COMMISSION OF THE EUROPEAN COMMUNITIES

COM (88) 393 final - SYN 144

Brussels, 8 July 1988

Communication from the Commission
to the Council and to the European Parliament
concerning a
Programme of Strategic Research and Technology
in the Field of Aeronautics

PILOT PHASE (1989-1990)

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1. INTRODUCTION

In its communication to the Council, COM(88)294, the Commission set out its concern about the future adequacy of the technology base of the European aircraft industry. It further described the effects which inadequacies in that technology base would have on the long term future of the industry and, particularly, on its ability to compete in world markets.

In conformity with the conclusions of that document, that there is an urgent need for a programme of strategic measures in aeronautical research and technology in Europe, the Commission herewith presents its proposals for a two year pilot phase, the first stage of the implementation of such a programme. To complement that proposal it also sketches out the main lines of the main programme which is to follow while making clear that further review will be necessary to update those programme intentions before embarking upon work in an area where technological advances are extremely rapid.

The Commission will present its substantive proposals for the main programme during the second year of the pilot phase. Meanwhile the programme of pilot projects which are defined in this communication will enable the industry, the Commission and the Member States to gain experience and thereby enable the main programme, when launched, to be based on methods of management, patterns of cooperation and modalities which have already been tested and when necessary modified. It will, furthermore, enable a programme whose urgency cannot be contested to be started while the detailed definition of the technical content of the main programme is being completed.

The principal objective of the programme is to improve the technological competitiveness of the European aeronautical industry. As such it is wholly consistent with the framework programme.[1]

2. OBJECTIVES

The purpose of the programme whose pilot phase is now proposed is to respond to the severe technological challenge which confronts the European aeronautical industry. To achieve this vital aim, the programme seeks to encourage and assist a qualitative leap in the scope and effectiveness of cooperation at European level between the many and varied organisations (aircraft companies, engine companies, equipment companies, national research centres, materials suppliers, research institutes, universities, etc.) whose work contributes to the European aeronautical technology base. The means by which this aim will be achieved is by establishing a strategic programme of precompetitive aeronautical research and technology acquisition, conducted at Community level, focussed upon key technology goals derived from industrial analysis of future generic product goals and concerted to the maximum extent with other national and international research and technology acquisition activities.

In line with these general objectives, the particular objectives of the proposed pilot phase of activity, are four fold:

- to create the essential impetus for the launching of a major and complex programme of actions;

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1. O.J. L302 87/516/Euratom, EEC

- to carry out research work in a number of areas of technological advance which are of great importance to the future capability of the aeronautical industry;

- to learn lessons regarding the management and operation of such a programme and to refine the definition of the longer term actions which should be pursued;

- to provide concrete evidence upon which decisions regarding future actions can be based.

3. THE PROPOSED PROGRAMME

3.1 Justification

The fundamental considerations which have prompted the Commission to propose urgent action in the field of aeronautical technology have been set out at some length in the Commission's communication COM(88)294. They may be briefly restated as follows.

The aeronautical industry of the Community is a key sector of the European industrial base. Aviation makes a vital contribution to the civil life and commerce of the Community and aircraft and helicopter are indispensable elements of national security. The activities of the industry involve the continued advance of knowledge and technique over a wide range of high technologies, a process which yields important spin-off benefits to other sections of industry and to education throughout the Community: and the industry is a major exporter. In those Member States who have an indigenous aeronautical industry, governments see that industry as having strategic importance and give substantial support of various kinds.

At the present time the industry is performing successfully in world markets with a range of products which are very

competitive. The necessity for cooperation between companies in the development and production of major aircraft has been recognised for many years and the practice is firmly established in the European industry: the most notable illustration of this reality is provided by Airbus Industry. Despite these important achievements in adaptation to the changing market and to the increasing sophistication of the product, the position of the industry is by no means secure. The climate of competition is increasingly severe and nowhere more so than in the area of technology which provides a vital basis for product competitiveness.

The pace of advance of aeronautical technology is very rapid. This advance is stimulated not only by the direct competitive thrust of the world's largest companies and national governments but also by the formidable state investments in research and development, notably by the U.S. in the defence field, which yield considerable 'dual-use' benefits to civil product design and manufacture. At the same time the sophistication and, hence, the intellectual and financial cost of making each major step is increasing. Failure to sustain a competitive, state-of-the-art, technology base would certainly be fatal to the prospects of the European aeronautical industry. However, the cost to individual companies of acquiring technology by their own research efforts has become unsustainable.

Buying technology under licence from the main external generating sources of technology, the U.S.A and Japan, is hardly feasible, given that the buyers and sellers in such transactions will be in direct competition with each other in the world market. There are also potential problems in fully exploiting any technology which may be licenced arising from measures such as the Export Administration Act. Even the possibility of balanced cooperation with U.S. or other companies in development and/or production of specific

products is contingent upon an adequate level of technology in European industry.

To overcome this threat the industry must be stimulated and assisted to extend its cooperation at European level, which already exists in development and production, to the field of research and technology acquisition.

The pursuit of such a goal is well justified. World markets for the sale of aircraft and rotorcraft of all kinds are growing steadily and studies have indicated that the European aeronautical industry can reasonably expect to maintain or improve its share of those markets - but only if it can maintain a command of state-of-the-art technology and anticipate new developments. That condition can be met, but only if qualitative leap can be achieved in the scope and quality of cooperative research and technology acquisition and if the focus of this enhanced work is a set of goals determined by a cooperative process based upon an analysis of future industrial needs. It should be stressed that this cooperation should be in accordance with the competition rules of the EEC Treaty and, in particular, the criteria set out in the block exemption regulation on research and development agreements[2].

3.2 Programme Content.

The essential content of the proposed programme is determined by its primary aim - to ensure the continuing adequacy of European aeronautical technology base. Following careful analysis of both market and technology trends, carried out by a group of European aircraft companies, a preliminary technology plan has been prepared, comprising research and technology acquisition tasks which are needed in order to reach key future technology goals.

