are of military origin, as are all of the 'spread spectrum' technologies now being examined for use in various civil radio-based systems. Likewise, much of the technology that underlies satellite-based personal communication concepts grew out of the DoD's Strategic Defence Initiative (the 'star wars' programme).

Profile 13. Computer systems

Key Initiative (a) - Computer systems interconnection and interoperability

The basic perception of interconnection and interoperability in computing systems has changed completely in the last decade. The issues used to be perceived in terms of promoting a multi-vendor environment for mainframe-based LAN and WAN configurations in private network installations. As some of these would traverse the public telecommunication network and others would not, the result was a complex and often conflicting mix of standards initiatives and institutions that yielded relatively few workable standards.

The proliferation of the Internet during the 1990s demonstrated that all public and private networking environments could be interconnected easily using open architectural principles that were system and platform independent. Interoperability was less of a problem in a PC environment where a high level of harmonisation was achieved because of the limited choice of commercially available operating systems. The Internet has all but eliminated interest in broad international standardisation initiatives like OSI, and reoriented the focus of suppliers of proprietary networking technologies towards TCP/IP-based private networking solutions in 'intranet' or 'extranet' configurations aimed at specific user groups.

Development and maintenance of the TCP/IP standards family occurs in the IETF, a loosely organised group of Internet experts and enthusiasts that operates almost totally outside of the SDO system, according to very informal rules. Links to mainstream ICT producers are organised mainly through the consortia system, and in particular through W3C, a consortium formed to co-ordinate the various technical communities that have grown up around the WWW with the ICT industries as a whole such that the Web environment remains essentially a public resource. However, not only is TCP/IP old technology (dating from the 1970s), but it is being applied on a scale that was never envisaged by its original developers. Its robustness is often called into question and promised major upgrades to support high bandwidth services have yet to materialise.

In general, the standardisation emphasis with respect to interconnection and interoperability is now on the functional criteria - like data security, data formats, and data transmission protocols - that facilitate specific kinds of networked computer applications. Current JTC1 interconnection and interoperability initiatives tend to be aimed at specific applications environments - machine tools, libraries and archives, financial services, electronic commerce, electronic imaging, industrial automation systems, transport systems, multimedia equipment, and nuclear instrumentation among many others.

The standardisation task has changed decisively from one of getting computer devices to interconnect and interoperate as such, to tailoring computer communication solutions to specific tasks, or the needs of specific groups of users. ICT firms no longer gain strategic advantage by restricting the interconnection and interoperability of basic platforms. Rather, strategic advantage is gained by controlling aspects of the environment in which interoperability is provided - access interfaces, software tools, data exchange formats and so forth.

In practice, this situation allows much scope for the proliferation of proprietary networking solutions and closed user group applications. It has also generated new approaches to tool development that are independent of platforms and operating systems - like object oriented technologies and JAVA. Most of these are developed in proprietary settings and distributed in the market as PAS. Many PAS become *de facto* international standards very quickly - for example, the leading standard for providing interoperability between software applications is CORBA, developed by the OMG consortium. JTC1 has evolved from being at one point the primary international organisation defining the interconnection/interoperability agenda, to being but one of many contributors to the standards pool.

Much of the early activity in computer networking occurred in a defence context (the Internet began as an ARPA initiative), but currently most of the interoperability and interoperation capabilities of defence systems is being achieved in ways that are identical with civil practices, and that involve most of the same vendors of equipment and network solutions. The defence sector is now largely a customer for the same kinds of standards - both proprietary and non-proprietary - that are employed in civil systems, the characteristics of which are determined mostly by vendors.

Key Initiative (b) - Data security

Concerns about data security have been heightened in recent years through the rise of essentially insecure data networking environments such as the Internet. These concerns have brought together the security interests of the computer and telecommunication communities. In the analogue 'circuit switched' telecommunication environment, a measure of security was ensured by the exclusivity of the circuit allocation. In the 'packet switched' environment, the potential for security problems is perceived to have increased although the evidence for this is often ambiguous.

There are basically four aspects to data security in an electronic environment. The first aspect is not specific to data in electronic form, but concerns *general security principles* for data gathering, archiving and exchange. Standards of this type are tangentially relevant to electronic data security in that they outline the secure administrative regimes within which the above three types of electronic data security provisions are often applied. Most security experts stress that the effectiveness of individual security elements provided by electronic means is determined primarily by the overall security regime in which they are applied. In industry, these regimes tend to be specific to individual sectors and/or product areas, and are developed mostly by specialist committees in national SDOs.

The second aspect is the *physical security* of the media themselves - the 'hardening' of components in order to minimise loss of system functionalities due to physical damage or malfunction. Standards in this area relate mostly to the physical characteristics of data storage and transmission elements. There are also close ties with standards initiatives in the areas of electromagnetic compatibility (discussed below in a separate profile). Many military applications of data systems require special protection - i.e. 'battlefield hardening' - if they are to be deployed in field operations. Typically, these are specified by individual armed forces, although some STANAGS exist in this area. However, physical security is not only a military concern. In the US, for example, ASTM sets physical security standards for various kinds of data exchange applications in specific industrial contexts, for example in civil nuclear installations.

The third aspect is *data integrity* - ensuring the reliability of systems and data transfer protocols such that data is not lost or corrupted during transfer. This aspect can also include provisions against unauthorised alteration of data by otherwise authorised users. These aspects are referenced quite extensively in several ISO and IEEE standards that have achieved wide international acceptance - like the IEEE Secure Data Exchange (SDE) and Interoperable LAN/MAN security (SILS) protocols. US Government agencies have been particularly active in security areas, and have produced several MIL-STDs and FED-STDs.

The fourth aspect is *maintaining the security of electronically encoded information* such that it cannot be deciphered or altered by unauthorised parties. Basically, this aspect of data security involves *data encryption* and it is currently generating many of the most hotly contested issues in computer networking, in both commercial and military contexts. The individual and commercial use of strong cryptographic methods presents obvious problems for security and law enforcement agencies. Encryption standards set out basic systems requirements and specify cryptography algorithms. By definition, access to the algorithm as such does not include access to the individual cryptographic keys necessary to decode encrypted messages.

Governments have for many years been leaders in the data encryption field, although not all governments publish the standards they use. The US case is instructive of the kinds of issues that arise even if they are published. A number of US MIL-STDs and FED-STDs are available covering mainly encryption support requirements. Most of these are related to the NBS Data Encryption Standard (DES), developed by the National Bureau of Standards (now NIST) in the late 1970s, and still the basis of US Federal Government encrypted communications. The

Data Encryption Standard (DES) specifies the approved cryptographic algorithm for use by US Government agencies, including the DoD. Devices for implementing this standard were developed largely by IBM and although patents apply in some cases, IBM grants nonexclusive, royalty-free licenses to other manufacturers. The major problem in terms of technology transfer to the commercial arena is that cryptography is considered a 'strategic' technology by the US and thus subject to export controls.

In the face of increasing pressure by governments around the world to impose control regimes on the commercial exchange and use of encryption technology, secure proprietary data exchange environments are developing rapidly. Most of this development is sector or activity based - for example, the Secure Electronic Transaction (SET) environment for electronic payment as developed by Microsoft and several leading financial services firms. Co-ordination of these activities, if it occurs at all, is mostly at the level of private arrangements between firms and consortia.

Profile 14 - Software

Key Initiative (a) Software engineering and documentation

The basic objective of software engineering as a concept is to apply quantitative methodologies - i.e. basic engineering principles - to the development of software. This involves simultaneous activities in areas ranging from general risk and quality management, to quantitative methodologies for monitoring the scheduling and execution of software writing tasks, including defect detection and tracking. Much of the software engineering approach is related to the documentation of software development processes. Much of the incentive for the development of formal software engineering methods has arisen from concerns about software failures in critical situations. The defence, aerospace and nuclear industries in Europe and the US have been among the major instigators of this approach.

There are especially close links between software engineering and quality assurance initiatives, and many of the standardised documentation regimes reflect the quality assurance standards regime. NATO, the US DoD and the defence procurement agencies of several EU Member States issue military standards for the development and implementation of software that are basically guidelines for the application of ISO 9000. Other military standards relate to software configuration management, and test procedures.

For the most part, international standards activity centred in JTC1 Sub-committee 7 concerns the life-cycle management of software suites and the development of standardised tools and terminology. The IEEE has done considerable work on the development of glossaries and taxonomies of software development elements, and on implementation, validation and testing. In addition to these more generic standards initiatives, numerous specialised software engineering regimes are emerging in discrete sectors. ASME has developed software engineering standards for CAD and robotics applications, and, with ANS, for nuclear installations. There is considerable debate in commercial technology areas as to the extent to which software development can be controlled using formal methods. Heretofore, software writing has been considered to be more of an art than an engineering discipline. In standards terms, the debate concerns the extent to which standardised generic software engineering processes and tools can be effective or even desirable.

Key Initiative (b) - Programming Languages

Computer languages are the vehicles by which instructions can be formulated and conveyed to computer systems. The basic rationale for standardisation in this area is to ensure the portability of languages between users and systems. The first programming languages were mostly proprietary to individual computer firms and not transferable between systems. This regime broke down over many years as the need increased for users of computer systems to transfer programmes and associated data-sets between systems.

Many basic languages, like COBOL, FORTRAN, Pascal, C, APL, ADA, Lisp, and Prolog, are all specified in ISO/IEC JTC1 standards. However, many other languages operate only in environments defined by proprietary operating systems. This is most notably true in the PC environment - as for example with Visual Basic in the MS Windows operating environment. Other proprietary initiatives (like JAVA from SUN Microsystems) aim to establish programming environments that are independent of operating systems. This is indicative of the conflict between the two basic approaches to generating network externalities in software environments - namely, either to control the environment outright (the Microsoft approach), or to generate revenues from the development of tools and services in a non-proprietary environment.

Aside from codifying languages themselves, standards are needed also to document the terminology and procedures associated with programming languages. Like conventional languages, programming languages tend to change with use over time - to develop 'dialects'. If these changes are not monitored and collected in some standardised way, ambiguities will at some point invade the language to the extent that its use is in practice restricted to discrete groups of users. The IEEE has been particularly active in this respect, producing standard glossaries of programming languages.

Furthermore, as general approaches to programming change, adaptations to existing standardised languages are often sought. Thus, for example, the defence-oriented ADA language suite has been updated (in ISO/IEC 86521995) to provide 'object oriented' capabilities based on approaches like C++.

Most of the key standardisation initiatives in this field reside in JTC1. Most of the major sources of technical input into these initiatives are US-based, in particular the ANSI-accredited committees convened by the National Committee for Information Technology Standards (NCITS) and the IEEE. Although there have been direct and indirect military linkages in the development of several of the language subjects (notably ADA), the US DoD has only peripheral direct involvement in language standards as such. Most European activity in this field (in CEN and CENELEC) concerns the transposition of JTC1 standards for European application.

Profile 15 - Electronic Components

Key Initiative (a) - Electronic components reliability

Semiconductor-based components are now integrated into a wide range of industrial products and processes. As these components and sub-assemblies come from many manufacturers around the world, a key issue for OEMs and equipment users is determination of performance and reliability parameters. Standards in this area relate ultimately to physical characteristics (like heat sensitivity, shielding and mounting requirements), but one of the main concerns is to develop standardised tests for quality assessment, fault prediction and component life-cycle management. This involves a considerable statistical element, and many of the standards specify statistical tests. Related standards areas include electromagnetic compatibility, logistics systems, and all engineering areas employing numerically controlled processes.

Standards related to the above matters come from many sources. At the international level, IEC is the primary SDO. IEC TC 56 co-ordinates the general work programme on dependability, maintenance and reliability, which includes electronic components. In addition, ISO and ITU both produce standards for specific application areas. CENELEC acts in a similar vein to IEC at the European regional level. Active national SDOs include ANSI, BSI, JSA, UTE, and VDE. However, standards are produced also by a wide range of industry groups, and even by producer firms. Some of the major industry associations producing standards in this area are based in the US. These include EIA, especially JEDEC (Joint Electron Device Engineering Council, the EIA semiconductor group), IEEE, SAE, and IPC (Institute for Interconnecting and Packaging Electronic Circuits).

At national and international levels, there is a very close link between electronics testing programmes and quality assurance/certification programmes based in the ISO 9000 system. IEC has a Quality, Dependability and Statistics (QDS) steering committee, related to the IEC 60,300 series of standards which are complementary to the ISO 9000 Quality Assurance standards.

The electronic components area has long been a major concern for defence agencies and contractors. The first international system of quality and reliability testing was set up during the 1960s and 1970s largely in response to defence needs. The aim was mutual approval of electronic components and the elimination of costly redundant component approvals.

This system has evolved into the IEC Quality Assessment System for Electronic Components. IECQ co-ordinates an international system of national certification bodies. IECQ certification can be gained on the basis both of formally promulgated standards, and *de facto* or provisional standards. IECQ acceptance of interim and proprietary specifications is on the basis of submissions through an authorised agency in one of the IEC member countries.

The area of electronic components reliability is one of the few examples of an international standardisation and certification system that co-ordinates closely both military and commercial requirements. However, this system developed in the first instance because of the market power of defence agencies in the procurement of electronic components. This power has eroded steadily over the past 20 years while the range of components and suppliers has enlarged and diversified.

Key Initiative (b) - Optoelectronics

Optoelectronic devices emit or respond to radiation in the visible infrared or ultraviolet areas of the electromagnetic spectrum. Optical fibre and laser technologies are used extensively in communication systems ranging from public network applications to fibre-based LANs. Other applications include optical character recognition, bar-code reading devices, and scanning technologies, as well as optical data recording and storage devices. Fibre optics can be used also in sensor technologies for electric current and magnetic field sensing, and lasers are used in a range of radiometry electronic measurement applications.

The cost of developing optoelectronic systems tends to be very high, and the basic standardisation rationale is to lower manufacturing costs quickly in order to acquire network externalities for new systems and devices, many of which can find very widely based markets once basic formats are established. International standardisation initiatives centred in IEC relate mainly to the physical and performance characteristics of display and imaging devices, and refer to terminology, definitions, symbols, equipment characteristics and rating criteria, measurement and test methods, as well as to reliability, hazard and safety matters. ISO activities relate mainly to peripheral optical devices - optical memory cards and optical disk cartridges for example. The major telecommunication SDOs produce large catalogues of standards for fibre-optic transmission systems.

The prime difficulty in defining standards for optoelectronics is the huge commercial range and diversity of possible applications. Each new configuration of laser-based and fibre-based technologies is potentially a source of major competitive advantage. Many key standards - like those for CD-ROMs and Mini-Discs -are essentially proprietary - SDO standards apply mainly to data formats and structures that can be used with these media. Furthermore, the arenas in which standards are developed tend to be segregated according to sector - different and not always compatible standards for fibre optic data transmission systems, and optical storage devices are developed within both the telecommunication and computer networking sectors. Other sources of technical change, and new standardisation requirements, include the instrumentation industries, control and process technology developers, retailers, logistics suppliers, consumer electronics firms, suppliers of automotive and aerospace components and systems. Defence requirements have played a major role in the development of optoelectronics and there is a substantial catalogue of MILSPECs and STANAGs covering generic aspects and testing for optical sensing, storage and data transmission technologies.

Profile 16 - ICT Application Areas

Particularly close relationships exist between standardisation initiatives in the ICT application areas and those in most of the other **Key Defence Technology Areas** already profiled. Table 7-6 identifies specific areas of linkage where there is significant technological crossover potential between standards committees for ICT application areas and committees oriented primarily to other **Key Areas**. It indicates, for example, all of the selected ICT application areas can be applied directly to logistics processes, and most have substantial links to engineering areas.

Table 7-6 ICT Application Areas

Category	KEY AREA	avionics	CAD	ENS	GIS	multi-media
A. Processes	1. Quality	•	•		•	
	2. Logistics	•	•	•	•	•
B. General Engineering	3. Const. & Civil		•		•	•
	4. Electrical	•	•	•	•	•
	5. Mechanical	•	•			•
C. Systems platforms & Transport	6. Aerospace	•	•	•	•	•
	7. Ships & Marine		•	•	•	•
	8. Land vehicles		•	•	•	•
D. Materials & Commodities	9. Chem., metals etc.		•		•	
	10. Fuels					
	11. Textiles		•			
	12. Health & Safety		•			•
E. ICT	13. Electronic comps.	•	•	•	•	•
	14. Telecom		•	•	•	•
	15. IT systems	•	•	•	•	•
	16. Software	•	•	•	•	•

Most of the standards for individual ICT application areas are developed within the basic institutional structure as described above, and according to many of the same basic rationales. The sections that follow outline briefly some of the main features and issues pertaining to the application areas we have selected, in order to demonstrate the basis for the overall assessments of standardisation dynamics we have made using the Analytical Matrix.

Key Initiative (a) - Avionics systems

An electronic avionics system uses computer-based technology to operate and monitor the control systems of aircraft. Most modern avionics systems are electronically operated or assisted. The 'fly-by-wire' concept is the most advanced form of electronic avionics system. Avionics systems must be certified in accordance with prevailing regulations in the countries of aircraft manufacture and operation.

The standardisation environment in this field is very complex as it intersects many technological areas related to computer systems, software, and electronic components. Avionics systems intersect with sensor and video systems, operating systems, Application Program Interface requirements, signal interfaces, electromagnetic compatibility, data bus technologies, liquid crystal displays, flight deck equipment layouts (abbreviations, acronyms panels, controls, and displays), data network requirements and temperature/humidity control. Many systems are subject to specialised test methods.

Organisations involved in various aspects of developing or supporting avionics standardisation include SAE, ARIN, GAMA, RCTA, EUROCAE, and AECMA. At this point neither ISO nor IEC issue avionics-related standards as such, although many of the JTC1 subject areas are directly relevant to specific avionics components and systems. Military and civil avionics requirements frequently overlap. There is a large catalogue of ML-STDs and STANAGs for avionics systems, many relating to the reliability of electronic components and to software engineering. Quality control regimes of many descriptions are applied in the avionics area.

In general, the incentive is high to standardise basic interfaces, support systems (e.g. electrical systems) process technologies and operational routines. However, pilot training and aircraft operation regimes tend to be tied to specific avionics configurations. This gives these systems commercial value in the highly competitive international aviation marketplace. An emerging commercial strategy is to standardise cockpit and avionics configurations such that the same basic configuration can be applied to several types of aircraft by the same manufacturer. This has been a highly successful strategy for the Airbus series, and it is being emulated by other aircraft manufacturers. This creates a high incentive to keep as much of the avionics system as possible tied up in proprietary specifications.

Key Initiative (b) - Computer-Aided Design (CAD)

Computer-aided design (CAD) systems began as relatively straightforward computer graphics packages for the generation of technical drawings. They are now highly sophisticated, frequently networked design-to-product systems that integrate graphical images with product specifications, standards and archival materials, as well as with procurement and administrative processes.

Modern CAD applications can be integrated with virtually all of the information management and and graphical presentation requirements that may arise over the life-cycle of a product or system. CAD development is on one level concerned with the migration of manual techniques for technical drawing and documentation to computer-aided environments. At a much more significant level it is closely tied in with other rapidly evolving computer-based activities like logistics support, electronic imaging, and product data identification. Conflicts have emerged on the CAD standards front concerning the integration of product identification and messaging systems which have tended heretofore to be industry and/or product specific.

Typically, CAD applications are not stand alone packages, but rather suites of software and hardware configured to meet the requirements of design, production and maintenance tasks in specific industrial sectors and/or individual companies. This creates a major problem for the development of CAD standards. Most standards for CAD applications are de facto and often proprietary - embedded in widely used commercial CAD products.

Standardisation at the SDO level is confined mostly to devising standard descriptions of the generic aspects of CAD techniques, establishing standard repositories of terminology and symbols, providing guidelines to facilitate the construction of CAD architectures, and standardising data exchange formats. Additional CAD standards relating to the physical characteristics and manufacture of electronic components is undertaken in IEC TC 93 (automatic assembly of components) and TC 100 (multimedia systems). The multimedia connection brings CAD into a very contentious standards arena (more below) in which many of the various stakeholder positions with respect to the multimedia environment have yet to be defined.

Other standards are available that relate to the use of CAD techniques for specific engineering tasks. For example, there is an ASME standard specifically oriented to fluid machinery design, and ASTM has devised a standard practice for computer-aided examination of castings.

At this point, design companies who work under contract typically adopt the standards used by individual clients, or otherwise undertake to provide continuous client access to whichever configuration of standards was used for a particular job by a particular design company. In the latter case, the CAD suite is often transferred to the client along with the completed design work as a condition of contract. This often means that design firms who are highly innovative in designing CAD suites, are presented with few opportunities to commercialise these suites as such. Thus, incentive is high among many users to reduce development costs through standardisation. The problem is that the range of CAD applications is highly diverse and often sector specific, leading to co-ordination problems in the development of standards except at very generic levels or very task-specific levels.

Key Initiative (c) - Geographical Information Systems (GIS)

A Geographical Information System uses computers to assemble, store, process and display information that is referenced to specific geographical locations. GIS principles and techniques are applied in hydrographic (marine) applications as well. All data in a GIS is identified according to geographical co-ordinates. This involves a complex set of data operations oriented to matching information from different sources in relational data bases - involving data capture, integration , projection and registration. GIS presents formidable data structure, modelling and management challenges. There are additional technological linkages to remote sensing, satellite systems, optics and photography, cartography and so forth. The main commercial uses for GIS are in the areas of natural resources exploration and management, and land, sea and air navigation.

At the present time, most GIS standardisation activity is concentrating on the data management methods, tools and services for acquiring, processing, analysing, accessing, presenting and transferring geographical/hydrographical data between different GIS platforms. The amount of international standardisation activity in this area is at present very limited. ISO TC 211 (Geographic Information/Geomatics) has convened a handful of working groups, but as yet there are no international standards. At the European level, CEN has issued about a half dozen standards for data description and management, including a reference model. Several national SDOs (notably those of Australia, New Zealand and the UK) have been active in the GIS area, spurred on by the needs of natural resource development interests in those countries, and to a lesser extent by military considerations. Likewise, US SDOs like ASTM and ASME have developed standards for very specific applications in areas like wind energy, ground water site identification and soil sampling. Reflecting the obvious military interest in GIS, the main source for GIS standards at the moment is NATO, which has published several STANAGS already and is developing more.

GIS is at the beginning of what will likely become an important standardisation initiative. Although GIS capabilities have been available for many years, advances in microelectronics within the GIS field itself and for GIS applications are developing rapidly. As a result, commercial opportunities are expanding for primary and value-added products based on GIS data.

Key Initiative (d) - Electronic Navigation Systems (ENS)

Electronic Navigation Systems are defined for present purposes as the family of electronic equipment and systems that provides navigation capabilities based on electronic access to GIS data in either stored or real-time modes. ENS includes satellite navigation devices and inertial navigation systems, as well as electronic cartography systems. Navigation systems of all kinds fall under various aspects of IMO and IHO international navigation regulations.

Standards are only beginning to accumulate in this field. Organisations developing or contributing to standards in this area include ICAO at the international level, EUROCAE at the EU level, and RCTA and ARIN in the US. IEC is active at the level of radio interfaces for global positioning systems, and ITU-R is involved owing to responsibilities for satellite-based communication systems. At present, ISO committees concentrate mainly on mechanical navigation equipment and systems. Defence agencies have had extensive involvement in ENS and several MIL-STDs and STANAGs have been promulgated. For obvious reasons, the particular characteristics of military navigation systems are often classified. MIL-STDs refer mainly to systems testing.

Data transfer standards for GIS and ENS are available from various sources, but display - particularly real time display - is as yet subject to no agreed standards. Conflicts are emerging between interests of national and international navigation and mapping agencies and commercial companies as to who wish to gain revenues from the sale of ENS technology, information and services.

Key Initiative (e) - Multimedia

Multimedia is a concept for the delivery of electronic services that requires the close integration of public and private networking technologies with various consumer electronics technologies, including PCs and broadcast media. Essentially, the concept is to provide an integrated audio-visual services capability in a digital environment. At this point, there are two arenas in which multimedia configurations are being developed. One is oriented to the industrial use of multimedia in design and production capacities - which extends from simple videoconferencing to the complex holographic design environments associated with 'virtual reality'. The other arena is oriented to consumer products and services. Included are most of the technologies available in commercial applications, but missing at this point are clearly defined consumer product characteristics and business models. Most consumer applications are little more than PC-based audio-visual platforms with Internet capability.

Multimedia applications are becoming crucial elements in a wide variety of military applications, and much of the basic research into multimedia systems has been funded by defence agencies, particularly the US DoD. These systems are used in heads-up displays, advanced terrain simulation technologies and navigation systems, and generally they are becoming essential facilities for providing modern military C3I capabilities.

Multimedia intersects virtually every other area of standardisation for computing, telecommunication and consumer electronics. Thus, there are few 'multimedia standards' as such but a huge number of standards from many sources that must be co-ordinated in the design and provision of these services. It is in this are that the emerging *insurgent* model of standards development is most prominent.

Most of the industry consortia in the ICT sector are in some way involved in multimedia. Especially important ones are ATM-F, DAVIC, DVB, IMA, MMCF, MSAF, OMG, VESA, W3C and XIWT. All but DVB are primarily oriented to emerging US market requirements. Furthermore, of the important SDOs involved in multimedia, most are based in the US. Most of the standards requirements identified in the ANSI IISP structure - whose participants include major organisations like IEEE, SMPTE, and EIA - deal in some way with multimedia requirements. US defence research agencies are amongst the most significant user groups to be represented in the IISP.

ISO/IEC JTC1 is likewise involved and there have been some notable standards successes at the international level, especially concerning video compression and imaging technologies that are key to the further development of multimedia products and services. The important committees in these areas are the Motion Picture Experts Group (MPEG) and the Joint Photographic Experts Group (JPEG). A large related IEC committee (TC 100 - multimedia systems) is working on standards for the physical electrical and electronic systems used in multimedia. The MPEG initiative has been successful enough to have spawned a consortia. The DAVIC agenda, although now encompassing most of the technological environment for multimedia, was founded originally by members of MPEG to develop commercial applications of video compression technology.

There is activity also in the telecommunication sector, both at the SDO level and in consortia linked to telecommunication technologies and vendors. IMTF is developing applications based on ITU-T teleconferencing standards, while consortia like TINA-C and NMF (led mainly by telecommunication firms) are working on service management problems in anticipation of requirements to support multimedia services over the public network. These initiatives are mirrored in varying degrees in the major regional telecommunication SDOs - ETSI, T1 and TTC. The ITU-T and JTC1 efforts are co-ordinated to a degree in the development of the Multimedia-Hypermedia Expert Group (MHEG) standard for object oriented document representation.

Multimedia illustrates the three main difficulties in ICT standardisation better than any of the other ICT core or application areas. First, different aspects of the underlying technologies are advancing (or not) at different rates of speed. Second, the quantity and diversity of standards and standards sources is large and getting larger, but there is relatively little co-ordination or formal oversight of these activities. Third, there is no coherent vision as to where the multimedia concept as a whole is going in commercial terms. PC and telecommunication vendors have one set of goals, ISPs, software developers, publishers and broadcasters have others - and already major conflicts have emerged between the computing, consumer electronics, telecommunication and photographic industry agendas. At this point, it appears that the main co-ordinating forces for standards are individual consortia tied to specific sector interests or application types, mostly in industrial rather than consumer electronics areas.

7.4 Policy options analysis

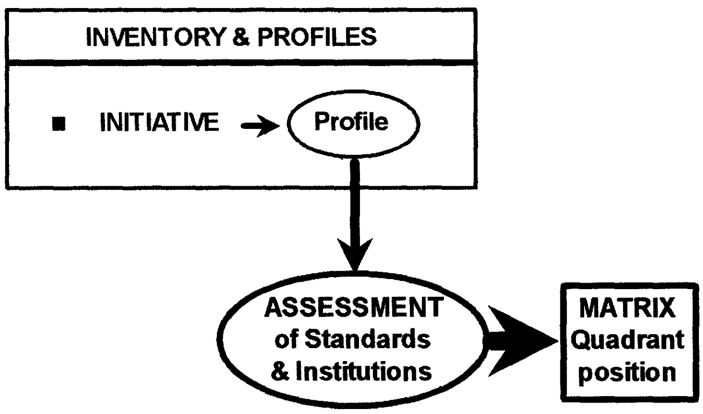
Our objective in this Chapter is to identify the kinds of **policy options** that appear most likely to enable the Commission

- to support the standardisation activities of European defence industries;
- to clarify and enhance the roles of European regional standards bodies; and
- to identify the types of co-operation that may be necessary with other standardisation bodies, especially NATO.

To this end, the information in the above ***profiles*** of standards initiatives was assessed using the **Analytical Matrix for Standardisation Strategies**. The information gathered for each of the ***profiles*** was analysed using the **Matrix** criteria. This value-added assessment was used to make quadrant assignations on the Matrix that summarise the dominant general characteristics of the initiative and of standardisation dynamics related to the **Key Defence Technology Area** illustrated by the initiative.

Although we recognise fully that the characteristics of standards initiatives can change over time, this quadrant rating system provides a valuable current 'snapshot' of the general state of standardisation activities that are likely to be relevant in dual use contexts. In this way, the Matrix tool summarises an enormously complex and dynamic range of standardisation activities, such that types of initiatives and institutions can be compared with types of civil and defence standardisation requirements, and with policy options.

The various kinds of policy options that are available to the Commission were then evaluated with reference to the results of the Matrix assessments. In each case, the Matrix assessment of the dominant institutional characteristics of the key initiatives was used to match civil and defence standards objectives with the most appropriate types of policy actions.



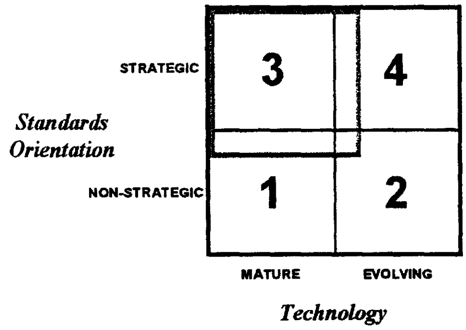
7.4.1 Matrix Analysis

The Matrix analysis that follows is organised according to the five general categories within which the Key Defence Technology Areas were identified: Process Management, General Engineering, Systems Platforms and Transport, Materials and Commodities, and Information and Communication Technologies.

Standards for Process Management

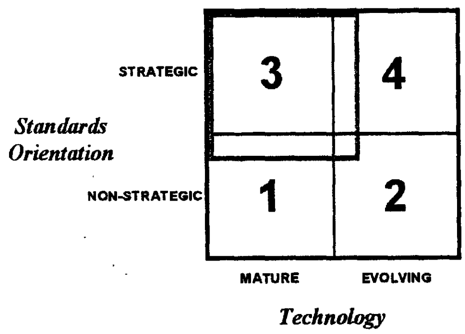
As shown in Figure 7-3, most standards related to Quality Assessment and 'best practice' in industrial processes relate to ***quadrant 3*** criteria. QA can be applied to virtually any process or product, but the rationales for seeking QA certification and setting up the mechanisms to achieve it are by nature clearer for more mature products and services in well defined market structures. The basic principles underlying most QA schemes are also quite mature. Nevertheless, a significant strategic dimension is present also: QA certification has by now spawned a competitive commercial environment for related products and services, and QA certification is used by firms *inter alia* as a tool to enhance competitiveness.

Figure 7-3 Matrix analysis - Quality



As shown in Figure 7-4, standards initiatives for logistics and support are similar to QA initiatives in that they define basic processes and procedures rather than necessarily the specific technological means to achieve them. As such, the basic principles and architectures of logistics and support schemes like CALS and ILS have remained realtively stable and can be considered mature. The evolution occurs mainly in the information technologies that are used to operationalise these schemes. Generally speaking, the schemes incorporate ICT standards from various sources, rather than define them as such. Nevertheless, the dynamics are centred in ***quadrant 3*** because the basic rationale behind logistics and support initiatives is the strategic control of supply chains in order to reduce life-cycle costs.

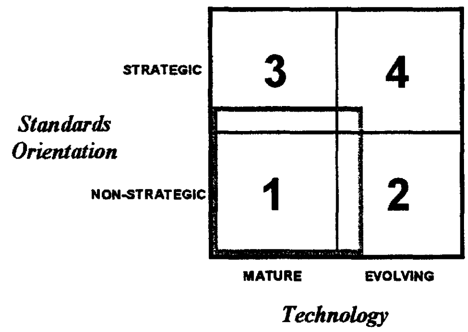
Figure 7-4 Matrix Analysis - Logistics and Support



General Engineering

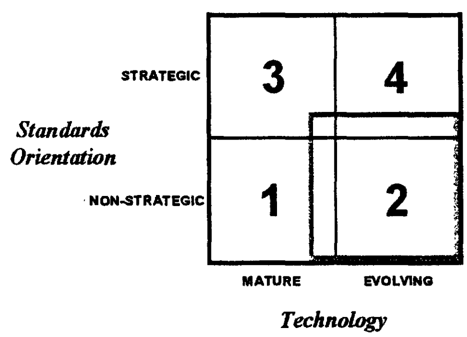
As shown in Figure 7-5, the construction and civil engineering sector is characterised by a relatively slow rate of technical change and a very high incentive to standardise basic structural elements and materials. Strategic commercial advantages are not generally linked to standards. Although many standards are specific to individual countries and/or geographic regions, provided that the standards are public and accessible, conversion to designing and constructing using these standards is generally accepted in the industry as normal business costs. ***Quadrant 1*** criteria describe most of the standardisation dynamics of this sector.

Figure 7-5 Matrix Analysis - Construction and Civil Engineering



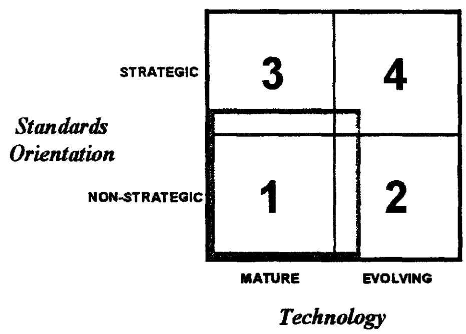
As shown in Figure 7-6, most of the standards characteristics of the electrical engineering sector conform to ***quadrant 2*** criteria. EMC is indicative of these dynamics in that it is the standards problem that is most widely shared by both generators and distributors of electricity, producers of electrical and electronic products, and industrial users of these systems and products. As the technologies and applications affected by EMC considerations are growing in number and complexity, EMC is a technologically dynamic field. However, aside from certain sector-based biases as described above concerning approaches to some EMC issues, generally there is minimal strategic positioning because EMC problems affect every stakeholder. The more negative the general effects of these problems, the higher is the incentive to develop standardised solutions. Trade barriers related to EMC, where they exist, are generally the product of idiosyncratic certification regimes, rather than of standards as such.

Figure 7-6 Matrix analysis - Electrical Engineering



Most of the standardisation characteristics of the mechanical engineering sector can be described with ***quadrant 1*** criteria (Figure 7-7). The example of fasteners illustrates that although mechanical technologies are subject to technical change (e.g. in materials and design), their basic function does not alter. Accordingly, the incentives to standardise remain very basic - variety reduction, better design, production and maintenance co-ordination and so forth. Many of the major issues for standardisation in mechanical engineering tend to stem from major generational shifts in technology (as with the shift from iron to steel, or from screw thread to twist-grip methods), and the resulting problems of having to retain standards for otherwise obsolescent mechanical systems and devices. The example of the US Fasteners Quality Act debacle illustrates that little competitive advantage is seen by industry to be gained from idiosyncratic national certification regimes - that the compliance costs are increased for domestic as well as foreign competitors.

Figure 7-7 Matrix Analysis - Mechanical Engineering



Systems Platforms and Transport

The standardisation dynamics of the aerospace sector are shown in Figure 7-8, Figure 7-9 and Figure 7-10. In this case, our rather conservative assessments may seem surprising as aerospace is generally considered to be a technologically dynamic field. Certainly, this is true for the 'systems' elements like avionics (see below), guidance and monitoring technologies, but less true for the physical elements that comprise the basic aerospace platforms.

In the area of metal alloys, aerospace requirements are highly exacting, but also conservative. Whether at firm or industry-wide levels, standards tend to be based on the results of long experience with particular alloys, typically involving rigorous tests in design and operational contexts over many years. Likewise for space vehicles, the basic physical characteristics of these platforms tend to change slowly. The standardisation effort is aimed less at accommodating major technical changes, and more at increasing the reliability and versatility of space vehicles. Although the launch market is competitive (at least for civil payloads) and the standards regimes of different national or regional programmes are not always well aligned, the incentive for greater harmonisation is high. Payload customers now actively seek to avoid lock-in, and, moreover, the US, Russian and EU space programmes are engaged in large co-operative initiatives (like the space station). Our overall conclusion was that the aerospace standardisation dynamics were best described by ***quadrant 1*** criteria, in some cases moving toward ***quadrant 2*** criteria.

Figure 7-8 Matrix analysis - Metal alloys

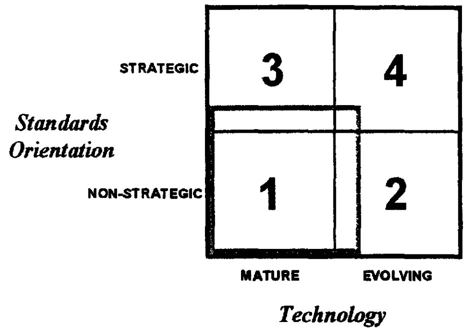


Figure 7-9 Matrix analysis - Space vehicles

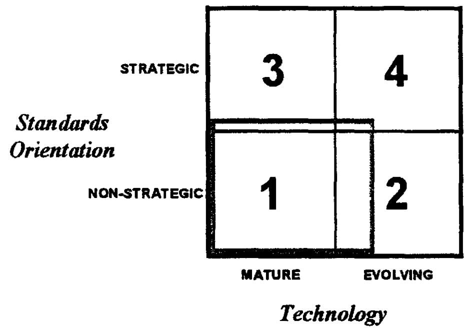
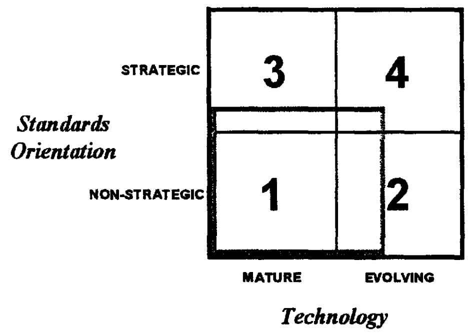
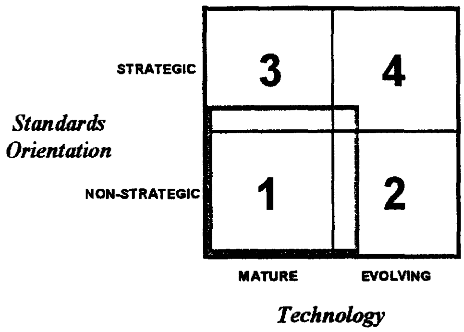


Figure 7-10 Matrix analysis - General assessment of Aerospace



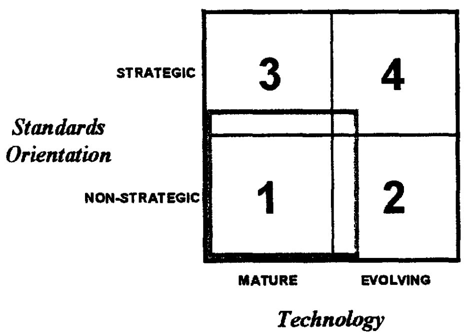
Likewise, as illustrated in Figure 7-11, the basic dynamics of standardisation in the ships and marine craft sector are described by ***quadrant 1*** criteria. Barring catastrophe, ships and marine craft tend to have relatively long life-cycles. Technical change at the level of physical sea-going platforms is incremental or occurs in generational shifts. In the civil field, the entire standardisation environment for structural elements tends to be driven by national and international regulations, closely tied in with the requirements for underwriting ships and cargoes. The economics governing many modern shipyards creates high incentives to harmonise the basic structural standards for both military and civil vessels.

Figure 7-11 Matrix analysis - Ships and Marine Craft



As with the other systems platform and transport areas, Figure 7-12 shows that most of the standardisation dynamics for land vehicles are described also by ***quadrant 1*** criteria. There is, of course, much technical change in the land vehicle industries, but most advanced vehicle features are governed by public standards only at very generic levels. Even where 'bolt-on' capabilities might seem to make economic sense in terms of widening the base of sub-contractors - as with special braking systems like ABS, for example - few components are directly transferable between vehicles of different manufacturers, each of whom may specify the physical configuration and performance parameters of the components differently. These factors are closely tied into the present structure of the automotive sector, in which most aspects of the mechanical life-cycle of a vehicle are organised according to vehicle marques (more so in Europe than in the US). This has an obviously more severe downside for reducing the cost to taxpayers of maintaining hundreds of thousands of military vehicles. Higher degrees of interchangeability for basic mechanical systems would increase the range of suppliers and could reduce costs. Moreover, there may be tactical battlefield advantages as well. However, considering the high incidence of dual-use technology in all but the most specialised land vehicles, it would be impossible to sustain a highly generic regime on the military side while retaining a highly non-generic regime on the civil side.

Figure 7-12 Matrix analysis – Land Vehicles



Materials and Commodities

The standardisation dynamics of petro-chemical products are illustrated in Figure 7-13, Figure 7-14 and Figure 7-15. The vast majority of these products are highly generic and producers and users share in the benefits of being able to vend and consume petroleum products on the basis of standard specifications and classifications rather than on the basis of manufacturer. That said, most standards are minima, and scope remains in most cases for individual manufacturers to add proprietary, performance enhancing features without necessarily altering the basic utility of the product concerned or forcing it out of an existing standards regime.

Nevertheless, the standardisation dynamics are different for fuels than for lubricants and fluids. Because fuels are used in great quantities, engines tend to be designed around available fuels. Differences such as those between the performance requirements of military and civil aero-engines notwithstanding, there is a high incentive to keep the number of types of fuels available to a minimum for basic reasons like minimising storage and handling costs. Most of the standardisation dynamics of fuels are described by ***quadrant 1*** criteria. On the other hand, lubricants and fluids are used in much lower quantities and are more frequently developed to accommodate specific technical changes in the mechanical systems to which they are applied, or to improve the performance of existing systems. Advanced motor oils, for example, can be used in older as well as newer engines. Because of the generally greater propensity for technical change in lubricants and fluids, the standards dynamics are in most respects better described by ***quadrant 2*** criteria.

However, our general assessment of the dynamics of petro-chemical standardisation as a whole is that mostly ***quadrant 1*** criteria apply. Although technical evolution make take place at quite rapid rates in some instances, few fuels, lubricants or fluids are produced for application environments that are immature.

Figure 7-13 Matrix analysis – Lubricants and Fluids

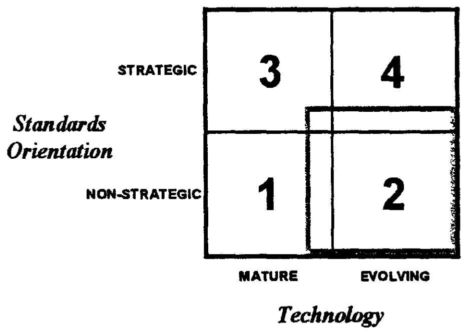


Figure 7-14 Matrix analysis - Aerospace fuels

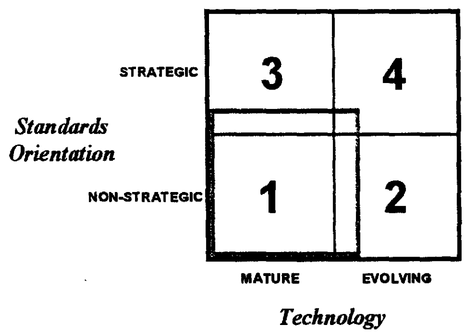
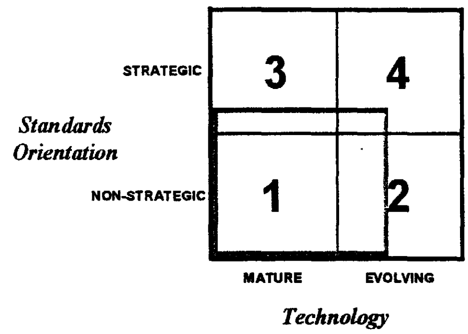
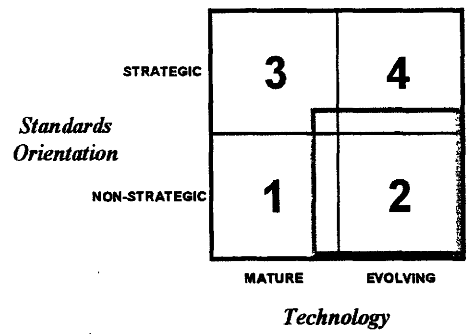


Figure 7-15 Matrix analysis - General assessment of Petro-chemical products



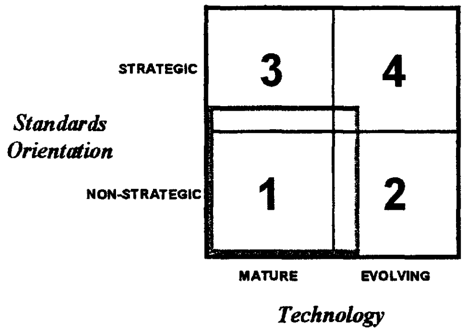
The standardisation dynamics for textiles are illustrated in Figure 7-16. As a whole, standards for textiles tend to refer to generic characteristics of raw materials and semi-manufactured elements (like yarns and fibres), production methods (i.e. mill technology), and fabric characteristics (strength, water and fire resistance etc.). For most types of use, producer and customer interpretation of these standards can be somewhat subjective - i.e. given reasonable similarity in product characteristics there is a substantial role for 'preference'. In the case of protective materials, by contrast, utility is the primary consideration owing both to the unique use profile of protective materials, and to the legal and regulatory environments to which most protective gear is subject. Technical change can be rapid in protective textiles, linked often to the adoption and/or special engineering of advanced materials in textile applications. Because of the high incentive to use standards in an information role (i.e. to specify clearly the performance parameters in a public standard designed to be communicated directly to users) the incentive to engage in strategic standardisation behaviour is tempered. Exceptions can occur where owners of proprietary materials (water-proof materials are a good example) establish supplementary 'benchmark' standards that can be achieved only by products made from their proprietary materials. In general, however, the textile area is well described by ***quadrant 2*** criteria. For most protective textiles that will be deployed in health & safety-critical contexts, conformance to standards recognised easily by most prospective users offers commercial advantages.

Figure 7-16 Matrix analysis - Textiles



As shown in Figure 7-17, most the standardisation dynamics of safety equipment can be described well by ***quadrant 1*** criteria. As with protective materials, there is a high incentive in the safety products area to define standard classifications, specifications and performance parameters such that they can be widely understood - in this case by users as well as purchasers of safety products, who are likely not to be the same individuals. Technical change in safety equipment tends to follow the development of new hazards or new approaches to combating them. Except for highly specialised equipment, however, the technological and standardisation dynamics tend to be relatively mature. The change from prescriptive to performance approaches does not appear to have altered substantially the basic standardisation rationales and structures in this area.

Figure 7-17 Matrix analysis - Safety



Information and Communication Technologies

The standardisation dynamics of telecommunication systems are shown in Figure 7-18, Figure 7-19 and Figure 7-20. Fixed network systems employ a great variety of infrastructure elements encompassing several generations of technology, both analogue and digital, in public and private networking environments. There is an imperative to maintain and develop many existing standards frameworks as well as to address the needs of new services environments. Thus, standardisation for fixed network applications as a whole can encompass all of the matrix quadrants to some extent, but the predominant dynamics in the sector are now highly strategic and best described by ***quadrant 4*** criteria. For wireless systems, the technological and market environments are especially dynamic and most standards issues reside decisively in ***quadrant 4***. A very significant standards battle is shaping up on a global basis with respect to which type of interfaces become basic standards for wireless digital voice and data services. There are much more pronounced regional strategic interests in the wireless field, but major strategic conflicts are developing on the fixed network side as well, although the stakeholders are aligned more in terms of new entrants and incumbents than in terms of national and regional groupings as such. Our overall assessment of the standardisation environment for telecommunication systems is that given the continuing widespread restructuring of services and equipment markets world-wide and the dynamic technology profile, virtually all of the standardisation in this field is strategic to a significant extent and that virtually the whole of standards activity is now centred in ***quadrant 4***.

Figure 7-18 Matrix Analysis - Fixed digital telecommunication systems

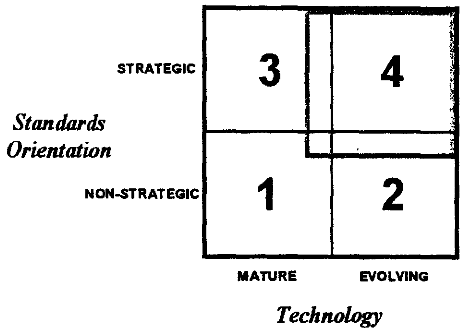


Figure 7-19 Matrix analysis - Wireless telecommuication systems

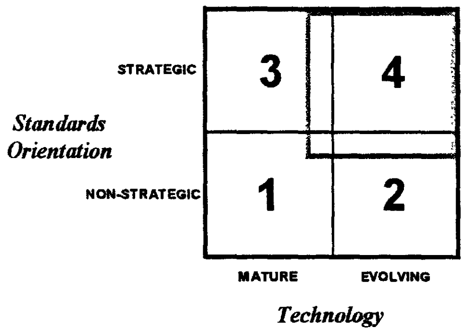
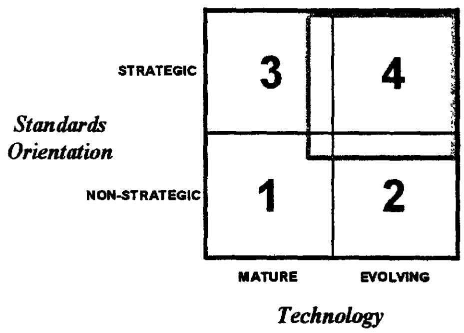


Figure 7-20 Matrix analysis - General assessment of telecommunication systems



The standardisation dynamics of computer systems are shown in Figure 7-21, Figure 7-22 and Figure 7-23. Taken together, the interoperation/interoperability and data security initiatives illustrate clearly that standardisation for computer systems remains primarily in the hands of key vendors in the sector. The profile of formal standardisation bodies like ISO/IEC JTC1 that began to develop in the 1970s has largely receded in these crucial areas, whereas the profile of proprietary systems and consortia specifications has increased very significantly. All of the traditional standardisation rationales and many of the institutional structures have been put under pressure by the implications - still not fully comprehended or understood - of the Internet. The situation is complicated further - as illustrated by the data security example - in that public and private sector agendas for important aspects of computer networking can conflict, as can the civil and military agendas. This is further opening up opportunities for standards gaps to be filled on an *ad hoc,* often sector by sector basis. Virtually all of the standardisation dynamics for computer systems now fall under ***quadrant 4*** criteria in some way.

Figure 7-21 Matrix analysis - Computer interconnection & interoperability

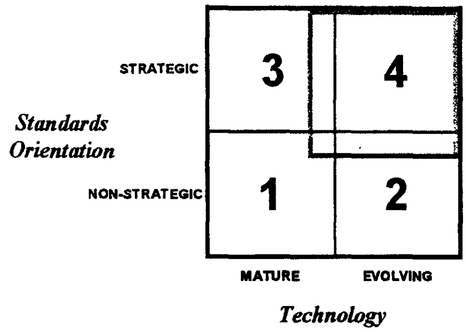


Figure 7-22 Matrix analysis - Computer data security

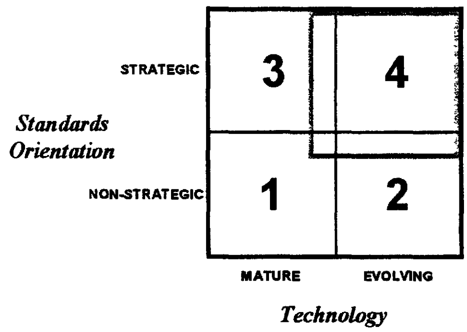
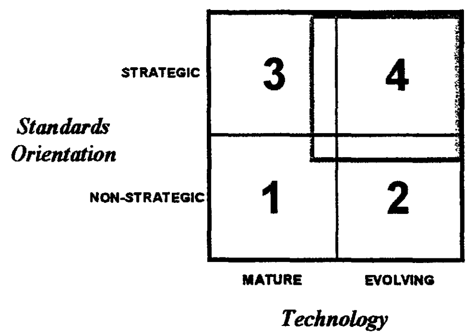


Figure 7-23 Matrix analysis - General assessment of computer systems



The standardisation dynamics in the software area are shown in Figure 7-24, Figure 7-25 and Figure 7-26. Virtually all standards activity in this area is strategic in some respect. However, much software in common use is rather old, or otherwise constructed by means of successive overlays on existing systems. A major problem with most software systems is 'legacy technology' - systems integration elements (sometimes undetected) that have been preserved as new capabilities are added incrementally to new systems. Software engineering and documentation initiatives are attempts to impose rationality on software development at all stages. They are highly strategic in that proprietors are emerging even though there is no widespread agreement about appropriate methodologies, or even if rigorous documentation and testing methodologies are workable in practice. On the whole, however, software engineering subjects are akin to QA and logistics subjects, and they tend to be described by similar ***quadrant 3*** criteria - i.e. they apply as much to existing systems as to new ones. Programming languages apply also to existing systems, but most of the currently significant initiatives in this area (like JAVA) are highly strategic - geared to leveraging computer users away from dependence upon specific computer platforms and operating systems. Accordingly, the programming languages area is described more accurately by ***quadrant 4*** criteria, as indeed are the standardisation dynamics of the software sector as a whole. This is a field now dominated by commercial interests and consortia seeking to establish network externalities in order to leverage potentially lucrative software support and tools environments.

Figure 7-24 Matrix Analysis - Software Eng.

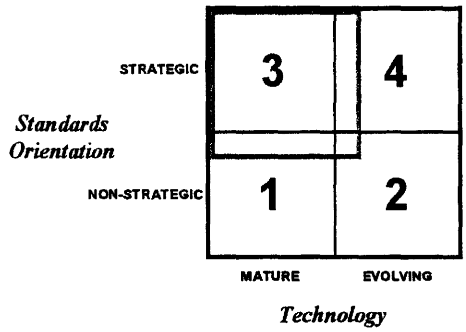


Figure 7-25 Matrix Analysis - Programming Languages

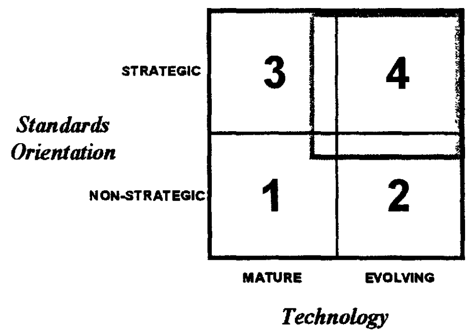
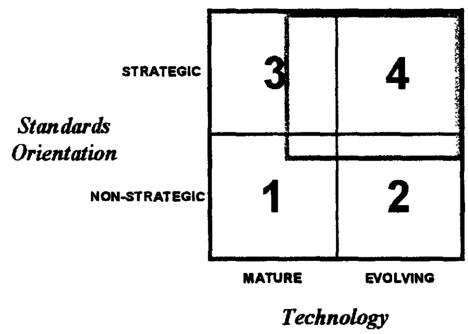


Figure 7-26 Matrix Analysis - General assessment of Software



The standardisation dynamics of electronic components are shown in Figure 7-27, Figure 7-28 and Figure 7-29. The reliability area has close parallels with QA rationales, although the methods involved are very different - concentrating on technical test methods rather than QA processes as such. Although standards in the reliability area can apply to electronic components at any stage of development, the principle use is for determining the suitability of already developed components in systems where the basic performance expectations are well defined. However, the range of electronic components and component producers is increasing, and new commercial stakes in reliability testing are emerging. Military/civil co-operation continues, but a much larger range of institutions now seek to set reliability standards. This increases the strategic element to the extent that at least the emerging dynamics are best described by ***quadrant 3*** criteria. Optoelectronics is one of the main areas in which advanced electronics components are applied. In this case, the rapid rates of technical change and the proliferation of new product types makes for a particularly dynamic marketplace. Already many of the key standards in areas like computer peripherals and consumer electronics are proprietary, and different institutional standards structures have formed around different application communities -telecommunication, instrumentation, retail identification devices etc.- resulting in ***quadrant 4*** criteria providing the best description of the environment for standards in optoelectronics. In general, however, the environment for components is somewhat less strategically-oriented than the systems integration environment that surrounds it. This is an area that straddles ***quadrant 3 and 4*** criteria.

Figure 7-27 Matrix Analysis - Electronic components reliability

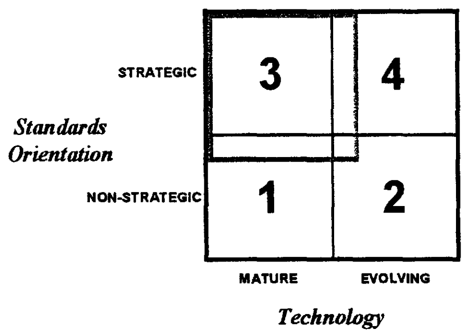


Figure 7-28 Matrix Analysis – Optoelectronics

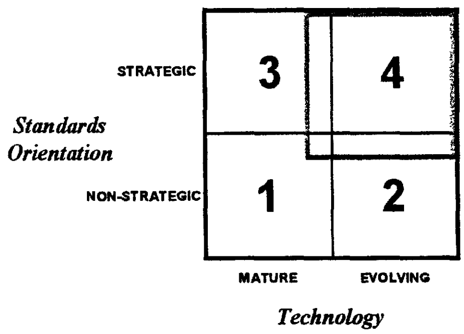
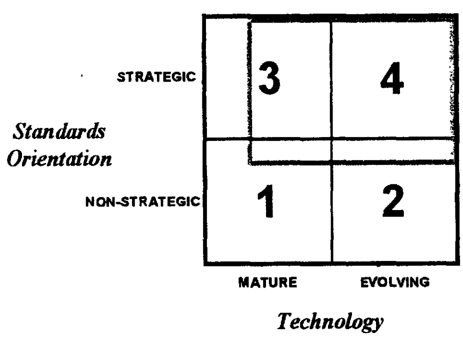


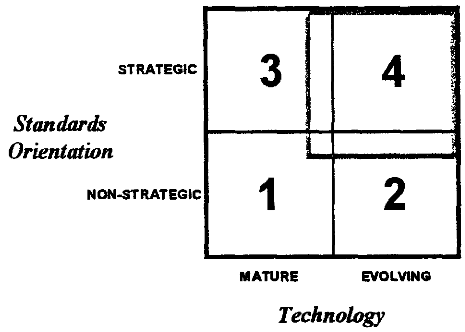
Figure 7-29 Matrix Analysis - General assessment of electronic components



The standardisation dynamics of the ICT application areas are shown in Figure 7-30 through Figure 7-35. New ICT application areas are developing very quickly and the rate of technical change for both new and old applications is especially dynamic.

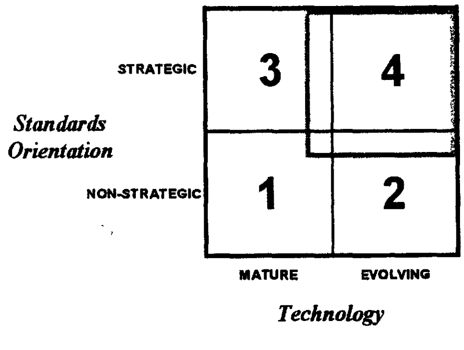
The situation in avionics (Figure 7-30) is highly strategic owing largely to the commercial implications for aircraft manufacturers (who configure avionics systems in different ways for commercially strategic reasons), and for component developers who can compete on features, especially in military environments. There is relatively little standardisation at international levels and many commonly used standards are set by industry associations (mainly US-based). The area is best defined by ***quadrant 4*** criteria.

Figure 7-30 Matrix Analysis - Avionics



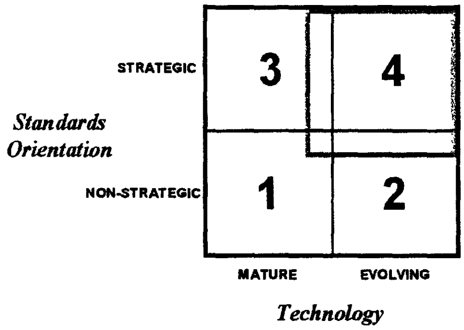
The standards environment for CAD systems is also best defined by ***quadrant 4*** criteria, (Figure 7-31) but the dynamics are very complex. On the one hand, as typical CAD systems must be integrated with other systems - like product identification data-bases and manufacturing systems - there would seem to be a high incentive for standardisation. On the other hand, as most complex design projects have highly individual characteristics, most CAD suites are in practice patchworks of proprietary and in-house software products, geared to the characteristics of specific projects or types of projects - i.e. the CAD requirements for the design of aircraft are likely to be different than for chemical processing plants. The few standards regimes that do exist tend to be task or sector specific, but the environment as a whole depends mostly on proprietary and *de facto* standards solutions.

Figure 7-31 Matrix Analysis - CAD



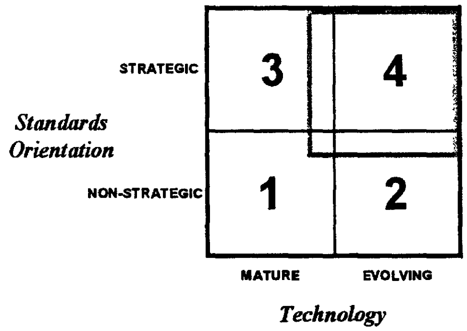
Likewise, the standards environment for GIS systems falls mostly into ***quadrant 4*** (Figure 7-32). Although there are incentives to develop voluntary standards for underlying systems functionalities - data transfer and presentation protocols etc. - much more of the GIS technology base is now being developed by commercial interests. Increasingly, the GIS marketplace is becoming structured more around value-added products based on GIS data, than upon GIS systems as such. This opens the field up to proliferation of *de facto* and proprietary standards.

Figure 7-32 Matrix Analysis - GIS



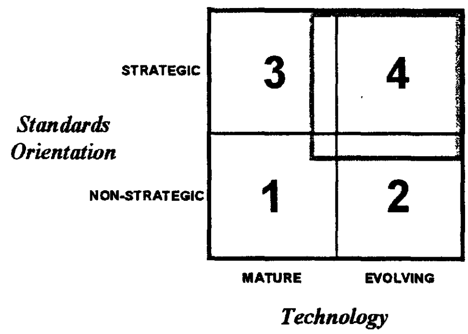
Electronic navigation systems are closely related to GIS and display similar standardisation dynamics. However, there are arguably greater external incentives that can be brought to bear in the case of ENS in that there are regulatory implications with respect to navigation in general, and the use of radio spectrum for navigation purposes. ENS characteristics are described best by ***quadrant 4*** criteria, but in this case the strategic aspects concern conflicts between the commercial interests of firms seeking revenues from provision of navigation equipment, information and services, and the interests of national and international agencies that govern the general environment for navigation.

Figure 7-33 Matrix Analysis - ENS



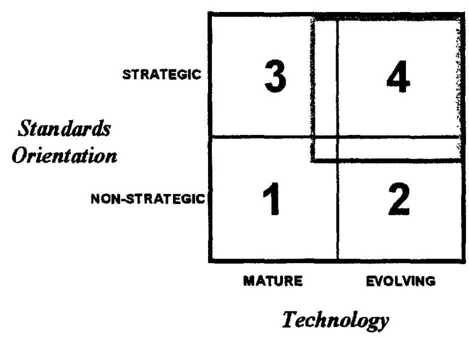
The dynamics of standardisation in the multimedia area (Figure 7-34) are so strategic that it is becoming difficult to envisage how any part of the existing standardisation system - consortia or SDOs - will be able to function in this environment. Virtually the only mature technologies in this context are the basic voice and data carrier networks, and even these are changing rapidly in response to the perceived requirements of multimedia services, much of it driven by the need to maximise huge sunk investments in installed base. The problem is that few sound business models for multimedia services have yet emerged. A huge amount of investment is speculative, and a large part of the strategy for converting investment into revenues involves the rapid build-up of externalities in the market by establishing standards. Multimedia provides the clearest example of how and why the *insurgent* model of standardisation evolved, but it is entirely too early to be able to predict how, when and where the stakeholders might elect to establish non-proprietary industry-wide standards.

Figure 7-34 Matrix Analysis - Multimedia



In general, however, although specific standardisation dynamics can vary from one type of ICT application area to another, the overall assessment of the field must be that standardisation in the ICT application areas is highly strategic and described best by ***quadrant 4*** criteria.

Figure 7-35 - General assessment of ICT Application Areas



7.4.2 Policy Options

The Matrix analysis given above illustrates the complexity and diversity of the standardisation environment in terms of technological, institutional and commercial factors. The final task in this Chapter is to evaluate the kinds of policy options that may be available to the Commission, and to suggest how they can be related to the range of standardisation dynamics shown in the Matrix assessments. Coupled with what we have learned from our examination of the US and European experience so far with civil/military standards convergence, the Matrix assessment exercise suggests strongly that policy action will not be a matter of selecting between available policy options, but of applying all available options in a strategic framework.

To begin, it is constructive to display the Matrix assessments in a summarised form according to the general categories from which the Key Defence Technology Areas were drawn. It must be kept in mind that this summary assessment refers only to the *standardisation* dynamics in these categories, not necessarily to the technological dynamics as a whole. In many cases, most of the standardisation activity occurs only at relatively generic levels, irrespective of the technical sophistication of the product or system concerned - aerospace and land vehicles and advanced materials being good examples. Likewise, our 'strategic/non-strategic' assessment refers to strategic behaviour tied specifically to the development and/or deployment of standards - i.e. where standards are used strategically to establish particular business models in the market. The summary of Matrix assessments is illustrated in Figure 7-36.

Figure 7-36 Summary of Matrix Assessments by General Category

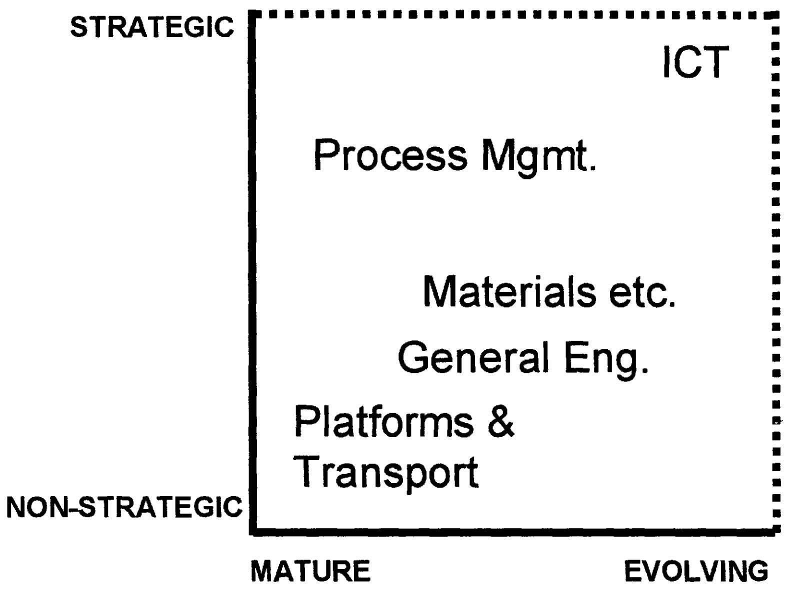


Figure 7-36 shows that, in general, it is in the Systems Platforms and Transport category where standardisation dynamics are least strategic, and where the technical subjects to which they apply are most mature. Products in this category tend to share only the most basic of rationales for standardisation - i.e. variety reduction in order to create economies of scale and scope for selected highly generic components and processes. Such cost-savings are obviously of particular interest to military customers, and are therefore a driver in the process of military/civilian standards convergence. On the whole, the physical configuration of basic systems platforms and transport facilities is not subject to *frequent radical* change.

The frequency and extent of technical change begins to accelerate in the General Engineering and Materials & Commodities categories. In some cases, the standardisation rationales in these categories extend beyond scale and scope economies - e.g. the provision of public information regarding the intended performance characteristics of safety equipment - but most remain basically non-strategic.

Standards in the Process Management category tend to refer to procedures for deploying technologies, rather than directly to those technologies as such. Also, they tend to refer more to processes with relatively well understood characteristics and for which realistic benchmarks can be set. The rationales in this category are nevertheless strategic in that process management techniques are geared to the strategic control of supply chains, extending to the role of the customer/user in the control of development, production and maintenance operations (attempts at developing specific defence standards in this field have to be seen in this context).

At the greatest extreme, most standards for ICT are now developed with highly strategic rationales. This is a field in which the technology is developing and diffusing far more rapidly than are the product and service models. In this technology-led environment, standards become crucial elements in determining which stakeholders acquire which stake in which new market.

Our analysis suggests that for policy action in the standards field to be effective, different policy options must be identified and pursued that can be matched to the overall standardisation dynamics of individual technology categories. In a defence standardisation policy reform context (as in any standardisation context), any overall policy will likely have to focus on co-ordinating several micro or meso-level policy initiatives, as well as on a few broad key initiatives that could apply collectively to all technology areas.

Policy Option Types

Based upon the various policy mechanisms that have been deployed already by the Commission in industrial and standardisation policy, three basic types of policy option can be identified.

1. Voluntary options

Voluntary Option Strategy - The Commission encourages stakeholders in an industry and/or technological field to set up or expand voluntary frameworks for standardisation by promoting and facilitating new kinds of links between producers, users and policy-makers at national, European and international levels.

This seems on the surface to be the easiest and least costly type of policy option to implement, but in practice it can be difficult to separate policies that 'encourage' greater standards co-operation from policies that 'require' greater co-operation.

In many respects, the Commission exercised an option of the 'voluntary' type when it officially recognised selected independent standards bodies (i.e. CEN, CENELEC and ETSI) and elected to incorporate their outputs (under the new approach) into various technical regimes associated mainly with single market objectives. This policy worked to good effect insofar as it increased awareness in industry of the need to harmonise the European standards regime, and encouraged industry voluntarily to devise EU-wide standardisation strategies and processes. However, the other effect was to impose an additional administrative layer between voluntary national and international SDO activities, resulting in a more complex structure that may now in some cases be having the effect of impeding co-operation. Our survey of European stakeholders, many of whom are producers of civil as well as defence products, uncovered a remarkable level of confusion and misunderstanding about how the European system of voluntary standardisation is intended to work.

Most of the time, voluntary options are targeted much more directly at specific technological developments. In our view, voluntary options have the best chance of yielding positive outcomes if they are applied on a topical basis. Some of the SDOs have adopted this strategy already, notably IEC and CEN with their industry workshop schemes.

However, there is scope for the Commission to act in ways that are not necessarily directed to the actual development of standards in specific organisations. This could involve *ad hoc* and standing workshops, consultation committees and discussion networks involving industry and Commission personnel that are oriented towards achieving consensus on how civil/military standards convergence should proceed in specific areas, and which standards institutions should take leading or supporting roles. It could also involve working groups within the Commission being advised by panels of senior industrialists.

The downside of voluntary options is that they are prone to becoming idle 'talking shops' that do little more than to bring key actors together. Some ideas for increasing their impact are given below.

2. Support Options

Support Option Strategy - The Commission supports (whether in principle, in kind or with direct funding) R&D projects, technology trials, and monitoring programmes that are oriented to standards-development goals.

R&D support strategies have been and are being used extensively by the Commission - they are actively addressed in the context of the research Framework programmes. The aim of these programmes is to increase the strength and competitiveness of the European science and technology base. Irrespective of the degree to which this occurs, however, these programmes have high latent potential to yield positive outcomes in terms of putting different European stakeholders from different regions in touch with each other such that science and technology capabilities grow in a more evenly distributed fashion throughout the EU. This latent potential applies also to the formation of the stakeholder networks that are necessary to define standardisation issues and carry initiatives forward. Many Fourth Framework consortia in the ICT area, for example, defined specific standardisation objectives in their research and field-trial agendas.

The Commission has always had the option with programmes like these of selecting projects for funding on the basis (if only partly) that they would contribute to standardisation goals in specific priority areas. In our view, exercising such preferences has high risks, not least in dynamic technical areas where standardisation goals that may have looked reasonable at the project specification stage either become redundant or are otherwise overtaken by events during the running time of the project in question. The more usual practice, correct in our view, is to ensure that the standardisation implications of EU-supported R&D and field trial projects are recognised by the participants and that adequate provision is made to make inputs into the standards-making process, particularly in vital areas for European industrial and trade policy.

3. Intervention Options

Intervention Option Strategy - Where necessary to ensure that standardisation occurs in the public interest in key areas identified by the Commission and/or the Council takes an instrumental role in developing and deploying legal, regulatory and other official measures (including the issuing of standards mandates).

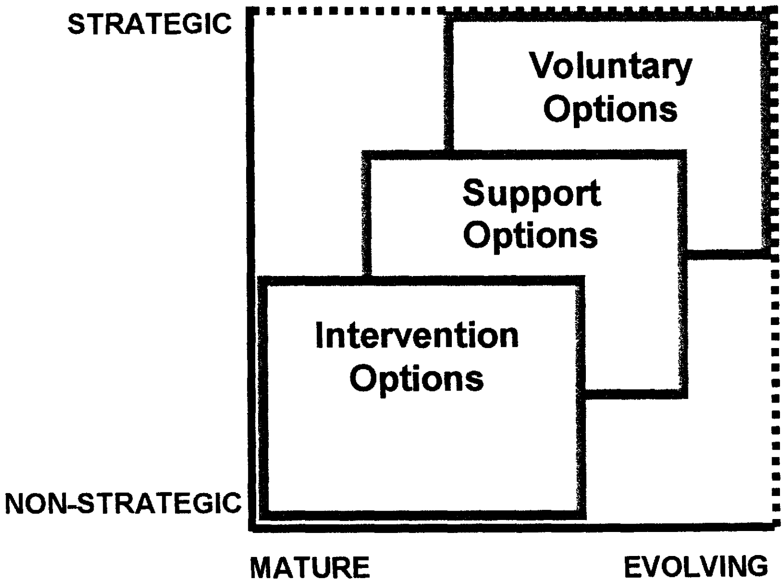
The problem with intervention options at the standards level is that often the root of the problem lies elsewhere - i.e. the reason that standardisation and/or standards harmonisation does not occur is primarily that the market or industry structures surrounding the technology in question do not favour standardisation. Although market failure of this kind is one of the prime justifications for intervention, action on standards alone is seldom enough to correct for market failure - i.e. in order to be effective, action on standards often must be linked with policy actions aimed at facilitating changes in industry and market structures.

Where intervention in standardisation is 'optional' - i.e. there is no legally defined imperative for the Commission to act - actions of this kind are often viewed as 'last resort' alternatives. In our view, this is too narrow a perspective. In some situations, intervention may be the most efficient way to clarify standards requirements at the outset in terms of the Commission's policy agenda and to put appropriate mechanisms in place quickly that can achieve standards within clearly identified policy frameworks. This is even more so in defence-related areas, where, as our survey has shown, there is a high degree of confusion and misunderstanding as to what the Commission can do.

Developing a policy framework

All three types of policy option could be mapped out using the same set of axes we used to display the summary of the Matrix assessments. A basic arrangement that reflects all of the most straightforward reasons and contexts for deployment of different options is given in Figure 7-37. However, for reasons explained below, we regard this arrangement as an example of the *poor approach* to the selection of policy options with respect to tackling the problems of standards convergence for civil and military use.

Figure 7-37 Example of Poor Option Strategy



As illustrated in the Figure, the justifications most commonly used for Intervention Options involve situations where there is no obvious technical problem in establishing or harmonising standards, and where a clear case can be made that standards should exist in the public interest, but where the industry is unable or disinclined to act. Certainly, standards and technical regulations set through governmental or intergovernmental intervention are likely to encounter least resistance where the technology is mature and the strategic interests of the stakeholders will not be affected. Indeed, in cases like these, it is not uncommon for stakeholders to request intervention. With reference to our five main technology categories, actions of this kind apply frequently to basic platforms, mechanical systems and materials.

The clearest case for selecting Support Options for standardisation purposes is in the intermediate goods areas - in our scheme encompassing advanced engineering and materials technologies, many ICT systems, and most process management systems. Specific R&D objectives can be defined with more clarity in these areas because evaluation of proposed business models is still possible using known criteria.

The use of Voluntary Options is often concentrated in fast-developing, highly strategic technology areas. In many cases, this is by simple default - because the risk of intervention options is perceived to be too high, or because the support options are too difficult to identify and/or too expensive to achieve. Too often, voluntary options are instituted because the kind of policy commitment is lacking that otherwise would be needed to underpin support or intervention options.

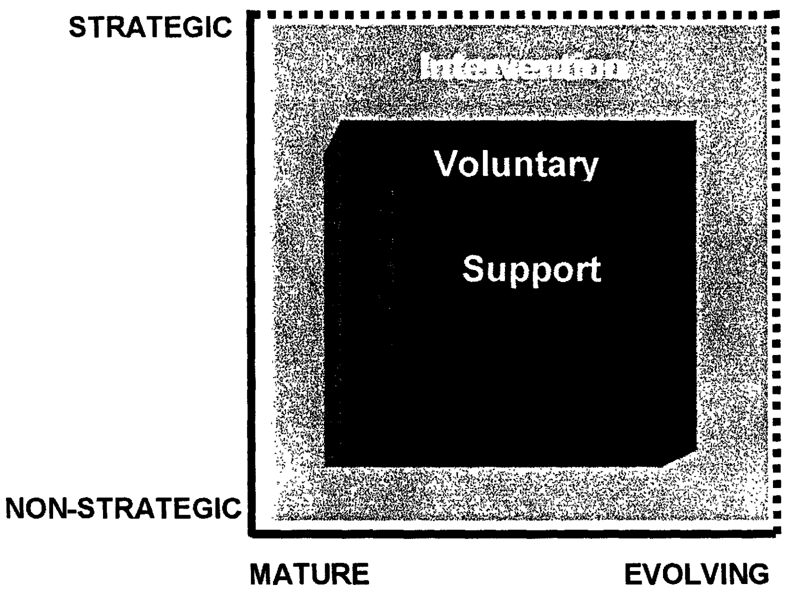
However, many of the circumstances and issues brought out in the study suggest that there are reasons not to concentrate policy options in this way. There are many special factors in connection with civil/military standards co-ordination and convergence in Europe that will require bold policy moves at several levels.