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2 Reg. no 418/85, OJ 1985 L 53

This outline plan has been discussed with a wide range of industrial, research institute and university experts and will continue to be reviewed and refined during the course of the pilot phase.

The first result of the analysis of technology needs has been the adoption of a structure of disciplinary fields (aerodynamics, materials, airborne systems and equipment, etc.) and the identification of key technology areas within those disciplinary fields. A tabulation of the disciplinary fields and key technology areas is given at Annex A.

Within this broad framework, an outline main programme technology plan has been prepared. This outline plan is contained in a Working Paper of the Commission; a condensed resumé of the plan is given in Annex B to this proposals. The coverage of the plan is extensive - ranging from aerodynamical problems to systems concepts and from esoteric mathematical analysis to concrete flight demonstrator activity. What all proposed technology activities in the plan have in common is that each represents an agreed, priority requirement in future industrial technology and one which should be pursued by a common European endeavour.

As presently defined, the main programme plan reflects the results of initial studies conducted mainly from the viewpoint of the airframe companies who are the designers of overall air vehicle systems. In consequence, the definition of needs in the fields of propulsion, electronic systems and operational systems are, as yet, only preliminary. Work will continue during the pilot phase to complete the necessary studies in these fields so that a balanced treatment can be achieved in a comprehensive workplan which will be prepared for the main programme.

For the pilot phase of programme implementation a careful review of the main programme technology plan has been carried out to identify a group of actions which it is most necessary and appropriate to undertake initially. In making this choice of actions, care has been taken to choose tasks which, as well as addressing key technology goals, will make an entry into most of the disciplinary areas to be covered by the programme and, in addition, can provide experience of the various patterns of cooperation which will be necessary in the main programme:

- projects which will essentially involve only the aeronautical industry and specialist research institutes;
- projects which will involve specialist companies in fields such as materials and software development; in such projects special attention will be given to the involvement of small and medium-sized enterprises and universities;
- projects which involve close interaction and coordination with other Community programmes.
- projects which will have as their central feature the concertation of already existing work funded nationally.

The detailed technical programme for the pilot phase which emerged from these considerations and which has been refined in the light of discussions[3] with experts is contained in a Commission Working Paper. An outline of the pilot phase programme content is contained in the Technical Annex which attached to the proposal for a Council Decision included in this communication.

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3. Workshop 22/24 June 1988 Brussels

4. MANAGEMENT CONSIDERATIONS

4.1 The Character of the Programme

The programme whose initiation is now proposed is aimed specifically to regenerate the essential technology base for the aeronautical industry. Its execution will include a very large contribution from the aeronautical industry but many other industrial contributions will be involved. Small and medium sized enterprises throughout the Community (including many in countries which do not have a strong aircraft industry) as well as research institutes, universities and companies in fields such as materials, equipment and systems engineering will be involved in projects in close partnership with companies in the aeronautical business. Every project will involve cross frontier collaboration within the Community and a minimum requirement will be that every project should involve at least two industrial companies independent from each other and established in two different Community countries. But the programme will also encourage projects which involve collaboration across the frontiers between the developers of new technologies and the users. So that a typical project might involve a partnership between, say, two companies interested in the development of a new instrumentation technique in two different countries working with two companies in the aircraft industry in yet two further countries. Indeed, the degree of technology transfer within the Community, beneficial to the aeronautical industry, which is likely to result from a project will be an important criterion in its assessment.

4.2 The Management of the Programme

The overall programme whose pilot phase is put forward in this communication has essentially been established by industry and it is the intention that there will be

continuous involvement of industry in the review of the technical content of the programme during the pilot phase and into the main programme. The technical definition of the programme will be contained in a workplan which will be updated as necessary.

Responsibility for this lies with the Commission but in drawing up and refining the work plan, the Commission is consulting industry at all relevant levels i.e. it will consult technical experts and those with other functions in industry who can comment on the application and exploitation aspects of the technologies to be included. The Commission will, furthermore, consult experts in the relevant fields who come from universities and research institutes and from other industrial sectors.

A first workplan for the pilot phase has been prepared. The key elements are listed in the technical annex to the attached draft Council decision and fuller details are contained in a working paper of the Commission.

Calls for proposals will provide the means for a degree of competition between consortia for the contracts to be allocated for work covering the various technical areas. In the recent past it has been the experience of the Commission that in programmes such as ESPRIT, BRITE and EURAM the ratio of unsuccessful to successful proposals has been up to ten to one. For many of the projects to be undertaken in the aeronautical research and technology acquisition programme such an oversupply of proposals is not expected. The number of competing consortia is inevitably limited for many subjects because of the need to involve at least some of the major aircraft companies. Nonetheless, it is expected that for most technical areas competing groups will emerge. In the assessment of competing proposals, the Commission will put great stress on the technical excellence of the

proposals. On the other hand there will be projects for which the degree of competition may well be much higher and there may be cases where it will be appropriate to fund projects which develop alternative solutions to particular technical problems at least for a sufficient length of time to ensure that the best technology available is in fact being pursued.

The programme as a whole will be managed by the Commission. It will be essential that the implementation of the programme is closely coordinated with the activities undertaken in Member States. To this end, the Commission will be assisted by a Committee as defined in the draft Council decision appended. During the implementation, individual projects will be managed by industry. The Commission will monitor the progress of the work and will arrange for it to be reviewed periodically by independent experts. The Commission will not intervene in the day-to-day management of any project.

The Commission's role will however, be much greater in respect of ensuring collaboration and coordination between the projects and in the organisation of workshops, seminars and specialised meetings to ensure the best possible interchange of information among those participating in the programme.

5. RELATIONSHIP WITH OTHER PROGRAMMES

5.1 Relationship with National and International Programmes

The existing pattern of aeronautical research and technology acquisition activity in Europe includes a number of national research programmes coordinated and supported by Member States' governments. These programmes play a major role in the regeneration of the European aeronautical technology base even though the greater part of such activity is pursued on a strictly national basis. In addition there are a number of multilateral international cooperative research and

information exchange activities organised by governments, of which GARTEUR[4] and AGARD[5] are the most notable: while, in many cases, product collaboration between companies (eg Airbus) is accompanied by cooperation in precompetitive research and technology actions. In recent years these actions have been complemented by a number of EUREKA projects which, although generally intended to promote research very close to the point of market application, include some which are concerned with generic aeronautical technologies.

In its previous communication[6] the Commission explained the need for action of a strategic character and explained that the above international activities, while making a most useful contribution, cannot fulfil this strategic role.

Considering the strategic nature of this programme, it is essential that effective measures be taken to ensure that the new Community programme relates in an entirely harmonious way with existing actions. This will ensure that the benefits to Europe of the several actions are cumulative and the reinforcement of the technology base is well focussed upon the key goals for future technological competitiveness. The outline main programme which has been prepared takes into account the results of extensive studies by companies having close involvement with international cooperative aeronautical research in Europe and with national programmes. One of the important guidelines used in drawing up the programme has been the avoidance of conflict or duplication with existing programmes. Beyond this initial precaution, the Commission

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4 Group for Aeronautical Research and Technology in EURope

5 Advisory Group on Aerospace Research and Development

6 COM(88)294 final

will make full use of its contacts with Member States' representatives, with major research institutions and with industry to ensure the continuing cohesion of Community action with those pursued by other mechanisms. An important activity in the pilot phase will be to explore and refine the process of concertation between programmes.

5.2 Relationship with Other Community Programmes

It is inevitable that some disciplines which make up the wide field of aeronautical technology will overlap the disciplinary areas of other Community programmes already in place such as BRITE, ESPRIT, EURAM and RACE. However, the aeronautical programme will be concentrated upon goals particularly related to aeronautical technology and its applications; by virtue of this concentration, the areas of potential overlap with other essentially horizontal programmes or with programmes directed at other sectors are, inherently, very small. Further, the Commission will ensure close coordination between the management teams responsible for the various programmes to ensure that work is not duplicated.

6. PROGRAMME EVALUATION

The Commission's proposal for the main programme, which is to follow the pilot phase, will be accompanied by an evaluation of the implementation of the pilot phase insofar as that is possible at that time. Evaluation criteria are set out in the proposal for a Council Decision which is appended to this communication.

ANNEX A

MAIN PROGRAMME
DISCIPLINARY FIELDS and KEY TECHNOLOGY AREAS

DISCIPLINARY FIELD		KEY TECHNOLOGY AREAS
Aerodynamics (including Flight Mechanics)	-	computational fluid dynamics, shape integration, high lift, drag reduction, air intakes, flight dynamics.
Structures	-	new concepts, new computational methods and tools, high-temperature structures, new experimental methods (verification and testing).
Materials	-	new metal alloys, composites, metal matrix, thermoplastics, high-temperature materials, related processing, etc.
Acoustics	-	external noise fields, cockpit and cabin noise, active noise control, measurement techniques, prediction methods, structure fatigue effects, noise shielding.
Computation	-	large-scale software, modelling, simulation, vectorial supercomputing.
Airborne Systems and Equipment	-	system architectures, new system concepts, man/machine interface, advanced optoelectronic concepts, detection and recognition, software engineering, lightning protection, flight control, sensors, actuators.

Annex A (cont.)

DISCIPLINARY FIELD		KEY TECHNOLOGY AREAS
Propulsion	-	engine/airframe integration, incorporation of new propulsion concepts (propfan, high bypass ratio, ramjets), fuel systems.
Multidisciplinary	-	cockpit integration, active control technology, structural mode control.
Design Technology	-	computer-aided design, methodologies and means leading to an increase of design productivity and integration with manufacturing processes.
Manufacturing Technology	-	computer-aided manufacturing, computer integrated manufacturing, flexible manufacturing systems, advanced manufacturing and inspection systems(robotics, non-destructive testing).
Operational Systems	-	air traffic control, overall fleet management, advanced navigation concepts.

ANNEX B

RESUME OF MAIN PROGRAMME TECHNOLOGY PLAN

B.1 AERODYNAMICS (including FLIGHT MECHANICS)

Most research activities in Aerodynamics involve the development and application of computational methods and computer codes for the analytical prediction of the aerodynamic performance of new or amended designs. This places heavy demands for ever increasing computational capability within companies, regionally, nationally and within Europe. In identifying, below, potential research topics for a future programme, it is assumed that the necessary computer power will be available to or accessible by the research teams involved. The provision of such computer facilities is separately discussed under Section B.5 below.

Aerodynamics research also normally requires the availability of wind-tunnel and, possibly, flight test facilities for the validation of predicted results. The availability of an appropriate wind-tunnel or flight test facilities is assumed, except where the objective of the research project includes the development of such facilities.

Aerodynamics research topics considered to be of major relevance to future generations of aircraft include:

- Computational Fluid Dynamics

- Improvements in Aerodynamic Efficiency through increases in lift or reductions in drag by:
  - Natural Laminar Flow;
  - Hybrid Laminar Flow e.g. induced by suction;
  - Variable camber;
  - Turbulence management, e.g. by longitudinal surface striations;
  - Larger Wing Aspect Ratio, without relative weight penalty, through the use of Supercritical Thick Profiles;
  - Shock/Boundary Layer interaction.
  - Improve understanding of high lift devices.

- o Aerodynamics of rotors for high speed helicopters and for future tilt rotor convertible aircraft, including:
  - Rotor geometry;
  - Active rotor control concepts.

- o Active flight control concepts; for fixed and rotary wing aircraft.

- o Reductions in Aerodynamic Noise.

- o Supersonic and Hypersonic Aerodynamics.
  - Air intakes;
  - Shape integration;
  - Development of theoretical and experimental facilities and techniques required for the design of hypersonic vehicles including Aerothermodynamics aspects;
  - Development of hypersonic aerodynamics design tools.
- o Aerodynamics/hydrodynamics optimisation of amphibious aircraft shapes.