A much better way to look at policy options in terms of our strategic/non-strategic - mature/evolving axes is to order the types of policy options in terms of strength, and then to consider what effects they might have given the characteristics of different kinds of standards initiatives as defined by our Matrix quadrant criteria. It is especially important to conceptualise the problem in this way given that a great many products as delivered to final customers (civil or defence) involve the integration of technologies and processes from each of the five main technology categories discussed above.

Intervention Options are inherently the strongest, but they are also the highest risk options and not applicable to every area in which policy action is required. Support Options can carry high financial risk (there is always an element of 'winner-picking') but they have more manageable political risks, and, in any case, they generate many indirect benefits in terms of technology and business networks. Voluntary Options (at least of the topical variety that we tend to favour) have very low risk, but their purposes can be difficult to define and sustain. Their effectiveness is highly variable, and, as noted above, they can degenerate into mere 'talking shops'.

In the course of this study, we reviewed carefully the experience of the US in carrying forward defence standardisation reform, along with the experience of particular EU Member States who have attempted or instituted similar reforms. Comparing this information to the Matrix assessments of standards dynamics in several key technology areas leads us to propose a ***nested policy strategy*** that would likely involve simultaneous application of Voluntary, Support and Intervention Options. The nested policy strategy is illustrated in Figure 7-38.

Figure 7-38 The 'Nested' Policy Option Strategy



Our assessment is that key interventions will be required across the spectrum of quadrant criteria. There is no reason to confine intervention to mature, non-strategic areas and there are historical examples of intervention options being applied successfully where the technologies were very dynamic and the standardisation rationales were highly strategic. Perhaps the best example in the EU is the telecommunication sector, where various Directives, Decisions and standards mandates have been directed at the goal of achieving a harmonised infrastructure for competitive provision of telecommunication services in Europe. This is an on-going process, but already it has yielded benefits to many industry stakeholders (new entrants in particular) in addition to preserving the public interest in an important service. It has also set the policy tone decisively.

Most of the issues that underlie the present study are much less well defined in a European context. The positions of Member States and defence industrialists with respect to European-level defence initiatives are still evolving. In this environment, very broad intervention options are needed to clarify the legal and policy environment surrounding defence procurement in the EU, set clear standards convergence objectives, give direction to European defence agencies and standards bodies in meeting these objectives, and setting performance targets and benchmark criteria.

Referring back to our Matrix analysis, it is clear also that more targeted interventions may be required, and that the form of these interventions will vary according to the criteria that describe each quadrant. In a key quadrant 1 technology area like shipbuilding, for example, policy intervention could help clarify the framework on an EU basis via which civil structural standards could be adapted to military use in European shipyards. For land vehicles, on the other hand, policy intervention may have to occur in tangential areas, like defining new rules for the licensing of generic spares production. In contrast, key areas in quadrant 4 are unlikely to respond positively to overly prescriptive interventions. In this case, interventions are required to establish broad performance requirements and goals in areas like interconnection and interoperability, or policy back-up in support of new data security initiatives.

One of the main problems we encountered during the study is that there is no institutional focus or structure for military/civil standards convergence in Europe that is commonly identifiable by defence and civil stakeholders. Our view is that voluntary policy options would be most effective at the level of institution-building -or more properly, building communities of interest that will shape the evolution of institutions. The effectiveness of voluntary options would be increased if a corresponding and targeted structure of voluntary actions could be linked to specific objectives in each intervention. The effect would be to create communities of interest that cross civil/military and industry sector boundaries, with the objective of making specific recommendations to governments, the EU, NATO, and the SDOs. With respect to the latter, voluntary options could be mobilised to interface with SDO-sponsored industry workshop schemes. Taking account of broad criteria established through intervention options, voluntary schemes could be instrumental in identifying government/industry consensus regarding support actions -mandates, R&D consortia, project teams, and so forth.

8

GENERAL CONCLUSIONS AND RECOMMENDATIONS

8 General conclusions and recommendations

Changes in the political, economic, industrial, and technological environment of defence production are posing key challenges to the way in which defence agencies have traditionally procured weapons systems, support equipment and materiel. Many defence agencies world-wide are now either implementing or considering ambitious procurement reform programmes.

One of the main issues in procurement reform is the role of military standards and specifications. It has long been accepted practice in most countries to issue design and procurement specifications for military products and systems on the assumption that most, if not all, military requirements were different from civil ones. This approach is now in question. Increasingly, a large part of the defence technology requirement is being procured from commercial suppliers, particularly in the high value added areas like information technology. Indeed, in many key dynamic technology areas the use of civil standards is now unavoidable - procurement agencies must act not out of choice but out of necessity!

In many cases, specifying commercially available technologies in defence procurement means that military specifications can be replaced outright with commercial standards. This practice can result in significant production efficiencies and reductions in procurement costs. It can also create market entry opportunities by facilitating participation of a wider range of civil contractors in defence markets and by opening up non-defence markets to defence contractors. However, at least in the short to medium term, the practice destabilises many traditional relationships between government procurement agencies and defence contractors.

Reform of the defence standards regime has risks as well as benefits. Much more of the responsibility for system specification, maintenance and evolution is transferred from the procurement agency to the contractor, and this carries risks for the long-term support and maintenance of some defence systems. Also, as more standards are drawn from civil standards bodies and trade associations, many procurement agencies and contractors will have to climb a steep new learning curve as they assume a more active role in civil standards development. Moreover, in vital areas like information and communication technology, the civil standards system is in a state of flux and many of the major standards in the market are proprietary. Most importantly, the implications of conversion to a civil standards regime for the development and maintenance of export markets are unknown.

In recent years, the US has implemented major reforms in its defence standards system. These are aimed at increasing industrial efficiency and lowering defence procurement costs by replacing military specifications with civil standards on a comprehensive scale. This action has potentially major repercussions for defence producers and customers in the European Union. Historically, US military standards have been dominant in the NATO standards regime and in the defence procurement regimes of many countries world-wide, including some EU countries. Thus, the US reforms have important implications for the NATO alliance, and for the structure of international defence markets.

Some EU Member States have adopted similar reform programmes, but the rates of reform are uneven and no Member State programme has the same scale, scope and momentum of the US initiative. Moreover, the ability of the EU defence community as a whole to respond positively and proactively to the US reform initiative is seriously constrained by the continued fragmentation of national defence markets in the EU. This situation is exacerbated by the lack of a coherent mechanism to monitor and co-ordinate defence standardisation activity in the Member States.

For all of the above reasons, standards reform is now a key element in shaping a common European market for defence products. The challenges of reform are nevertheless very substantial. Changing the approach to defence standards means changing the approach to how defence systems are defined and procured. This has 'ripple effects' throughout the entire defence procurement system.

This Report has examined a wide range of issues with respect to the convergence of civil and defence standardisation regimes. The issues have been examined both in the context of changes in defence procurement practices and in the overall context of standardisation dynamics, practices and procedures. In investigating these matters, the study team has taken three main perspectives:

- ***The European perspective*** - The need for change in defence procurement and standardisation practices has been recognised by many EU member States for several years, but concerted action at the European level is only now being contemplated. We have collected the views of public and private sector stakeholders in the European defence industries as to the current state-of-play in European defence standardisation, the requirements for further action and/or reform, and the challenges and opportunities that arise out of the European regional dimension.

- ***The US perspective*** - As Europe stands poised to embark upon actions to review and revise procurement and standardisation practices, the US has accumulated several years of experience with specific reform measures, many of which are being examined by defence agencies in EU Member States, and by the Commission. The parts of this Report that deal with the US experience give valuable guidance as to the intended and actual outcomes of an extensive defence standardisation reform process that has already been implemented.

- ***The institutional perspective*** - Virtually all of the actual or potential changes in defence standardisation that are being discussed by US and European interests involve defining new interfaces with the civil standards system. Although well established institutionally, this system is itself undergoing very significant change as stakeholder requirements and attitudes toward standardisation evolve. Likewise, new interfaces will likely develop between the SDO system, and the defence standardisation agencies in individual countries and in NATO.

This final chapter synthesises what was learned by adopting the above three perspectives and relates this to a set of recommendations for consideration by the Commission. The final aim is to recommend a work programme that will assist the Commission, other relevant bodies, and the European defence industries in promoting a coherent EU-wide system for the development and use of standards in defence procurement, referring to civil standards whenever possible.

Presentation of our key findings and recommendations is organised around thirteen key problem areas that collectively encapsulate the many opportunities and challenges for defence standards reform in Europe which we have identified in this Report. The discussion for each problem area incorporates a critical analysis of the principal issues raised in our studies of the European and US situations, coupled with issues, examples and analysis from our matrix analysis of standardisation dynamics in various key defence technology areas. Our recommendations have been generated from this analysis and they are interspersed as appropriate throughout the text. Finally, Section 8.28.2 situates the recommendations in a work programme framework for implementation purposes.

8.1 General Analysis, Conclusions and Recommendations

Problem Area 1: Placing defence standards reform in the context of defence industry rationalisation

Our study shows that there are two main interrelated sets of motivations behind the need to promote and support the reform of defence standardisation systems in Europe. The first set of drivers were described in section 3.1 and relate to global patterns of change in defence production. The decline of defence procurement expenditures in the countries with the largest defence industries, has now confronted producers and defence agencies with the already longstanding upward trend in the cost of developing and manufacturing complex defence systems. At the same time, the relationship between defence and civilian technologies is changing, with civilian markets funding an increasing share of R&D investments in key areas like electronics and information technologies.

Commercial producers are now able to supply components and sub-systems at a lower cost, and often to higher performance specifications, than comparable goods developed exclusively for military markets. In this situation, defence producers and customers are forced to find mechanisms to exploit the technological capabilities being developed in the civilian sector, and to adapt their defence procurement systems in order to allow and promote the application of commercial technologies in defence systems. This change will affect the structure of the defence industry, which, to remain competitive, must increase the links with civilian industrial and research base. This change must be supported by a reform of the defence standardisation systems to minimise the creation or maintenance of walls between civilian and military activities in technology development and application.

The second set of drivers behind the reappraisal of the defence procurement and standardisation situation in Europe is the desire to articulate a European common foreign and security policy. One of the necessary conditions in realising this objective is that the EU should have an effective and competitive defence industry. However, the European defence industry remains fragmented along national lines. Our European survey indicated wide agreement as to the need to increase the competitiveness of the European defence industry through policy actions aimed at the development of a European common defence market and cross-border consolidation of the defence industries. European defence standards regimes are widely viewed as one of the areas in need of urgent reform to support the rationalisation of the European defence industry.

Rationalisation can be achieved through formal consolidation in key sectors - i.e. through cross-border mergers, acquisitions and long-term joint ventures. This objective is currently being pursued across the spectrum of European defence industries. It is important to consider, however, that industry consolidation may not in itself result in the rationalisation of European defence production if fragmentation persists in national defence markets.

In a fragmented marketplace, there is nothing to prevent firms that have consolidated across European borders from electing to pursue individual markets in different ways in different countries. Common standards do not in themselves rationalise the market conditions in which they are applied. A good example is GSM, which is the common technical and administrative basis of most digital mobile telecommunication in Europe (see Profile 12, key initiative (a) in section 7.3.5). In this case, technical standardisation supports a wide variety of business models (often several in the same country) that set very different conditions for the acquisition and use of otherwise highly standardised technology. Moreover, many of the European developers of GSM also have substantial profiles in foreign (mainly US) markets organised around entirely different standards.

RECOMMENDATION 1: ***Decisions by the Commission and/or any other relevant bodies to intervene in civil standards initiatives pursuant to policy objectives in defence procurement reform should be based primarily on the principle of supporting and facilitating the progressive development of a common European market for defence goods and services. In our view, it should not be expected or assumed that standards initiatives, by themselves, can lead directly to the integration and rationalisation of the European defence industries. The policy emphasis should be on market reforms, and actions on standards should be subsidiary to this goal.***

RECOMMENDATION 2: ***Progress on defence standardisation reform measures must not be assessed in isolation, but with frequent and direct reference to progress in the other actions identified by the Commission in the 'Action Plan for the defence-related industries' (COM(97)583 final/ Annex II).***

RECOMMENDATION 3: ***A European Defence Standardisation System should be developed that provides a common, transparent structure for the reforms of European defence standardisation, and the subsequent maintenance of this regime. This structure must be linked to the existing European-level civil standardisation system, and to the international standards system in both civil and defence arenas. The other recommendations in this Report should be viewed as steps in facilitating progress towards this central goal.***

In our view, the relationship between market and industry consolidation is critical in a standards reform context in that it determines the degree to which standards policy might be used to leverage rationalisation objectives. Some of the industry and government stakeholders we interviewed see standards reform as a way to promote rationalisation. In particular, our discussion in section 5.2 indicates that many European defence ministries and defence firms believe that improved standardisation practices would help create a more competitive environment in Europe, and a more level playing field for European companies in export markets. Others see rationalisation as the instrument that will eventually deliver standards reform. The US survey showed clearly that US industrialists consider industry consolidation to have had a much greater influence on competitiveness, profits and export markets than have government-led procurement and standards reform initiatives (see sections 6.4.2 and 6.4.3).

There is a *prima facie* economic argument that rationalisation initiatives will have important impacts on the evolution of the standards regime. Clearly, in an environment where internationally consolidated firms operate in an open market, non-harmonisation of standards would become only a source of costs for defence contractors, as would retention of defence standards where there are market opportunities in the civil sector, or where commercially available technology is cheaper and/or superior.

The case is much less clear for the argument that standards reform could be used strategically to leverage rationalisation, although certainly standardisation activity might be used in a secondary role to facilitate and support such goals. As demonstrated in our general discussion of commercial standardisation processes (section 2.3), and by our specific examples of different sector dynamics in standardisation (section 7.3), the outcomes of standards initiatives can be difficult to predict, much less to mobilise in a context of industry and market transformation.

In determining policy regarding the relationship between standardisation and broader industry and market rationalisation goals, it is important to distinguish between '*standards problems*', and '*problems involving standards*'. Not all of the issues and problems that involve standards are 'standards problems', in the sense that taking action in the standards arena itself will have the desired remedial effects. In our view, a 'standards problem' is one where the primary solution to the problem lies specifically with the content of a standard, the process by which it was produced, the terms of access to a standard, and the availability of information relating to the development and application of a standard.

Perhaps the best example of a 'problem involving standards' that was repeatedly encountered during our study is certification - discussed in more detail below with reference to Problem Area 15. Other kinds of 'problems involving standards' are created by the industry or market environment surrounding the standards (or the lack of them) and not by the standards or standardisation processes as such. Our Profiles in Chapter 7 demonstrated many aspects of this problem. We saw, for example, how different government attitudes towards generic automotive parts could create greater or lesser incentives for the industry to standardise at higher or lower levels (see 7.3.3 Profile 8, Land Vehicles), and how differences in the strategic positions of the computer and telecommunication industries with respect to facilities sharing for data networking can lead to difficulties in establishing the technical basis for electromagnetic compatibility standards (see 7.3.2 Profile 4, EMC). Examples like these imply that the solution to many rationalisation problems will require mainly action in related policy fields aimed at altering existing market and industry structures in quite fundamental ways, such that standardisation initiatives have a greater chance of a successful outcome.

Even where real 'standards problems' are concerned, it is important to distinguish between those standards that by design or in practice constitute genuine trade barriers and those that do not. The difference lies normally in the costs of conversion. Where these costs are absorbed as normal costs of business (i.e. the costs of harmonisation outweigh the costs of case-by-case conversion, and the rewards of market entry outweigh the conversion costs) action to harmonise standards is usually inappropriate. Situations like these arise frequently with respect to 'fundamental' standards (like metrology) and for many basic prescriptive standards (machining tolerances, for example). In such cases, the important element is that both foreign and domestic competitors have equal access to the standards concerned.

Problem Area 2: Assessing the significance of cost savings as a factor in standards reform

Although the rationale for engaging in defence procurement and defence standardisation reform is clear, there are significant difficulties in determining the success of reform initiatives from an economic point of view. For example, several of our interviews expressed the fear that the short-term savings of using COTS could be obtained at the price of higher long-term maintenance costs. There are also additional factors, beyond the control of government agencies, that have a bearing on the final outcome of procurement reform. For instance, the US study indicated that savings from the introduction of commercial components in defence production will not be realised unless prime contractors find mechanisms to open up their contracting policy to newcomers, thus enabling the change of industrial suppliers in the lower production tiers (1997 Annual Report of the OSD Pilot Programs Consulting Group mentioned in section 6.2.4).

All of our European respondents recognised that there were many difficulties in providing a systematic analysis of the cost benefits in standards conversion. In section 5.3, the following difficulties were highlighted:

- assessing the balance between design and production savings, and longer-term maintenance and replacement costs;
- assessing the long-term costs of reliance on commercial stockists;
- comparing the costs and reliability of testing by military authorities with the costs of certification by civilian bodies;
- cost savings may be put at risk if the new procedures act to create a dominant market position for a specific manufacturer.

Indeed, we found little evidence of systematic approaches in analysing cost-savings. The only published attempts to estimate cost savings and to develop cost assessment methodologies come from the US. Section 6.2.4 provided a discussion of the most relevant studies carried out so far, and argued that the most relevant work is still the TASC/Coopers&Lybrand study that estimated the cost premium of military regulations and specifications at an average 18% of product value-added.

Nevertheless, available studies fall short of offering an indisputable measure of the economic effects of MILSPEC reform. Very different assessments emerge, depending on the methodology and scope of the study. However, two points are important to note:

- no study to date has shown an *increase* in the cost of procuring defence systems as a direct consequence of procurement or defence standards reform;
- all analysis that is based on surveys of expert opinion tends to generate higher saving estimates than those based on systematic methodologies or on *ex-post* case studies. Estimates from expert opinion range between 30% and 50%, whereas estimates from more systematic studies range between 10% and 20%.

This trend is confirmed by our European survey. Respondents did not doubt that there would be savings as a result of a transition towards commercial standards, but their estimates differed greatly - from as little as 15% to as much as 50% (see section 5.3). Again, it is important to note that no respondent anticipated higher costs. It is important also that no respondent linked the estimates given to a cost assessment methodology, indicating that at this point, European industry may not be equipped to assess cost-savings adequately.

Opinion in the US, where the experience of reform is more extensive, was actually more cautious regarding the magnitude of real or possible savings. As explained in section 6.4.3, government officials are not convinced universally that the migration to commercial specifications has led necessarily to reduced costs as much as it has to the shifting of costs. In particular, increased reliance on commercial specifications has contributed to a trend of shifting R&D costs from DoD agencies to contractors. If the net result has been to increase cost to companies, DoD officials expect that these costs will be passed back to them in the form of higher procurement prices.

It is important to stress the implications of defence standards reform for the distribution of design responsibilities between defence customers and industrial suppliers. In some cases, what may appear as short-term gain to the defence customer may be no more than a cost shift upwards to the suppliers.

RECOMMENDATION 4: ***National governments must be encouraged to make systematic appraisals of the cost implications of changes in defence standards regimes. A possible role for the Commission may be in assisting Member States to develop methodologies for making cost-savings assessments, and to encourage the eventual harmonisation of as many aspects of these methodologies as possible, given that the initial conditions of defence production and procurement differ throughout the Member States.***

However, our US survey confirmed that company officials recognise also the long-term potential for savings that could be generated by conforming to commercial practices and standards, even though they do not detect any significant gains as yet. Besides, there is evidence of short-term gains in those areas where industry has been participating most actively in the reform effort. These accrue particularly from reforms of commercial practices resulting in reductions in overheads and administration costs for all defence suppliers. More than 60% of the respondents to our US survey indicated that substantial or significant positive impacts had occurred with respect to company operations, and more than 80% detected similar impacts on their industry sectors as a whole (section 6.4).

Although studies to date have not been able to give consistent estimates of savings, and despite some scepticism (particularly among US government officials) that savings are there to be measured in the first place, the balance of existing evidence (general analysis, expert opinion, circumstantial evidence and case studies) suggests overwhelmingly that reforms will result in savings to some degree.

RECOMMENDATION 5: ***Arguments for exemption from defence standards reforms that are based on the assumption that short-term gains are cancelled out by long-term costs should not be accepted without supporting evidence gained through the use of an agreed methodology as set out in Recommendation 4.***

This general recommendation has a practical corollary as exemplified by the DCMC observation on the application of the SPI programme (section 6.3.3). The DCMC noted that, in many cases, the government is unable to identify short-term savings that might result from SPI proposals, with the result of approvals being delayed. The DCMC has argued that the inability to identify instant contract savings should not be an impediment to SPI approvals. We find no reason to question this conclusion.

RECOMMENDATION 6: ***Policy options concerning defence standards reform should be neither pursued nor pre-empted on the expectation of specific levels of cost savings.***

Problem Area 3: Guiding the regime shift from technical specifications to performance requirements

Most of the standards-related issues and arguments in defence procurement that have been identified in this Report are related in some way to fundamental changes in the philosophy of issuing procurement specifications. The 'old regime' (still in operation in many EU States) was built around detailed technical specifications, set out mostly by the defence customer, to which contractors would be bound under terms of contract. The 'new regime' focuses on defining performance parameters for military systems, leaving many more of the technical details - including the specification of standards - up to the contractor (see for instance the use of Cardinal Point Specifications in the UK –section 3.3.1– and the implementation of new defence procurement practices in the US –section 6.2.2). The use of defence standards for the purpose of providing detailed product specifications has been among the main targets for elimination by reform initiatives.

The new regime considerably widens the scope for incorporation of commercial technology and standards into military systems. However, the increased recourse to commercial items whose technical characteristics cannot be pre-defined by the military customer, implies the need to define broad performance parameters, accompanied by specific process control standards with which to assess the performance of commercial products and suppliers in this context.

Stressing performance criteria shifts much of the standards emphasis away from 'technology standards' and towards greater reliance on 'process standards'. Our study has shown that many of the civilian standards being applied in the defence industry under the emerging standardisation reforms are process standards. In areas like Quality Assurance the new emphasis in defence procurement is on implementing adequate quality control processes along established commercial practices rather than detecting defects through intensive *ex-post* inspections (section 6.2.5). This shift emphasises performance levels and the ways to achieve them, rather than detailed product specifications.

Very significantly, the US experience to date has been that defence suppliers have tended to concentrate their interest in standards reform on the modification of production and project management processes; particularly in the Quality Assurance area. This is generally indicative of the shift in philosophy from prescriptive standards to performance standards, and determination to tackle the testing and certification issues that will necessarily accompany the increased emphasis on performance standards.

It must also be noted in this regard that in many areas commercial standardisation regimes are likewise moving away from standards involving prescriptive technical specifications towards a standardisation approach aimed at performance objectives. These are usually based on definitions of what constitutes 'adequate' processes under the performance objectives set out in the standard (see for instance the case of fire equipment discussed in section 7.3.4 - Profile 11).

Inevitably, however, this emerging regime creates new difficulties. The US survey highlighted government fears that the use of commercial standards has added complexity to the procurement process (section 6.4.2). In Europe, our survey showed that the emphasis on performance criteria was causing concern to defence manufacturers (sections 5.2 and 5.6.2) in that process standards can often be more difficult to negotiate than technology standards, and, more importantly, often more difficult to apply uniformly. The 'versioning' of ISO 9000 quality assurance standards for defence-related aerospace applications is an example of the kinds of problems being envisaged by European industry in this respect (see section 7.3.1).

In a performance-based standards regime, it is impossible to separate the doctrine of reference to civil standards from fundamental reforms of the defence procurement structure. These involve substantial devolution of responsibility for defining technical content to prime contractors. By eliminating MILSPECs and substituting civil standards, the onus for standards development - along with any of the attendant risks - is passed on to industry. These changes involve expanding the contractual commitment of prime contractors such that it spans the life-cycle of a product. This creates a new relationship between the defence customer and the prime contractor.

Evolution in the role of prime contractors in defence procurement processes under new performance-based regimes is an important general issue for procurement reform, but it is out-of-scope for this study except as it may concern standards. In this respect, we must point to the strong links that exist between prime contractors and defence procurement agencies in many European countries, and to the major role that prime contractors can play as vehicles for co-ordinating and developing specifications and standards that are crucial to individual defence projects. During our European survey, we encountered concerns about this situation and the possibility that enhanced levels of control could be used by prime contractors to protect existing market positions and carve out protected new positions. In policy terms, the important conclusion for the Commission is that defence procurement reform (including the reform of the defence standardisation system) does not necessarily guarantee a more open market structure.

The evolving role of the prime contractor in a standards context requires careful monitoring. In our view, the role of sub-contractors in defining and/or influencing standards in this new framework is not likely to increase. The common expectation and practice with many sub-contractors, particularly SMEs, is that they will follow the specifications and standards required by their prime contractor clients, irrespective of whether they were commercial or military, proprietary or in the public domain. Some of the suppliers we contacted were totally unconcerned about broader standardisation issues and problems (see section 5.6.1). The new standards regime may reinforce the control of prime contractors over their supply chains.

The US study confirmed these problems. The general technical reports that are replacing MILSPECs in defence procurement can increase the possibilities for contractors to capture government customers. Selected contractors can participate in setting out the performance specifications, thereby making sure that the technical features are favourable to themselves (section 6.4.2). In relation to the effects on supply chains, US experience is that the impact of the reforms on the entire system of prime contractors and subcontractors is not yet understood in terms of effects on industry integration, symmetries or asymmetries of impact on higher and lower levels of the supply chain, effects on the future profitability of US firms, and the possible effects of collaboration with foreign-owned firms. As discussed in section 6.3.3, the evidence so far suggests that the influence of prime contractors in the US is increasing.

The important point to stress with respect to all of the above is that the reform of military standards and specifications cannot occur in isolation from other actions that affect the dynamics of defence procurement. In the US, standards reform is part of an overall programme of acquisition reform aimed at changing the relationship between suppliers and buyers of defence-related goods and services in quite fundamental ways. Similar schemes are being launched in some European countries. In the British 'Smart Procurement Initiative' (see section 3.3.1), the objective is to reduce the inherent risks in the new procurement model through improved planning, particularly at the early programme stages, and by building up 'life-cycle' partnerships with defence suppliers. It is in the context of these larger efforts that the final effectiveness of standardisation reforms has to be assessed.

RECOMMENDATION 7: ***A major Europe-wide initiative is required to promote best practice in defence procurement through the adoption of life-cycle approaches in procurement programmes. Useful contributions to this effort could be derived from the implementation of the benchmarking exercises foreseen in the Commission Action Plan (item 13).***

Problem Area 4: Enhancing competitiveness - balancing strategy and efficiency goals in standards reform

Throughout our study, the issue of the relationship between procurement reform measures and the competitiveness of the European defence industry appeared repeatedly. In the defence case, as in the case of similar commercial challenges in other industry fields from the US, Asia and elsewhere, the case is strong that the fragmentation of European suppliers is causing serious competitiveness problems. The questions here concern how and to what extent these problems can be addressed by standards. Our basic conclusion is that although standards can enhance and consolidate competitive positions in some instances, they are seldom sufficient mechanisms to accomplish these goals.

Irrespective of the present or potential competitive position of the European defence industries, the overwhelming response of stakeholders contacted in the course of this study was that there is now virtually no choice with respect to the migration to civil standards in most areas. The prevailing market dynamics for most key defence technology areas are now commercial, particularly in the ICT areas where increasingly large amounts of defence procurement budgets are committed. Even in sectors where the rate of technical change is slower, the tables have turned or are turning in terms of the procurement power that can be brought to bear by defence agencies on basic design and build considerations. In other words, the competitive positions of civil and defence technology producers in Europe are now closely linked to an unprecedented degree.

In seeking to understand the significance of this close relationship for standardisation systems, it must be stressed that in most circumstances, commercial firms do not seek standards. In practice, their natural inclination is to avoid standards wherever possible, and to embrace them only where necessary. Certainly, the requirement to eliminate redundant or superfluous standards (whether military or commercial in origin) was the sub-text of most comments by both US and European industry respondents.

As shown by our matrix analysis in section 7.4.1, the link for most types of industry between standards and competitiveness is related primarily to *efficiency* – '…is the standard needed?' and '…does it work technically?' - rather than to *strategy* – '…what standards do we need to be competitive?'. Only in the ICT and process management areas is there a predominance of strategic rationales, but even here the emphasis is on the development of technological support for specific new business models. If we take ICT and process management out of the picture, we are left with a very conservative industry attitude towards standards - ten of the remaining thirteen remaining key technology areas we profiled fell into quadrant 1 (i.e. they were overwhelmingly oriented to efficiency goals, mostly through simple variety reduction).

The potential 'flashpoints' between these 'reactive' and 'proactive' standards cultures are clearly in those areas that involve applications of ICT and new process management techniques to user industries. In this case, real dangers exist in that highly strategic standards environments are prone to 'standards inflation'. The process of seeking standards in order to gain commercial advantage succumbs easily to an over-proliferation of initiatives and can generate severe problems regarding redundancy and lock-in/lock-out effects. This creates added standards selection and management costs for standards users, and over-proliferation of standards is now arguably a greater impediment to competitiveness in some areas than lack of standards. In our profile of computer interconnection and interoperability, for example (see section 7.3.5 Profile 13), we noted how the increasing array of specialised interfaces, tools and data formats can lock-in users to proprietary interconnection environments.

Where industrialists seek to establish standards for strategic reasons, it is often necessary to scrutinise these initiatives in the public interest. Likewise, where the market fails to set standards in areas deemed to be in the public interest, government intervention is legitimate. In other words, a major part of standards policy to promote competitiveness involves ensuring that competition in the market is not impeded by technical barriers that could be overcome with common standards.

Our European survey revealed differences of opinion on the relationship between standards and competitiveness. Some argued that reforms in the standardisation regime can promote competitiveness directly by opening up markets for defence products in Europe and abroad. Others believed that the relationship between standards and competitiveness is secondary, and follows in this case from the use of standards reforms to facilitate the transition to international best practice in defence project management.

The argument for direct linkage between standards and competitiveness appeared most often in our European survey in relation to the role played by US standards in the international defence market. Fears were expressed in Europe (see section 5.5) that the relatively more advanced state and greater scope of US reforms may threaten the position of European firms in export markets. On the other hand, some US commentators expressed worries that the effect of US reforms on the future of established US markets may be negative. US military standards are widely accepted in international markets. Indeed, they are the preferred choice of defence contractors and customers in some EU countries (more below). Furthermore, as some US respondents were keen to point out, US export markets have been built up and maintained under the MILSPEC regime (section 6.4.2). As yet, there is little experience of building or sustaining these markets under a commercial standards regime.

US MILSPEC reform is bound to have a direct impact on the export (and in some cases even domestic) markets of European defence producers, in that the decisions to retain, modify, or eliminate US MILSPECs rest solely in US hands. Furthermore, when MILSPECs are cancelled they are often substituted by US civilian standards, which are generated and managed within a complex US domestic standardisation system (see section 2.4) which European manufacturers (and some US manufacturers as well) may find more difficult to negotiate.

The argument for a secondary effect of standards reform on competitiveness is more straightforward. At issue here is the source of US competitiveness in defence products, and particularly export success. In this respect, many respondents in Europe and the US acknowledged that much if not most of US export success in the past has been attributable to historically higher US productivity in developing new defence systems relative to competitors. In short, the US produces new systems more frequently than its competitors, and brings many of them to export markets more quickly. In other words, most US standards are established in world markets by US products and not the other way around. This product orientation means that the function of standards is seen more in terms of production efficiency than necessarily as an *a priori* source of competitive advantage.

As noted in section 5.3, estimates are that 80% of R&D costs are related to solving routine problems - the very tasks to which most standards have traditionally been oriented (see section 2.1.1). In terms of competitiveness, many of the benefits of standards reform for the European defence industry should be seen in the light of the kinds of production efficiency benefits expected from standards in commercial markets - variety reduction, compatibility and interoperability, increased safety (section 6.4.2).

RECOMMENDATION 8: ***Policy actions with respect to defence standards conversion should focus primarily on enhancing the responsiveness and efficiency of European defence producers. Strategic standardisation activities in areas like ICT and process management must be evaluated for policy purposes in terms of their impacts on basic design and production efficiency goals in the defence-related industrial sectors in which they are applied. This is a 'sister' principle to the one set out in Recommendation 1 that the primary aim of standards reform should be to support reform in EU defence markets.***

Problem Area 5: Determining optimal types and levels of standardisation in a defence context

One of the Commission's concerns in initiating this study was to determine if the effects of standards reforms were related to specific types of standards (interface standards, test methods, codes of practice and so forth). The implication is that policy action may be more appropriate for some types of standards than for others, or that targeted measures may be required depending on the type of standards used in specific contexts.

Our discussion in Chapter 7 illustrated that the relationship between the type of standard employed, the level at which it is applied and the context of its application is highly complex and that configurations of these factors are usually case specific. However, our analysis of standardisation dynamics in Chapters 2 and 7 illustrated that there are some general ways of looking at types and levels of standardisation that may be helpful in guiding policy.

A formal typology for standards that is significant in the context of US defence standards reform was set out in section 2.1.2 (in this case as defined by the US Department of the Navy). This included nine types covering a comprehensive range of industrial activities to which standards can be applied. As discussed briefly in Section 5.6.2, all of these standards types can be aggregated into two basic categories:

- ***'technology' standards*** that describe physical and (in the case of information technologies) logical characteristics, set out technical specifications and conformance tests, and define related physical and logical interfaces;
- ***'process' standards*** that set out procedural and management requirements, practices and protocols related to the production and application of technology.

The primary distribution of the US Navy typology given in section 2.1.2 according to these categories is shown in Table 8-1.

Table 8-1 Classification of standards types

Technology Standards	Process Standards
Interface standards	Design or selection criteria
Test methods	Management standards
Reference standards	Manufacturing process standards
Data acquisition and interchange standards	Codes of Practice
	Maintenance standards
	Data acquisition and interchange standards

Quite clearly, most of the types of standards in the US Navy list can be classified as primarily process oriented. The exception is 'data acquisition and interchange standards' which has significant technology and process dimensions. In terms of the key standardisation initiatives we analysed in Chapter 7, most or all of the process-related standards in the right-hand column of the table fall into matrix quadrants 3 or 4 (i.e. the rationales for developing and applying them in a commercial context have a high strategic element).

As discussed above in connection with Problem Area 3, process standards initiatives play especially important roles in the shift from technical to performance-based procurement regimes. The trend indicated by our exercise with US SPI data is that US industry is giving (at least initial) priority to process standards in responding to defence standards reform initiatives.

This trend is significant in that for many years the principle in civil standardisation of preference for performance standards over prescriptive standards has been gaining momentum. Although US respondents were not specific in this regard, it is reasonable to propose that a defence procurement reform initiative based on performance principles offers an opportunity for defence contractors to build new gateways between themselves and commercial technology areas through the development of common process-related standards.

As discussed in section 4.1.1 the NATO standards system acknowledges four basic levels of military standardisation:

1. *compatibility* - whereby two or more systems, components or procedures can function in the same system or environment without mutual interference;
2. *interoperability* - whereby different systems, components and procedures can be operated together in order to deliver a specific functionality;
3. *interchangeability* - whereby the functional and physical characteristics of selected components and procedures are equivalent in terms of performance such that one can be exchanged for another without alteration or adjustment;
4. *commonality* – whereby systems, components and procedures are identical.

Categories 1 and 2 in this scheme correspond roughly to the main objectives of civil standardisation as set out in Chapter 2, and to the types of 'technology' standards listed in the above Table. Most voluntary civil standards normally are not oriented to achieving 'commonality' or 'interchangeability' objectives as such. For the most part, voluntary technology standards concentrate on compatibility and interoperability which can be achieved either through description and/or prescription, or, increasingly, through setting out performance criteria. In a commercial context, interchangeability is sometimes an outcome of the application of compatibility and/or interoperability standards, but often - as shown for example in connection with mechanical components (see section 7.3.3) - commercial industry consensus on compatibility and interoperability goals often evaporates at the level of the full interchangeability of parts - i.e. a Ford and Mercedes-Benz fuel pump could be made to exactly the same performance standards, but there would be no commercial incentive to make them fully interchangeable because of the lucrative secondary market in replacement parts. In other cases, however, interchangeability is a logical requirement in both military and civilian contexts. The best mutual examples are consumables - like firearms ammunition, or fuels and lubricants where only in exceptional circumstances would a customer not insist on access to standard products.

On the other hand, 'process' standards are very much concerned with commonality. The main objective in this case is to support variety in the market by providing buyers with objective standardised information about how products and services are produced and how they can be expected to perform, rather than necessarily to specify levels of product functionality as such. In this respect, process standards are close in principle to current NATO 'commonality' objectives, the majority of which relate to matters of doctrine (how things are to be done) rather than to technology as such.

In the European survey, most interviewees agreed that in most cases interoperability was both the most achievable and desirable level of standardisation for military purposes. Most did not regard higher levels of standardisation as feasible objectives, and noted in this regard that too high a level of standardisation can inhibit the market from generating innovations. On the other hand, if the principle objectives in defence agency management are defined too narrowly in terms of cost savings, defence procurement officials may be faced with incentives to aim for higher levels of standardisation that may or may not be reasonable or effective in the longer-run.

Furthermore, there are legitimate arguments in military strategy and tactics against too much commonality in equipment and systems. In battlefield conditions, variety complicates the task of your opponent in trying to defeat you. Military commanders prefer commonality only for areas like military doctrine and related procedures - issues that are beyond the scope of this study. The rule of thumb that emerged from our discussions with serving or former military staff is that in all cases a minimum level of compatibility, interoperability and interchangeability should be sought that is commensurate with enabling defined configurations of armed forces to achieve defined battlefield objectives.

A similar rule of thumb applies in the civil arena. As noted above in connection with Problem Area 5, most industrialists seek to standardise only where absolutely necessary. It is important in our view to stress that a major part of the argument behind defence standards reform is to *minimise the use of standards altogether* - not just to harmonise them or to convert military standards to commercial ones. In our view, one of the best ways to control the possibility of standards abuse - using them to close markets rather than to open them - is to control their proliferation. This can be accomplished in many positive ways - the best probably being to insist on standardisation at supra-national levels whenever possible.

RECOMMENDATION 9: ***The new European defence standards regime proposed in Recommendation 3 should be oriented to the principle of specifying only the minimum levels of standardisation in the defence arena that can be justified by the defined common operational objectives of European forces (including their NATO commitments), the common production objectives of European defence producers, and the common principles and rules of public procurement in the EU. In some cases, achieving the optimal minimum level of standardisation will require reducing the quantity of existing standards through harmonisation or rationalisation. In other cases, achieving the optimal level may require the development of new or revised standards. In both cases, there may be opportunity for the Commission to play a positive role - in the latter case perhaps under the existing 'mandate' programme.***

Many respondents to the European survey equated the objective of achieving interoperability with the need to focus on interface standards. This can be problematical as a general approach, however, in that an interface standard does not necessarily assure interoperability. Two computer systems may share the same physical (plug) interface but they will not be interoperable unless there are also common data protocols. The history of standardisation efforts in the ICT area has shown that it can be folly to attempt to standardise interfaces and data protocols at too high a level - for reasons of commercial interest, the closer you get to the actual user application, the less likely it is that consensus on standards will emerge. Arguably, one of the main reasons for the attractiveness of the Internet protocol is that it concentrates on the most basic levels of data exchange, not on the interoperability of specific applications and specialised data formats - these are selected by individual computer users in the market.

Our analysis with respect to the problem of determining the appropriate levels of standardisation and defining the appropriate types of standards required to achieve these levels, is that defence standards reform in Europe should be linked to the broader goal of establishing open systems architectures in all major new defence systems. Systems designed on this principle will facilitate modifications to incorporate the additional functionality of new technological developments as they come on stream while retaining interoperability capabilities at each stage, and contribute significantly to best practice in obsolescence management (see section 3.1.5).

The logic of performance-oriented procurement and standards reforms is the close integration of 'technology' and 'process' standards - virtually every 'technology' standard will require counterpart 'process' standards to assure and verify that performance objectives are being met. Therefore, our study does not indicate that it would be appropriate for policies to be developed around the perceived need to target interface standards, quality standards or any other particular type of standard. It makes more sense in our view to target policies to those specific aspects of standards dynamics as analysed in section 7.4 where conflict arises with the public interest in establishing a Europe-wide defence standards regime that has an open systems orientation.

RECOMMENDATION 10: ***The new European defence standardisation reform initiative as set out in Recommendation 3 should aim to establish the 'open system' as a basic design principle in as many existing defence technology systems as possible, and in all major new development projects. The Commission and/or any other relevant bodies should not focus on intervention measures on specific types of standards as such, but should orient its efforts towards mediating conflicts between 'technology' and 'process' standards.***

Problem Area 6: Managing defence standardisation exceptions

How far should the policy of avoiding the use of military standards and specifications go? If we allow that there are cases in which the drafting of military-specific standards is justified, how should we manage these exceptions? Our study indicated a number of instances where the retention of defence standards could be justified on the grounds that no appropriate or equivalent civil standards exist, and that the incentive to develop them would be unlikely to arise in the civil standards system.

One of the main danger areas with respect to the implementation of a defence standards reform programme in Europe is that the scope of these initiatives is open to misinterpretation by both industry and government procurement agencies. In our view, not all military standards can or will be replaced efficiently with commercial standards. The problem is how to manage these exceptions on a European basis.

It was the view of many US officials that under the current reform programme crucial military standards initiatives for which there was no commercial equivalent have been scrapped needlessly, with negative consequences. Indeed, US government officials have successfully resisted replacing MILSPECs in some cases. As shown in section 6.4.3, the Joint Technical Architecture (a mechanism governing DoD acquisition and development efforts in command, control, communications, computers and intelligence) escaped the trend to convert to commercial specifications and standards. JTA mandated a set of 400 MILSPECs, mainly to retain consistency and common configurations in information technologies.

Our European survey indicated general agreement by both government officials and industrialists that there are legitimate reasons to retain selected military standards, but we found no consensus as to what exceptions should be made, or on how to determine when these exceptions might be justified (section 5.6.4). These matters appeared to be linked more to policy and national attitudes than to objective criteria (sections 5.6.1 and 5.6.4). Other European industrialists expressed concerns about the retention of any military standards at all, pointing out the potential barriers to market entry and additional costs that maintaining them could generate. It was noted also that in some cases, there were often substantial time lags in making decisions to convert to civil standards, during which time defence standards continue to be developed and applied.

RECOMMENDATION 11: ***A specific function should be set up within an appropriate body with responsibility for monitoring current defence standards catalogues and work programmes in the Member States. This function should be supported by a policy initiative endorsed by the national defence authorities in the Member States to file defence standards catalogues and work programmes such that they can be monitored by the appropriate body. This requirement should be linked to Recommendations below with respect to developing a European defence standards information strategy. The purpose of establishing this monitoring function is to identify cases where current standards requirements and work programmes could negatively affect access by EU firms to domestic European defence markets, or otherwise impede progress to Europe-wide action on defence standards reform.***

Furthermore, even after conversion has been made, problems of military 'versioning' of commercial standards can arise. We noted in section 5.6.4, for example, that the versions of ISO 9000 for military applications were causing problems to some suppliers. We found that for process standards (especially for QA, and logistics support), new defence standards or versions of existing commercial standards, were imposing practices on suppliers that differed from the processes used in commercial operations and that may be increasing costs of market entry in some instances. This is occurring even in areas that have been clearly targeted for defence standards elimination (as with AQAP versions of existing ISO quality standards).

The 'versioning' problem is important because it will not disappear with the increased use of civil standards. Indeed, 'versioning' is normal practice in many civil standards areas, especially for international standards which typically contain 'sub-sets' in order to respond to differences in national or sector-based application conditions. In our view, it is as important to monitor the extent and implications of versioning in the defence context - for both military-specific and civil standards - as it is to manage the selective retention of defence standards.

Another possible problem area in the conversion to civil standards arises because the contexts within which civil standards are developed are often different to the military contexts in which they might be applied. It must be considered that civil standards can also occasionally raise costs by transposing civil issues into defence contexts. For example, we noted how Italian standards on workplace conditions resulted in design changes on the Horizon Frigate (section 5.5.1), and how the cost of specialised military vehicles increases due to requirements to conform to civil engine emission standards that were drafted to deal with a pollution problem created mainly by non-military vehicles.

However, the reverse can be true also where standards that have originally a defence orientation move into the civil arena, an occurrence that is likely to increase if defence stakeholders take more active roles in civil standards initiatives. CALS and ILS have been referred to repeatedly as examples of positive standards collaboration involving adoption of commercial practices. However, CALS and ILS have defence rather than civil roots. We observed how initiatives of this kind that might offer real benefits in the defence area can result in over-regulation of commercial industrial processes (see section 7.3.1, Profile 2). Where international logistics chains are concerned, this problem can be intensified where countries maintain slightly different approaches to CALS and ILS (there is no NATO ILS standard, for example, and a wide variety of ILS standards and approaches are used in different countries and sectors).

We conclude that rigorous insistence on civil standards could in certain cases be counterproductive to defence objectives and thus may not yield the intended economic benefits. However, in order to ensure that overall progress on beneficial defence procurement and standardisation reforms in Europe is not impeded by spurious national claims for exceptions, there is a need to set clear exemption justification criteria and to monitor and document all approved military exemptions from and versions of civil standards. This will ensure that exemptions and versions are transparent to all potentially interested parties.

Our study found no clear example of best practice in this respect, either in the US or in Europe, but we did find perhaps an embryonic best practice model in some of the ideas presented to us by officials in the French MoD and in AFNOR. Although we are not in full agreement that the examples of military specificity given in the French response are all necessarily valid (especially in the areas of data formats and security), the two basic classifications given by the MoD for defining criteria for the retention of defence standards seem to us to provide a reasonable basis for drawing distinctions and building up more detailed exemption criteria (see section 5.6.4). Briefly, the French document distinguishes between two areas:

- areas identical to the civil domain, subjected to the same requirements and constraints
- areas with specific military requirements, where the required performance is higher than in the civilian field or where the operational environment is much harsher

The problem for the development of a common European approach is how to determine which cases fall into which category equitably and consistently. The basic principles suggested by AFNOR in this regard are reasonable in our view and largely supported by our analysis of standards dynamics in both civil and defence arenas. The AFNOR principle is that only in the definition of performance levels, product specifications (we would insist that these be defined specifically in terms of highly specialised products), and codes of practice that military clients should be able to specify unique standards. Most commercial firms would reserve the same rights, either as customers or suppliers.

RECOMMENDATION 12: ***To generally clarify the policy direction at the European level on how retention of specific defence standards will be managed within the broader context of standards reform, a requirement should be established that national defence procurement agencies must demonstrate justification for the retention of a defence-specific standard according to principles and rules agreed at the European level.***

RECOMMENDATION 13: ***In consultation with industry and the European national defence agencies, the Commission and/or any other relevant bodies should establish harmonised criteria and documentation procedures for retention of defence-specific standards. This should include rules for country-specific retention of defence standards and for retention on an EU-wide basis. Once agreed, the criteria could be considered for EN status.***

RECOMMENDATION 14: ***In consultation with industry, the defence agencies and the European regional standards bodies, the Commission should develop harmonised criteria and documentation procedures for military 'versioning' of civil standards. Once agreed, the criteria could be considered for EN status.***

One of the main difficulties in all of the above respects is that different types of standards are available from different sources - international, regional and national SDOs, trade associations and consortia, NATO, national defence agencies and so forth. Clearly, the issue of granting exemptions from the requirement to convert to civil standards is contingent upon developing a coherent set of criteria as to which sources of standards should be preferred, and as to the order in which alternative sources should be preferred. Some EU Member States have issued clear guidelines in this respect - hierarchies of standards sources for defence procurement. The problems is that not all of these hierarchies are congruent - indeed, as not all Member States responded to our requests for this kind of information, we can not be sure that defined hierarchies exist or are made public in all Member States.

RECOMMENDATION 15: ***In order to clarify directions and expectations with respect to the use of civil standards in defence procurement, the Commission and/or any other relevant bodies should establish a regionally harmonised hierarchy of standards sources for defence procurement. We recommend that this hierarchy itself be established as an EN, referenced accordingly in EU Directives, and applied in the defence procurement agencies of every Member State. We have included for discussion purposes only a sample basic hierarchy (see Figure 8-1) that is based closely on the existing practice of most major EU defence producer countries.***

Figure 8-1 Suggested basic EU-wide hierarchy for standards in defence procurement

Civil equivalent available	No civil equivalent available
• International civil standards • European civil standards (EN and ENV)	
	• NATO standards
• National civil standards • National civil standards of other EU countries • National civil standards of other non-EU NATO countries (e.g. ANSI, CSA) • Standards produced by internationally recognised industry bodies (e.g. SAE, ECMA) that have not been proposed as international or national standards	
	• National defence agency standards • National defence agency standards of other EU countries. • National defence agency standards of other NATO countries (e.g. MILSPECS)
• Miscellaneous consortium, *de facto* and proprietary standards	

Problem Area 7: Managing organisational and administrative factors in implementing defence standards reform

One of the clearest indications to emerge from the US study was that organisational and administrative factors are extremely important in determining the success or failure of procurement reforms and defence standards conversion goals. Most of these factors have a significant 'cultural' dimension in that they relate to institutionally entrenched ways of perceiving problems and dealing with change. Cultural obstacles like these can occur in industry as well as in the defence agencies. In the US, the success of reform efforts is seen to depend on simultaneous cultural change in both industry and government (see section 6.4.1).

The US study shows that most of the motivation for change continues to reside at higher management levels, and that a 'top down' approach has been crucial in driving co-ordination of reform aims in both industry and the DoD (see section 6.2.5). US officials acknowledged that inculcating the reform philosophy at middle management levels will be the eventual key to the success of these initiatives, but that this 'trickle-down' process has only begun. Not all of the requirements for sustaining the reforms are yet evident and indications of 'best practice' for effecting these changes are only beginning to emerge.

Our survey of European opinion revealed many similar obstacles to change in attitudes and practices. In our analysis, most of these obstacles relate to 'cultural' factors at both senior (including political) and middle management levels. Few of the reasons given to us for retaining the *status quo* in defence standardisation were credible in economic or defence strategic terms - those cases where exceptions may be legitimate are discussed above under Problem Area 7 (defence exceptions).

The prime difference between the US and European situations in this respect is that there is as yet no European consensus at senior management and political levels as to the extent of change or the possible routes to change. Many concerns at senior management levels are generated or reinforced by general political concerns in several of the Member States about the potential for unintended negative consequences (in terms of unemployment, regional imbalances and so forth) due to rationalisation and restructuring of the defence industries.

The problem is compounded in that some European countries (like France, Spain, and Italy) have large state-owned defence production enterprises whereas others (like Germany, the UK and Sweden) rely mostly or entirely on private contractors. Our description of defence procurement and defence standardisation in Europe (Chapters 3 and 4), supplemented with evidence form the European survey revealed that 'cultural' differences among the EU Member States in the organisation and administration of defence standardisation systems are generated largely by the kinds of roles played by national government agencies in the defence industry structure. In the absence of political commitment to rationalise this structure, or at least to make it transparent, it is unlikely in our view that positive influence for 'cultural' change can be brought to bear at the crucial mid-management levels of the national procurement hierarchies.

In France and Sweden for instance, procurement agencies are closely involved in defence project management, which in turn is linked with general national industrial policy. In France, the link with the general policy apparatus is arguably stronger in that government retains a large stake in the main French defence producers. This results in a system where specialised industrial groups that are themselves often government-owned interact very closely with defence clients. In the French case, at least, this has produced a defence standardisation system that can be very opaque to potential new market entrants (domestic as well as foreign). Current reform efforts in France are aimed at increasing the transparency of this system.

However, the problem of opaque systems is chronic in the military sector, and not unique to countries like France where there is a high degree of government ownership in defence production. The UK has been involved in a process of standardisation reform for many years, and this is now being aligned with broader changes in the procurement structure (the 'Smart Procurement Initiative'). However, even in cases like this where there has been a long-standing policy of using commercial standards whenever possible, the view of many industrialists was that unnecessary defence standards (old and new) continue to proliferate.

As the US study showed in more detail, established organisational and administrative cultures die hard. Even where there is a strong official commitment to defence standards reform, it is necessary to promote the reform ideal actively and to monitor progress. In this respect, the main lesson to be drawn form the US experience to date is that at every stage, every aspect of the reform effort must be motivated at the highest political level.

In the US case this meant that the reforms were driven by legislation and championed by the DoD. The effect was to instil confidence in defence suppliers and DoD procurement offices alike that the likelihood of reforms being abandoned was low. In turn, this increased expectations that the costs of adjusting to the reforms could be amortised, and encouraged forward planning. Indeed, one of the most important concerns about the US programme at the present time (see section 6.4.2) concerns the vulnerability of the reforms to unanticipated shocks. Some US officials fear that a major procurement scandal could derail the reforms entirely, incurring huge financial losses in industry, and making any further government-industry consensus on reforms very difficult if not impossible to achieve.

Several responses to the European survey - from industry as well as government - argued that a step-by-step approach to reform was the only politically acceptable way forward given the added complexity of the European context. The general consensus of our industry respondents in Europe was that sector-based approaches that hold out the promise of commercial cross-benefits are the best route to reform. While appreciating the need to be pragmatic, we believe it is important to point out in the light of the above analysis that the step-by-step strategy carries major risks, especially if it is based initially in specific international defence system development programmes.

In the first place, there is no equivalent agency to the US DoD in the European arena in terms of leveraging and steering the reform effort with procurement power, or in terms of managing the vulnerability of reforms. The potential for reversal towards national protectiveness in the application of standards in European defence procurement is high. A step-by-step approach presents many more opportunities for adverse circumstances to arise (like a procurement scandal, or a high profile withdrawal from a collaborative effort to co-ordinate national reforms) thus setting back the entire programme. Reversals would be costly to European industry. Industry must have confidence that there is top level political commitment to sustaining EU-wide reforms or they are unlikely to contribute the human and technical resources that would be crucial to their success.

Obtaining this commitment at the European level may not be straightforward as it involves both defence and civil issues. Meetings of European Defence Ministers do not take place on the same basis as other Ministerial meetings under the Council of Ministers. However, it is of paramount importance that high-level political commitment is obtained from both the defence and civil communities, in that the main standards reform initiatives that follow from this commitment must be pursued jointly by defence and civil stakeholders. Using defence-specific fora (like the WEU or NATO) will not in our view be the optimal way of developing this consensus, because it may focus attention unduly on the defence sphere.

The proposal in section 5.7 (from the French MoD) to focus these reform activities through a collaborative project with a specific deliverable - in this case a 'handbook' - seems very sensible to us and a fruitful way forward. Furthermore, a potentially useful prototype for the formal structure of such a handbook exists in UK Defence Standard 00-00 - a document that lays out all of the standardisation principles and procedures used by the UK MoD, along with high-level classifications and descriptions that outline virtually the entire UK defence standards regime. No document of similar scale and scope was forthcoming from any of the other Member States.

RECOMMENDATION 16: ***In our view, EU institutions are a major forum for achieving the degree of high-level political and management consensus required to overcome administrative and organisational obstacles to the progress of defence standards reform. We therefore recommend that the Commission and the other relevant bodies undertake a bold initiative endorsed at the level of the Ministers of Defence in the Member States. We***

propose that the initiative should be a collaborative project to develop a European Handbook of Defence Standards and Standardisation Procedures - a 'living' document (preferably in electronic form) updated at regular intervals that sets out according to a common scheme all details of national defence standards regimes in Europe and their relationships to the defence procurement regimes of the Member States. The project should be co-ordinated by the Commission and WEAG, with contributions from each country assembled under the supervision of the national armaments directors. We recommend also that as the handbook project progresses, close liaison be maintained with industry and the civil SDOs, by including representatives from these constituencies on a project management board. The Handbook will be a crucial tool in achieving administrative transparency and in promoting the development of harmonised best practice.

The Handbook is naturally linked to the measures presented below in Recommendations 30-32 aimed at promoting transparency and reducing information asymmetries in national defence standards programmes and catalogues.

Constructing a Defence Standards Handbook involves two main elements:

1. *Structure and presentation format.* A set of elements must be defined that will be presented in the Handbook over a period of years, as well as they way in which the Handbook will be organised for presentation purposes. For each participating country the Handbook will include information on the main legislative and regulatory instruments pertaining to defence standardisation, the basic organisational structure of defence standardisation bodies, the procedures for the definition and publication of defence standards, and the sources from which defence standards can be obtained. The Handbook will therefore provide a high-level description of the defence standards regime for all EU countries. To develop the Handbook it will be necessary to define the level of detail of such descriptions, as well as its format. Given that the Handbook must be a "living document", constantly updated to reflect changes at the national level, it may be advantageous to use an Internet-based electronic format structured around 'hyperlinks' leading the user to relevant sources of national information (e.g. national defence standards catalogues). It must however be assessed whether such an approach could result in the perpetuation of information assymetries, and whether centalising the responsibility for the production of the Handbook may be a more adequate tool to address the problems at hand.

2. *Data gathering and management.* Once the structure of the Handbook is agreed a data gathering and management regime will be required. This includes the identification and co-ordination of the national defence procurement offices that provide points of contact with the Handbook and contribute information to it, and the establishment of procedures to ensure that the Handbook becomes a "living document".

Whatever the scope or structure of the Handbook initiative, it is of paramount importance that it be endorsed by high-level political authorities. Once the problem of obtaining high-level commitment is addressed and basic tools like the Handbook are in place, progress can be sought in transforming organisational and administrative regimes at middle levels. On the administrative side, many European defence procurement agencies continue to be dominated by what one observer termed the 'cult of exceptionalism' - i.e. by procurement regimes that view all defence standardisation requirements as being different in principle from any commercial analogues they may have (see Section 5.5.5).

Organisational and administrative change will involve ensuring that top down commitment permeates the mid and lower levels where adaptation to change is often slowest. The US study noted that with respect to procurement and standards reform, there is a bifurcation between the political leaders in the DoD, who promote the changes, and the career civil servants who actually operate the procurement process, who tend to resist change. In is at the career level that legacies of existing defence standards are most likely to be preserved and initiatives to generate new defence-specific standards generated. It is also at this level that most of the day-to-day exchange of technical information takes place between defence customers and suppliers - i.e. it is at the middle management levels where most standardisation requirements are most likely to be determined.

Our analysis is that the problem of bridging emerging cultural gaps between senior and mid-management levels in the defence procurement structure in Europe will require an even greater effort than in the US. In the European case, consensus is required among fifteen separate procurement administrations. Some are committed to reforms and others are not. Already committed Member States are all at different stages of reform. Non-committed States need to be convinced that there are real incentives for reform, and that there are advantages in participating in the reform process at the EU level.

We envisage a positive role for the Commission in facilitating the evolution of an organisational and administrative culture that is receptive to reform efforts. The task as we see it is to build up a sense of professional community in European defence standardisation that transcends national considerations and concentrates instead on identifying, generating and disseminating best practice principles based on mutual experience.

RECOMMENDATION 17: ***Intermittent 'best practice' workshops should be arranged for middle management officials in defence agencies and their counterparts in industry. These workshops should take a 'case study' approach based on experiences with best practice development in Member States, and in other NATO countries, and on the findings of independent studies undertaken by the Commission and other institutions, including firms.***

RECOMMENDATION 18: ***An interactive EU-wide on-line bulletin should be instituted to publicise relevant research into defence standards and procurement best practice. The bulletin should draw attention to significant case studies, and introduce new administrative methodologies (as for programme benchmarking and cost efficiency assessment) for consideration by procurement professionals.***

On the technology management side, the argument invoked frequently by European respondents in defence agencies concerned their status as 'informed customers'. Fears were expressed that the greater use of commercial standards may lead to possible loss of technical competency in defence research agencies, and that this will have a knock-on effect in terms of the efficient specification of technology requirements in procurement contracts (see Section 5.3).

We share some of the concerns about retention of technical competencies, but would suggest that this process could be more efficient at a Europe-wide level. We would draw attention also to the fact that relationships between some contractors and defence agencies in some countries are particularly close already, making it difficult to determine the actual balance of technical expertise in many cases. Furthermore, as shown in Section 2.1.5, there is already substantial incentive for defence agencies to participate in SDO initiatives in addition to defence-specific initiatives, along with evidence that to a significant extent they do so already.

In addressing technological management problems like these, there was wide consensus among the European industrialists interviewed that the voices of defence industries and their trade associations should be more widely taken into account by national defence policy-makers: that industry should be involved to a larger degree in consultations and programme planning with defence procurement agencies and military research facilities, and that these agencies should in turn make efforts to become more transparent to industry.

Greater transparency is required to achieve these goals (in this we agree entirely with the industry consensus). However, a procurement environment based on commercial standards does not necessarily result in a more open procurement process. As discussed below with reference to developing the interface with the commercial standards system (Problem Area 12), commercial standards as such are not immune from capture by special interests.

Problem Area 8: Developing a European response to US standards reform

Given the advanced state of US defence standards reforms, and the pivotal position of US defence products in world markets (including in many cases European markets), it is virtually inevitable that the course of action taken in Europe will be influenced strongly by US experience and future actions. Our survey of European defence industry stakeholders yielded two main conclusions in this regard:

1. the US model is widely seen as both the most important challenge to the present situation in Europe, and as the most significant example of how the European defence industries might gear up to respond to this challenge;
2. there is an urgent need for Europe to respond to the US procurement reform initiative, which includes reforming the defence standardisation regime.

Nevertheless, not every aspect of the US reform programme will be applicable or even possible in Europe. The overall results of our study indicate strongly that although much important guidance can be obtained from the US experience, there is no 'US model' that can be applied in Europe. Furthermore, developing a unique European solution presents a more complex problem than that faced by US defence planners and reformers - indeed, some of the complexity is added by the need to respond to existing or planned US reforms.

The most obvious difference between Europe and the US is that political agreement for reforms in Europe will involve fifteen countries, each with its own sovereign armed forces. A problem is presented at the outset in that not all Member States agree even on the interpretation of key legal instruments concerning the responsibilities of the Commission with respect to defence matters, including procurement.

Our basic view is that there is nothing in Article 223 of the Treaty of Rome that in any way precludes action by the Council or the Commission in addressing standardisation issues in a defence procurement context. Article 223 explicitly says that the common market for products not intended for *specifically* military purposes should not be endangered by exceptions claimed for defence reasons. Moreover, as the issues under consideration here intersect with civil standardisation matters, the Commission has an obligation to ensure that the technical harmonisation objectives of the new approach are being met (along with prior and subsequent Directives and Decisions related to the new approach objectives). The scepticism concerning EU authority in these matters that was expressed by some respondents to our European survey is unfounded in our view.

Furthermore, there was a remarkable degree of agreement on the part of most of the European industry stakeholders that the Commission had a key role to play in this area, and that change should be pursued at a European level as a matter of defence strategic and economic urgency. Nevertheless, survey respondents expressed concern that many discussions about reform have been proposed in the past without significant effect. The clear implication is that any further attempts at policy action should be decisive; that bold initiatives were more likely to attract industry and defence agency interest and participation than would further exploratory initiatives.

Problematically, given this implication, the overall view tended to be that the Commission should play a guiding and facilitating role, built-up first using more informal approaches, gradually becoming formalised in line with the development of international best practice - i.e. the kind of step-by-step approach discussed critically above in the context of Problem Area 8. Proposed positive action was that the Commission should undertake greater liaison with the defence industries across Europe, examining specific obstacles to trade in specific defence equipment markets.

National officials interviewed in the European survey indicated that the general source of many of these obstacles is the intensely national nature of the military culture. Defence cultures in the Member States remain centred in nation states, not in the institutions of the EU (see sections 5.4 and 5.5.5). There is no central focus for military procurement in Europe that could assume a co-ordination function on anything like the scale provided by the US DoD. The result is that although there may be agreement on the need for change, there is as yet no European consensus on the way to form a single defence market (see section 5.7).

There is a perception in some quarters - one we do not share - that defence standards reform in Europe may require a less intensive initiative than in the US. The argument is one of scale: that there are fewer specific military standards in Europe than in the US and therefore a smaller reform effort will be required (see section 5.4). Linked to this argument is the French position that unlike the case of US MILSPECs not all European military standards are obligatory. In our view these arguments are largely spurious. They misrepresent the nature of the reform problem which in Europe is not related primarily to a 'scale of quantity' in terms of numbers of standards to be rationalised, but to a 'scale of complexity' in terms of the national, institutional and industrial interests that must be reconciled, some on a transatlantic basis.

Respondents to our European survey identified a number of issues which we concur will be important determinants of the success of any European defence standards reform process. First, they confirm that the move away from MILSPECs in the US can actually disadvantage European firms in some respects. As the US standards regime moves to the commercial arena, European firms must cope with the highly diverse US civil standards system. This system tends not to be user friendly to foreign firms because of its high degree of decentralisation and the prevalence of trade association standards that are assumed by US industry to be 'international' when in fact they may be common only in US products (a problem analysed at length in our discussion of 'supra-national' standards in section 2.5.3). The move towards civil standards in the US increases the information requirements for foreign firms, and may increase the probability that many of them will have to become directly involved in monitoring or participating in US-based civil standards initiatives. As noted in our profiles of the ICT sectors, for example, US-based SDO and consortia initiatives now form the primary arena for participation by major European ICT firms in standards development (see section 7.3.5).

Other issues arise in that already there is close interaction between the US and European defence sectors. In some cases, EU countries purchase US defence goods. In other cases, European firms collaborate with US firms in joint defence-related ventures. Indeed, there is speculation that rationalisation of the industry in the US (and eventually in Europe) increases the possibilities for cross-investment - European firms investing in US defence businesses and vice versa. Clearly, a European solution to defence standards reform involves collaboration with the US reform effort. In the report, we noted examples (e.g. the data bus used in US avionics systems - see section 5.5.1) where there was potentially costly confusion as to which MILSPECs would be replaced by commercial standards. Many individual MILSPECs have acquired a significant user base outside of the US (not least through transposition into STANAGS), but the decision to replace them is solely a US decision.

RECOMMENDATION 19: ***As a significant part of the European defence standards reform agenda necessarily requires responding to parallel on-going initiatives in the US, a European response should involve close monitoring of the progress of both US and European reform programmes, and supporting collaboration between these programmes. The Commission should take a leading role in this action.***

RECOMMENDATION 20: ***The Commission should support initiatives in launching a series of international meetings involving senior defence procurement officials in the EU and the US, heads of operations in major regional and international standards bodies (including CEN, CENELEC, ETSI, ISO, IEC, ITU and other related agencies), Commission officials, directors of key international trade associations, and senior representatives of the US civil standards system. The objective of these meetings would be to identify existing and emerging problems affecting transatlantic co-operation and collaboration as a result of defence standards reform and conversion, and to propose solutions.***

A fundamental problem for the EU in terms of achieving consensus on defence standards reform is the wide discrepancies of interest in achieving reform among Member States. Defence production in the EU is concentrated in five Member States (Britain, France, Germany, Italy and Sweden). For future policy initiatives in civil/military standards co-ordination to be successful, closer interaction is required between major producer states, smaller producer states, and 'customer' states. Defence procurement bodies in the smaller countries are usually very marginal participants in the defence standards process, if indeed they participate at all (see section 5.5.4 and section 4.2.6). Moreover, medium-sized countries that have modest or specialised defence production capabilities often have no particular economic incentive to get involved in defence standards directly (see section 5.6.1). This situation is potentially a major inhibitor of European consensus on or commitment to reforms. One respondent in the Netherlands, for example, reported that the US DoD was considered to be the main provider of guidance on defence standards to Dutch industry (see section 5.5.4).

RECOMMENDATION 21: ***The Commission and/or any other relevant bodies should encourage defence procurement officials in smaller producer and customer countries to participate in all of the events and meetings referenced in our recommendations. An active liaison should be maintained between the Commission and these officials, and programmes should be developed with them to enhance their interaction with European defence standards reform initiatives.***

Problem Area 9: Developing the interface between EU defence standards reform initiatives and NATO

The NATO standards regime is currently in a state of flux, but it is moving steadily in the direction of becoming more compatible with commercial practices. At least in the transition period, this is requiring the adoption of a more structured top-down approach to standardisation. The long-standing bottom-up approach in NATO is conducive mainly to maintaining the *status quo*. The NATO officials we contacted generally accept that new management approaches are required to inculcate the culture of reducing dependence on military standards throughout the NATO administrative and command structure.

Nevertheless, developing a productive relationship with NATO on standardisation is problematical for the EU. Most obviously, NATO has an exclusively national membership and there is no immediate or natural interface between NATO and regional levels of governance like the EU. Secondly, one of the major European defence producer states - namely Sweden - is not a member of NATO. At the most general level, furthermore, the complex organisational structure of the NATO standardisation system makes it very difficult to locate the best interlocutors. The system is split between military and civilian management groups, each with its own administrative protocols, and STANAG development is separated structurally from STANAG application.

Nevertheless, our European survey yielded a very broad consensus to the effect that NATO would continue to have a significant role to play in defence standardisation. Most European stakeholders view NATO as the main forum for drafting international defence standards, and as the only institution where active transatlantic co-ordination of defence technology requirements can take place at a strategic level.

However, there was wide agreement also that where security permits, the process by which STANAGs are established should be made much more transparent to industry. At the moment, this process is seen to be dominated by the armed forces and defence procurement agencies of the NATO countries. Pursuant to greater transparency in the European standardisation context, more co-operation was advocated between NATO and CEN/CENELEC. It was proposed that NATO should take a leading role in rationalisation where defence procurement is concerned, but that the development of STANAGs should be co-ordinated with the development of ENs and ENVs. One comment even went so far as to suggest that STANAGS could be published as ENs.

Because of its position at the hub of the transatlantic alliance, NATO is uniquely positioned to monitor civil/military standards conversion initiatives in the US and Europe, and to co-ordinate standards information in the defence agencies of its member countries. It could act also to co-ordinate the participation of defence stakeholders in international SDOs. For any of this to occur, however, political, structural and procedural issues must be addressed, and herein lie the main difficulties.

Before a productive relationship could be established, the conduit between the EU and NATO on standardisation and procurement matters would require considerable reinforcement. So also would the conduits between NATO and the civil standards structure. At present, NATO does not interact formally with civil SDOs. Indeed, there are practically no direct links at all except in isolated cases like CALS, and in the case of indirect linkages, as perhaps to CEN via AECMA. Even though US MILSPECs are very significant factors in the STANAG regime, US respondents noted that the 'Perry initiative' resulted in no reinforcement of links between NATO and civil standards bodies at the international level.

Furthermore, were closer links to be established, serious problems would remain in determining the nature of the relationship between NATO and the civil SDOs. We received one suggestion (see section 5.7) to the effect that with agreement from the NATO Council, European SDOs could participate in NATO standardisation work. On balance, the arguments and evidence presented in this report lead us to disagree strongly with this suggestion. As will be discussed in more detail below in connection with Problem Area 12, this would run counter to the entire logic of standards reform in defence procurement. If CEN/CENELEC and NATO co-operation were to occur, the logical order of things would be for NATO representatives to contribute to CEN/CENELEC committees in the development of new standards in which there is a defence stakeholder constituency. Indeed, this already occurs to a small extent with CALS.

It is important in our view for this situation to be clarified and appropriate actions taken. Irrespective of how the NATO standardisation agenda evolves, NATO will remain at the heart of the major strategic defence planning processes involving co-operating European and US armed forces that are likely to require standards development and/or harmonisation. Aside from all of the above considerations, many European defence stakeholders currently regard NATO as the centre of gravity for European defence standards, and see US standards as being dominant in the NATO regime (see sections 5.4 and 5.5.3). Some US and European actions on defence standards conversion may filter through into the STANAG regime, but others may not, resulting in situations where STANAGs are retained even though key NATO members have converted their national equivalents to civil standards. In all events, the need for more extensive contact between the EU and NATO appears inevitable.

RECOMMENDATION 22: ***The Commission should establish much more direct links with the NATO standardisation structure. In our view, the Commission should take a proactive role in encouraging the development of more extensive communication channels between NATO standards officials and counterparts in the European SDOs. This should be facilitated by high-level political contacts between the Commission and WEAG, and CNAD. The immediate objective of this initiative should be to agree mechanisms for NATO interaction with the activities of civil international and regional SDOs.***

Problem Area 10: Enhancing the interface between the defence community and the civil standardisation system

A great many 'standards problems' in all commercial fields are laid at the feet of the SDO system itself. Certainly, many of the respondents to our European survey believed strongly that the civil and defence standardisation systems in Europe, and internationally to a somewhat lesser extent, were not performing as efficiently as they could be. In our European survey there was general consensus that European regional civil SDOs should accelerate the delivery of standards, make efforts to make the extent and nature of their activities more transparent, and facilitate access for defence agency and industry representatives. Almost all references made to us about civil SDOs related to CEN and CENELEC - ETSI was of much less concern to respondents in a defence standards context.

With respect to the reform of civil standardisation systems, European survey respondents made comments to the effect that the current system requires rationalisation to reduce duplication of standards and work items. They advocated also that standards should first be international, secondly regional and then national. Most respondents believed that in principle standards should define interfaces rather than products, and that interoperability should be the underlying aim. The general view was that present civilian standards-setting procedures should be reformed not just to minimise delays, but also to avoid the proliferation of overlapping and competing standards, and the intrusion of technical barriers created by artificial compromises made in SDOs only in order to balance competing interests.

Needless to say, this reform agenda is virtually identical to similar lists that appear in virtually every study of standardisation issues in the civil arena. All of these issues are familiar already to Commission officials working in the standardisation area, and they have been at the root of a series of Commission initiatives dating back to the 1980s aimed at increasing the responsiveness of the civil system to single market objectives (see section 2.2).

At various places in this Report, we have noted many of the administrative challenges being encountered by the SDO system, and we would certainly not suggest that any of the stakeholders in standards, much less the Commission, refrain from promoting improvements in this system where they see fit. However, this Report is not concerned to evaluate SDO performance as such, but rather to examine how defence and civil standardisation activities might converge given the characteristics and dynamics of the SDO system. This involves some careful judgements about the nature of reforms in the civil standardisation system, and the possible impact of greater defence sector influence on these reforms.

It is worth stressing again that the general indication from our survey was that there is a low overall level of awareness in the defence industries at large of exactly how the civil standards system (particularly the European system) is structured and operated. As pointed out in Section 5.5.2, we encountered assumptions as to how defence standardisation agendas could be transposed into the civil arena that took no account of the funding and resource allocation structures of civil standardsisation, and recommendations for basic structural reforms that have been in place already for several years. In other words, it is likely that firms and defence procurement agencies in several countries will have to climb a significant learning curve in order to obtain value from the system as it already exists, much less be in positions to recommend reforms.

Clearly, there are national differences in this regard. The French civil standards system in which standards development for public and private sector application is closely integrated can be seen as problematical at a number of levels in that it can in practice confuse users (domestic and non-domestic) as to the mandatory or voluntary nature of individual standards. On the other hand, a system like this may be uniquely placed to provide valuable lessons as to how to facilitate organisational learning in the defence sector with respect to using the commercial standards system effectively.

RECOMMENDATION 23: ***In our view, a Commercial Standards Awareness and Strategy Exercise is required in order to assist technology project managers and strategists in firms whose products are primarily defence-oriented in understanding the European civil standards system better, and in creating opportunities to use the system productively in coping with changes in the European defence procurement regimes. The Commission could play a facilitating role in this respect, but we envisage that this Recommendation should involve the existing public relations and advisory arms of CEN, CENELEC and ETSI. The exercise could involve both high-level seminars at a strategic planning level, and workshops aimed at the project management level.***

Our most fundamental conclusion with respect to developing the interface between defence and civil participants in the commercial standardisation process is that the direction of change being proposed by most stakeholders in this context is overwhelmingly away from the historical logic of the defence standards regime and towards that of the civil regime. Essentially, this means that we need to envisage the basic problem as one of integrating a new defence-oriented stakeholder constituency into the civil regime and not the other way around.

This leads us to the conclusion that although defence stakeholders will almost certainly acquire more influence in civil SDOs and in any further changes to the SDO system, it would be inappropriate to consider significant *a priori* re-organisation of the European SDO system simply to accommodate or promote the possibility of greater defence sector participation. Defence stakeholders participate in this structure already (very extensively in some areas like aerospace and ICT), and will have the same opportunity as any other stakeholder to advocate whatever changes they deem necessary.

RECOMMENDATION 24: ***Enhancement and evolution of the interface between the defence stakeholder constituency and the civil standardisation system in Europe should be pursued within a framework that is oriented to the European standards system as it is currently constituted. Further adjustments to the structure should be worked out as required from within the structure itself.***

Our view is that there is a limit to the amount of root-and-branch reform that is possible in the SDO system before it becomes an entirely different system with a different purpose, and that probably (in Europe at least) this limit has been reached. Implementation models for defence standards reform that involve SDOs must take into account that the European standards system has undergone much change in a short time period, and that many of the implications of these changes are not yet clear to many European and non-European industrial interests (particularly US interests).

Furthermore, we believe the question to be moot of whether the existing US or European SDO systems as a whole are more or less capable of adapting to the evolving needs of a possibly enlarged defence stakeholder constituency. The standards systems of the US and the EU are fundamentally dissimilar for historical reasons, and unlikely to converge. The US civil system is structurally in much more direct contact with the marketplace, but this results in a significantly more diverse and complex structure to that in Europe, making cost and efficiency comparisons largely meaningless. In a defence context, this may be moderated by the level of co-ordination imposed on the defence industries by a unified DoD procurement regime - an institutional feature that is unlikely to be duplicated at a European regional level for many years, if at all.

In our view, there is no point in trying to argue the merits of one system over another - both have (largely offsetting) merits and disadvantages. There is *much* merit, however, in facilitating dialogue aimed at making evolution in these respective systems transparent and comprehensible to defence stakeholders and policy-makers on both sides of the Atlantic. Sector-specific initiatives in this regard have been taken already by European and US trade associations - most notably AECMA is establishing a corresponding relationship with SAE. In general terms, we view these initiatives as positive steps, but, as we will discuss in more depth in connection with Problem Area 12 (concerning 'informal' standardisation activities) we are concerned that the problem of transatlantic co-operation and co-ordination has implications that cross sector boundaries.

As defence and civil standards regimes converge, the existing SDO system offers at least a touchstone of stability in a transition process that is likely to experience volatile episodes. To engage in a civil/military standards convergence exercise simultaneously with major reforms of the SDO system in Europe would in our view reduce the chances of success for either initiative. Indeed, our European survey showed wide consensus that any reform of commercial standards-setting processes should be undertaken internally by the SDOs.

However, the risk must be considered that at some point some defence interests may become overly powerful in the civil system, with the result that parts of the commercial standards regime take on some of the negative exclusivity of the old defence standards regime. As shown in our discussion of standardisation dynamics in Chapters 2 and 7, capture of commercial standards processes by vested interests is not uncommon, particularly in areas where 'informal' standards activities proliferate. Our profile of the CALS initiative, for example (see section 7.2), illustrated that the main drivers of comprehensive standardisation in this area are the defence interests, not the commercial ones.