B.2 STRUCTURES

Research activities in the Structures area will be concerned with new concepts, new computational methods and tools, structures for high temperatures and new experimental methods of verification and testing. Amongst the topics which are considered to be of importance are:

- o Investigations of the construction methods of advanced composite material, their damage tolerance and acoustic fatigue properties in order to increase life expectancy.

- o The use of composite materials in civil transport aircraft structures, including application in new high aspect ratio using structures.

- o Development of the technology for aerothermostructural concepts, with low weight and adequate strength, essential for the development of hypersonic vehicles. In particular investigations will embrace:
  - Thermal protection systems; based on a variety of materials and techniques;

  - Hot structures, including ceramic systems and actively cooled systems.

- Potential implementation of a European medium sized aerothermal structural test facility incorporating at least one 20 - 30 MW arc plasma jet facility, necessary for the development of hypersonic vehicles.

B.3 MATERIALS

A wide range of new materials is under development which has potential for application in aircraft. Hypersonic aircraft in particular, will require materials which are damage tolerant, resistant to oxidation and ablation and retain structural integrity at very high temperatures. Materials research activities for inclusion in a future programme are:

- Development of materials with a high endurance temperature limit and high specific strength and stiffness properties up to 1600 degrees C.

- Development of the means of testing and characterisation of new materials and establishing their application techniques

- Development of electrically conducting polymers and sealants to improve the integrity of advanced composite airframe structures in the presence of lightning and to provide a controllable electrostatic shell for screening and antenna design.

- Development of non-chemical methods of paint-stripping from composite structures.

B.4 ACOUSTICS

Acoustics research is generally concerned with the analysis, prediction and reduction of noise from all sources in an aircraft and via all transmission paths, whether external or internal in air or via the aircraft structure. It is also concerned with the perception of noise, its effects on people and on materials and the regulatory framework within which aircraft noise must be minimised. Specific aspects of acoustics research which should be addressed by the future programme are:

- Theoretical and experimental investigation of active noise/vibration control devices.

- Development of an improved technology for the prediction, control and reduction of passenger cabin noise.

- o Establishment of a common European approach on the acoustics of V-STOL transport aircraft.

- o Setting up a European outdoor engine test bed for acoustic certification.

B.5 COMPUTATION

Future civil and military aircraft designs will require extensive research and technology work in such areas as aerothermodynamics, aeroelastics, structural optimisation and advanced flight controls. Much of this work will be dependent on the availability of very high performance computation facilities capable of ever more complex numerical simulation of 3-dimensional flow, turbulence and combustion phenomena. The concentrated computer power enabling very large scale flow simulations will require the availability of an extensive computer centre equipped with the most advanced super-computers and with a massive data storage capability. New or updated algorithms for numerical analysis must also be developed to make optimum use of the parallel architecture of the new-generation computers. European researchers must also be trained in the use of these methods and facilities.

Computation activities which should be undertaken within a future programme include:

- o The establishment, on a co-operative basis, of a Super-Computer Centre which, when linked appropriately to their individual or regional computation facilities, will give the European Aeronautical Industry, Universities, and Research Organisations access to a computer power comparable with that available to major competitors.

- o The development of new mathematical models and algorithms to make efficient use of the computer power made available by the new generation of super-computers.

- o The training of researchers in the methods and use of the advanced computation facilities.

B.6 AIRBORNE SYSTEMS AND EQUIPMENT

Airborne systems play a major part in assuring the efficient, safe and economic operation of aircraft. For example, the concept of Active Control Technology (ACT) will introduce an artificial stability system in future transport aircraft which will permit greater aerodynamic and structural efficiency, higher flight safety and comfort, better operational procedures and simplified maintenance.

This, in turn, will lead to savings in fuel and lower direct operating costs. Research into new and improved systems concepts which exploit actual or anticipated advances in technology is an essential and important aspect of the proposed programme. Topics to be addressed include:

- o New systems concepts such as the "all-electric" aircraft, in which electrical power is established as the prime source of secondary power generated by the engines.
- o The enhancement of aircraft reliability and maintainability by the incorporation of on-board "Expert Systems".
- o Definition and development of standards for such aspects as a future high-rate digital data transmission bus for commercial aircraft and the performance definition and evaluation of airborne computers.
- o Improvements in the methods of aircraft fire control/suppression of aircraft fires.
- o Helicopter obstacle warning systems.
- o Improved high pressure hydraulic systems.

B.7 PROPULSION

The current work definition mainly focusses on the integration of new propulsion concepts and their impact on aircraft design. These include the propfan or high-bypass-ratio turbofan, the integration of engines with the airframe and with the fuel systems which are required. Amongst the research activities in this area proposed for inclusion in a future programme are:

- o Technology development for the integration of advanced propeller and prop-rotor systems; involving theoretical, wind-tunnel and laboratory tests of a range of engine mounting configurations.
- o Ramjet Propulsion: involving studies, experimental work and demonstration of ramjet engine technology for different fuels and the investigation of combustion instabilities in propulsion systems.

B.8 MULTIDISCIPLINARY

This area, as its name implies, is concerned with aspects of an aircraft in which several technological disciplines must interact, such as in the cockpit, or with features or

methods which are or can be common to a number of technological disciplines. Multidisciplinary aspects to be included in the future work programme are:

- o Flight-Deck/Cockpit environment; for both fixed wing and rotating wing aircraft advances in technology give promise of reductions in cockpit workload which need to be investigated by multidisciplinary teams and where appropriate become the subject of experimental work.
  - Cockpit display/control panel technology, the Man/Machine interface;
  - Application of "Expert Systems" in the cockpit;
  - Integration of on-board systems, e.g. navigation with Flight Management System.
- o Studies of the technology implications of a second-generation high speed transport for the year 2000, in which aircraft configurations are evaluated to assess the trade-off between concept viability and optimum speed.
- o The establishment within the industry of common methods and tools for systems development, for both software and hardware systems. It is noted that this activity will be able to start from a baseline of software development tools, developed under such programmes as ESPRIT, which can be adapted to the specific requirements of the industry.
- o Measures which will improve productivity in the elaboration of the European Aerospace Standards vital to collaborative efforts and to the establishment of a single market.
- o Studies of variable configuration aircraft concepts.
- o Studies of landing gear concepts for unprepared fields.