Participation in civil standards committees has always been a prerogative for defence stakeholders, but the subjects covered in these committees and the resources allocated to their administration have been selected for the most part according to civil priorities. In our view, there is no logic in altering this situation, as this would run counter to most of the economic arguments underpinning dual use policies. Furthermore, retaining and enhancing a commercially oriented priority-setting and management philosophy in SDOs would be a safeguard against the risk of domination by exclusive defence agendas.

As more and more civil standards are used in defence procurement, civil SDOs must work out ways to accommodate the views and requirements of defence stakeholders, but the overall direction-setting function in the SDOs should not in our view pass out of civil hands. Civil stakeholders are by definition always closest to being able to determine the market requirements for commercially-oriented standards.

However, in the discussion above concerning Problem Area 6 (managing defence exceptions) Recommendation 14 was generated by the possibility that versions of civil standards could become problematical in defence contexts. Our study collected many comments to the effect that much of the work done at the moment in defence standards agencies could be devolved or sub-contracted to civil SDOs. However, the SDO system considers requests for new standards according to available administrative resources which, for the most part, are contributed collectively by the (predominantly civil) SDO membership. Most of the established criteria for determining the priorities for accepting new initiatives are thus oriented primarily to civil needs and to public interest criteria - a situation that should remain in our view.

There is neutral a way to allow defence interests to sub-contract defence-specific standards projects to SDOs in areas where exemptions from the use of civil standards can be claimed under criteria developed as set out in Recommendations 12 to 15. A '*voluntary work programme*' similar to the one that has been in operation in ETSI for many years would allow defence agencies to pursue defence-specific standards projects, while assuring that the development of all new standards initiatives that originated on the defence side would be integrated automatically into the civil standards regime. The current CEN Associated Standards Bodies scheme provides in essence a similar kind of possibility. Should SDOs and stakeholders decide to participate in such schemes, the additional required administrative resources would be contributed by participants in the initiatives. In cases where defence-standards initiatives that are primarily oriented to national circumstances or needs can be shown to meet exemption criteria, arrangements of this kind could be made with national SDOs, subject to existing requirements for notification at the European regional level (as under the 'new approach').

Where deemed necessary in the public interest, this kind of scheme could provide scope for the Commission to provide financial incentives, perhaps through the existing mandate mechanism. At the very least, it would be another mechanism to institutionalise the principle that defence-specific standards should be the exception, not the rule.

RECOMMENDATION 25: ***The Commission should encourage the setting up of a Work Programme for Defence Standards for purposes of sub-contracting defence-specific standards projects to SDOs in areas where exemptions from conversion to civil standards can be claimed under criteria developed as set out in Recommendations 12 to 15.***

The final aspect of developing an enhanced interface with the civil standards system involves the international SDOs - particularly ISO, IEC and ITU. The level of regional policy influence on European industry and the standardisation system is not at present reflected in the level or quality of interaction between the Commission and these bodies. Even though in most instances Commission participation is limited to an observer role, such roles should be approached more strategically in consultation with European stakeholders. This is of special importance in the defence context as the current defence standards reform process will inevitably place greater pressures on the administrative resources and capabilities of the international SDOs. Our view is that the Commission should undertake to develop a much more generally direct and active diplomatic interface with the international standards bodies with respect to civil standards - particularly with ISO, IEC and ITU - and that the mechanism suggested above under Recommendation 20 should be deployed actively to develop co-ordination mechanisms for dealing with defence standards conversion issues.

Problem Area 11: Integrating 'informal' standards into a European defence procurement regime

As shown in Chapter 3, fragmentation persists in European defence procurement, and evolution towards a single market for defence products has been very slow. Our European survey confirmed that this has led to scepticism about the power of formal institutional mechanisms within the EU and WEU to effect any substantial change in European defence procurement matters.

We found that European stakeholders as a whole - particularly in industry - tend to have greater confidence in lower-level structures of co-operation, These can revolve around

- specific international defence systems development programmes like the Horizon frigate;
- specific standards initiatives like ECSS or CALS;
- procurement management organisations like OCCAR;
- process initiatives like 'smart procurement'.

Many stakeholders in industry and government see these structures as the real routes to generating a common framework for defence standardisation.

However, our view is that although organisations and initiatives like these have a role to play, they cannot be allowed to become the basis of defence standardisation policy. Informal standardisation regimes create as many problems as they solve, and a proliferation of informal defence bodies would make convergence with the civil regime an even more complex task than it is already.

Informal organisation of standards activity can have both positive and negative implications for the structure of civil and defence technology markets. Used positively, the potential is great that these initiatives can increase the efficiency of formal standardisation and procurement processes. Used negatively, they can result in virtual cartels. Even where used positively, the PAS approach can increase the risk that standards will proliferate that are incomplete or immature, or that different versions of a PAS will not be harmonised - as regards backward compatibility, for example, or proprietary specifications (whether of EU or non-EU origin) that commit producers and procurers to technical directions over which they have limited or no subsequent control. Currently, EU policy in this respect is imprecise - consistent rules and guidelines are lacking with respect to the use of 'informal' specifications in public procurement, including defence procurement.

RECOMMENDATION 26: The Commission and/or any other relevant bodies should take immediate steps to help clarify or develop further the general European policy framework with respect to the ever widening range of 'informal' industry technical agreements like PAS, and toward the widening range of consortia and consortia-like structures in both the civil and defence arenas. A policy and set of guidelines for referencing PAS in defence procurement should be developed and harmonised with similar initiatives as they evolve in the civil sector.

With respect to this Problem Area in general, the views expressed by our European respondents were not always logically consistent, reflecting perhaps the limited experience of some defence stakeholders in the commercial standardisation arena. One of the issues defence stakeholders felt most strongly about was the often diffuse nature of the civil standards system - especially as between national, regional, and international levels. Consistently, their preferred option was that standards activity be centralised to the greatest degree and at the highest possible level. Referring back to our analysis of standardisation dynamics in Chapters 3 and 7, however, it is clear that the preference of commercial technology suppliers in many fields - particularly the high value-added ICT-intensive ones - is for less and less SDO-centred standardisation. As shown in particular in section 7.3.5, this can result in an extraordinarily diffuse structure with high co-ordination costs. Again, the views of the defence stakeholders are somewhat inconsistent in this respect - some advocate greater centralisation of specific initiatives in a PAS environment, while others push for a more prevalent SDO role.

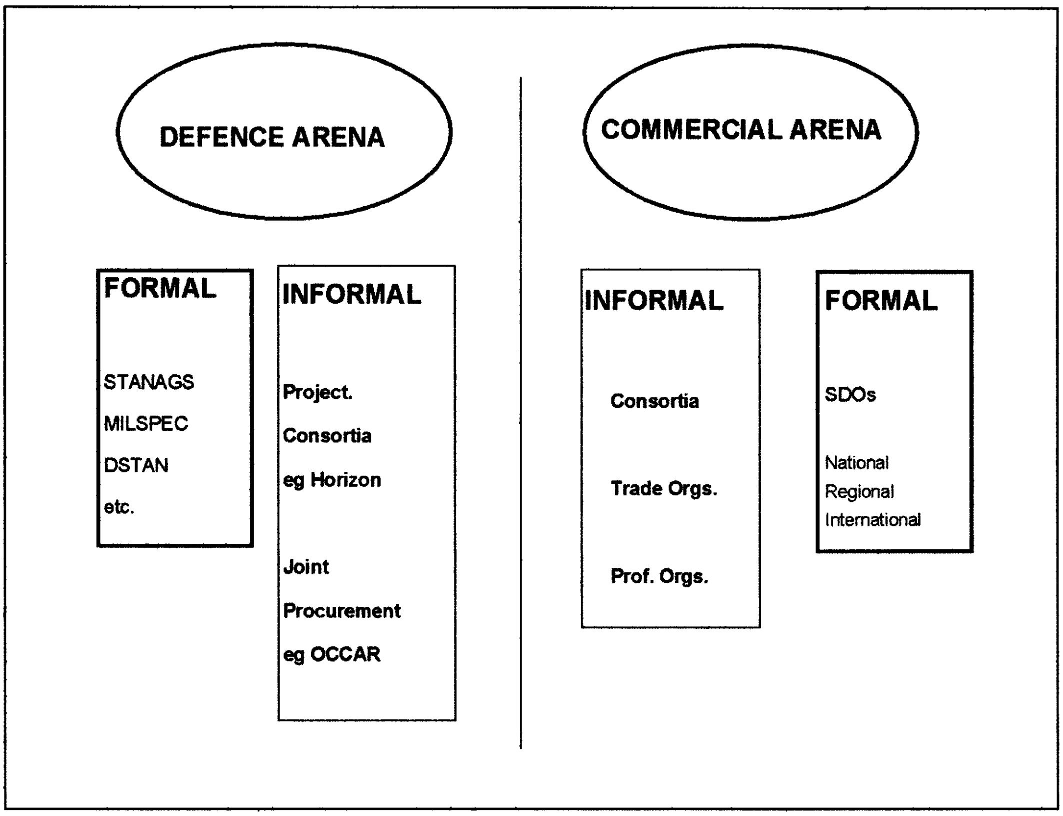
There are ways to reconcile these positions, but all involve at least tacit acceptance of one of our main observations, namely that the civil standardisation system is becoming more complex not less. As shown in many of the profiles, the emerging *insurgent model* (see section 2.3) of standardisation is not an accident but the result of changing commercial priorities and product strategies. As the kinds of high value-added technologies that are now encompassed in the insurgent model percolate steadily through more basic technological areas, more-and-more types of products are likely to require more active interfaces with the insurgent model.

Our Matrix analysis in section 7.4 showed clearly that in most cases the dynamics of standardisation revolve less around the actual type of standard involved (in terms of interfaces, process standards, codes of practice etc.) and much more around the rate of technical change and the position of a standards initiative in the commercial strategies of product and services providers and users. The problems encountered by SDOs in responding to market needs for standards become more severe as the strategic areas of the Matrix (quadrants 3 and 4) are approached, and, likewise, the scope for informal initiatives increases.

The institutional interface problem in a standards system increasingly characterised by informal as well as formal structures is illustrated in Figure 8-2. At present, both commercial and defence standardisation arenas include informal as well as formal elements. On the commercial side, informal organisations are mainly trade associations, professional bodies and consortia. These are at least 'public' bodies in the sense that their standards-related activities are relatively open to participation by interested stakeholders and their outputs are mainly PAS. The problem is that the outputs of the informal sector as a whole are subject to no overall organisation or scrutiny except when they are voluntarily placed into the SDO system for consideration as formal standards.

In the defence arena, the problems are more complex. In the first place, there is much less overall co-ordination between formal institutions, most of which are national and few of which have an openly 'public' interface. The relationship between the national defence standards agencies and the STANAG regime is not equivalent to that between the national civil SDOs and ISO or IEC. Moreover, the informal defence standards sector tends to be engaged less in standards-making as such, and more in standards selection and configuration. Thus, they create clusters of standards and standards institutions around specific projects in a manner that is often transparent only to direct participants in these projects.

Figure 8-2 The structure of standardisation systems in the defence and commercial arenas



Although many European stakeholders have accumulated experience in dealing with individual 'informal' standards development or configuration initiatives, the experience is so diverse that it is impossible at this point in time to extrapolate systematically from various individual encounters with individual programmes to general statements about best practice in deploying 'informal' standards initiatives and in co-ordinating them with 'formal' programmes in SDOs.

However, the consensus of our European survey was that SDOs should encourage the evolution of interim standards as a way to improve their own performance in delivering the standards that are most needed in the market, and that PAS should be given greater recognition by formal standards-making bodies. There was consensus also that the Commission should facilitate procedural harmonisation and institutional rationalisation in both formal and informal standardisation sectors, in order to develop a standardisation framework that is more coherent with respect to how formal and informal standards are or are not related.

Many European respondents saw further development of a role for European trade associations as a key element in this framework. Some of the suggestions we received from European stakeholders concerning trade association activity are valid and constructive in our view. In particular we concur that the network of European-wide trade associations should be enhanced in order to harness the standards-related inputs of national associations and co-ordinate them at a European level.

Although most European stakeholders expressed a generally favourable opinion of the work of trade associations in specific areas, but they pointed out that most trade associations cannot muster the resources necessary to influence standards effectively (see section 5.5.7) and that national associations are generally less effective in this regard than EU-wide associations like AECMA, or international trade associations (many of which are in any case US-based). Indeed, it should be stressed in this connection that the US civil standards system is largely constructed around independent trade association activity in standards, which includes a substantial informal element.

Greater co-ordination of non-SDO inputs in defence-related contexts is essential in our view. PAS are potentially valuable vehicles to synchronise the standards-making process more closely with the pace of change in technology and market conditions. Recognising this, SDOs and trade associations have been active already in developing mechanisms to co-ordinate their activities better at a number of levels. In order to minimise the potential for negative effects from 'informal' standardisation activities. Industry technical agreement programmes like the one we encountered in IEC and the newly instituted CWA programme in CEN are at least pointed in the direction of best practice in our view, and it will be important to monitor their progress and outcomes.

However, co-ordination is only part of the problem with informal standardisation activity in the defence context. Most of the civil consortia, trade associations etc. are (at least in principle) open to participation and influence by any interested stakeholder, and the standards activities (both as regards development and configuration) are carried out in the public arena - indeed, the outcomes are often promoted as products in the market. The same is not true on the defence side where most of the roughly equivalent kinds of consortium structures (with respect at least to their roles in standardisation) are essentially closed groups of contractors and procurement agencies formed around specific systems development programmes, or procurement management organisations (like OCCAR).

We were favourably impressed with the potential of ECSS as a model that could be used both to open up existing defence industry consortium structures where standards are concerned, and to impose structure on future defence systems development consortia in this respect. The ECSS model links aspects of the CWA concept (integrating consortia and PAS into a common standards framework) with active liaison between national and international activity at the formal standards development level. It includes scope for participation by European and non-European interests, and is poised organisationally to mediate the implementation of a transitional business model in the space sector that balances both defence and civil orientations. Comments received on the performance of ECSS to date were universally favourable, and in our view it embodies best practice to the extent that this can be defined in the light of limited experience.

RECOMMENDATION 27: ***Once policy clarification is achieved under Recommendation 26, we recommend that the Commission take an active role in developing a general best practice framework for the management of standardisation activity in defence systems development programmes and procurement consortia that would make these activities more open and accessible to non-members of these groups. Application of the framework should be primarily voluntary on a sector-by-sector basis according to stakeholder assessments of need. However, use of the framework could be made mandatory in selected instances where the Commission determines that a public interest consideration exists. We recommend ECSS to the Commission as potential model of best practice that could form the basis of a general framework.***

Problem Area 12: Co-ordinating standards developed in collaborative projects

Closely allied to the problem of integrating formal and informal standardisation activity is the issue of managing the standards-related outputs of collaborative technology projects. Collaborative projects have been widely regarded by European defence agencies as effective routes towards (a) distributing the development costs of major new defence projects more widely, and (b) facilitating technical harmonisation.

However, our European survey indicated strongly that, with respect to standards, the experience of contractors in collaborative European projects has been mixed. Projects like the Tornado fighter were singled out as successful examples of the use of a consortium structure to develop project standards, but serious problems have been encountered in attempting to transpose project-based standards like these into broader standards regimes - especially civil ones. Other projects, like the Tiger helicopter (see section 5.6.1) were seen by some observers to have promoted mostly national agendas and the commercial interests of a particular consortium over progress towards European-level standards.

Respondents reported that as there was no central agency structure to co-ordinate the outputs of these projects, the result was often that different suites of standards accumulated around different projects (see section 5.5) and that little or no harmonisation occurred. Furthermore, collaborative efforts sometimes involved huge standards management problems, such as conformity verification and translation of standards texts. In the French-British-Italian Horizon Frigate project, these efforts had to be set out in the project management structure as a specific task. Despite efforts to manage these problems, however, there is only limited evidence to suggest that collaborative projects of this kind have contributed to the overall objective of Europe-wide standards harmonisation in the defence field.

The other dimension to the problem is that some collaborations involve US and European partners. Our US survey drew attention to the possibility that the move to more commercial standards could open up the environment for international collaborations between US and European firms (see section 6.4.2). UK sources cited the joint US-UK Harrier programme as a successful example of the harmonisation of US and UK standards through a joint project, but this pre-dates the Perry initiative and involved a mutual agreement simply to accept the military specifications used in the Harrier project irrespective of whether or not they conformed to existing US or UK defence standards. As such, this is not an example of harmonisation in the type of defence standards reform environment under consideration here.

Our general conclusion is that much of what is perceived to be general progress on standards development and harmonisation in a collaborative project context is the result of a lack of alternatives. Project-based standards activity can yield topical results very efficiently, even though it can also store up expensive co-ordination and harmonisation problems that may only emerge further along in the life-cycle of a defence system. On the other hand, there is no point in trying to limit project-based work on standardisation or to inflict yet an additional level of bureaucracy upon it. As more and more civil R&D projects are now likewise collaborative, we must assume that much of the net technical contribution by commercial industry to formal as well as informal standardisation initiatives is to some degree based on experience gained in these projects. We conclude that the 'project-based' approach has no future as a basis for policy in support of Europe-wide technical harmonisation objectives, but that there may be scope to encourage industry to link progress made on standards at the project level to broader standardisation initiatives at the European and international levels.

RECOMMENDATION 28: ***Following on from Recommendation 27, we recommend that the Commission and/or any other relevant bodies actively promote the best practice framework approach, with the objective of encouraging as much project-based standards activity as possible to interact with European and international level initiatives.***

Problem Area 13: Co-ordinating information resources on defence standards reform

This Report indicates strongly that a major reform initiative is needed in Europe with respect to the issue of access to standards and standards information for suppliers who must reference both military and civil standards. Virtually all of the above recommendations are contingent in one way or another on achieving this basic objective, and the Commission is in a pivotal position to promote and co-ordinate these actions. Increasing the transparency of military standardisation regimes in the EU Member States is a pre-requisite to all other initiatives aimed at increasing cross-border activity in the production and marketing of defence-related goods and services.

RECOMMENDATION 29: ***In the short to medium term, the Commission should focus on developing and implementing policies and actions aimed at addressing the major problem of reducing the information asymmetries on standards that now exist between suppliers and defence procurement agencies throughout the Member States. A formal statement of intent to this effect should be issued as soon as possible.***

Public access to civil standards catalogues is at present good and improving. CEN, CENELEC and ETSI information resources are easily accessible on-line, as are those of the main international SDOs and most European national SDOs. On the defence side, however, relatively few resources are available in most countries in any form. Moreover, even where both defence and civil catalogues are easily accessible (as in the UK for example), the catalogues are neither linked nor cross referenced.

We found that the quality of communications between defence agencies and national SDOs varies considerably between different Member States, and that some defence agencies have much more open general approaches than others towards information dissemination about standards. We found that the levels of open access and transparency in information exchange between the procurement agencies, the civil and military SDOs and the defence industry at large was closest to an approximation of domestic best practice in the UK than in most other EU countries. The DSTAN information system may provide a model for building European regional best practice in this regard. Not only is access provided to standards documents and information, but updates are provided frequently alongside supporting value-added analysis of the implications of changes in standards and procedures.

RECOMMENDATION 30: ***As a first step in reducing information asymmetries the Commission should take immediate action in association with other relevant bodies to encourage national civil SDOs and defence standards agencies in the EU to build active information bridges between civil and military standards catalogues in their respective countries. We also consider the UK DSTAN programme as an example of current best practice in the provision of a defence standards information programme that could be built upon at the European level.***

In terms of basic information facilities for defence standardisation, the US is well ahead of Europe. Between the DoD ASSIST programme database, and the ANSI standards database, suppliers in any country can at least locate easily most MILSPECs, ANSI standards, US and foreign PAS, STANAGs, international standards (ISO, IEC and ITU) and European standards (EN, ENV and selected national SDO standards). Although most of these US facilities are basically just catalogues, nothing close to an equivalent level of comparative information services exists in Europe. The PERINORM database (European in origin but available in the US market as well) used by many European firms concentrates exclusively on formally promulgated national and international civil standards. The ASSIST facility provides access to various value-added services on defence standardisation, such as links to DoD databases on standardisation projects and data on the progress and management of MILSPEC reform.

Our US study confirmed that the development of the ASSIST regime has been key element in the US reform programmes, as it ensures that every stakeholder has access to essential information as to which MILSPECs and civil standards are in use in military projects, and where changes are in progress or planned (see section 6.2.4). The provision of similar value-added information services will be crucial in a European context.

At present, there are basic difficulties gaining access to information on defence-related standardisation and certification requirements in the EU. Moreover, despite the more advanced access facilities in the US, the level of value-added for European stakeholders is often low with respect to information on the significance and dynamics of particular US-based standards activities. European survey respondents noted that this was a particular problem where US trade associations and PAS were involved. In Europe and the US, much of the communication between defence suppliers and customers concerning standards occurs on a project specific basis and the result is often a patchwork of public and proprietary standards the logic of which is often unfathomable to all but the original participants in the project. European firms and defence agencies often have limited understanding of this dynamic in the US, and, likewise, US counterparts lack information on European activity. This creates a mutual information deficit that could be the source of needless increased future conflict, especially in the context of the transatlantic defence alliance.

One of the key areas of consensus from our European survey was that measures should be taken to provide an integrated database of European (national and regional), US and international standards and certification requirements for defence industry use. European survey respondents indicated that discrepancies in knowledge and understanding of US reforms as between US and European firms was already a source of friction and disadvantage. Some Swedish respondents believed that a standards information strategy was even more important than a standards development strategy (see section 5.5). The UK has taken its own initiative in this vein, and is running specific projects that track US procurement reforms as they relate to the TRACER and MLRS programmes (see section 5.4).

The information problem has potentially enormous consequences with respect to building a Europe-wide programme of standards reform that has the support of both the major and minor defence producer countries and the 'customer' countries. At the moment, (see section 5.5.4) some countries have clear, accessible statements of standardisation hierarchies in procurement and others do not. There is little harmonisation of these hierarchies, some of which may indeed contravene the spirit, if not the letter, of EU legislation on reference to standards in public procurement. One of the possible consequences of this confused situation is that it may make the relatively more organised US information regime more attractive to European users. There is already evidence that smaller EU countries make widespread use of the US DoD as a basic source of information on standards, and US standards may gain increased influence in European defence procurement simply because information about them is easier to obtain (see sections 5.5 and 5.6.1).

RECOMMENDATION 31: ***In the short term, the Commission and/or any other relevant bodies should act to facilitate a level of public access to European national defence standards catalogues that is equivalent to the level of access currently provided by most civil SDOs. These catalogues should be made available on-line wherever possible with links provided to abstracts and/or to the texts of these standards. In our view, this action would have an immediate effect in terms of increasing the transparency of the defence standards regime in Europe.***

In addressing recommendations 30 and 31 it is now possible to learn from the experience of European and US agencies in mounting defence-related catalogues, information facilities, and value-added services on the Internet. It is possible, for instance, to assess in detail the US ASSIST initiative and the UK D-STAN approach, as well as to analyse the on-line publication formats and strategies followed by SDOs. This could provide the background for the design of a publication/dissemination strategy for European defence standards.

RECOMMENDATION 32: ***In the medium to longer term, the Commission and/or any other relevant bodies should take progressive action to set up a European defence standards information facility that would collect, manage and disseminate information resources on standards in defence procurement in both the US and Europe. It would be advisable in our view to provide this service in conjunction with existing European civil standardisation information services as provided by CEN/CENELEC and ETSI. Integration at some point with the US ASSIST programme would be a useful goal. The Commission and/or any other relevant bodies should consider the provision of start-up funds for such a facility.***

8.2 A defence standardisation policy action plan

This final section outlines an action plan that will in our view provide a useful framework for the implementation of the above recommendations. In the chart that follows:

- each of the Actions stated or implied in one of our recommendations is summarised and listed next to the particular recommendation to which it refers;

- each of the Actions is related to the type or types of policy option that in our view would be most appropriate to the aims of the recommendation to which the Action refers. In section 7.4.2, we outlined three types of policy option that the Commission could pursue:

    - *voluntary options* by which the Commission could facilitate voluntary actions by stakeholders pursuant to a policy objective;
    - *support options* by which the Commission could provide financial or in-kind resources to support policy-oriented programmes and projects in collaboration with stakeholders;

- *intervention options* by which the Commission could take an instrumental role through the development or deployment of official measures.

- some of the recommendations are primarily statements of policy goals and/or general guiding principles. In these cases, no specific Action is given;

- where Actions are specified, an indication is given of the approximate time frame that would in our view be optimal for pursuing that Action. We have classified Actions as short-term, medium-term and long-term according to the following scheme:

    - *short term* refers to actions that should start immediately and be completed within 1-2 years;

    - *medium term* refers to actions that should be undertaken within 2 years and completed within 3-4 years;

    - *long term* refers to actions that will need time to develop - in some cases they build upon short and medium term Actions - and are unlikely to be realised in less than 4-5 years.

    - some Actions span two or more of these time frames and are indicated accordingly.

Table 8-2 Defence Standardisation Action Plan

Rec. No.	Action description	Action types	Time frame
Problem Area 1: Placing defence standards reform in the context of defence industry rationalisation			
1	n/a	Principle	
2	Assess progress in the context of the whole action	Intervention	Short/Medium/Long
3	n/a	Goal	
Problem Area 2: Assessing the significance of cost savings as a factor in standards reform			
4	Encourage governments to assess cost savings systematically	Intervention	Short
	Assist in development and harmonisation of methodologies	Support	Short&Medium
5	n/a	Principle	
6	n/a	Principle	
Problem Area 3: Guiding the regime shift from technical specifications to performance requirements			
7	Initiative in best practice defence procurement	Support	Short&Medium
Problem Area 4: Enhancing competitiveness – balancing strategy and efficency goals in standards reform			
8	n/a	Principle	
Problem Area 5: Determining optimal types and levels of standardisation in a defence context			
9	n/a	Goal	
10	n/a	Goal	
Problem Area 6: Managing defence standardisation exceptions			
11	Defence standards monitoring function Requirement for EU states to file defence standards catalogues and work plans	Intervention & Support	Short
12	Establish requirement to justify defence standards exemptions	Intervention	Short
13	Establish harmonised criteria for defence standards exemptions	Intervention & Support	Short&Medium
14	Develop 'versioning' criteria	Intervention & Support	Medium
15	Establish harmonised hierarchy of standards sources	Intervention	Medium
Problem Area 7: Managing organisational and administrative factors in implementing defence standards reform			
16	Obtain high-level political endorsement for Defence Standards Handbook Project	Intervention	Short
	Develop Defence Standards	Voluntary &	Short/Medium/Long

	Handbook	**Support**	
17	**Best practice workshops**	**Volunatry**	**Medium&Long**
18	**On-line defence standards reform bulletin**	**Support**	**Medium**
	Problem Area 8: Developing a European response to US standards reform		
19	**Monitoring of US reforms and collaboration support**	**Support**	**Short&Medium**
20	**Transatlantic meetings**	**Voluntary**	**Short**
21	**Liaison with smaller EU producer and consumer countries**	**Voluntary & Support**	**Short&Medium**
	Problem Area 9: Developing the interface between EU defence standards reform initiatives and NATO		
22	**Enhance links with NATO**	**Intervention**	**Short**
	Develop communication channels between NATO and civil SDOs	**Support**	**Medium**
	Problem Area 10: Enhancing the interface between the defence community and the civil standardisation system		
23	**Commercial Standards Awareness Strategy**	**Voluntary & Support**	**Short**
24	**n/a**	**Principle**	
25	**Work Programme for Defence Standards**	**Voluntary & Support**	**Long**
	Problem Area 11: Integrating 'informal' standards into a European defence procurement regime		
26	**Clarify general policy on PAS**	**Intervention**	**Short**
	Establish guidelines for use of PAS in civil and defence procurement		**Medium**
27	**Develop best practice framework for project-based standards activity**	**Voluntary**	**Medium&Long**
	Problem Area 12: Co-ordinating standards developed in collaborative projects		
28	**Encourage greater interaction of project-based standards with European/international initiatives**	**Voluntary**	**Long**
	Problem Area 13: Co-ordinating information resources on defence standards reform		
29	**Statement of intent to address information asymmetries**	**Intervention**	**Short**
	Information strategy focus		**Short & Medium**
30	**Encourage bridging of national civil and defence standards catalogues**	**Support**	**Short**
31	**Make national defence standards catalogues publicly available**	**Intervention**	**Short**
32	**Set up European defence standards information facility**	**Intervention & Support**	**Medium & Long**

9

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APPENDIX A:
FIELDWORK (VISITS, INTERVIEWS,....)

Appendix A: Fieldwork (visits, interviews,...)

During the study, the research teams in Europe and the United States have engaged in a broad programme of formal and informal interviews. Information was gathered on a variety of defence standardisation issues, and the project was exposed in this way to a wide variety of European industrialists and government officials.

The formal interview programme with industrialists, government officials, industrial associations and standards organisations across Europe was carried out by ESL&Network and involved over 70 interviews covering a broad base of decision-makers from high-level corporate and government officials to standards specialists both at the firm level and within defence agencies. Table 1 lists the officials and industrialists formally interviewed by ESL&Network as part of 'Stream B' of our study.

Table 1
Stream B: Formal interviews carried out

Belgium

Coloner Van Caelenberge, Chief of Planning and Programmes Section, Air Force Staff
Mr. G. Micheels, R&D Director, Herstal, S.A.

France

French officials and industrialists preferred to provide formal written responses to the questionnaire. The largest French defence firms provided a joint response through CIDEF (Conseil des Industries de Défénse Françaises) CIDEF response was drawn up by experts from GICAT, GIFAS, and GITEP-EDS, the main French industrial associations involving defence producers. Thomson-CSF and Aerospatiale supplying. additional written comments. Responses were provided by:

Mr. Raoul Gourjon, Thomson-CSF
Mr. Serge Catoire, Quality Director, Aerospatiale

AFNOR the French standardisation agency provided a written answer through its Director, Henri Martre. A detailed document answering our questionnaire was drafted by:

Mr. Pascal Poupet, Head of the Information and Communication Technologies Department, AFNOR
Mr. Jean Hyenne, Head of Strategic Department, AFNOR

The French Ministry of Defence provided a co-ordinated single answer to all the questionnaires sent to different administrative branches. This formal answer was then approved by the other WEU Member Countries, through WEAG. Finally, DCN responded to the questionnaire through an annex to the French official government response.

Germany

M. Müller, Responsible for Standardisation, Missiles Department, BGT
Avionics Department, BGT
F. Nüssle, Norm security department, BGT
Colonel Quast, Ministry of Defence
Mr Windhorst, STN-Atlas
Mr Hillenherms, DASA-Airbus
Colonel Crome, Air Support Command
M. Schloenbach, Vice-President, BWB
Generall Fell, Army Support Comand
H.Ch. Schade, Department of marine technologies, DIN
Brigade-General Lanz, President, Federation of the German Army
Mr. Axel F.W Zweiner, BDLI.

Italy

Several industrialists were interviewed with the assistance of AIAD (Associazione Industrie per l'Aerospazio, i Sistemi e la Difesa). Many of the industrial interviewees requested complete anonymity, we have however been able to list their industrial affiliations:

Comandante Roberto del Toro, AIAD
Col Sampaolo, Capitano di Fregata Amati, Tenente Iacone, all at SEGREDIFESA, Arms Policy Office, Ministry of Defence
Maggiore Pavano, Army Staff, Office for Doctrine, Training and Regulation (DAR), Ministry of Defence
Dott. Alfredo Cuzzoni, Director General for Productive Development and Competitiveness, Ministry of Industry
Gen. Renzo Romano, Thomson-CSF
Com. Roberto Marini, International Advance Projects, Alenia Sistemi Navali
Fincantieri
Marconi
Alacatel Italia
Alenia Difesa
Alenia Aerospazio Divisione Aeronautica
Alenia Aerospazio Divisione Spazio

Netherlands

Han Willems, Senior Technical Advisor Technology, Netherlands Defence Manufacturers Association
Mr. J.J.Vonk, Managing Director, Eurometaal Holding NV
Mr. John Rietbergen, Interim Manager, Gemco Industries BV
Mr. W.P.Laros, Executive Vice-President (Marketing and Sales), Schelde Shipbuilding
Mr. Pieter N. Mijnarends, Marketinq, Hollandse Signaalpparaten
Mr. E. Veltman, Standardisation and Central Quality Management, Hollandse Signaalpparaten

Mr. F. Mulder, Programmes, Hollandse Signaalpparaten
Mr. Hein van Ameijden, General Manager, Signaal USFA
Mr. F. Versluys, Managing Director, Delft Instruments Electro Optics BV
Mr. C.J. Moolenburgh, Managing Director, Damen Shipyards

Norway

The Norwegian WEAG representative provided a written response to the questionnaire.

Portugal

General Directorate of Armament and Defence Equipment (Written response)
Empordef (Written response)
The Portuguese Industry Association through its Defence Industry Committee provided a written paper on the issue.

Spain

Mr. Pascal Pery Paredes, Director General for Arms and Materiel, Ministry of Defence
General Jesús Domingo Palacios, Sub-Director General for Inspection and Technical Services, Ministry of Defence
Mr. José Sempere, Director of Exports, E.N. Bazán de Construcciones Navales Militares, S.A.
Mr Fernando García Arcal, Export Area Manager, E.N. Santa Bárbara
Mr. Mariano Alonso Romero, Quality Control Director, Construcciones Aeronáuticas, S.A. (CASA)
Mr. Antonio de Carvajal, Director for Technology and Quality, INDRA Sistemas, S.A., Member of the Board, EDIG
Mr. Joaquín Peralba, Legal Advisor, INDRA Sistemas, S.A.

Sweden

Mr. Ebbe Sylvén, Assistant Under-Secretary for International Affairs, Department of Military Affairs, Ministry of Defence
Mr. Leif Olsson, Director of Standardisation, Swedish Materiel Administration (FMV)
Mr. Dag Törnblom, Director, Association of Swedish Defence Industries (FiF)
Mr. Bo Granbon, Manager of Electromagnetic and Radiation Effects Section, Ericsson Saab Avionics
Mr. Bengt Gustavsson, Systems Analyst, Command Control and Information Systems, Celsius Tech Systems
Mr. Per Johnson, Celsius AB (until Jan. 98 Executive Vice-President Kockums AB)
Mr. Ture Svendlund, Quality Assurance Manager, Hägglunds
Mr. Carl-Johan Wilén, CALS Manager Business Development, Saab AB

United Kingdom

Robert Mulligan, Vosper Thornycroft Cliff Simpson, Varity Perkins Mr.Harrison and Mr. Derwick, Department of Trade and Industry Commander Mark Whelan, Director General, British Marine Equipment Council Major General Alan Sharman, Director General, Defence Manufacturers Association Sir Robert Walmsley, Chief of Defence Procurement, Procurement Executive, Ministry of Defence Keith Hayward, Research Director, Society of British Aerospace Constructors Mick Garrigan, Society of British Aerospace Constructors David Wright, Managing Director, Cost Analysis Group, GKN-Westland John Colston, GEC Avionics Tracer Technical Manager, Vickers plc Jonathan Sawyer, Business Manager, Aeronautical and General Instruments Ltd (written comments)
The British WEAG representative provided a written response to the questionnaire.

In addition to the formal interview programme researchers in the 'core team' conducted a series of informal interviews with the objective of gathering data and information (**Table 2**).

Table 2
Interviews and informal meetings

J.Guy Reny, Senior Administrator, MAS, NATO (Brussels)
Denis Roger, European Commission, DG-XII (Brussels)
David Cooper, Coordinator to Asst.Sec.Gen. for Defence Procurement, NATO (Brussels)
Tony Scott, Land Armaments Division, Defence Systems Division, NATO (Brussels)
Anton Van de Grample, Senior Staff Officer, Office of Standardisation, NATO (Brussels)
Philip Wells, Standardisation Policy, DSTAN, UK MoD (Glasgow)
George McEwan, Standardisation Operations, DSTAN, UK MoD (Glasgow)
Graham Woodcock, Secretary General, EDIG (Brussels)
Gaston Michaud, Direcor, Corporate and Legal Affairs, CEN (Brussels)
Stewart Sanson, Manager, Publications-Information Systems, CEN (Brussels)
Jan Van Herp, Director Standards Programme, CEN (Brussels)
Michael Smith, Director of Standards, ISO (Geneva)
A. Gorchkov, Technical Programme Manager, Standards Department, ISO (Geneva)
Timothy J. Hancox, Technical Programme Manager, Standards Department, ISO (Geneva)
F. Abram, Technical Programme Manager, Standards Department, ISO (Geneva)
Bernard Williams, Section Chief Mechanical and Aeronautical Engineering, BSI (London)
Alain Jondet, Consultant (formerly Head of Binorm, French Ministry of Defence) (Paris)
Donald J. MacLean, Chief, Strategic Planning and External Affairs Unit, ITU (Geneva)
Robert W. Jones, Director, Radiocommunication Bureau, ITU (Geneva)
Giuliano Rossi, Senior Counsellor, Head, Study Group Department, Radiocommunication Bureau, ITU (Geneva)

Jean-Pierre Brotons-Dias, Technical Director, IEC (Geneva)
Peter Bonner, Mountgrace Associates (formerly Commercial Director BSI), (Potters Bar, UK)
Informal interviews with specialists from HR Smith, Aerospace Metals, Ericsson, ERA Technology, and Mobil were conducted during the Farnborough Air Show.

The 'core team' also conducted a mailshot (including a small questionnaire) aimed at gathering information from European defence agencies responsible for standardisation and procurement matters. From defence procurement agencies, we received responses from the UK, France, Luxembourg, Norway, Germany, Italy and the Netherlands. From defence standardisation agencies, we received responses from the UK, Luxembourg, Norway, Spain, Denmark, Germany, and Portugal.

In the United States the following organisations were represented in TASC's survey of defence companies and interviews with government and corporate officials on acquisition reform and defence industry consolidation. Where specific offices or titles are not listed, it means that the identity of the individual contacted could be discerned from the institutional title or affiliation (for example: President, Chief Executive Officer or a similar, unique position). "Senior management" represents corporate level directors, general managers or vice presidents. In many cases, pre-merger company names are used for more accurate identification of sources.

Companies:

AAI Corp.	
Aerojet	Defense Systems
AIL Systems, Inc.	Government Relations
AIL Systems, Inc.	Programs & Technology
AIL Systems, Inc.	Technical Services Operation
Alliant Techsystems, Inc.	International Sales
AlliedSignal, Inc.	International Government Relations
AlliedSignal Aerospace Company	Advanced Programs & Business Development
Allison Transmission Division	
AM General Corp.	
American Systems Corp.	Business Development
ANSER	Logistics
Automated Sciences Group, Inc.	SSET
Avenue Technologies, Inc.	
BBN Corp.	Government Relations
BBN Systems and Technologies	
BDM Corp.	C^4 Systems
BDM Federal	Information Systems
BDM International, Inc.	Business Development
Boeing Commercial Aircraft Group	Industrial Development Office
Boeing Company	C^4I Systems
Boeing Company	Government Relations
Boeing Company	International Business Development
Boeing Company	Senior management
Boeing Company	Information, Space and Defense Systems
Boeing Company	Rocketdyne Propulsion and Power Division

Boeing Defense & Space Group	Business Development Modification Services
Boeing Defense & Space Group	Int'l Business Development
Boeing Defense & Space Group	Marketing Operations
Boeing ISDS	Aircraft and Missile Systems
Boeing ISDS	Information & Communication System
C^3I	
Computing Devices International	Operations
Computer Sciences Corp. (CSC)	Executive Staff (multiple)
Dakota Delaware Co.	
Delfin Systems	SD Operations
Eaton Corp.	Government Contract Administration
EFW, Inc.	
GAI	
Gatewood Products, Inc.	Senior management
GenCorp Aerojet	
General Dynamics	International Affairs
General Dynamics	Land Systems
General Dynamics	Land Systems Army Tank Plant
General Dynamics Information Systems	Information Management Systems
General Electric Company	GE Aircraft Engines
GMD Solutions	Senior management
Government Electronic Systems	
GTE Government Systems	Marketing & Business Development
Harris Corp.	Business Development, Electronics Sector
Harris Corp.	GCSD
Hicks & Associates, Inc.	Senior management
Honeywell Inc.	Senior management
Hughes Aircraft Company	North American Manufacturing Systems
Hughes Danbury Optical Systems	
Hughes Defense Communications Co.	
Hughes Missile Systems Co.	
Hughes Sensors & Communications Co.	Systems Sector
Hughes Space & Communications Co.	Defense Programs/Government Marketing
Hughes Space & Communications Co.	Executive staff
IMS, Ltd.	Senior management
ITT	Aerospace/Communications Division
Kaman Sciences Corp.	Executive staff
Kaman Sciences Corp.	Advanced Programs & Marketing
Litton Industries	Corporate Planning
Litton Industries	Ingalls Shipbuilding
Litton Industries	International Operations
Litton Industries	Information Systems Group
Litton Industries	Logistics & Supply Chain Management
Lockheed Martin Aeronautical Systems	Business Development
Lockheed Martin Aeronautical Systems	Maritime Patrol Aircraft
Lockheed Martin Aircraft Center	
Lockheed Martin Astronautics	Ground Systems
Lockheed Martin Control Systems	
Lockheed Martin Corp.	Senior management (multiple).

Lockheed Martin Corp.	Integrated Logistics
Lockheed Martin Corp.	Program Development, Electronics & Missiles
Lockheed Martin Corp.	Electronics & Missiles
Lockheed Martin Corp.	Fairchild Defense Systems
Lockheed Martin Corp.	Federal Systems
Lockheed Martin Corp.	Government Electronic Systems
Lockheed Martin Corp.	Ocean Radar & Sensor Systems
Lockheed Martin Tactical Aircraft Systems	Business Development, North Asia
Lockheed Martin Tactical Aircraft Systems	Corporate Development
Lockheed Martin Tactical Aircraft Systems	Japan F-2 Program
Lockheed Missiles & Space Co.	
Lockheed Martin Vought Systems	
Logicon	
LOGTEC, Inc.	Senior management
McDonnell Douglas Aerospace	Combat Simulation Technology
Motorola, Inc.	Senior management
Motorola, Inc.	Gov't. Electronics Group
Northrop Grumman	DSSD
Northrop Grumman	Electronics & Systems Integration Division (ESID-CSS-W)
Northrop Grumman	ESID & SBMS
Northrop Grumman	International Business Development
Northrop Grumman	Military & Aircraft Systems
Northrop Grumman International, Inc.	Senior management
Pacer Infotec, Inc.	Senior management
Pratt & Whitney	Senior management
Raytheon Company	Air Force Programs & Ballistic Missile Defenses
Raytheon Company	Corporate Planning
Raytheon Company	International Programs
Raytheon Electronic Systems	Logistics
Raytheon Electronic Systems	Strategic Planning
Raytheon Systems Company	AM³ Supplier Management
Rockwell Collins	Government Relations
	International Business Development
Rockwell International	Business Development
SABRE Decision Technologies	DoD Logistics Program
SAIC	International Business Development
SAIC	Group Managers/Vice Presidents (multiple)
Soladyne	
SRA International	
System Science Consultants	
Talley Defense Systems, Inc.	Marketing
Texas Instruments, Inc.	
Textron Systems	Corporate Planning
Thiokol Corp.	
TRW, Inc.	Air Force/Civil Business Unit
TRW, Inc.	Strategic Planning
TRW, Inc.	Business Development, Federal Systems Division (2)
TRW, Inc.	Government Relations

TRW Integrated Engineering Division	Civil Telecommunications
Unisys Corp.	Government Systems Group
United Missile Defense Co.	
United Technologies Corp.	Missiles Group
United Defense LP	International Marketing
Vitro Corp.	Senior management

Independent consultants (6)

Industry associations:
National Defense Industry Association (NDIA)
Aerospace Industries Association (AIA)

Government officials:

Department of Defense	Office of Acquisition Reform (multiple) International Programs Office (multiple) OUSD(A&T), International Programs Office (multiple) ODUSD(A&T), Office of Acquisition Reform (multiple) OUSD(A&T), the Under Secretary Deputy Under Secretary for International Affairs, Armaments Cooperation Division Office of Assistant Secretary of Defense, Production and Logistics Manufacturing Modernization/Commercial Acquisition CALS Directorate (multiple) Defense Contract Management Command (DCMC), Single Process Inititiave (SPI) Office Defense Logistics Agency (DLA) Defense Logistics Agency, Defense Standardization Program Defense Systems Management College (DSMC - multiple) Defense Standardization Office Naval Air Systems Command Naval Specifications and Standards Office Service acquisition reform offices (US Army, Air Force and Navy)

APPENDIX B:
QUESTIONNAIRE FORMATS

Appendix B: Questionnaire formats

Format of European Questionnaire

A Study of the Standardisation Systems in the Defence Industries in the EU Member States and the USA

Questionnaire Outline

THE SITUATION

The study is interested in examining three general categories of standards (compatibility, procedural, product specifications). For each one of these categories:

What are the main institutional sources of standards?
Where is rationalisation and harmonisation required?

Give examples of standards in these areas that are used in the defence industries but are not mandated specifically by defence customers

Background information. We are looking mainly for the main types of standards that defence producers use, and whether or not they are mandated to do so by their defence customers. We expect that many of these standards will be generated by "civil" standard bodies like ISO, but some may be particular to the defence industries. We define the following general types of standards, and this definition should be explained to the interviewees:
Compatibility standards: To include interface (specifying the physical interface characteristics of items to permit interchangeability, interconnection, interoperability,...), data acquisition and reference standards
Procedural standards: To include test methods, management, manufacturing processes, codes of practice and maintenance
Product specifications: To include "design and selection criteria" plus performance specifications

THE INSTITUTIONAL SETUP

Where in your view should most of the standards setting activity be centred?

Are there differences depending on the technology and/or the products?

Should this be different with military customers? Why?

Are your national defence customers changing the ways in which product characteristics are specified and/or the types of standards called for? How? Give examples.

Background information. The objective is to gather information on the standards needs of the defence-related industries in the standards front, and an indication of the institutional priorities they might prefer.

1. How effective is the coordination between standards bodies, specially between European, international and national organisations

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

If not satisfactory, what needs to be changed? Give examples.

How effective is the coordination between the international civilian standards bodies and the international defence standardisation structure, and particularly NATO

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Background information. We are particularly seeking for insights and opinions on the relationship between European standardisation processes and NATO's own standardisation procedures.

If not satisfactory, what needs to be changed? Give examples.

What value do you receive from formal standards development organisations (like CEN, ISO, National Standards bodies)?

How would you rate your national defence procurement bodies in terms of their role in the development of standards, specifications and procurement practices

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Background information. A "positive role" would mean that the agencies play a necessary part in the development of standards and specs.; these would be required by the nature of the business and are not considered to be superfluous. Such specifications serve clear purposes for the user and/or the producer, and their absence would mean, ultimately an increase in costs. Their role would be perceived as negative when the agencies "pile up" standards, specifications and requirements that are not perceived as necessary; the organisation would then be perceived as too bureaucratic, and their requirements would add to the development and production costs.

How would you rate your national defence procurement bodies in terms of guidance given to your organisation in the area of standards/specification requirements

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Are the defence procurement requirements congruent with those of other government procurement agencies?

Questions on trade associations, for industrialists.

What value added do you receive from your trade associations on the standards front?

Providing information on standards requirements or procurement practices
Association:

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Association:

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Association:

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Supporting your interests by playing an active role in standards-setting organisations
Association:

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Association:

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

Association:

Very Satisfactory	Satisfactory	Unsatisfactory

Comments:

If your trade association sets standards or specifications directly, do you view this as a positive thing?

Background information: Some trade associations, like AECMA, have been particularly active in the development of formal standards; in some cases though associations may develop sets of specifications and rules which are not *formally* recognised as standards. We are interested in both types of activities.

THE POLICIES

Do you think current US initiatives in the areas of

procurement reform

MILSPEC reform

dual-use policies

presents a model that can work in Europe. If so, why? If not, why not? Give examples of where it would work and where it would not work.

Background information. The US has led the way in the field of defence procurement reform, including the reform of military specifications (MILSPECs) and standards (MILSTDs) processes. The reform of practices in the field of MILSPECs and MILSTDs is has to be seen within the broader strategy of defence procurement reform, and ultimately underpins a new approach to defence industrial policy. In the US a vigorous defence procurement reform has been ongoing for several years. One of the main pillars of the present approach is the principle of "civil/military integration"; this means that whenever possible military and civilian research and production should take place in the same premises thus allowing for flexibility and synergy between both fields of activity; it is argued that present separation of military and civilian activities is largely due to the peculiar procedures common in the defence markets (including a large number of unnecessary specifications and standards). Procurement reform geared to simplify procurement processes and make them more similar to those common in the commercial world is seen as a tool to bring about civil/military integration. MILSPEC reform is implemented in this context. Europe is lagging behind, but keenly observing the US situation. Vigorous opinions are being expressed, usually reflecting broader attitudes to defence procurement reform, and broad opinions on the scope for changes in military standards. To ask about the US experience is therefore an indirect way to gauge the general attitudes of interviewees on the issues under discussion.
Another issue that may emerge under this question, is whether Europe depends on US standardisation initiatives; this is a different topic, and not the main objective of the question, but if referred to it should be noted.

Do you think MILSTD and MILSPEC reform will result in lower procurement costs for defence equipment? If so, can you offer any approximate estimate of the possible savings?
Are there, or should there be, sectoral differences in terms of standards policies

Background information. The question can be rephrased as follows: should there be different approaches in different sectors? It could be possible for instance that for one sector (say, telecommunications) commercial standards and practices are perfectly adequate, where in other fields there is a perceived need for specific defence standards and practices.

NATO distinguishes four "levels" of standardisation:
commonalty (highest level)
interoperability
interchangeability
compatibility (lowest level)
In general, how "high" should the standardisation process aim? At which of these levels? Are there specific instances where you would need to aim higher (or lower)? Give examples.

Background information. : *Commonalty*: the products/components are totally interchangeable. This would be the "highest level" of standardisation. *Interoperability*: Different systems can operate together as if they were a single system ; for instance in the field of communications messages could be transferred across different systems. *Interchangeability*: Some components can be exchanged across different systems without causing problems (i.e. munitions that can be fired from different systems). *Compatibility*: Two different systems can operate side-by-side without interfering with each other (for instance in areas like Electronic Warfare and communications). This would be the "lowest level" of standardisation. This can be used if the interviewee is familiar with it; the main distinction is however between "commonalty", "interoperability" and "compatibility".

Overall, what approaches to defence standardisation you see as politically possible in Europe?

US Industry Standardization Survey: questionnaire format

The impact of reduced DoD procurement budgets on defense acquisition activities has been most evident in two areas:

- DoD acquisition reform
- Consolidation of the US defense industry.

This survey is intended to measure the effect of these two developments on the business of US defense contractors. It does not ask for quantitative information, but rather seeks qualitative assessments of where companies now find themselves in relation to doing business with DoD, as well as opportunities in other defense markets.

I. Acquisition Reform

Milspec reform

a. To what extent has your company's costs been lowered by reductions in Milspec regulation?

_____direct, substantial impact
_____less direct, but significant
_____little if any
_____unclear

b. To what extent has your company's profits been increased by reductions in Milspec regulation?

_____direct, substantial impact
_____less direct, but significant
_____little if any
_____unclear

c. What has been the effect of milspec reduction on the defense industry as a whole?

_____direct, substantial impact
_____less direct, but significant
_____little if any
_____unclear

Commercial practices

d. To what extent has your company's operations been affected by increased use of commercial practices in DoD procurement?

_____direct, substantial impact
_____less direct, but significant
_____little if any
_____unclear

e. What has been the effect of increased commercial practices on the defense industry as a whole?

_____direct, substantial impact
_____less direct, but significant
_____little if any
_____unclear

Cultural change

f. Have you noticed changes in your company's relationships with DoD acquisition officials?

more efficient?	more positive?
_____yes	_____yes
_____no	_____no
_____unclear	_____unclear

in what way?____

g. Do you see significant changes in DoD's approach to the defense industry as a whole?

more efficient?	more positive?
_____yes	_____yes
_____no	_____no
_____unclear	_____unclear

in what way?____

Overall

h. What acquisition reform initiative provided the greatest benefit to your company?

_____TINA
_____FASTA/FARA
_____Regulatory Compliance
_____Configuration Management
_____Quality Standards
_____Material Management
_____Other

i. Will acquisition reform play an important role in increasing your company's competitiveness in world markets?

_____direct, substantial impact
_____less direct, but significant
_____little if any
_____unclear

In what way? ________________________________

II. Industry Consolidation

Resources, Costs

a. Has your company benefited from greater access to resources through industry consolidation?

_____direct, substantial benefit
_____less direct, but significant
_____little if any
_____unclear

b. Has your company benefited from reduced costs through industry consolidation?

_____direct, substantial benefit
_____less direct, but significant
_____little if any
_____unclear

c. To what extent do these benefits extend to the US defense industry as a whole?

_____direct, substantial benefit
_____less direct, but significant
_____little if any
_____unclear

Market Position

d. Has consolidation strengthened your company's position in the US defense market?

_____substantially
_____somewhat
_____little change
_____unclear

e. Have other market opportunities for your company (foreign and/or commercial) expanded because of industry consolidation?

_____substantially
_____somewhat
_____little change
_____unclear

f. How has consolidation strengthened the US defense industry in domestic and foreign markets?

_____substantially
_____somewhat
_____nil
_____unclear

III. Impact of Acquisition Reform vs. Industry Consolidation

a. Which development – acquisition reform or industry consolidation – has had the greater impact on the competitive position of your company? On the US defense industry in general?

Company		Industry
_____	substantially greater in the case of acquisition reform	_____
_____	somewhat greater in the case of acquisition reform	_____
_____	substantially greater in the case of industry consolidation	_____
_____	somewhat greater in the case of industry consolidation	_____
_____	cannot tell which has had the greater impact	_____
_____	not an 'either-or' choice; each significant in its way	_____

comment?________________________________

b. Do you see ongoing acquisition reform and industry consolidation as interdependent processes, mutually reinforcing activities, or essentially separate developments?

_____interdependent – benefits from one difficult to realize without progress in the other.
_____mutually reinforce – but progress in one area facilitates developments in the other.
_____separate – either process can evolve without reference to the other.

comment?________________________________

APPENDIX C:
DOD POLICY AND GUIDANCE AND THE DCMC BLOCK CHANGE PROCESS

APPENDIX C: DoD policy and guidance and the DCMC Block Change Process

Documents Include:

- Office of the Under Secretary of Defense Memorandum December 1995 Establishing the Single Process Initiative
- Defense Logistics Agency Memorandum December 11, 1998 directing the adoption of Common Processes at Defense Contractors
- Secretary Cohen's Letter informing Vice President Gore of DoD Goals for the National Partnership for Reinventing Government (includes Reference source for each goal)

Defense Reform Initiative issued by Secretary Cohen.

ACQUISITION AND TECHNOLOGY

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000

DEC 1995

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS, CHAIRMAN OF THE JOINT CHIEFS OF STAFF, UNDER SECRETARY OF DEFENSE (COMPTROLLER), ASSISTANT SECRETARY OF DEFENSE (COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE), GENERAL COUNSEL, INSPECTOR GENERAL, DIRECTOR OF OPERATIONAL TEST AND EVALUATION, DIRECTORS OF DEFENSE AGENCIES

SUBJECT: Single Process Initiative

Secretary Perry's memorandum of December 6, 1995 requested that I promulgate guidance for making block changes to existing contracts to unify the management and manufacturing requirements of those contracts on a facility-wide basis, wherever such changes are technically acceptable to the government. Secretary Perry further directed that the single point of contact for this effort will be the Administrative Contracting Officer (ACO) assigned to a facility. Accordingly, I am providing the following additional guidance on these issues.

Replacement of multiple government-unique management and manufacturing systems with common, facility-wide systems should, in the long run, reduce the costs to both our contractors and the DoD. Contractors will, however, in most cases incur transition costs that equal or exceed savings in the near term. We expect that cases where this does not hold true are in the minority, mostly dealing with high value, long-term contracts. Accordingly, I direct use of an expedited, streamlined approach to ensure that the contractors' proposals of block changes are technically acceptable and to quickly identify those cases where there may be a significant decrease in the cost of performance of existing contracts.

ACOs are directed to encourage contractors to prepare and submit concept papers (see the attached TAB A) describing practices that will permit uniform, efficient facility-wide management and manufacturing systems and a method for moving to such systems. Contractor recommendations included in the concept paper should be accompanied by a cost-benefit analysis adequate to determine the rough order of magnitude of the costs and benefits to the contractor of the proposed system changes (including any impact on the cost of performance of existing contracts). This cost benefit analysis shall be performed without requesting certified cost or pricing data. The detail included in these concept papers/cost analyses is intended to be just sufficient to allow an informed, rapid judgement by the ACO on whether proposed changes to management and manufacturing processes can be approved on a no-cost, block change basis, applying guidance in this letter.

Where such a proposal is technically acceptable and there are no significant net savings in the cost of performing existing contracts, the ACO, after appropriate consultation with program managers, shall issue class modifications to those contracts without seeking an equitable adjustment. In those cases where the contractor's proposal will result in significant decreases in the overall net cost of performance of existing contracts, the contractor should be asked to submit a formal proposal for an equitable adjustment (consideration) and to submit separate, detailed cost data in support of the proposed amount. The negotiation of equitable adjustments should not delay the modification of contracts.

Note that the specific shift from MIL-Q-9858A to ISO-9000 does not in itself result in significant contractor savings in most contracts, and hence can be made on an expedited basis.

I also direct that, effective immediately, ACOs have the authority to execute class modifications, subject to receipt of necessary programmatic authorization from affected components.

The Commander, Defense Contract Management Command (DCMC) shall approve all requests for certified cost or pricing data in connection with this initiative unless such data are required by law. He will also be the focal point for implementing these efforts within DoD, and will facilitate the coordination of the change process. Tab A depicts the block change process detailing underlying assumptions, roles, and responsibilities.

The Commander, DCMC should prepare for me and for the Component Acquisition Executives a brief quarterly report that describes the progress achieved in replacing multiple government-unique management and manufacturing requirements in existing contracts with more efficient, common facility-wide practices.

Paul G. Kaminski

BLOCK CHANGE PROCESS

The block change process depicted here designates DCMC as the lead facilitator to implement plant-wide changes. The process is built on existing structures within the components and OSD and is designed to create a sense of urgency in the approval process for streamlining of specifications, standards or other processes.

PROPOSAL DEVELOPMENT

Industry is encouraged to prepare and submit concept papers for streamlining specifications and standards with emphasis on early customer involvement and interface. Once the cost and benefit of the change has been determined through this early involvement, industry shall submit block change proposals. As a minimum, the proposals should detail the proposed processes and associated metrics, rough order of magnitude cost benefit analysis, the consequent changes in government's involvement in the process and required regulatory/contractual changes.

APPROVAL

Following submittal of the proposal, the Contract Administration Office (CAO) shall determine the contractual/regulatory scope of change, confirm the component customer base impacted and, if required, organize a local management council based on the nature of the proposal. The management council should be comprised of senior level representatives from the local CAO, the cognizant Defense Contract Audit Agency (DCAA) office, the contractor and subject matter experts representing the key customers within the affected components. Notionally, the key customer base shall be comprised of customers who represent 80% of the total dollar value of affected contracts.

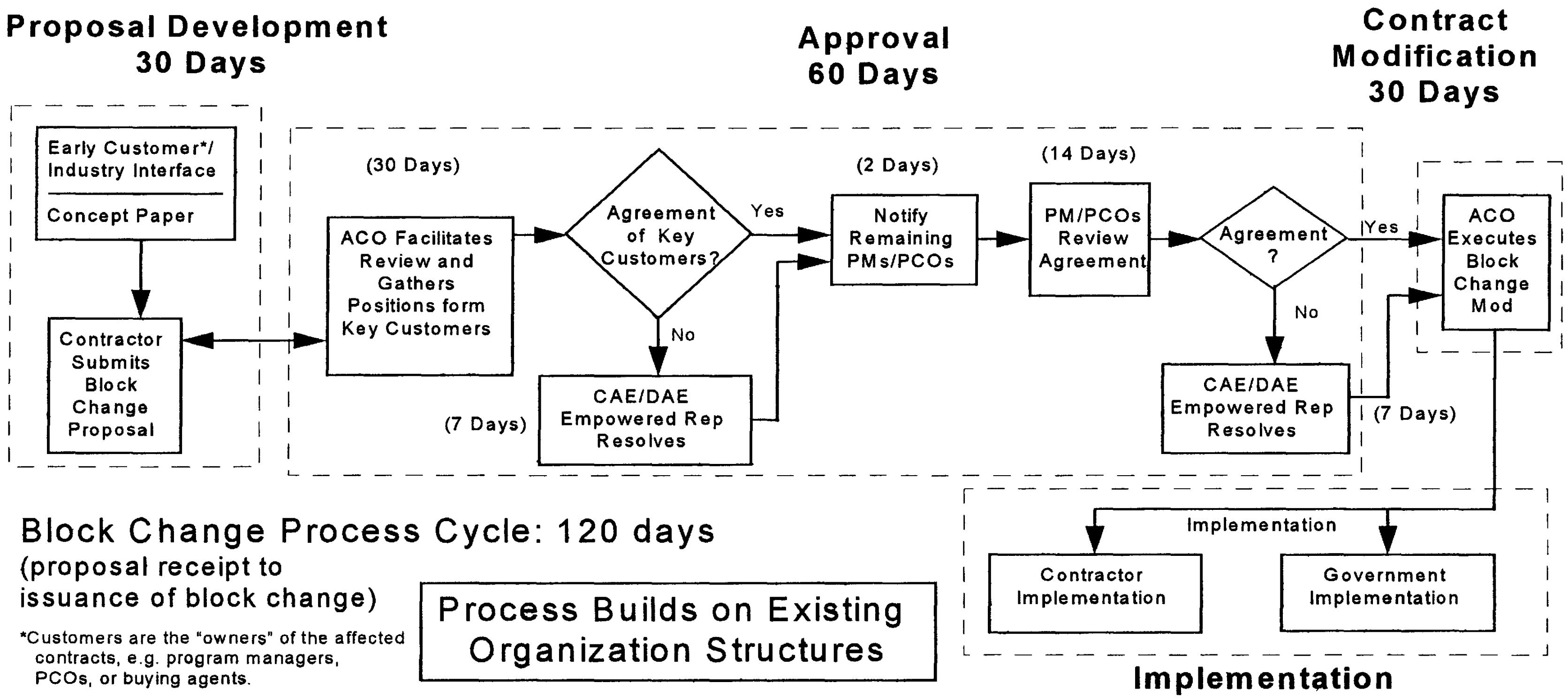
ROLES AND RESPONSIBILITIES

The role of the management council is to analyze the merits and cost benefits of the change. Empowerment of subject matter experts from the key customer base is critical. To minimize delay, a component team leader should be designated and granted decision authority by the CAE to represent the key customer base. Component team leaders are responsible for achieving consensus with other component team leaders, the key customer PCOs and PMs, the component team members and the CAE. The CAO should be responsible for facilitating and leading the management council. The ACO will have the contractual authority to execute all block changes. The attached diagram shows the decision process along with timelines expected of this streamlined process.

INTERNAL GOVERNMENT RESOLUTION PROCESS

The objective of this process is to resolve disagreements, facilitate consensus, elevate and resolve issues of substantial concern, and reemphasize the overall goal and objective. If there is disagreement between PM or other customers within a component, the issue must be raised to a level within the service as designated by the CAE. If there is disagreement among the components the issue must be raised to a level within theDepartment as designated by the DAE. Once resolved, the ACO executes the change.

Block Change Process Overview



DEFENSE LOGISTICS AGENCY
THE DEFENSE CONTRACT MANAGEMENT COMMAND
8725 JOHN J. KINGMAN ROAD, SUITE 2533
FT. BELVOIR, VIRGINIA 22060-6221

DEC 11 95

IN REPLY
REFER TO AQ

MEMORANDUM FOR COMMANDERS, DEFENSE CONTRACT MANAGEMENT DISTRICTS
COMMANDER, DEFENSE CONTRACT MANAGEMENT COMMAND INTERNATIONAL

SUBJECT: Adoption of Common Processes at Defense Contractor Facilities

The adoption of common processes by contractors in lieu of multiple, unique DoD standards and specifications is one of the cornerstones of acquisition reform. Recently issued letters by Secretary Perry and Under Secretary Kaminski underscore the importance of accelerating this shift toward facility-wide common processes (Attachment 1). DCMC will play a pivotal role in this major initiative by both encouraging contractors to submit common process proposals and expediting their review and approval.

Common processes are intended to help reduce contractor operating costs, and contribute to cost, schedule, and performance benefits for the Government. Unlike traditional contract specific changes, process changes are intended to cross all contracts at a particular facility. For this reason, and although it is clear that both the Government and contractors can mutually benefit from the adoption of common processes, the review and approval of contractor process change proposals require special technical and cost consideration. Attachment 2 provides further guidance in each of these two areas.

Critical to the success of this effort are communication and coordination with customer buying activities and program management offices. Cost-benefit analysis must be fully explored and coordinated in order to build consensus among all parties on the concept. Each field office should establish a Management Council comprised of contractor, DCMC, DCAA, and key customer representatives in order to facilitate a timely and constructive exchange of information. The field office should work closely with the Management Council to ensure that the concept paper contains sufficient technical and cost information to permit adequate evaluation.

To help promote this initiative and also assist ACOs and other DCMC functional specialists in the review of contractor proposals, we are establishing a Block Change Management Team at HQ DCMC. A draft charter for this team is at Attachment 3. Among other tasks assigned to the team are the development of a "Road Show" package for conducting briefings across the Command, and the establishment of field level SWAT teams that will be available to assist ACOs in reviewing common process proposals.

2

Should there be any questions, the point of contact is Mr. Frank J. Lalumiere. He can be reached at (703) 767-2412 or DSN 427-2412.

(signed)
ROBERT W. DREWES
Major General, USAF
Commander

Attachments

Common Process Block Changes

A block change is a contract modification that implements a common process across all contracts at a contractor's plant. Listed below are some key steps that should be taken to facilitate the proper review and disposition of common process proposals submitted by contractors.

1. CONTRACTOR/CUSTOMER/CAO INTERFACE: The Contract Administration Office (CAO) acts as the primary industry interface, proactively informing contractors about the common process approach, and advising contractors how to prepare and submit initial concept papers and more detailed proposals, if necessary. The concept paper should include a cost/benefit analysis by the contractor, sufficient to identify the rough order of magnitude of the cost and technical impact of the proposed common process change on government contracts. Contractors should be encouraged to consider any common process approach that realizes a cost schedule or performance benefit for both the contractor and the Government. The CAO will notify the key customers when a contractor volunteers to participate in the process. The CAO shall request from the largest component customer in accordance with the Service issued guidance that an individual be designated as the component team leader. After the program office/buying activity identifies the component team leader, the CAO will notify all Service customers who that individual is.

2. CONCEPT PAPER/PROPOSAL REVIEW & EVALUATION: The CAO must perform a review of the adequacy and reasonableness of the contractor's concept paper and supporting cost/benefit analysis. The concept paper should outline the proposed process and planned transition approach. Technical feasibility, cost effectiveness, and program risk are elements that should be fully explored with the contractor.

The CAO should work closely with customer buying activity and program management office customers and the contractor during review. The intent is to expedite a review and determination by the ACO as to whether the change can be approved on a no cost, block change basis. In those instances where it is determined that significant cost savings will result, the ACO, in coordination with the customers, must determine the format and amount of detail required to be included in a more formal contractor proposal. Business judgement should be used to ascertain the required level of supporting documentation.

The proposal should be reviewed by a local team of CAO technical and cost specialists, the cognizant DCAA auditor and the key customers. The contractor should participate in this review and provide any necessary, additional supporting data concurrent with the review process.

3. TECHNICAL CONSIDERATIONS:

(1) The common process should be sufficiently defined, structured, and documented to permit full evaluation. Customer buying activity programs that are affected in the various Service components or other defense/civilian agencies must be identified.

(2) Among other questions and issues that should be addressed during review of the contractor's proposal are:

(i) Will implementation of the common process be advantageous to the government? Does the common process encourage the use of advanced practices, eliminate nonvalue added requirements, eliminate redundant audits, reduce oversight cost, etc.?

(ii) How will the contractor demonstrate acceptability and reliability of the common process?

(iii) What is the impact on the government and contractor if the common process is approved/disapproved? Has a risk analysis been performed (The technical feasibility of the common process must be addressed in relation to the impact on such areas as quality, maintenance, and life cycle cost.)?

(iv) How will the contractor implement the common process? Will the change be phased in? How does the contractor propose to maintain quality, schedule, etc. during the transition?

(3) The kind and degree of technical review will vary with the complexity of the processes involved. Some process changes may not have a significant impact on quality, maintenance, performance, or life cycle cost. Other process change proposals will present a myriad of technical issues requiring in-depth review by contractor, DCMC, and buying activity personnel. Further, while some proposals may be readily adopted for all contracts on a facility-wide bases, other proposals may be suitable for the majority, but not all government contracts at a particular contractor facility.

For example, the proposed common process might involve the adoption of commercial packaging practices. Prior to approval on a facility-wide basis and modification of all government contracts, a technical review must confirm that there are no special packaging or packing requirements needed to satisfy cold weather storage, salt water exposure, or shelf-life expectancy, etc.

Other common process proposals may require an assessment by contractor, DCMC, and program office personnel of the impact on maintenance, supply availability, and associated costs to the government. Should a common process proposal, for example, introduce multiple variants of a component or system, the government would need some assurance that the contractor could produce sufficient, timely notification of correct configuration information for each variant, down to the piece part level. To the extent that a change introduces more parts, part numbers, or substitutes for original parts, an evaluation of the proposed change must consider whether there is sufficient technical documentation of theparts to permit the government to identify the proper application, and whether the government can properly control and adequately disseminate the information to ensure supportability. Also, the evaluation of some proposals will require an assessment of the need to train government personnel on the changes, and the associated training costs. These kinds of complex, technical issues will surface with greater frequency in situations where end product performance specifications are proposed as substitutes for multiple military specifications. On occasion, however, they may arise during the review of common process proposals submitted by contractors.

4. COST CONSIDERATIONS:
(1) Should the review indicate that the proposed change generates significant savings on an existing contract, consideration should be negotiated for the contract. If the resulting contract modification involves a price adjustment that exceeds the TINA threshold, certified cost and pricing data may be required per FAR 15.8. (The Commander, DCMC shall approve any ACO request for certified cost and pricing data, unless specifically required under TINA.)
(2) If the review reveals that the implementation cost is equal to the savings realized, or the savings are immaterial on existing contracts, a block modification may be used to implement the change at no cost to the Government. Consideration should be determined based on normal business judgment which could include the absolute dollar value, as well as the dollar value of savings as measured against the overall contractor sales base. Under some circumstances, consideration flowing to the Government may be other than monetary consideration. ACOs must apply good business judgement following a full review of each concept paper or proposal and the factors involved.
(3) In order to ensure the government realizes savings on future contracts and contract modifications, contractor proposals should address forward pricing rate reductions. The ACO and auditor should review the adequacy of the proposed rate reductions for use and incorporation in forward pricing rates.
(4) The overall objective should be to reduce the administrative burden as much as possible, yet still satisfy customer requirements. Once the ACO has selected the appropriate course of action (block changes, individual modifications or a combination of the two), the proposed actions should be presented to the Management Council for concurrence.

5. MANAGEMENT COUNCIL OVERSIGHT: The Management Council structure at each CAO will help to facilitate the review and disposition of common process proposals. The Council membership should include DCMC and DCAA representatives, as well as representatives from key customer buying activities. Generally, representation on the Council should account for at least 80 percent of the customer buying activity business base impacted by the process change. Upon reaching agreement at the Management Council level, any other buying activity/program management office customers must be advised of, and concur with, the process change.

DRAFT CHARTER
BLOCK CHANGE MANAGEMENT TEAM

RESPONSIBILITIES

1. Encourage contractors to submit change proposals .

The DoD letters direct the ACOs to encourage contractors to submit block changes. The team will be responsible for developing methods to facilitate early field office comprehension of the common process/block change policy and procedures because the first message needs to be consistent, consistently stated, and stated as quickly as possible. Specifics follow.

A. Develop a standard letter for ACOs to use in encouraging contractors to submit common process concept papers.

B. Develop a "road show" package for DCMC personnel (briefing charts, script, handouts, etc) that explain the DoD objective in the common/process block change policy, the purpose of block changes, the benefits to contractors, success stories from others who have already done it, the process, etc.

C. Develop mechanisms to enable ACOs to continue to spread the message and encourage submittals after the team's departure.

2. Provide assistance to ACOs in processing/negotiating block changes.

A. Stand up "SWAT teams" that are capable of assisting ACOs in processing/negotiating block changes. SWAT teams should be teams of DCMC technical and business experts who can give advice or go on-site to assist in analysis and negotiations.

B. Facilitate interactions with customers to get approval for common processes and block changes.

C. Develop networks to enable ACOs to find assistance after SWAT teams are disestablished.

3. Refine guidelines for processing/negotiating block changes.

A. Amend/expand guidelines for processing/negotiating block changes as needed to respond to experiences and lessons learned.

B. Develop one book chapter for common process/block changes.

4. Keep DCMC Commander, OSD, and the SAEs informed of progress.

A. Develop and submit required reports to OSD. The DoD letter requires quarterly reporting of progress from the DCMC Commanders. Develop report format, put in place collection procedures for the field, gather data, and submit reports.

B. Submit "weeklies" (weekly status reports) to the SAEs. Reports should concentrate on the places where SAE involvement and encouragement would be worthwhile.

5. Monitor execution in field.

A. Keep in touch with CAOs to cheerlead, remove barriers, etc, but

B. Do not burden the field with extraneous reporting requirements.

6. Go out of business within 9 to 12 months.

A. Develop plan to institutionalize processing/negotiating block changes within DCMC.

B. Get plan approved and execute it.

MILESTONES

Develop standard letter NLT 5 Jan
Develop road show NLT 15 Jan
Do road shows 15 Jan - 15 Mar
Stand up SWAT teams NLT 31 Dec
Develop reporting requirements NLT 15 Jan
Rest TBD by team

MEMBERS

Mr. Mike Vezeau (DCMC) -- Lead TBD (OSD)
Ms. Jane Curtis (DCMC) TBD (Army)
Mr. Syd Pope (DCMC) TBD (Navy)
Mr. Dave Robertson (DCMC) TBD (Air Force)
Ms. Josephine Ross (DCMC) TBD (DCAA)
Mr. Mike Dudley (DCMC) TBD (DoD IG)
MAJ Jack Econom (DCMC) TBD (DLA)
Ms. Pat Matura (DCMC)

DCMC team members to round up TBD members. Also to augment with DCMC field personnel if necessary.

National Partnership for Reinventing Government Supporting References
DELIVERING GREAT SERVICE
Deliver new major defense systems to the users in 25% less time. [OUSD(A&T)/API with DUSD(I&CP)/DUSD(AT)/DUSD(L)]

"Acquisition Reform: A Mandate for Change," Secretary of Defense William Perry, 1994
DoDD 5000.1, Defense Acquisition, March 1996
"Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition," Secretary of Defense, May 10, 1995
Study on the Effectiveness of Modeling and Simulation in the Weapon System Acquisition Process, Patenaude et. al., October 1996

Achieve visibility of 90% of DoD materiel assets while resupplying military peacekeepers and warfighters and reducing average order to receipt time by 50%. [DUSD(L)]

Defense Total Asset Visibility Implementation Plan, November 1995.
Logistics - "A Mosaic of Support to the Warfighter," 1997.

Government Performance and Results Act of 1993.
Logistics - "A Mosaic of Support to the Warfighter," 1997.
DoD Logistics Strategic Plan, 1998 Edition.

Simplify purchasing and payment through use of purchase card transactions for 90% of all DoD micropurchases while reengineering the processes for requisitioning, funding, and ordering. [DUSD(L) with ASD(C3I) and Comptroller]

Office of the Under Secretary of Defense (A&T), "Enhancing Use of the Government-Wide Purchase Card," July 5, 1996
Under Secretary of Defense (Acquisition and Technology) Memo, "Micro-Purchases," March 20, 1997
Under Secretary of Defense (Comptroller), "Purchase Card Reengineering Implementation Memorandum #4: Use of IMPAC for Transactions with the Defense Automated Printing Service," May 5, 1997
Deputy Secretary of Defense, "Approval of Purchase Card Program Reengineering Recommendations," June 16, 1997
Under Secretary of Defense (Comptroller), "Purchase Card Reengineering Implementation Memorandum #1: Certifying Officer Guidance," October 17, 1996
Under Secretary of Defense (Comptroller), "Purchase Card Reengineering Implementation Memorandum #2: Conversion of DOD Purchase Cards to New Contractor-Offered Platform," November 12, 1996
Under Secretary of Defense (Acquisition & Technology) and Under Secretary of Defense (Comptroller), "Transmittal of the Joint Report for Purchase Card Reengineering," February 26, 1997
Under Secretary of Defense (Comptroller), "Purchase Card Reengineering Implementation Memorandum #3: Streamlined Financial Management Procedures," March 27, 1997
Under Secretary of Defense (Comptroller), "Purchase Card Reengineering Implementation Memorandum #4: Use of International Merchant Purchase Authorization Card for Transactions with the Defense Automated Printing Service," May 5, 1997
Under Secretary of Defense (Comptroller), "Purchase Card Reengineering Implementation Memorandum #5: Accommodation Checks," August 5, 1997.

Create a world-class learning organization by offering 40 or more hours annually of continuing education and training to the DoD acquisition related workforce. [DUSD(AR)]

"Interim Policy on Continuing Acquisition Education and Training" (August 7, 1996) - DUSD(AR)

"Technology Based Education and Training Concept Plan" (June 5, 1997) - DAU (http://www.acq.osd.mil/dau/files/concept.pdf)
FOSTERING PARTNERSHIP
With no top-line budget change, achieve annual defense procurement of at least $54 billion toward a goal of $60 billion in 2001. [OUSD(A&T)/API with Comptroller/PA&E]

In the spirit of fostering partnerships and community solutions, DoD will complete disposal of 50% of the surplus property baseline and privatize 30,000 housing units. [DUSD(IA&I)]

Defense Authorization Amendments and Base Closure and Realignment Act of 1988 (BCRA 88), Public Law 100-526
Defense Base Closure and Realignment Act of 1990, (DBCRA 90), Public Law 101-510
Announcement by President Clinton Regarding the Base Closure Commission, July 2, 1993
Revitalizing Base Closure Communities, USD Memorandum, July 15, 1993
Federal Property and Administrative Services Act
Surplus Property Act
Base Closure and Community Assistance Act
Comprehensive Environmental Response, Compensation and Liability Act
Base Reuse Implementation Manual, DoD 4165.66-M
1996 National Defense Authorization Act contains the privatization of military housing initiative.