B.9 DESIGN TECHNOLOGY

The methodologies and means of increasing design productivity and of integration with manufacturing processes are of major importance in the continuing efforts to reduce the costs of aircraft production. Within aerospace companies, Computer Aided Design is widely used and has already played a large part in achieving economies. With more and more emphasis on collaborative ventures between European companies, it is increasingly important that design information exchanged between partners is compatible and accurate. Similar logic should be followed by project

partners in the management of changes to design and manufacturing information. Planning methods should also be harmonised. Research activities proposed for this area of technology include:

- The application of new computer-aided and video techniques for training design staff in the use of CAD/CAM facilities and the development of appropriate training material.

- The establishment of the fundamental logic of interface design, parts management and configuration control governing the definition of complex items undergoing high rates of change. Investigation of how this logic can be implemented in different commercial CAD/CAM/CIM systems.

- The development of European standardised planning methods.

- The development of the strategy and framework for the establishment of a common data bank system for collaborative projects. It is envisaged that the data bank will contain data ranging from aerodynamics, performance, structure; CAD-data and engine characteristics to information for manufacturing and maintenance. Computational results as well as wind-tunnel and flight test results will be included.

B.10 MANUFACTURING TECHNOLOGY

Aerospace companies are already in the forefront of users of advanced manufacturing technology and must continue to be so in order to maintain their competitive position. Whilst many aspects of this area of activity are embraced by other programmes such as ESPRIT, the following specific needs for research projects within the aerospace industry were identified:

- The co-operative development of Numerical Control planning, device driver and part monitoring techniques which exploit the unique possibilities of 3-D modelling. This should lead to a significant reduction in the planning, part programming, monitoring and inspection costs as well as elapsed time.

- A study of the technical potential and economic viability of a comprehensive design/production engineering data transfer system aimed at direct automation of Process planning and production requirements definition from design data.

B.11 OPERATIONAL SYSTEMS

The full benefits of advanced technology applied to the design and manufacture of the whole air vehicle cannot be realised unless due attention is devoted to the complementary elements of the overall operational environment within which the air vehicle is used. It is, therefore, of the first importance that key operational problems in areas such as air traffic management, navigation systems, safely systems, fleet management, etc. be addressed.

- Study and experimentation in the area of integration between airborne flight management systems and air traffic control information systems.

B.12 DEMONSTRATOR PROJECTS

An essential complement to the pursuit of basic data and enabling technology, largely describe above, is the design, construction and testing of experimental demonstrator equipment. Only by such activity can the integration and interplay of diverse sub-systems be fully explored and the necessary mastery of overall system technology be demonstrated. The following needs for demonstrator activities have been identified:

- to design, construct and test a research tilt-rotor aircraft;

- to set up arrangements for a coordinated European flight demonstrator capability harnessing aircraft, airfield and range facilities of both industry and research establishmentary;

- to design, construct and test a research high speed helicopter.

PROPOSAL FOR A COUNCIL DECISION ADOPTING THE PILOT PHASE OF A PROGRAMME OF STRATEGIC RESEARCH AND TECHNOLOGY IN THE FIELD OF AERONAUTICS

The Council of THE EUROPEAN COMMUNITIES

Having regard to the Treaty establishing the European Economic Community and, in particular, Article 130 Q (2) thereof,

Having regard to the proposal from the Commission [1],

In cooperation with the European Parliament [2],

Having regard to the opinion of the Economic and Social Committee[3],

Whereas Article 130 K of Treaty provides that the framework programme shall be implemented through specific programmes developed within each activity;

Whereas the Council, by adopting the framework programme of Community research and technological development (1987 - 1991)[4] acknowledges the interest of an action on science and technology for the manufacturing industries in the field of modernisation of industrial sectors;

Whereas promotion of European industrial competitiveness is one of the major goals of the framework programme;

Whereas the European Parliament, in its assessment of the situation and development of the European aeronautical industry [5] stressed its role for the future political, social and economic development of the Community and made particular reference to a series of actions to be promoted;

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[1] O.J. No C ...

[2] O.J. No C ...

[3] O.J. No C ...

[4] O.J. No L 302, 24.10.87 - p.1.

[5] resolution of 15.10.1987, PV 33 II, PE 117.164

Whereas the Commission, together with the aeronautical industry, has analysed the future needs for aeronautical research and technology in order to assure the international competitiveness of the European industry in the medium and long term and has concluded that there is an urgent need for action at Community level;

Whereas a Community programme meets the need to strengthen and broaden the research and technology base of the European aeronautical industry; whereas its beneficiaries must therefore be the undertakings, universities and research centres in the Community which are best suited to attain these objectives;

Whereas it is essential that actions taken in the field of aeronautical research and technology acquisition at national level and at Community level should be fully coherent;

Whereas it is necessary to make an urgent start on a preparatory phase in order to develop new methods of collaboration and co-ordination of aeronautical research in the Community before a major programme of aeronautical research and technology can be implemented;

Whereas the Scientific and Technical Research Committee (CREST) has expressed its opinion,

HAS ADOPTED THIS DECISION

Article 1

A specific programme of research and technological development in the field of aeronautics, as defined in the Technical Annex is hereby adopted for a period of 2 years, from the 1st January 1989;

Article 2

The amount deemed necessary for the execution of the programme is 60M ECUs over 24 months, including expenditure on staff whose costs shall not exceed 4.5% of the Community's contribution.