Decrease paper transactions by 50% through electronic commerce and electronic data interchange. [DUSD(L) with ASD(C3I) and Comptroller]

President Clinton (July 17, 1997) "Electronic Commerce"
Deputy Secretary of Defense (July 2, 1997) "Policy for the Transition to a Digital Environment for Acquisition Programs"
Under Secretary of Defense for Acquisition and Technology (July 15, 1997) "Guidance for the Transition to a Digital Environment for Acquisition Programs"
Under Secretary of Defense for Acquisition and Technology (July 17, 1997) "Life Cycle Information Integration"
Under Secretary of Defense Comptroller May 21, 1997 Management Reform Memorandum #2
Under Secretary of Defense Comptroller July 7, 1997 Management Reform Memorandum #15
Secretary of Defense November 1997 "Defense Reform Initiative"
Federal Acquisition Streamlining Act of 1994 (PL 103-355)
"DoD Electronic Commerce/Electronic Data Interchange in Contracting" John Deutch, 28 April 1994
DoD Logistics/Electronic Commerce Integration Organization Requirements, Systems, and Implementation Strategy (October 17, 1996)
DoD CALS Architecture

Reduce total release of toxic chemicals by a further 20%. [DUSD(ES)]

Executive Order 12856 "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," August 3, 1993, DoD Instruction 4715.4 "Pollution Prevention," June 18, 1996 and USD (A&T) Memorandum "Acquisition Pollution Prevention Initiative" May 15, 1997.

INTERNAL REINVENTION
Eliminate layers of management through streamlined processes while reducing the DoD acquisition related workforce by 15%. [DUSD(AR) with OUSD(A&T)/API]

Section 906, FY 96 Defense Authorization Act.
Section 912(a), FY 98 Defense Authorization Act.
Defense Reform Initiative, The Business Strategy for Defense in the 21st Century, November 1997, page 15.

Define requirements and establish an implementation plan for a cost accounting system that provides routine visibility into weapon system life-cycle costs through activity based costing and management. The system must deliver timely, integrated data for management purposes to: permit understanding of total weapon costs; provide a basis for estimating costs of future systems; and feed other tools for life cycle cost management. [OUSD(A&T)/API and Comptroller/PA&E with DUSD(L) support]

Defense Accounting and Finance Service Long Range Plan; Federal Accounting Standards Advisory Board; and Cost Management Systems Program of the Consortium for Advanced Manufacturing - International.

Dispose of $2.2 billion in excess National Defense Stockpile inventories and $3 billion in unneeded Government property while reducing supply inventory by $12 billion. [DUSD(IA&I), DUSD(IA&I)/DDP, and DUSD(L)]

The Strategic and Critical Materials Stock Piling Act (50 USC. 98 *et seq.*)
Strategic and Critical materials Report to Congress (annual)
Stockpile Requirements Report (biennial)
National Stockpile Sales-Defense Reform Initiative, the Business Strategy for Defense in the 21st Century, November 1997, page 33.

Federal Acquisition Regulation, Part 45, Government Property
Defense FAR Supplement Part 245.

DoD Logistics Strategic Plan, 1998 Edition, Objective 15.1, on Inventory Reduction.
DoD Materiel Management Regulation, DoD 4140.1-R, Chapter 4 F 1, and DD Form 1138-1, Report Control Symbol DD-A&T(A)1000, both of which specify an annual requirement to report inventory as of September 30 by February 1.

(12) Minimize cost growth in major defense acquisition programs to no greater than 1% annually. [OUSD(A&T)/API with Comptroller/ PA&E]

President's Budget (PB)

Program Objective Memorandum

APPENDIX D:
RELEVANT SPECIFICATIONS (US STUDY)

APPENDIX D: Relevant specifications (US study)

This appendix illustrates the comprehensiveness of the US efforts to identify and eliminate cost drivers associated with the use of military unique specifications and requirements. Included are:

D.1 The Office of Secretary of Defense DoD Regulatory Cost Premium Working Group 59 Cost Driver focus areas identified for major Defense Reform

D.2 MILITARY STANDARDS CANCELED AS A RESULT OF DoD-WIDE REVIEW (Unless otherwise noted documents were canceled as of December 5, 1995)

Office of Secretary of Defence DoD Regulatory Cost Premium Working Group, 59 cost drivers

Driver #	Cost Drivers
1	DoD Quality Program Requirement
2	Truth in Negotiation Act (TINA)
3	Cost/Schedule Control System Criteria (C/SCSC)
4	Configuration Management
5	Contract Specific Requirements/SOW
6	DCAA/DCMC Interface
7	Cost Accounting Standards (CAS)
8	Material Mgt and Accounting System
9	Engineering Drawings
10	Government Property Administration
11	Technical Customer Interaction
12	Contractor Purchasing Requirements Including CPSR
13	Correct Action/Disposition System for Nonconforming Material
14	Contract Data Requirements List
15	DoD Soldering Requirements
16	Work Measurement Reporting
17	Shipping Documentation
18	Contract Cost Principles
19	Systems Development
20	Defense Industrial Security Program
21	Solicitation Phase Reviews, Proposal Prep & Negotiation
22	DoD Software Development
23	Micro-Electronics Test Methods
24	Specificaiton Practices
25	Packaging, Handling, Storage & Transportability Program
26	Unallocated or Secondary Cost Impact
27	Standard Inspection System
28	Specification Practices

29	Supplier Quality Assurance Program Requirements
30	Procurements Limited to QPL Vendors
31	Supplemental Cost Principles, Penalties & Procedures
32	Separate Accounting for Contract Mods
33	Contract Administration and Reporting
34	Socioeconomic Programs
35	Non-specific Pre-solicitation Interaction with Government
36	Rights in Technical Data and Computer Software
37	Business Ethics/Procurement Integrity Administration
38	Contract Financing
39	DoD Industrial Modernization Incentive Program
40	Reliability Design Qualification Acceptance Test
41	Test Data Requests for Nonstandard Parts
42	Test Provision for Electric Systems & Associated Equipment
43	Testability Program for Electronics Systems & Associated Equipment
44	Environmental Test Methods & Engineering Guidelines
45	Printed Wiring
46	Electromagnetic Emersion & Susceptibility for Control of EMI
47	Electronic Parts
48	Reliability Program for Systems & Equipment Development & Production
49	Safety
50	Reliability Prediction of Electric Equipment Development & Production
51	Logistics Support analysis
52	Miscellaneous Technical Publication Specifications
53	Parts Control/Evaluation
54	Preparation of Test Requirements Document
55	Calibration Systems Requirements
56	Preparation of Test Requirements Document
57	Quality Program Requirements for Space & Launch Vehicles
58	Human Engineering Design Criteria
59	Production Management

Military standards cancelled as a result of DoD-wide review

(unless otherwise noted documents were cancelled as of December 5, 1995)

Document Number	Title
MIL-STD-17/2B(1)	Mechanical Symbols for Aeronautical & Aerospacecraft Use
MIL-STD-35/44A	Automated Engineering Document Preparation System
MIL-STD-35/45A	Automated Engineering Document Preparation System, Resolvers Electrical
MIL-STD-102B	Anti-Friction Bearing Identification Code
MIL-STD-162E	Materials Handling Equipment Preparation for Shipment, Storage, Cyclic Maintenance, Routine Testing & Processing
MIL-STD-172C	Color Code for Containers of Liquid Propellants **Canceled by Notice 2, 17 October 1995**
MIL-STD-178A	Definition Applicable to Speed-Governing of Electric Generator Set
MIL-STD-187/310	Standards for Long Haul Communications Switching Planning Standards for the Defense Communication
MIL-STD-187/320	Standards for Long Haul Communications Transmission Planning Standards for the Defense Communication
MIL-STD-188/100(3)	Common Long Haul and Tactical Communication System Technical Standards
MIL-STD-188/194	Integrated Services Digital Network Profile
MIL-STD-188/310	Subsystem Design & Engineering Std. For Tech Control Facilities **Canceled by Notice 1, 5 May 1989**
MIL-STD-188/318	System & Subsystem Design & Engineering & Equipment Technical Standards for Closed Circuit TV
MIL-STD-188/331	Interoperability and Performance Standard for Video Teleconferencing

MIL-STD-188/340(1)	Equipment Technical Design Standards for Voice Orderwire Multiplex
MIL-STD-188/342	Standards for Long Haul Communications Equipment Technical Design Standards for Voice Frequency
MIL-STD-190C	Identifications Marking of Rubber Products
MIL-STD-195(1)	Marking of Connections for Electric Assemblies
MIL-STD-200K(1)	Electron Tube, Selection of
MIL-STD-205	Frequencies for Electric Power
MIL-STD-250	Aircrew Station Controls & Displays for Rotary Wing Aircraft **Canceled by Notice 2, 11 September 1995**
MIL-STD-255B	Electric Voltages Alternating and Direct Current
MIL-STD-277(1)	Static Acceptance Test for Light Output of Flash Munitions
MIL-STD-295	Bill of Material Preparation of
MIL-STD-372	Welding, Gas Metal-Arc and Gas Tungsten-Arc, Aluminum Alloys, Readily Weldable for Structures
DOD-STD-396	Weapon Caliber and Ammunition, Metric System for Identification
MIL-STD-417A	Classification System and Tests for Solid Elastomeric Materials
MIL-STD-450B	Signs for Contaminated or Dangerous Areas
MIL-STD-606A	Helmet Welders'; Shield, Welding, Hand Held and Lenses, Helmet
MIL-STD-627A	Sprocket Wheels for Power Transmission and Conveying Chains
MIL-STD-637A(1)	Machine & Automatic Guns & Machine-Gun Trainers Through 30-mm
MIL-STD-645B	Dip Brazing of Aluminum Alloys
MIL-STD-670B	Classification System and Tests for Cellular Elastomeric Materials
MIL-SDT-698B	Quality Standards for Aircraft Pneumatic Tires & Inner Tubes
MIL-STD-708	Formula for Binder Solution

MIL-STD-717	Formula for Binder Solution II **Canceled by Notice 2, 28 November 1995**
MIL-STD-721C	Definition of Terms for Reliability & Maintainability
MIL-STD-725A(1)	4 Method of Marking Scales for Sights and Fire Control Instruments
MIL-STD-731A(1)	Quality of Wood Members for Containers and Pallets
MIL-STD-739A(1)	Trailer and Semitrailers, Commercial
MIL-STD-782D	Reconnaissance/Mapping Data Marking
MIL-STD-787	Joint Optical Range Instrumentation Type Designation System
MIL-STD-850B	Aircrew Station Vision Requirements for Military Aircraft
MIL-STD-858	Testing Standard for Personnel Parachutes
MIL-STD-872(1)	Test Requirements and Procedures for Aircraft Emergency Ground and Ditching Escape Provisions
MIL-STD-908	Provisions for Evaluating the Quality of Spare Parts for Mechanical & Textile End Items
MIL-STD-912	Physical Ear Noise Attenuation Testing
MIL-STD-964(1)	Manufacture and Packaging of Drugs, Pharmaceuticals and Biological Products **Canceled by Notice 2, 18 August 1995**
MIL-STD-989	Certification Rqts for JAN Semiconductor Devices **Canceled by Notice 1, 28 July 1995**
MIL-STD-1005	Renovation, Cleaning and Glazing of Bake Pans
MIL-STD-1163	Lithographic Chemicals
MIL-STD-1165	Glossary of Environmental Terms (Terrestrial)
MIL--STD-1201C	Ethyl Alcohol (Ethanol), Technical and Denatured Grades
MIL-STD-1210B	Fog and Ice Preventive Compounds

MIL-STD-1212A	Industrial Safety Belts, Straps, and Related Equipment
MIL-STD-1215B	Water Purification Compounds
MIL-STD-1216A	Preventive Compounds (Corrosion) and Inhibitors
MIL-STD-1221B	Protective Compounds (For Personnel)
MIL-STD-1226A	Engine, Gas, Air Cooled, Ind Type, 1-1/2 BHP MILSTD, Model 1A08 Install Procedures
MIL-STD-1227B(1)	Engine, Gasoline, Air-cooled, 3 BHP, 4-Cycle, Military Design, Model 2A016, Installation Procedures
MIL-STD-1256A(1)	Rubber Coated Parts for Machine Gun, 7.62MM, M60
MIL-STD-1258	Chromium Plated 5.56MM, 7.62MM, and Caliber .30 Small Arms Barrel Bores
MIL-STD-1261C(1)	Arc Welding Procedures for Constructional Steels
MIL-STD-1267	Dimensioning of Barrel Chambers of Small Arms Weapons **Canceled by Notice 2, 12 July 1995**
MIL-STD-1270A(1)	Patching of Wood Stocks for The 7.62MM, M14 and M14E2 Rifles
MIL-STD-1272A	Door Hardware, Vehicular
MIL-STD-1278	Filters, Light, Photographic
MIL-STD-1281	Internal Transient Control for Solid State Power Supplies
MIL-STD-1288(3)	Aircrew Protection Rqts. Nonnuclear Weapons Threat
MIL-STD-1289C	GDRQ Airborne Stores Ground Fit & Compatibility, Rqts. For
MIL-STD-1290A	Light Fixed & Rotary-Wing Aircraft Crash Resistance
MIL-STD-1293	Electro-Mechanical Command Instrument System for Rotary Wing Aircraft
MIL-STD-1294	Acoustical Noise Limits in Helicopters

MIL-STD-1300A(1)	Engine, Gasoline, Air-Cooled, 6 BHP, Military Design, Model 4A032, Installation Procedures
MIL-STD-1326(1)	Test Point, Test Point Selection & Interface Rqts for Equip. Monitored by Ships **Canceled by Notice 2, 1 June 1995**
MIL-STD-1343	Glossary of Terms For Electronic and Weapons Control Interface Functions (Naval Ship Combat Systems)
MIL-STD-1348	Knob, Control Selection of
MIL-STD-1361A	Fluidics Test Methods and Instrumentation
MIL-STD-1372A(1)	Process for Soldering Accident Dosimeter to Film Badge Holder for Radiac Detecting Element
MIL-STD-1373(4)	Screw-Thread, Modified, 60 Deg. Stub, Double
MIL-STD-1375(1)	Provisioning, Initial Support, General Rqts For
MIL-STD-1395B	Filters & Networks Selection & Use of
DOD-STD-1399/204A	Interface Standard For Shipboard Systems Section 204A Ambient Air Conditions in Surface Ship
DOD-STD-1399/406B	Interface Standard for Shipboard Systems Section 406 Digital ComputerGrounding (Metric)
DOD-STD-1399/533 (1)	Interface Standard For Shipboard Systems Section 533 Potable Water Service (Metric)
MIL-STD-1399/534(1)	Interface Standard For Shipboard Systems Section 534 Auxiliary Steam Service, Surface Ships
MIL-STD-1401(1)	Engine, Gasoline, Air Cooled, 20 BHP, 4 Cycle, Military Design, Model 4A084 Installation Procedures
MIL-STD-1402(1)	Engine, Gasoline, Air Cooled, 20 BHP, 4 Cycle, Military Design, Model 4A084 Installation Procedures **Already canceled per DoDSSP - have no information on date of cancellation**
MIL-STD-1410A	Methods for Selection of Industrial Engines for End Item Application

MIL-STD-1422A	Mask, Chemical Biological
MIL-STD-1424	Hydrogen Ion Meters
MIL-STD-1427A	Activated Desiccants (Metric)
MIL-STD-1433B	Climber Sets, Tree and Pole
MIL-STD-1434A	Goggles (Metric)
MIL-STD-1439	Thickened Hydrocarbon Flame Fuels, Consistency of, Mobilometer Test
MIL-STD-1440A	Test Facility for Determining Percent Agent Recovery
MIL-STD-1442A	Inorganic Peroxides, Technical Grade
MIL-STD-1453	Ballistic Standards and Test Method for Evaluating and Selecting 5.56MM Ammunition For M16/M1
MIL-STD-1478	Task Performance Analysis
MIL-STD-1493	Contractual Service Requirements for Automatic Dishwashing Machine Accessory Equipment and Supplies
MIL-STD-1524	Table of Differential Pressure in Relation to Calibrated Airspeed
MIL-STD-1529	Vendor Substantiation for Aerospace Propulsion System Items
MIL-STD-1549	Common Termination System for Electrical & Electronic Parts
MIL-STD-1555	Aircrew Station Displays & Assoicated Equip., Definitions of **Canceled by Notice 2, 28 September 1995**
MIL-STD-1562W	Lists of Standard Microcircuits
MIL-STD-1570A	Oil Analysis in Equip. Design, Provision For
MIL-STD-1592	Mockups, Air Vehicle Engines, Construction & Inspection of
MIL-STD-1598	Studs Preferred For Design, Listing of **Canceled by Notice 1, 27 July 1995**

MIL-STD-1606A	Technical Information Requirements for Air Launched Guided Missile Proposals
MIL-STD-1621A	Acoustical and Vibrational Standard Reference Quantities
MIL-STD-1634B	Module Descriptions for the Standard Electronic Modules Program
MIL-STD-1648A	Criteria & Test Procedure for Ordnance Exposed to an Aircraft Fuel Fire
MIL-STD-1659	Sealing Condition of Ammunition Primer Tube Flash Holes
MIL-STD-1671	Schematic Wiring Diagram (External DC Power Connector, Aircraft)
MIL-STD-1695	Environments, Working, Minimum Standards for
MIL-STD-1759	Rivets & Rivet type Fasteners Preferred for Design, Listing of
MIL-STD-1761	Fastener Recess Test, Method For Damage Tolerance Evaluation
MIL-STD-1772B	Certification Rqts for Hybrid Microcircuits Facilities & Lines
MIL-STD-1774	Process For Cleaning Hydrazine Systems and Components
MIL-STD-1775	Propellant, Hydrazine-Uns-Dimethylhydrazine 50/50 Blend
MIL-STD-1777	Internet Protocol
MIL-STD-1778	Transmission Control Protocol
MIL-STD-1780	File Transfer Protocol
MIL-STD-1781	Simple Mail Transfer Protocol
MIL-STD-1782	Telnet Protocol
MIL-STD-1788A	Avionics Interface Design Standard **Already canceled per DoDSSP - have no information on notice date**
MIL-STD-1790B	Data Rqts. Associated with Tech Manual Acquisition & Maintenance
MIL-STD-1805A	Breathing Apparatus, Self-Contained, 30 Minutes

MIL-STD-1819	Performance Evaluation For Plasma Spray Masking Tape **Canceled by Notice 1, 28 September 1995**
MIL-STD-1838A	Common ADA Language Support Environment (APSE) Interface Set (CAIS)
MIL-STD-1875	Ultrasonic Inspection, Rqts for
MIL-STD-1907(1)	Inspection, Liquid Penetrant And Magnetic Particle, Soundness, Requirements for Materials, Parts, and Weldments
MIL-STD-1946A(2)	Welding of Aluminum Alloy Armor
MIL-STD-1947	Ultrasonic Welding of Aluminum & Aluminum Alloy Materials
MIL-STD-1948	Glossary of Terms & Definitions for Neutron Radiographic Testing
MIL-STD-2001	Manuals, Tech, Systems Operator S Interface Procedures for Writing Marking of Electric Systems
MIL-STD-2065	Test Methods for Still Photographic Equipment (Less Optics)
MIL-STD-2072	Survivability, Aircraft, Establishment and Conduct of Programs for
MIL-STD-2076	Unit Under Test Compatibility With Automatic Test Equipment General Requirements for
MIL-STD-2078	Requirement for Preparation of Support Equipment Depot Level Rework Standards
MIL-STD-2081	Assembly Procedures, Gimbal **Canceled by Notice 2, 18 August 1995**
MIL-STD-2082A(1)	Assembly Procedures, Gyro **Canceled by Notice 2, 18 August 1995**
MIL-STD-2094	Missile Guidance Set, Aim/Rim-7M, First Article Tests
MIL-STD-2095	Missile Guidance Set, Aim/Rim-7M, Production Verification Test
MIL-STD-2114	Electro Acoustical, Mechanical and Environmental Test Methods for Audio or Acoustical Component Parts

MIL-STD-2120	Connectors, Electromagnetic Interference (EMI) Filter Contact
MIL-STD-2126A	Reduced Smoke Rocket Motor Processing & Test Procedures (Sidewinder)
DOD-STD-2144	Induction Clutches, Low Magnetic Field Design of (Metric)
MIL-STD-2172	Aeronautical Equipment Service Record
MIL-STD-2189-302-1	Design Methods for Naval Shipboard Systems Section 302-1 AC Motor and Controller Application
MIL-STD-2189-305-1	Design Methods for Naval Shipboard Systems Section 305-1 Designation and Marking of Electric System
MIL-STD-2190	Non-Metallic Seal Materials (Controlled Distribution)
MIL-STD-2200	Requirements for Employing Standard Enclosure System
MIL-STD-600002-DMA	Department of Defense DMA Stock Number Bar Coding **Not canceled yet - DoDSSP trying to get copy so can process**

APPENDIX E:
TOP 200 GOVERNMENT CONTRACTORS AND TOP MILITARY CONTRACTORS

APPENDIX E: Top 200 Government contractors and top 100 Military Contractors

Rank	Parent Company	Total $	DoD $	Civilian $	DoD Rank	Civilian Rank	SPI Partici-pant?-	% OF Top 200 FY96 Contractor Sales
1	Lockheed Martin Corp.	19,758,033	14,009,181	5,748,852	1	1	Y	17.17
2	McDonnell Douglas Corp.	12,524,380	12,150,097	374,283	2	21	Y	14.89
6	Northrop Grumman Corp.	3,505,503	3,387,099	118,404	3	47	N	4.15
5	Raytheon Co.	3,712,625	3,306,320	406,305	4	14	Y	4.05
4	General Motors Corp.	3,930,388	3,284,226	646,162	5	10	Y	4.02
8	United Technologies Corp.	2,851,022	2,491,335	359,687	6	22	Y	3.05
3	Boeing Co.	4,223,364	2,317,834	1,905,530	7	4	Y	2.84
11	Litton Industries Inc.	2,363,589	2,264,560	99,029	8	57	Y	2.77
12	General Dynamics Corp.	2,123,307	2,092,427	30,880	9	200	Y	2.56
9	Rockwell International Corp.	2,597,199	1,347,787	1,249,412	10	6	Y	1.65
13	General Electric Co.	1,563,602	1,321,890	241,712	11	30	Y	1.62
19	FMC Corp.	1,093,224	1,093,224	0	12	--	Y	1.34
16	Computer Sciences Corp.	1,381,849	978,149	403,700	13	15	N	1.20
7	Westinghouse Electric Corp.	3,482,004	918,106	2,563,898	14	2	N	1.12
21	Textron Inc.	851,234	843,590	7,644	15	733	Y	1.03
14	TRW Inc.	1,505,632	799,254	706,378	16	8	Y	0.98
22	Tracor Inc.	736,257	713,980	22,277	17	271		0.87
26	Bath Holding Corp.	702,368	702,368	0	18	--	Y	0.86
23	ITT Corp.	718,775	674,728	44,047	19	144	Y	0.83
28	Texas Instruments Inc.	655,287	652,819	2,468	20	--	Y	0.80
20	AT&T	976,682	643,546	333,136	21	23	N	0.79
31	GTE Corp.	633,628	609,214	24,414	22	245		0.75
25	Science and Applied Tech.	710,767	586,558	124,209	23	46		0.72
30	Halliburton Co.	636,133	576,708	59,425	24	104		0.71
18	Allied-Signal Inc.	1,188,492	541,852	646,640	25	9	Y	0.66
27	DynCorp	677,974	507,334	170,640	26	39	Y	0.62

24	Science Applications Intl. C..	712,489	497,931	214,558	27	32	Y	0.61
36	Alliant Techsystems Inc.	491,698	491,614	84	28	--	Y	0.60
35	Logicon Inc.	498,480	482,017	16,463	29	347		0.59
38	Rolls Royce PLC	482,763	475,891	6,872	30	809	Y	0.58
39	Tenneco Inc.	473,133	470,505	2,628	31	--	Y	0.58
43	Aetna Life and Casualty Co.	452,768	451,501	1,267	32	--	*N*	0.55
45	Exxon Corp.	446,983	446,735	248	33	--	*N*	0.55
32	Electronic Data Systems Corp.	621,734	416,738	204,996	34	34		0.51
42	Olin Corp.	452,995	399,591	53,404	35	121		0.49
40	MITRE Corp.	462,229	375,264	86,965	36	68		0.46
50	BDM Corp.	393,567	333,947	59,620	37	103		0.41
56	Foundation Health Corp.	334,153	333,611	542	38	--		0.41
57	Avondale Industries Inc.	333,566	328,701	4,865	39	--		0.40
58	Renco Group Inc.	326,534	326,493	41	40	--	Y	0.40
54	Massachusetts Inst. of Tech.	360,934	321,868	39,066	41	164		0.39
60	Nassco Holdings Inc.	317,229	317,229	0	42	--		0.39
46	Chrysler Corp.	439,130	301,857	137,273	43	44	Y	0.37
53	Motorola Inc.	380,197	295,223	84,974	44	71	Y	0.36
41	Harris Corp.	458,284	280,744	177,540	45	36	Y	0.34
67	Atlantic Richfield Co.	282,253	280,611	1,642	46	--		0.34
62	Honeywell Inc.	310,377	273,754	36,623	47	172		0.34
69	Worldcorp Inc.	270,876	270,876	0	48	--		0.33
29	UNISYS	640,105	263,283	376,822	49	20	Y	0.32
64	Canadian Commercial Corp.	306,085	258,879	47,206	50	137		0.32
66	Gencorp Inc.	284,211	253,155	31,056	51	197		0.31
55	Johnson Controls Inc.	342,988	248,734	94,254	52	60		0.30
77	Federal Express Corp.	243,408	241,692	1,716	53	--	*Y*	0.30
72	OHM Corp.	267,362	237,273	30,089	54	205		0.29
65	Sverdrup Corp.	289,081	234,306	54,775	55	116		0.29
82	Philip Morris Co.	232,429	231,893	536	56	--		0.28

81	Charles Stark Draper Labs	233,427	227,334	6,093	57	893		0.28
83	Nichols Research Corp.	225,739	225,728	11	58	--		0.28
85	UNC Inc.	222,432	222,302	130	59	--	Y	0.27
76	General Electric Co. PLC	249,952	218,413	31,539	60	195		0.27
63	Johns Hopkins University	308,500	217,749	90,751	61	63		0.27
87	Procter & Gamble Co.	214,230	214,230	0	62	--		0.26
84	Galaxy Scientific Corp.	224,544	208,148	16,396	63	348		0.26
89	Royal Dutch Petroleum Co.	206,637	206,637	0	64	--		0.25
96	Oshkosh Truck Corp.	188,815	188,815	0	65	--		0.23
97	Humana Inc.	188,701	188,183	518	66	--		0.23
68	Booz Allen & Hamilton Inc.	279,763	185,716	94,047	67	61		0.23
99	MCI Communications Corp.	187,273	180,900	6,373	68	858		0.22
100	Kaman Corp.	185,121	180,695	4,426	69	--		0.22
15	Bechtel Group Inc.	1,486,512	180,290	1,306,222	70	5		0.22
70	Bell Atlantic Corp.	268,657	177,985	90,672	71	64		0.22
73	Clark Enterprises	266,613	172,022	94,591	72	59		0.21
104	UCCI	170,404	170,404	0	73	--		0.21
98	Foster Wheeler Corp.	187,542	167,907	19,635	74	298	Y	0.21
79	CSX Corp.	236,765	159,342	77,423	75	82		0.20
112	Aerospace Corp.	157,818	155,690	2,128	76	--		0.19
105	University of Texas System	169,100	155,505	13,595	77	412		0.19
113	Hunt Building Corp.	154,730	154,730	0	78	--	Y	0.19
115	Kuwait National Petroleum Co.	152,601	152,601	0	79	--		0.19
117	ENI SPA	151,860	151,860	0	80	--		0.19
120	Stewart & Stevenson Services	149,765	149,667	98	81	--		0.18
118	Coastal Corp.	151,093	147,673	3,420	82	--		0.18
93	UNICOR	195,571	146,349	49,222	83	130		0.18
125	Intermarine USA	144,942	144,942	0	84	--		0.18
61	IBM Corp.	315,165	143,389	171,776	85	38		0.18

86	Wang Laboratories Inc.	220,214	141,902	78,312	86	81	Y	0.17
102	Jacobs Engineering Group Inc.	176,301	141,138	35,163	87	178		0.17
109	IT Corp.	160,563	140,632	19,931	88	294		0.17
126	European Utilities Cos.	138,855	138,855	0	89	--	Y	0.17
91	McKesson Corp.	200,311	137,922	62,389	90	97		0.17
132	Cubic Corp.	129,720	129,720	0	91	--		0.16
133	Tower Air Inc.	128,166	128,166	0	92	--		0.16
33	Battelle Memorial Institute	596,593	127,551	469,042	93	13		0.16
135	Bergen Brunswig Corp.	126,777	123,514	3,263	94	--		0.15
137	ESCO Electronics Corp.	123,140	123,094	46	95	--		0.15
88	Teledyne Inc.	209,926	121,722	88,204	96	65	Y	0.15
90	CAE Industries Ltd.	205,027	120,087	84,940	97	72		0.15
140	International Shipholding Corp.	117,535	117,535	0	98	--		0.14
114	Hewlett-Packard Co.	154,425	117,016	37,409	99	169		0.14
141	Talley Industries Inc.	116,533	116,284	249	100	--		0.14
143	Government of Germany	116,095	116,095	0	101	--		0.14
146	International Research Institute	114,405	114,405	0	102	--		0.14
147	Salomon Inc.	114,030	114,030	0	103	--	Y	0.14
152	VSE Corp.	110,030	109,885	145	104	--		0.13
92	GTSI	195,909	109,591	86,318	105	69		0.13
129	Ogden Corp.	134,202	108,395	25,807	106	227		0.13
155	Okinawa Electric Power Co.	106,780	106,780	0	107	--		0.13
151	ARINC Inc.	110,153	106,174	3,979	108	--		0.13
111	Lucent Technologies Inc.	160,160	105,686	54,474	109	119		0.13
157	Eaton Corp.	105,062	104,567	495	110	--	Y	0.13
49	EG&G Inc.	395,683	101,962	293,721	111	25		0.12
116	Telos Corp.	152,336	100,350	51,986	112	125		0.12
163	Analysis & Technology Inc.	102,053	99,935	2,118	113	--		0.12
165	Duchossois Industries Inc.	99,399	98,975	424	114	--		0.12

154	E.I. Du Pont de Nemours & Co.	108,429	98,295	10,134	115	561		0.12
107	J.A. Jones Construction Co.	161,429	98,091	63,338	116	95	Y	0.12
161	Flightsafety International	102,948	97,921	5,027	117	--		0.12
169	Delta Dental Plan California	97,449	97,449	0	118	--		0.12
121	Mantech International Corp.	147,484	95,322	52,162	119	124		0.12
176	Heisei Kenso Co. Ltd.	94,337	94,337	0	120	--		0.12
153	Parsons Corp.	108,546	93,604	14,942	121	383		0.11
178	Arctic Slope Regional Corp.	93,606	93,330	276	122	--		0.11
172	Comsat	95,792	91,901	3,891	123	--		0.11
142	Eastman Kodak Co.	116,392	91,000	25,392	124	232		0.11
184	Space & Sensors Associates	90,042	90,042	0	125	--	Y	0.11
185	Day & Zimmermann Inc.	89,612	88,843	769	126	--		0.11
193	Compania Espanola de Petroleos	87,085	87,085	0	127	--		0.11
194	Goodyear Tire & Rubber Co.	86,899	86,781	118	128	--		0.11
188	Turner Corp.	88,236	86,537	1,699	129	--		0.11
196	Holly Corp.	86,450	86,450	0	130	--		0.11
197	Milcom Systems Corp.	86,201	86,201	0	131	--		0.11
168	Gilbert Associates Inc.	98,652	85,653	12,999	132	435		0.10
187	Rand Corp.	89,145	85,544	3,601	133	--		0.10
200	Parker-Hannifin Corp.	85,369	85,369	0	134	--		0.10
101	BTG Inc.	185,097	84,458	100,639	136	56		0.10
170	Primark Holding Corp.	97,441	84,193	13,248	138	431		0.10
52	Mason Hanger-Silas Mason Inc.	390,931	84,180	306,751	139	24		0.10
164	Coleman Research Corp.	100,763	84,149	16,614	140	343		0.10
145	Carlyle Group	115,397	80,804	34,593	143	182		0.10
183	Ceridian Corp.	91,137	77,306	13,831	148	407		0.09
130	Xerox Corp.	131,546	76,413	55,133	149	113		0.09
127	Digital Equipment Corp.	135,266	75,431	59,835	150	102		0.09

110	Morrison-Knudsen Corp.	160,352	73,267	87,085	152	67		0.09
136	CACI International Inc.	124,490	73,094	51,396	154	127		0.09
191	Sun Microsystems Inc.	87,410	71,935	15,475	159	369		0.09
122	SRI International	147,096	67,662	79,434	167	79		0.08
158	United Industrial Corp.	104,951	64,406	40,545	176	155		0.08
138	General Atomics Tech. Corp.	121,245	64,376	56,869	177	110		0.08
198	Illinois Institue of Technology	86,153	61,138	25,015	185	238		0.07
148	Federal Data Corp.	113,052	58,478	54,574	190	118		0.07
134	Orbital Sciences Corp.	127,016	57,672	69,344	194	87		0.07
173	AMS	95,550	57,611	37,939	195	167		0.07
189	ABB Asea Brown Boveri Ltd	88,124	57,130	30,994	196	198		0.07
44	Thiokol Corp.	452,236	56,052	396,184	200	17		0.07
162	CH2M Hill Companies Ltd.	102,437	55,418	47,019	202	139		0.07
195	Earth Technology Corp.	86,849	54,888	31,961	206	193		0.07
175	Bell & Howell	94,730	54,207	40,523	208	156		0.07
177	M.A. Mortenson Cos.	94,116	51,040	43,076	215	146		0.06
171	KPMG Peat Marwick	96,354	50,859	45,495	216	143		0.06
180	Hensel Phelps Construction Co.	93,001	41,851	51,150	266	128		0.05
123	Silicon Graphics Inc.	145,514	40,622	104,892	278	52		0.05
167	Roy F. Weston Co.	98,789	38,279	60,510	299	100		0.05
174	Sterling Software Inc.	94,952	38,273	56,679	300	111		0.05
131	Conagra Inc.	130,782	35,062	95,720	324	58		0.04
10	University of Calif. System	2,466,873	33,108	2,433,765	341	3		0.04
59	Fluor Corp.	322,351	32,690	289,661	346	26		0.04
124	Ford Motor Co.	144,981	29,542	115,439	386	49		0.04
199	Sprint Corp.	85,398	29,462	55,936	387	112		0.04
149	Caddell Construction Co. Inc.	112,319	29,087	83,232	392	76		0.04
94	Computer Data Systems Inc.	191,210	26,745	164,465	422	41		0.03
190	ICF Kaiser International Inc.	87,641	25,946	61,695	433	98		0.03

78	Stone & Webster Engineering Corp.	239,456	25,588	213,868	443	33		0.03
181	Centex Corp.	92,797	25,347	67,450	451	90		0.03
71	Stanford University	268,210	17,825	250,385	646	29		0.02
139	Hanson PLC	118,061	16,093	101,968	709	55		0.02
48	McDermott Inc.	397,543	12,429	385,114	893	19		0.02
166	National Industries for the Blind	98,986	11,457	87,529	958	66		0.01
34	Kaiser Hill Co. LLC	565,729	0	565,729	--	11		0.00
37	University of Chicago	491,139	223	490,916	--	12		0.00
47	Associated Universities Inc.	400,281	0	400,281	--	16		0.00
51	Amerisource Distribution Corp.	393,203	1,518	391,685	--	18		0.00
74	GUBMK Constructors	266,000	0	266,000	--	27		0.00
75	Universities Research Assn.	265,659	0	265,659	--	28		0.00
80	Ohio Valley Electric Corp.	235,684	0	235,684	--	31		0.00
95	Turner Construction Co.	189,827	0	189,827	--	35		0.00
103	Management & Training Corp.	175,347	0	175,347	--	37		0.00
106	Midwest Research Institute	168,211	259	167,952	--	40		0.00
108	Electric Energy Inc.	160,700	0	160,700	--	42		0.00
119	H.B. Zachry Co.	151,088	6,088	145,000	--	43		0.01
128	Archer-Daniels-Midland Co.	134,450	1,853	132,597	--	45		0.00
144	Peabody Coal Co.	115,912	0	115,912	--	48		0.00
150	Inter-American College of Physicians	112,300	0	112,300	--	50		0.00
156	K&W Reinigungs GMBH	106,350	0	106,350	--	51		0.00
159	Mario Saiegh	103,708	0	103,708	--	54		0.00
160	Wackenhut Corp.	103,661	-924	104,585	--	53		(0.00)
179	Cyprus Amax Minerals Co.	93,202	-414	93,616	--	62		(0.00)
182	Perini Corp.	92,723	7,330	85,393	--	70		0.01
186	World Wide Technology Inc.	89,166	9,280	79,886	--	78		0.01

192	Cal Western Packaging Corp.	87,359	3,037	84,322	--	73		0.00
17	California Inst. of Technology	1,203,572	5,867	1,197,705	--	7		0.01
		115,443,991	81,612,721	33,831,270				

APPENDIX F:
PRIMARY SECTOR IDENTIFICATION FOR EACH CONTRACTOR FACILITY (US STUDY)

APPENDIX F: Primary sector identification for each contractor facility (US study)

The following appendix derives the industry sector and commodity group relationship. Drawing from our long-standing expertise in DoD industrial analysis, we applied two DoD recognised standards available on CD-ROM based sources and an online service. Utilising Dunn & Bradstreet marketplace CD-ROM, the 8-digit Standard Industrial Classification (SIC) code identifying manufacturing orientation was applied to facility location knowledge to identify sector affiliation. This information was augmented with the CorpTech Explore Database of Technology Companies, which is updated quarterly, and contains significant detailed information about the products produced at a particular location. As a final resource prior to sector identification, we consulted the Haystack Online directory from Information Handling Services.[52]

All contractor sites participating in SPI were matched based on their location (city, state, zipcode+4). Where possible, the location's Contractor and Government Entity (CAGE) code was referenced in order to confirm that facilities in the same zip code were involved in government contracts. From there, the plant was assigned a primary sector based upon the product mix that was cited in the database. For example, if Lockheed Martin Missiles and Space produced both missiles and satellite launch equipment at a single facility, the primary sector was determined by the number of parts produced by the plant that were in the respective Federal Supply Class (FSC). The FSC data was obtained through the Haystack database. In some instance, major suppliers transcend several commodity groups. Proposals, which crossed commodity groups, were assigned to all relevant sectors for trend analysis.

The following provides the results of the commodity group analysis and classification used for each manufacturing facility used in this analysis.

52 More information about these products is available through the following web sites: http://www.corptech.com, http://www.mktplace.com and http://www.ihsgroup.com.