Article 3

Rules for the implementation of the programme are set out in the Technical Annex.

Article 4

In the second year of the programme implementation, the Commission shall undertake a review of the programme and it shall report to the Council and to the European Parliament on the results thereof.

An evaluation of the results achieved shall be conducted by the Commission, which shall report thereon to the Council and the Parliament.

The above mentioned reports shall be established having regard to the objectives set out in the Annex to this Decision and in conformity with the provisions of Art. 2 (2) of the framework programme.

Article 5

The Commission shall be responsible for the execution of the programme and shall be assisted in its implementation by a Committee, hereafter referred to as "the Committee" composed of two representatives of each Member State and chaired by the representative of the Commission.

Members of the Committee may be assisted by experts or advisors depending on the nature of the issue under consideration.

The proceedings of the Committee shall be confidential. The Committee shall adopt its own rules of procedure. The Secretariat shall be provided by the Commission.

Article 6

The procedure laid down in Article 7 shall apply to:

- the assessment of proposed projects and the estimated amount of the Community's financial contribution,
- the definition of appropriate procedures for the exchange of information pursuant to Article 9,
- the participation in any project or action by organisations and undertakings as provided for in Article 10,
- the measures to be undertaken to evaluate the programme.

Article 7

Where the procedure laid down in this Article is to be followed, the representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148 (2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

The Commission shall adopt measures which shall apply immediately. However, if these measures are not in accordance with the opinion of the committee, they shall be communicated by the Commission to the Council forthwith. In that event the Commission may defer application of the measures which it has decided for a period of not more than one month from the date of such communication.

The Council, acting by a qualified majority, may take a different decision within the time limit referred to in the previous paragraph.

Article 8

The contracts entered into by the Commission shall regulate the rights and obligations of each party, including the methods of disseminating, protecting and exploiting the results of the programme.

Article 9

With regard to the activities provided for in Article 1, the Member States and the Community shall exchange all appropriate information to which they have access and which they are free to disclose concerning the areas covered by this decision, whether or not planned or carried out under their authority.

The information shall be exchanged in accordance with a procedure to be defined by the Commission after consulting the Committee and will be treated as confidential at the supplier's request.

Article 10

Where framework agreements for scientific and technical cooperation between non member European countries and the European Communities have been concluded, organisations and undertakings established in these countries may, under appropriate conditions, to be defined by the Commission, become partners in a project undertaken within this programme.

No contractor established outside the Community who participates as a partner in a project undertaken within the programme shall be entitled to Community financing intended for the programme.

Article 11

This decision is addressed to the Member States.

Done at .....

For the Council,

The President.

TECHNICAL ANNEX

Defining the Pilot Phase of a Programme of Strategic Research and Technology in the Field of Aeronautics

I. APPROACH AND OBJECTIVES

a) Approach

As regards the programme as a whole, the means by which the above objectives will be achieved is the establishment of a strategic programme of precompetitive aeronautical research and technology acquisition, conducted at Community level, focussed upon key technology goals derived from industrial analysis of future generic product goals and concerted to the maximum extent with other national and international research and technology acquisition activities.

For the pilot phase the same basic methods are to be followed but they will be implemented at a smaller scale of activity than that envisaged for the main programme. The work plan specified for the pilot phase is chosen to provide valid research in this field. Thus the programme addresses a number of important problems, ranging over most of the disciplinary fields of interest and comprehending a representative variety of types of activity. Within these broad criteria, the subject chosen have been suggested by the industry and have been refined after extensive discussion by experts.

The scope of activity implied by reference to research and technology acquisition in this field covers all types of action which are not related to design, manufacture or sale of specific products and which are downstream of basic research.

b) Objectives

The essential objective of the overall programme is to respond to the severe technological challenge which confronts the European aeronautical industry. To achieve this vital aim, the programme seeks to encourage and assist a qualitative leap in the scope and effectiveness of cooperation at European level between the many and varied organisations (aircraft companies, engine companies, equipment companies, national research centres, materials suppliers, research institutes, universities, etc.) the work of which contributes to the European aeronautical technology base.

The specific objectives of the pilot phase are:

- to create the essential impetus for the launching of a major and complex programme of actions;
- to carry out research work in a number of areas of technological advance which are of great importance to the future capability of the aeronautical industry;
- to learn lessons regarding the management and operation of such a programme and to refine the definition of the longer term actions which should be pursued;
- to provide concrete evidence upon which decisions regarding future actions can be based.

II. TECHNICAL CONTENTS

The programme shall consist of the following tasks :

AERODYNAMICS (INCLUDING FLIGHT MECHANICS)

Analysis and optimisation of high speed aircraft configuration including Aerothermodynamics heat load estimates.

- Framework and integration
- Optimisation strategy and methods
- Approximate methods (loads and coefficients)
- Transport and thermodynamics phenomena and models
- Numerical methods
- Grid generation
- Shock/Vortex boundary layer interactions
- Experimental Techniques - measurements and data base
- Low speed performance

Laminar flow control

- Wind tunnel Calibration and utilisation
- Testing Techniques and suction device development
- Numerical flow field calculation
- Surface quality and degradation
- Flight test requirements
- Technology of non-wing applications, fixed wing aircraft and helicopters
- Final cost-benefit analysis

MATERIALS

- Aluminum-lithium alloys
- Metal matrix composites
- Powder metallurgy
- Test methods for the characterisation and qualification of material
- Organic composites for service-temperatures above 120°C
- Fibre-reinforced carbon and fibre-reinforced ceramics
- Surface Technologies
- Adhesives
- Composites with organic matrices for service-temperature up to 120°C
  - Composites
  - Composite/Metal Combinations

ACOUSTICS

Aircraft noise source identification, prediction and reduction.

- Helicopters and Tilt-rotors ...
  - Acoustic sources
  - Prediction codes
  - Transmission paths
  - Community and passenger noise impact

- Advanced propellers and propfans
  - Near and far field noise prediction schemes
  - Validation of the prediction schemes by low speed and high speed wind-tunnel tests
  - Installation effects

- Engine testbed for acoustic measurements
  - Specifications
  - Design and construction
  - Instrumentation
  - Calibration

Interior noise prediction and reduction

- Prediction techniques
- Active noise control
- European aircraft interior noise test facility

Exterior noise reduction by active control

- Theoretical investigations
- Development of anti-noise generators
- Development of controlling logic for periodic and stochastic noise

Acoustic fatique and related damage tolerance on advanced composites

- Investigation of materials and construction methods
- Static and dynamics test of coupons and components
- Modal test programme
- Acoustic fatigue tests
- Theoretical analysis of damage tolerance and acoustic fatigue
- Development of non destructive testing methods for new fibre composite materials and structures

COMPUTATION

- Requirements
- General supercomputing
- Mathematical/Physical models and algorithms
- Integration of engineering and design tools
- Knowledge based systems
- Software environment
- Basic tools
- Communication
- Software production environment

AIRBRORNE SYSTEMS AND EQUIPMENTS

Integration and Operation of systems and Equipment

- Digital Technology
  - Centralised/decentralised Computing
  - Data Transmission
  - Sensors and actuators
  - Electrical power
- Systems development and evaluation tools
- Flight Deck operational concepts and Flight Management Systems
- On board intelligent knowledge based systems (IKBS)

All-Electric Aircraft

- Ice protection
  - Ice physics
  - Advanced Ice protection concepts
  - Electrical Impulse de-icing (EIDI)

- Flight Control actuation

  - Electromechanical actuators (EMA)
  - Electrohydraulics pumps (EHP)
  - Electrohydrostatics actuators

- Secondary Power Generation

  - Electrical generation
  - Replacement of engine bleed Air
  - New high power Electrical distribution system

PROPULSION

- Definition of experimental parameters to be obtained for the difference operating conditions
- Study and define configuration for the main phase testing
- Assessment and selection of suitable wind tunnels, and type and sizes of models
- Aerodynamic design of models
- Specification and design of the wind tunnel models and their components
- Specification of suitable drive motors
- Definition of model propellers and engine nacelles preferably in cooperation with propeller and engine manufacturers
- Detailed definition and specification of the experimental programme, together with measuring equipment data acquisition and analysis requirements
- Acquisition and assembly of hardware.

DESIGN AND MANUFACTURING TECHNOLOGY

- Intelligent interfaces
- Common data base
- 3 D Solid Modelling

III. IMPLEMENTATION

The programme shall comprise pre-competitive research and technology projects, carried out by means of contracts to be concluded with companies, including small and medium-sized undertaking, research centres, universities resident in the Community. Pursuant to Article 10 of the decision, the programme may also be open to similar entities resident in the countries concerned.

Particular attention will be given to the coordination and the complementarity with activities carried out under the programmes of the Member States and of the Community.

The programme shall include the organisation of meetings and consultation of experts.

The selection of projects is carried out by the Commission, assisted by the Committee, having regard to the objectives defined in this annex.

The projects shall, as a rule, be submitted in reply to an open invitation published in the Official Journal of the European Communities and involve the participation of at least two independent industrial partners not all established in the same Member State. Each contractor will be expected to bring a significant contribution to the project. Contractors shall be expected to bear a substantial proportion of the costs. The Community contribution shall normally be 50% of the total expenditure. Alternatively, in respect of universities and research institutes carrying out projects or actions, the Community may bear up to 100% of the additional expenditure involved.

IV. EVALUATION CRITERIA

The Commission's Communication to the Council concerning a Community Plan of Action relating to the evaluation of Community research and development activities for the years 1987 to 1991 (COM (86) 660 final) states that the objectives and milestones of each research programme have to be set out in a testable form, which are set out below:

1. As the principal objective is to enhance the competitive position of the Community aeronautical industries, the evaluation should determine :

   - The extent to which the project were selected against industrial criteria.

   - The value of the management structure set up the implementation of the pilot phase.

2. A further objective is to encourage transfrontier collaboration in the strategic aeronautical industrial research and technology, to reduce duplication of the efforts and provide better utilisation of facilities.
   The implementation of the programme will offer the smaller Member States of the Community the opportunity of contribute to participate in high advanced technological programmes and this is a further powerful factor in promoting European unity

   The evaluation should determine:

   - To what extent links were established between partners (aeronautical companies, SMEs universities and research centers).

   - To what extent satisfactory procedures were established for management and exploitation of intellectual property created by the programme.

3. As a typical objective of a "pilot programme" we can expect the following results:

   - the provision of experience and relevant information,
   - the successful preparation of the main programme.

   The evaluation should assess these outputs.

FINANCIAL STATEMENT

1. BUDGET TITLE

7333 - A Programme of Strategic Research and Technology in the field of aeronautics
Pilot phase : 1989 - 1990
- Line 3.1. of the Framework programme : "Modernization of industrial sectors" (60MECUs)

2. LEGAL BASIS

Article 130 Q

3. PROGRAMME DESCRIPTION AND OBJECTIVES

The pilot phase programme launches an important initiative in strategic research and technology acquisition in the field of aeronautics. Against the background of a provisional workplan for the envisaged main programme, a number of critical research tasks, lying in a range of technology areas, have been identified for execution in the pilot phase. The tasks chosen have been selected to provide, at the same time, important results for the future European aeronautical tecnology base and a representative experience of the management and implementation of a strategic programme in this field. Execution of the research will be undertaken by transnational teams, containing at least two industrial partners from different Member States and usually also involving SME's[1], research institutes and/or universities. Community support to the research projects will not normally exceed 50% of full economic cost or 100% of marginal cost for universities. The fields within which research will be carried out are:

- Aerodynamics (including flight mechanics)
- Materials
- Acoustics
- Computation
- Airborne systems and equipment
- Propulsion
- Design and manufacturing technologies

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1 SME - Small and Medium Enterprises/Companies

The objectives of the pilot phase programme are:

- to create the essential impetus for the launching of a major and complex programme of actions;

- to carry out research work in a number of areas of technological advance which are of great importance to the future capability of the aeronautical industry;

- to learn lessons regarding the management and operation of such a programme and to refine the definition of the longer term actions which should be pursued;

- to provide concrete evidence upon which decisions regarding future actions can be based.