Manufacturing Facility	Sector Identification
AAI Corporation, Hunt Valley, MD	Other/Svcs
AAI SMI (AAI Systems Management Inc., AAI subsidiary), Hunt Valley, MD	C3I Electronics
ABA Industries, Pinellas Park, FL	Engines
Aerojet ElectroSystems, Azusa, CA	C3I Electronics
Aerojet-Sacramento Operations, Sacramento, CA	Engines
AeroThrust Corporation, Miami, FL	Engines
AETC, Inc., San Diego, CA	Unknown
AIL Systems, Inc., Deer Park, NY	Avionics
AIL Systems, Inc., Deer Park, NY	EW
Alliant Defense Electronics Systems, Inc., Clearwater, FL	C3I Electronics
Alliant Techsystems, Inc., Hopkins, MN	C3I Electronics
AlliedSignal Aerospace Corporation, Etobicoke, Ontario, Canada	Avionics
AlliedSignal Aerospace Equipment Systems (AES), Tempe, AZ	Tactical Aircraft
AlliedSignal Aerospace Equipment Systems, Torrance, CA	Tactical Aircraft
AlliedSignal Avionics, Olathe, KS	Avionics
AlliedSignal Avionics, Olathe, KS	EW
AlliedSignal Engines, Phoenix, AZ	Engines
AlliedSignal Inc., Aircraft Landing Systems, South Bend, IN	Engines
AlliedSignal Inc., Electronic Systems, Teterboro, NJ	Vehicles
Allison Engine Company, Indianapolis, IN	Engines
Allison Transmission Division, Indianapolis, IN	Vehicles
AM General, Corp., South Bend, IN	Vehicles
Anthopology Research Project, Yellow Springs, OH	Other/Svcs
Applied Data Technology, Inc., San Diego, CA	C3I Electronics
Applied Research Associates, Inc., Albuquerque, NM	Tactical Aircraft
Applied Research Associates, Inc., Albuquerque, NM	Transport Aircraft
Argo-Tech Corporation, Cleveland, OH	Engines
AstroTerra Corporation, San Diego, CA	C3I Electronics
Aurora Cord and Cable Co., Aurora, IL	C3I Electronics
Avtron Manufacturing, Inc, Cleveland, OH	Engines
B.F. Goodrich Aerospace, Vergennes, VT	Transport Aircraft
B.F. Goodrich Landing Gear, Cleveland, OH	Transport Aircraft
Battelle Memorial Institute, Columbus, OH	Other/Svcs
Bell Helicopter Textron, Ft. Worth, TX	Helicopters
Blue Star Systems Corp, Surrey, BC, Canada	Unknown
Boeing Aircraft & Missile Systems, Helicopter Systems, Mesa, AZ	Helicopters
Boeing Aircraft & Missile Systems, Helicopter Systems, Mesa, AZ	Missiles
Boeing Aircraft & Missile Systems, Helicopter Systems, Mesa, AZ	Tactical Aircraft
Boeing Aircraft & Missile Systems, St. Louis, MO	Missiles
Boeing Aircraft & Missile Systems, St. Louis, MO	Tactical Aircraft
Boeing Defense & Space Group, Helicopters Division, Philadelphia, PA	Helicopters
Boeing Defense & Space Group, Huntsville, AL	Missiles
Boeing Defense & Space Group, Huntsville, AL	Satellite
Boeing Defense & Space Group, Huntsville, AL	Space
Boeing Defense & Space Group, Product Support Division, Wichita, KS	Tactical Aircraft
Boeing Defense & Space Group, Seattle, WA	Tactical Aircraft
Boeing Guidance Repair Center, Heath, OH	Missiles
Boeing ISDS, Guidance Repair Center, Heath, OH	C3I Electronics
Boeing ISDS, Information and Communication Systems, Seattle, WA	C3I Electronics
Boeing ISDS, Space Systems, Guidance Repair Center, Heath, OH	C3I Electronics

Boeing ISDS, Space Systems, Huntington Beach, CA	C3I Electronics
Boeing ISDS, Space Systems, Huntsville, AL	C3I Electronics
Boeing McDonnell Douglas Aerospace, Huntington Beach, CA	Tactical Aircraft
Boeing McDonnell Douglas Corporation, St. Louis, MO	Helicopters
Boeing McDonnell Douglas Corporation, St. Louis, MO	Tactical Aircraft
Boeing McDonnell Douglas Helicopter Systems, Mesa, AZ	Helicopters
Boeing McDonnell Douglas Military Transport Aircraft, Long Beach, CA	Transport Aircraft
Boeing N. American, Aircraft Div. (NAAD), Seal Beach, CA	Tactical Aircraft
Boeing N. American, Autonetics & Missile Sys Div. (A&MSD), Anaheim, CA	Tactical Aircraft
Boeing N. American, Autonetics & Missile Sys Div. (A&MSD), Duluth, GA	Tactical Aircraft
Boeing N. American, Comm & Information Mgmt Sys Div. (C&IMD), Anaheim, CA	Tactical Aircraft
Boeing N. American, Rocketdyne Div., Canoga Park, CA	Tactical Aircraft
Boeing N. American, Space Sys Div. (SSD), Downey, CA	Tactical Aircraft
Buckeye Rubber Products, Lima, OH	Vehicles
C J Machine Inc., San Antonio, TX	Unknown
Call/Recall Corporation, San Diego, CA	C3I Electronics
Carver Pump Company, Muscatine, IA	Engines
Chromalloy Gas Turbine, Midwest City, OK	Engines
Chromalloy Nevada, Carson City, NV	Engines
Coherent Technologies, Lafayette, CO	C3I Electronics
Communications & Power Ind. Microwave Power Tube Products, Palo Alto, CA	C3I Electronics
Computing Devices International, Bloomington, MN	C3I Electronics
Conval Inc., Somers, CT	Engines
Conval Inc., Somers, CT	Vehicles
Crane, Lear Romec, Elyria, OH	Engines
Cubic Defense, San Diego, CA	C3I Electronics
Datafusion, Westminster, CO	C3I Electronics
Delavan Gas Turbine Products Division, West Des Moines, IA	Engines
Dyncorp Aerospace Technology, Ft. Worth, TX	Tactical Aircraft
Eaton Valve and Actuator Division, El Segundo, CA	Unknown
Edison Welding Institute, Columbus, OH	Other/Svcs
EFW, Inc., Ft. Worth, TX	Tactical Aircraft
ELANO Corporation, Dayton, OH	Vehicles
Electro Methods Inc., South Windsor, CT	Unknown
Engineered Air Systems, Inc (EASI), St. Louis, MO	Tactical Aircraft
ESAB Group, Inc., Ashtabula, OH	Other/Svcs
Ferrotherm Company, Inc., Cleveland, OH	Engines
Fidelity Technologies Corp., Reading, PA	C3I Electronics
Fike Metal Products, Blue Springs, MO	Engines
Freightliner Corporation, Portland, OR	Unknown
Frontier Engineering, Stillwater, OK	Transport Aircraft
Fuel Systems Textron, Zeeland, MI	Engines
G.E. Aircraft Engines, Cincinnati, OH; Lynn, MA; Arkansas City, KS	Engines
G.E. Support Services, Mt Laurel, NJ	Engines
Garlock Corp, Sodus, NY	Other/Svcs
GDE, San Diego, CA	Avionics
GDE, San Diego, CA	EW
Gear Systems, Inc., Park City, UT	Engines
GEC-Marconi Avionics, Inc., Norcross, GA	Avionics
GEC-Marconi Avionics, Inc., Norcross, GA	EW
GEC-Marconi Avionics, LTD., Rochester, England	Avionics

GEC-Marconi Avionics, LTD., Rochester, England	C3I Electronics
GEC-Marconi Avionics, LTD., Rochester, England	EW
GEC-Marconi Hazeltine Corp., Wayne, NJ	C3I Electronics
GEC-Marconi Hazeltine, Greenlawn, NY	Tactical Aircraft
GEC-Marconi Sensors LTD., Basildon, England	C3I Electronics
General Atronics Corp, Glenside, PA	Unknown
General Dynamics Armament Systems, Burlington, VT	Ordnance
General Dynamics Armament Systems, Burlington, VT	PGM
General Dynamics Defense Systems (GDDS), Pittsfield, MA	Vehicles
General Dynamics Land Systems Army Tank Plant, Lima, OH	Vehicles
General Dynamics Land Systems, Tallahassee, FL	Vehicles
General Dynamics Land Systems, Warren, MI; Scranton, PA	Vehicles
General Motors Diesel Division, Ontario, Canada	C3I Electronics
General Motors Diesel Division, Ontario, Canada	Vehicles
Godfrey Aerospace, Piqua, OH	Tactical Aircraft
Golden Mfg. Co., Inc., Golden, MS	Unknown
Group Technologies Corp., Tampa, FL	C3I Electronics
GTE Government Systems, Taunton, MA	C3I Electronics
GTE Government Systems-Electronic Systems Division (ESD), Mt. View, CA	C3I Electronics
Guardian Manufacturing Company, Willard, OH	Unknown
Gulton Statham Transducers Inc., Costa Mesa, CA	C3I Electronics
Hamilton Standard Division of UTC, Windsor Locks, CT	Engines
Harris Electronic Systems Sector (ESS), Palm Bay, FL	C3I Electronics
HERCO Aircraft Machine Inc., San Antonio, TX	Engines
High Tech Solutions, Inc., San Diego, CA	Tactical Aircraft
Honeycomb Company of America, Inc, Sarasota FL	Unknown
Honeywell Defense Avionics System Division (DASD), Albuquerque, NM	Avionics
Honeywell Defense Avionics System Division (DASD), Albuquerque, NM	EW
Honeywell MAvD, Clearwater, FL	Tactical Aircraft
Honeywell MILitary Avionics, Minneapolis, MN	Avionics
Honeywell MILitary Avionics, Minneapolis, MN	EW
Honeywell, SASSO, Clearwater, FL	Avionics
Honeywell, SASSO, Clearwater, FL	EW
Hughes Aircraft Company - Naval & Maritime Systems (NAMS), Fullerton, CA	Ships
Hughes Aircraft Company - Naval & Maritime Systems (NAMS), Mukilteo, WA	Ships
Hughes Aircraft Mississippi, Inc., Forest, MS	Tactical Aircraft
Hughes ASD, San Diego, CA	Avionics
Hughes ASD, San Diego, CA	EW
Hughes Danbury Optical Systems, Danbury, CT	C3I Electronics
Hughes Danbury Optical Systems, Danbury, CT	Soldier
Hughes Danbury Optical Systems, Danbury, CT	Weapons
Hughes Defense Communications Company, Ft. Wayne, IN	C3I Electronics
Hughes Missile Systems Company, Tucson, AZ	Missiles
Hughes Sensors & Communications Systems Sector (SCS), El Segundo, CA	C3I Electronics
Hughes Space & Communications Company (HSC), El Segundo, CA	C3I Electronics
Hughes Training Inc., Arlington, TX	Other/Svcs
Hughes Training Inc., Herndon, VA	C3I Electronics
Hyperox Technologies, San Diego, CA	Unknown
Innovative Technologies Corp., Dayton, OH	Other/Svcs
ITT Aerospace/Communications Division, Fort Wayne, IN	C3I Electronics

ITT Avionics, Clifton, NJ	Avionics
ITT Avionics, Clifton, NJ	EW
ITT Defense & Electronics, Van Nuys, CA	C3I Electronics
ITT Night Vision, Roanoke, VA	Soldier
ITT Night Vision, Roanoke, VA	Weapons
Jacobs Engineering Group Inc., Pasadena, CA	Other/Svcs
Jaycor, San Diego, CA	Other/Svcs
Kaiser Electronics, San Jose, CA	C3I Electronics
Kaman Aerospace Corporation, Bloomfield, CT	Helicopters
KDI Precision Products, Cincinnati, OH	Engines
Klein Associates, Fairborn, OH	Other/Svcs
Kollmorgen Electro-Optical, Northampton, MA	C3I Electronics
Korean Air - Aerospace Division (Kimhae Plant), Kangseo-gu, Pusan, Korea	Avionics
Korean Air - Aerospace Division (Kimhae Plant), Kangseo-gu, Pusan, Korea	Transport Aircraft
Kratz-Wilde Machine Company, Cincinnati, OH	Unknown
Kurt Manufacturing Company, Minneapolis, MN	Engines
Kurt Manufacturing Company, Minneapolis, MN	Ships
Kurt Manufacturing Company, Minneapolis, MN	Vehicles
L-3 Communications, Communications Systems-East, Camden, NJ	C3I Electronics
L-3 Communications, Communications Systems-West, Salt Lake City, UT	C3I Electronics
Lackerbetrieb Frank Gmbh, Schifferstadt, Germany	Unknown
Laguna Construction, Laguna, NM	Other/Svcs
Landmark Manufacturing, Gallatin, MO	Unknown
Lear Astronics Corporation, Santa Monica, CA	Satellite
Lear Astronics Corporation, Santa Monica, CA	Space
Lear Astronics Corporation, Santa Monica, CA	Transport Aircraft
Leslie Controls, Inc., Tampa, FL	Engines/Other Svcs
Litton Amecom, College Park, MD	Avionics
Litton Amecom, College Park, MD	EW
Litton Data Systems Division, Agoura Hills, CA	C3I Electronics
Litton Electro-Optical Devices, Tempe, AZ	C3I Electronics
Litton Electro-Optical Systems Division, Garland, TX	C3I Electronics
Litton Guidance & Control Systems Division, Woodland Hills, CA	Avionics
Litton Guidance & Control Systems Division, Woodland Hills, CA	EW
Litton Guidance & Control Systems Division, Woodland Hills, CA	Missiles
Litton Life Support, Davenport, IA	Transport Aircraft
Litton Poly-Scientific Division, Blacksburg, VA	Avionics
Litton Poly-Scientific Division, Blacksburg, VA	EW
Litton Systems Canada, Toronto, Ontario, Canada	C3I Electronics
Lockheed Martin Aeronautical Systems, Marietta, GA	Transport Aircraft
Lockheed Martin Aeronutronic, Santa Margarita, CA	Satellite
Lockheed Martin Aeronutronic, Santa Margarita, CA	Space
Lockheed Martin Aircraft Center, Greenville, SC	Transport Aircraft
Lockheed Martin Astronautics, Denver, CO	Satellite
Lockheed Martin Astronautics, Denver, CO	Space
Lockheed Martin Command and Control Systems, Colorado Springs, CO	C3I Electronics
Lockheed Martin Control Systems, Fort Wayne, IN	C3I Electronics
Lockheed Martin Control Systems, Johnson City, NY	C3I Electronics
Lockheed Martin Electro-Optical Systems, Pomona, CA	C3I Electronics
Lockheed Martin Electronics and Missiles, Orlando, FL	C3I Electronics
Lockheed Martin Electronics and Missiles, Orlando, FL	Missiles
Lockheed Martin Fairchild Defense Systems, Yonkers, NY	Tactical Aircraft

Lockheed Martin Fairchild Systems, Syosset, NY	Tactical Aircraft
Lockheed Martin Federal Systems, Boulder, CO	C3I Electronics
Lockheed Martin Federal Systems, Inc., Gaithersburg, MD	C3I Electronics
Lockheed Martin Federal Systems, Manassas, VA	C3I Electronics
Lockheed Martin Federal Systems, Owego, NY	C3I Electronics
Lockheed Martin Government Electronic Systems, Moorestown, NJ	C3I Electronics
Lockheed Martin Information Systems, Orlando, FL	C3I Electronics
Lockheed Martin Logistics Management, Inc., Arlington, TX	Other/Svcs
Lockheed Martin Missiles & Space, Sunnyvale, CA	Missiles
Lockheed Martin Missiles & Space, Sunnyvale, CA	Satellite
Lockheed Martin Missiles & Space, Sunnyvale, CA	Space
Lockheed Martin Ocean Radar and Sensor Systems, Syracuse, NY	C3I Electronics
Lockheed Martin Ocean Radar and Sensor Systems, Syracuse, NY	Ships
Lockheed Martin Sanders, Nashua, NH	C3I Electronics
Lockheed Martin Tactical Aircraft Systems, Ft. Worth, TX	Tactical Aircraft
Lockheed Martin Tactical Defense Systems, Akron, OH	C3I Electronics
Lockheed Martin Tactical Defense Systems, Akron, OH	Missiles
Lockheed Martin Tactical Defense Systems, Akron, OH	Tactical Aircraft
Lockheed Martin Tactical Defense Systems, Great Neck, NY	Tactical Aircraft
Lockheed Martin Tactical Defense Systems, St. Paul, MN	Missiles
Lockheed Martin Tactical Defense Systems, St. Paul, MN	Tactical Aircraft
Lockheed Martin Vought Systems, Dallas, TX	Tactical Aircraft
Lockheed Martin Western Development Labs, San Jose, CA	C3I Electronics
Loral Space Systems, Palo Alto, CA	Satellite
Loral Space Systems, Palo Alto, CA	Space
Lord Corporation Mechanical Products Division, Erie, PA; Dayton, OH	Tactical Aircraft
Lord Corporation Mechanical Products Division, Erie, PA; Dayton, OH	Transport Aircraft
Los Alamos Technical Assoc., Los Alamos, NM	C3I Electronics
Manchester Tank, Elkhart, IN	Vehicles
Metric Systems Corporation, Fort Walton Beach, FL	Avionics
Metric Systems Corporation, Fort Walton Beach, FL	EW
Microsensor Systems, Bowling Green, KY	C3I Electronics
Modern Technologies, Inc., Dayton, OH	Other/Svcs
Motorola, Scottsdale, AZ	C3I Electronics
Nanomaterials Research Corp., Tucson, AZ	C3I Electronics
National Airmotive Corporation, Oakland, CA	Transport Aircraft
Nippi, Yamato-shi, Kanagawa-ken, Japan	Unknown
North American Aircraft (NAA), Seal Beach, CA	Transport Aircraft
Northern NEF Inc., Colorado Springs, CO	Unknown
Northrop Grumman Aerospace Corp., Great River, NY	Tactical Aircraft
Northrop Grumman DSSD, Hawthorne, CA	Tactical Aircraft
Northrop Grumman Electronic Sensors and Systems Division, Baltimore, MD	C3I Electronics
Northrop Grumman Electronic Warfare Systems, Rolling Meadows, IL	C3I Electronics
Northrop Grumman ESID & SBMS, Bethpage, NY	C3I Electronics
Northrop Grumman ESID & SBMS, Bethpage, NY	Satellite
Northrop Grumman ESID & SBMS, Bethpage, NY	Space
Northrop Grumman ESID & SBMS, Melbourne, FL	C3I Electronics
Northrop Grumman ESID, Hawthorne, CA	C3I Electronics
Northrop Grumman Marine Systems, Sunnyvale, CA	Ships
Northrop Grumman MASD, Hawthorne, CA	Engines
Northrop Grumman MASD, Hawthorne, CA	Tactical Aircraft
Northrop Grumman MASD, Hawthorne, CA	Transport Aircraft

Northrop Grumman Vought Aircraft, Dallas, TX	Tactical Aircraft
Northrop Grumman, St. Augustine, FL	Tactical Aircraft
Ohm Remediation Services Corp, Findlay, OH	Other/Svcs
Olin Ordnance, St. Petersburg, FL	Ordnance
Olin Ordnance, St. Petersburg, FL	PGM
Olin Winchester, East Alton, IL	Ordnance
Olin Winchester, East Alton, IL	PGM
Omnitech Robotics, Englewood, CO	Other/Svcs
Orbital Sciences Corp., Fairchild Defense, Germantown, MD	Satellite
Orincon, Corp., San Diego, CA	Other/Svcs
Oshkosh Truck, Oshkosh, WI	Vehicles
Pemco Aeroplex, Inc., Birmingham, AL	Missiles
Photon Research Associates,Inc.,San Diego, CA	Unknown
Pluribus Products Inc., New York, NY	Unknown
Pratt & Whitney Overhaul & Repair Europe B.V, The Netherlands	Engines
Pratt & Whitney West Palm Beach, FL; East Hartford, CT	Engines
Praxair, Inc., Danbury, CT	Helicopters
PRC, Inc., El Segundo, CA	C3I Electronics
Preci Manufacturing, Inc., Winooski, VT	Other/Svcs
PRIMEX Aerospace Co., Redmond, WA	Transport Aircraft
PRIMEX Technologies, St. Petersburg, FL	Ordnance
PRIMEX Technologies, St. Petersburg, FL	PGM
Primus Technologies, Inc., Williamsport, PA	Unknown
Propper International, Mayaguez, PR	Unknown
Prosser/Enpo Industries, Inc., Piqua, OH	Other/Svcs
Raytheon Aerospace, Del City, OK	Transport Aircraft
Raytheon Aircraft Company (RAC), Wichita, KS	Transport Aircraft
Raytheon Co., DBA Raytheon Systems Co., Ft. Wayne, IN	Avionics
Raytheon Co., DBA Raytheon Systems Co., Ft. Wayne, IN	EW
Raytheon E-Systems, Greenville Division, Greenville, TX	Avionics
Raytheon E-Systems, Greenville Division, Greenville, TX	EW
Raytheon E-Systems, Inc.- Waco, Waco, TX	Avionics
Raytheon E-Systems, Inc.- Waco, Waco, TX	EW
Raytheon E-Systems, St. Petersburg, FL	Avionics
Raytheon E-Systems, St. Petersburg, FL	EW
Raytheon Electronic Systems, Bedford, MA	C3I Electronics
Raytheon ESD, Goleta, CA	C3I Electronics
Raytheon Systems Co., Defense Systems Segment, Missile Systems, Tucson, AZ	Missiles
Raytheon Texas Instruments Systems, Inc., Dallas, TX	Avionics
Raytheon Texas Instruments Systems, Inc., Dallas, TX	EW
RDL Inc., Conshohocken, PA	Unknown
REMEC Inc., San Diego, CA	C3I Electronics
Rockwell - Collins Avionics and Communications Div., Cedar Rapids, IA	Avionics
Rockwell - Collins Avionics and Communications Div., Cedar Rapids, IA	EW
Rockwell International Communication Systems Division, Richardson, TX	C3I Electronics
Rohr, Inc., San Diego, CA	Other/Svcs
Rolls Royce MILitary Aero Engines Ltd., Filton, Bristol, United Kingdom	Engines
SAIC, San Diego, CA	C3I Electronics
Sanders - A Lockheed Martin Company, Nashua, NH	C3I Electronics
Santa Barbara Research Center, Goleta, CA	C3I Electronics
Sargent Fletcher Inc., El Monte, CA	Vehicles
SCI Systems, Inc. Huntsville, AL	C3I Electronics

SCI Systems, Inc. Huntsville, AL	Missiles
Science and Applied Technology, Inc., San Diego, CA	Other/Svcs
Sechan Electronics, Inc., Lititz, PA	Avionics
Sechan Electronics, Inc., Lititz, PA	C3I Electronics
Sierra Nevada Corporation, Sparks, NV	Engines
Sikorsky Aircraft Corporation, Stratford, CT	Helicopters
Simrad, Inc., San Diego, CA	C3I Electronics
Smart Telecommunications, Inc., Verdi, NV	C3I Electronics
Smiths Industries, Aerospace, Clearwater, FL	Avionics
Smiths Industries, Aerospace, Clearwater, FL	EW
Snap-Tite Inc., Union City, PA	Engines
Soladyne, San Diego, CA	C3I Electronics
Special Project Services, San Diego, CA	Other/Svcs
Spectra Research, Inc., Dayton, OH	C3I Electronics
Spectral Systems, Inc., Dayton, OH	C3I Electronics
Sperry Marine, Inc., Charlottesville, VA	Ships
Stokely USA Inc., Oconomowoc, WI	Other/Svcs
Sundstrand, Rockford, IL	Tactical Aircraft
Sundstrand, San Diego, CA	Tactical Aircraft
Sverdrup, Dayton, OH	Other/Svcs
Syndetix, Inc., Las Cruces, NM	Unknown
SYS, San Diego, CA	Unknown
Systems and Electronics, Inc., St. Louis, MO	C3I Electronics
Systran Corporation, Dayton, OH	Unknown
Tactair Fluid Controls Inc., Liverpool, NY	Tactical Aircraft
Talley Defense Systems, Inc., Mesa, AZ	Engines
TAMSCO, Inc., Polson, MT	Missiles
TDA Research, Wheat Ridge, CO	Other/Svcs
Technical Solutions, Inc., Mesilla Park, NM	C3I Electronics
Technical Solutions, Inc., Mesilla Park, NM	Other/Svcs
Technology Scientific Services, Dayton, OH	Other/Svcs
Teledyne Electronic Technologies, Rancho Cordova, CA	C3I Electronics
Texas Instruments Defense Systems & Electronics (TI DS&E), Dallas, TX	C3I Electronics
Textron Systems, Wilmington, MA	Helicopters
Thiokol Propulsion Group, Brigham City, UT	Engines
Torrey Science Corporation, San Diego, CA	Unknown
Tracor Aerospace Systems, Inc., Austin, TX	Tactical Aircraft
Tracor Flight Systems, Inc., Austin, TX	C3I Electronics
Tracor Systems Division, Austin, TX	C3I Electronics
Trescomp, Quincy, IL	Unknown
TRW Avionics Systems Division, San Diego, CA	Avionics
TRW Avionics Systems Division, San Diego, CA	EW
TRW Space and Electronics Group (S&EG), Redondo Beach, CA	C3I Electronics
TRW Space and Electronics Group (S&EG), Redondo Beach, CA	Satellite
TRW Space and Electronics Group (S&EG), Redondo Beach, CA	Space
TRW Systems Integration Group (SIG), Dominguez Hills, CA	C3I Electronics
UNC Lear Services, Inc., Oklahoma City, OK	Tactical Aircraft
UNC Lear Services, Inc., Oklahoma City, OK	Transport Aircraft
United Defense LP, Armament Systems Division, Louisville, KY	Vehicles
United Defense LP, Armament Systems Division, Minneapolis, MN	Vehicles
United Defense LP, Ground Systems Div., York, PA	Vehicles
United International Engineering, Inc., Albuquerque, NM	Engines
United Technologies - Chemical Systems Division (CSD), San Jose, CA	Other/Svcs

Van Camp Seafood, San Diego, CA	Other/Svcs
Vocational Guidance Services, Cleveland, OH	Other/Svcs
Voss Scientific, Albuquerque, NM	Unknown
Westar Corporation, Albuquerque, NM	C3I Electronics
Westar Corporation, Albuquerque, NM	Other/Svcs
Wisconsin Ordnance Works, LTD, Winnebago, WI	Ordnance
Wisconsin Ordnance Works, LTD, Winnebago, WI	PGM
Woodward Clyde Federal Services, Denver, CO	Other/Svcs
Woodward Governor Company, Rockford, IL	Engines
Xetron Corporation, Cincinnati, OH	C3I Electronics
Yarway Corp., Blue Bell, PA	Engines

APPENDIX G:
NOTES ON SECTORAL DEFINITIONS (US STUDY)

APPENDIX G: Notes on sectoral definitions (US study)

Our aim was to introduce a sectoral classification that can be employed at all stages of our study, thus providing for internal consistency. The *Specifications* in the Invitation to Tender called for the study to supply details on aspects requiring rationalization and harmonization in several categories of standards, and "information for drafting a work program making specific proposals to promote a systems of homogeneous standards" *for each sector involved in the defense industry*. Sectors mentioned in the invitation are shipbuilding, aeronautics, space, land-base armaments, electronics, etc. However, these are not homogeneous self-contained entities. The aeronautics industry for instance is increasingly reliant on a broad base of electronics technologies, sometimes generated by specialist "avionics" producers, other times from diversified electronics companies, or produced in-house by the systems assembler.

Many standard-setting activities are generated at the level of generic technologies applicable across sectors. However, the terms of reference asks for details of standards requirements and activities to be supplied for each industrial sector involved in defense production, with specific mention being made of sectors like shipbuilding, aeronautics, space, land-based armaments and electronics. These sectors are very different in their internal composition and, by extension, their requirements and activities in the field of standards. The original proposal distinguished three main types of sectors:

1) "Systems sectors" supplying final systems; their core competence lie on systems integration and the mastery of some critical system technologies.
   - Shipbuilding
   - Aerospace
   - Telecommunications
   - Land vehicles (including armored fighting vehicles)
   - Construction and civil engineering
   - Arms and munitions
2) "Generic Sectors" supplying sub-systems based on generic technologies applicable across different final products.
   - Electronics components
   - Chemical and materials (non-metal)
   - Information systems (including computers and office equipment)
   - Software tools
   - Metals (including advanced alloys) and mechanical equipment
3) "Supporting sectors" supplying provisions, fuel, uniforms and other support items.
   - Foodstuffs
   - Textiles and Clothing

The incompatibilities of these initial definitions with classifications used in Single Process Initiative (SPI) programs and standard Defense industry/sector descriptions led to redefining sectors in the manner described in section 6.3

APPENDIX H:
INDUSTRY STANDARDISATION SURVEY (US STUDY)

Appendix H: Industry standardisation survey (US study)

Section I - Industry Standardization Survey

The impact of reduced DoD procurement budgets on defense acquisition activities has been most evident in two areas:

- DoD acquisition reform;
- Consolidation of the US defense industry.

This survey is intended to measure the effect of these two developments on the business of US defense contractors. It does not ask for quantitative information, but rather seeks qualitative assessments of where companies now find themselves in relation to doing business with DoD, as well as opportunities in other defense markets.

I. Acquisition Reform

Milspec reform

a. To what extent has your company's costs been lowered by reductions in Milspec regulation?

__7__ direct, substantial impact
_10_ less direct, but significant
_30_ little if any
__1__ unclear

Industry Comments

1. Working performance base specifications and flowing down to suppliers/subcontractors will greatly reduce our future cost.

2. Increased costs are expected to verify that the part meets the old "standards & requirements."

b. To what extent has your company's profits been increased by reductions in Milspec regulation?

__3__ direct, substantial impact
__8__ less direct, but significant
_32_ little if any
__5__ unclear

Industry Comments

1. Transfer of responsibility and risk has forced us to focus on customer needs.

2. Decreasing defense dollars are increasing vendor flight from DoD contract is increasing cost.

c. What has been the effect of Milspec reduction on the defense industry as a whole?

__9__ direct, substantial impact
__17__ less direct, but significant
__11__ little if any
__12__ unclear

Industry Comments

1. Probably brings in more competition.

2. Lack of Milspecs has forced many PMs to increase expenditures on the requirements process.

Commercial practices

d. To what extent has your company's operations been affected by increased use of commercial practices in DoD procurement?

__11__ direct, substantial impact
__18__ less direct, but significant
__14__ little if any
__4__ unclear

Industry Comments

1. Hasn't really happened enough to impact us. But it should for the future.

2. Major savings from COTS the use Commercial-Off-The-Shelf implementations will significantly reduce cost!

e. What has been the effect of increased commercial practices on the defense industry as a whole?

__11__ direct, substantial impact
__29__ less direct, but significant
__4__ little if any
__5__ unclear

Industry Comments

1. Effect of commercial practices has not had sufficient time to show true results. The culture change will take time.

2. Particularly in IT and C4I.

3. Commercial world is Standard Measurement Technique (SMT) driven mil-spec parts world is shrinking and obsolescence is a major concern.

Cultural change

f. Have you noticed changes in your company's relationships with DoD acquisition officials?

more efficient?	more positive?
16 yes	16 yes
20 no	21 no
11 unclear	11 unclear

in what way?______________________________________

Industry Comments

1. Cooperation rather than confrontation.

2. More data available in award debriefs.

3. Government officials at the working level generally operate on a "Business As Usual" basis. Officials at the policy level believe policies are being implemented, but they are distant from contractual negotiations.

4. There has been an increased acceptance of commercial practices and waivers to parts of the FAR.

5. Acquisition Reform produces more conflict with working level government officials who persist in "business as usual" for the most part.

6. Customer-to-contractor communications have improved.

7. No real change in DoD – GSA schedules are having a bigger impact. The pre-negotiated nature and flexibility of the contract vehicle greatly improve the ability to get on contract.

8. No change.

9. Morale is terrible at mid management level.

10. Culture has yet to change at Contract Office level.

11. DoD's skepticism continues.

12. Flexibility.

13. More trust.

14. However, with Industry Consolidation, 1st tier suppliers like us are having a more difficult time getting "face time" with senior government acquisition officials.

15. As a result of downsizing, Government officials have too much work, not enough people. Those that remain have adversarial dispositions.

16. Relationships have improved when industry and government seek the same end.

g. Do you see significant changes in DoD's approach to the defense industry as a whole?

more efficient? more positive?

more efficient?	more positive?
18 yes	18 yes
21 no	17 no
10 unclear	10 unclear

in what way?__________________________________

Industry Comments

1. Manage risk rather than eliminate risk by "how to's".

2. The approach may be different, but the results are unclear.

3. The Policy Proclamations are welcomed but many of the reforms have failed to be internalized at the working level.

4. DoD's approach has changed at the top levels, but has not flowed down as yet.

5. DoD seems to want credit for reform but is unwilling to make meaningful process changes and infrastructure reductions. You can't have it both ways. This approach creates conflict as industry tries to react to policy and senior level guidance when the PCOs/PMs are not listening to the bosses at the Pentagon.

6. No concern for loss of capability.

7. Again, communication interfaces, ease of.

8. I see much intent from high level officials but little real change to execution level.

9. Navy, particularly is moving towards integrating "in house" vice using prime contractors.

10. Little confidence in DoD management.

11. Access at higher levels is easier.

12. Lowering costs and sharing risks.

13. Expectation of DoD has resulted in aggressive cost goals. Cost as independent variable.

14. More open in sharing data across the board but still see significant distrust of industry motives. Also, still significant reluctance to use greater discretion.

15. Increased direct vendor delivery to warfighter.

16. Government is more willing to listen to industry and change where approriate

Overall

h. What acquisition reform initiative provided the greatest benefit to your company?

__4__ TINA
__7__ FASTA/FARA
__4__ Regulatory Compliance
__10__ Configuration Management
__13__ Quality Standards
__0__ Material Management
__0__ Other

Industry Comments

1. Internet Based Logistics.

i. Will acquisition reform play an important role in increasing your company's competitiveness in world markets?

__5__ direct, substantial impact
__15__ less direct, but significant
__21__ little if any
__5__ unclear

In what way? ______________________________

Industry Comments

1. Other factors are more significant in international dealings — Government influence, briefing, etc.

2. We are totally commercial. This opens up many more opportunities for the future.

3. If we can ever really get to a single process, yes, if not it will not really have an impact.

4. Easier shifts between DoD and non-DoD projects.

5. Lost in the noise, as far as "competition" is concerned; mega mergers have had the most impact – far exceeds reforms!

6. If it keeps going!

7. Emphasis in contractors to meet performance/cost requirements rather than how to design and cost as an independent variable (CAIV).

8. Cost reduction.

9. Lower costs, more synergy a cross commercial/military lines makes us more competitive. Have not directly consolidated so impact is based on competitive standing against consolidated companies.

10. US acquisition reform has nothing to do with how we contract, support and communicate with our overseas customer our world competitiveness with suffers under

out dated and cumbersome export administration rules and processes – unchanged since 1920.

II. Industry Consolidation

Resources, Costs

a. Has your company benefited from greater access to resources through industry consolidation?

__13__direct, substantial benefit
__16__less direct, but significant
__13__little if any
__5__unclear

Industry Comments

1. Detriment.

2. Costs are higher. Access is more restricted and in some cases the resource has vanished.

b. Has your company benefited from reduced costs through industry consolidation?

__10__directly and substantially
__7__less direct, but significant
__27__little if any
__3__unclear

Industry Comments

1. No

c. To what extent do these benefits extend to the US defense industry as a whole?

__9__directly and substantially
__17__less direct, but significant
__12__little if any
__9__unclear

Market Position

d. Has consolidation strengthened your company's position in the US defense market?

__19__substantially
__7__somewhat
__15__little change
__3__unclear

Industry Comments

1. Negative.

2. Big guys moving into our areas.

3. No!

4. No.

5. Yes, consolidated we are now #1

6. No.

e. Have other market opportunities for your company (foreign and/or commercial) expanded because of industry consolidation?

__12__substantially
__17__somewhat
__10__little change
__4__unclear

Industry Comments

1. Reduced.

2. Tougher not easier.

3. No!

4. No.

5. No.

f. How has consolidation strengthened the US defense industry in domestic and foreign markets?

__13__substantially
__18__somewhat
__5__nil
__12__unclear

Industry Comments

1. Consolidation has strengthened our markets except for France and Israel.

2. Synergy.

3. Only those who have been part of the consolidation.

III. Impact of Acquisition Reform vs. Industry Consolidation

1. Which development — acquisition reform or industry consolidation — has had the greater impact on the competitive position of your company? On the US defense industry in general?

Company		Industry
__3__	substantially greater in the case of acquisition reform	__2__

5	somewhat greater in the case of acquisition reform	4
12	substantially greater in the case of industry consolidation	12
11	somewhat greater in the case of industry consolidation	7
9	cannot tell which has had the greater impact	9
6	not an 'either-or' choice; each significant in its way	8

comment?________________________________

Industry Comments

1. Acquisition reform has been heavily slanted so far, in making things easier for the buyer, not the seller.
2. Consolidation is changing the whole landscape in industry and competition.
3. More confusion in teaming/competitive analysis.
4. Mega firms manage the services, the Congress and the budget.
5. Negative impact. Only big 3 left.
6. Acquisition Reform is a big player.
7. Both has been instrumental in reshaping the industry.

2. Do you see ongoing acquisition reform and industry consolidation as interdependent processes, mutually reinforcing activities, or essentially separate developments?

   __4__interdependent — benefits from one difficult to realize without progress in the other.
   __10__mutually reinforce — but progress in one area facilitates developments in the other.
   __34__separate — either process can evolve without reference to the other.

comment?________________________________

Industry Comments

1. The driver is the same — reduced DoD $'s industry reaction consolidation, DoD reaction acquisition reform.
2. Consolidation is changing the form of the industrial base, acquisition reform is changing (a little) the way business is done.
3. There is little or no correlation between the two!
4. The clear thing from consolidation is that politics rule the defense budget process. Indications from the current budget negotiations are that the mega-firms had their way with their high electronics based systems. The Loral-China deal recently made public show the clear level of corruption now manipulating the US system. As a result of the consolidation, mega-firms clearly have more power than any other force in our

governmental process including systemic checks and balances. Zones within the bureaucracy follow the mega-firms in milking budgets and programs. The country is driven by special interests to a greater extent than any time since 1962. We are moving at great speed away from military preparedness toward tragic results on some future battlefields where American kids are going to be placed with inadequate weapons. There is systemic press toward high tech systems that will take much longer to field than advertised, they will under perform and they will break the budgets of the Army in particular. The futures defeats will see our kids as the most well informed, but losing and dying Army in US history. We are approaching the mismatch of capability seen in Desert Storm on the other side. There seems no way to curtail the weakening of the defense process by the mega-firms and their ability to drive higher than realistic expectations. Until and unless the warfighters ever regain control of the process, America is on a downward slide that cannot be stopped.

5. But part of an overall effort is to maintain readiness, technology, equipment refresh, and industrial base with drastic reduction (>40%) in Total Obligation Authority (TOA) for DoD. Other issues are just as important – commonality, interoperability, reduced Congress intervention, oversight, and Integrated Product Teams, all play a part in but are never considered. Increasing educational levels of military and civilian personnel will have long-term impacts, at short-term costs. The productivity increase could prove exceptional.

6. Absolutely correct in my view.

7. For us, its too soon to tell – we are in process of consolidation.

8. Need both dependence and reinforcement.

9. I have observed very little change in the mainstream of DoD Acquisition and Procurements due to reluctance to change on the part of some (many) Program Managers and Logistics Procurements Officials. Being set in their way of doing business, they seem suspect of industry personnel who have actually sat down to read the new Acquisition Reforms and have come to understand them. Government contracting officers and some program managers prefer to believe "there is no real change in the acquisition program". "The Acquisition Reform Bills were just a hype to quite some roudy industry execs". All seems just as it was when I retired from the military," Ignorance is not only Bliss, But, You do not have to read any manual or publication as long as I DID NOT KNOW is a viable excuse for inaction.

10. Actually, consolidation at this point they may be becoming detrimental to each other as companies become so large they lose the agility to take advantage of/embrace new ways of doing business.