4. PROGRAMME JUSTIFICATION

The pressure for technological competition in the world market is rapidly accelerating. It has become a matter of urgency to enable the European aeronautics industry to take up this challenge at Community scale, with a view to strengthen its competitive position in years to come.

Effectively, two important factors plainly favour Europ's major competitors:

. The availability of a large and uniform domestic market and a powerful public procurement of Research and equipment.

. The availability of a broad high-technology base derived by government funded strategic programmes. Moreover, the availability a large number of test facilities which are both sophisticated and costly and have been set up with public funding.
For this reason, the European industry is constrained to operate from a competitive base which has structural and financial disadvantages.

Therefore it is necessary to influence the factors which can improve the co-operation and strengthen the competitiveness of European industries by:

. Broadening of European co-operation in the field of aeronautics.

. Concentration of research effort in key technology categories, with joint goals.

. A balenced and measured increase in funds to enable European technological research.

The fulfillment of the pilot phase will permit to initiate this new type of co-operation and gain experience with its management; it is through the conduct of a main programme that progressively the European acronautics industry could improve its "self-sufficiency" in acquiring and maintaining the technology needed to meet competition on the world market.

5. FINANCIAL IMPLICATIONS FOR INTERVENTION APPROPRIATIONS

(million ECU)

5.1. Total cost over duration : (two years : '89-'90)

- From the budget of the Community 60

5.2. a) Commitment schedule

	1989	1990	1991	1992	Total
Staff	0.70	1.13	-	-	1.83
Administration	0.55	0.67	-	-	1.22
Contracts	38.75	18.20	-	-	56.95
Total	40.00	20.00	-	-	60.00

b) Payment appropriations

	1989	1990	1991	1992	Total
Staff	0.70	1.13	-	-	1.83
Administration	0.55	0.67	-	-	1.22
Contracts	7.75	34.20	10.00	5.00	56.95
Total	9.00	36.00	10.00	5.00	60.00

5.3. Method of calculation

a) Expenditure by contract

This expenditure covers the Community's financial contribution to the research carried out under shared-cost contracts to be concluded with industry and the research institutes of the Member States. It includes also expenditure for external evaluation by independent experts estimated to be 150.000 ECUs.

b) Operating expenditure

This expenditure covers administrative costs (the committee which supports the Commission in the execution of the programme, working party meetings, document distribution and dissemination of information), use of data processing and telecommunications facilities and other supporting activities.

c) Personnel costs

The requirement for this programme have been estimated on the basis of auxiliary staff, consultants, costs of mission and statutory required staff[2] of :

1) in 1989

4 statutory officials - category A

1 statutory official - category C

This staff is requested under the budget 1989 and 1990.

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[2] The cost of the new staff is calculated at the 50% rate in the enrolment year.
- The expenditure concerning personnel has been calculated on the following bases :
  . 93.000 ECUs/year for a A official
  . 58.000 ECUs/year for a B official
  . 37.000 ECUs/year for a C official

2) for 1990 [3]

8 statutory officials - category A
2 statutory officials - category B
3 statutory officials - category C
This supplementary staff will requested under the budget 1990.

6. FINANCING OF EXPENDITURE

The appropriations required to cover the Community's contribution to this project are to be entered in the Community's future budgets.

7. The proposed budget includes expenditure for the assessment and the evaluation of the pilot phase (about 150KECUs).

8. TYPE OF CONTROL

- Administrative control by the Directorate-General for Financial Control as regards budget implementation.
- Scientific control by the Directorate General for Science, Research and Development
- Audits by the Court of Auditors in accordance with the provision of the Treaty.

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[3] 4% inflation has been provided for 1990.

EVALUATION OF THE IMPACT ON SMALL AND MEDIUM SIZED ENTERPRISES (SME's) AND EMPLOYMENT STATEMENT

The programme has, as a general objective, the acquisition of advanced technical knowledge, appropriate to allow the European aeronautics industry to rise to the challenge of its competitors on the world market.

The research activities to be developed will be orientated towards the actual needs of the European aeronautics industry; they will have quite specific objectives and their research topics will be defined in considerable detail.

It is therefore obvious that the SME's, which by their nature are particularly active in applying research results to product goals, can find real possibilities of active participation, either in the association with projects carried out by the major European aeronautics companies, or as sub-contractors.

Numerous projects will lend themselves particularly well to the promotion of co-operation between research centers, SME's and the aeronautical industry, which very often will assure the prime contractor role. Amongst the research activities needing to be developed, one can cite advanced materials for aeronautics structures, where the characterisation and the behavioral tests of alloys and composite materials for specific applications could largely fall into the sphere of interest and competence of SME's.
The participation of the SME's in the fruition of the programme will therefore be encouraged.

The SME's can derive numerous advantages through their participation.

- Access to previous results of basic research originating from research laboratories, universities and the European aeronautics industry.

- The possibility of applying their own technology and know-how to the solution of critical problems, specific to the European aeronautics industry, subject to the protection of Intellectual Property Rights.

- The feedback of information resulting from tests under simulated conditions achieved in the expensive facilities of the European aeronautics industry.

- The spin-off from high-technology, which could be adapted in an appropriate form and employed in other more conventional sectors.

- The possibility of being qualified for a very important high technology market.

The European aerospace industry currently employs close to 500,000 people in Europe. Continual updating of its high technology is the Key to maintaining this level and creating new jobs. The SME's and generally all the Member States can be the beneficiaries of it. A community programme in this area is almost the sole mechanism for SME's and universities in Member States, which have no major Aeronautics industry, to benefit from this technology.