IT Forum

ESPRIT CONFERENCE WEEK

Esprit

Europe 1992 : Technology and Market

Proceedings of the IT Forum at the

4th ESPRIT Conference

Brussels

30 September 1987

Commission of the European Communities
DG XIII:Telecommunications, Information Industries and Innovation

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Contents

EROFFNUNGSREDE

Karl-Heinz Narjes
Vizepräsident
Kommission der Europäischen Gemainschaften

Meine sehr geehrten Damen und Herren,

Die Teilnahme an den ESPRIT-Konferenzen gehört für mich zu den willkommensten Terminen, denen ich mich im Laufe eines Jahres zu unterziehen habe. Dies gilt schon, weil diese Konferenz mich mit Damen und Herren zusammenführt, die sich engagiert der Zukunft verpflichtet fühlen und die bereit sind, unsere Lebensverhältnisse von morgen zu gestalten. Dies ist ein wohltuender Gegensatz zu den zahlreichen Vertretern der Anspruchsgesellschaft, die sich darauf spazialisiert haben, überkommene Strukturen zu Lasten des Steuerzahlers und letztlich auch der betroffenen Arbeitnehmer um nahezu jeden Preis zu erhalten - zu Lasten unserer Zukunft und unserer Kinder.

So liegt es mir denn besonders am Herzen, in dieser Woche nahezu 4000 Forscher, Ingenieure, Kaufleute der informationstechnischen Industrien hier in Brüssel zu begrüßen. Auch dieses Jahr wieder ist die ESPRIT Konferenz eine qualitativ beeindruckende Veranstaltung:

- 17 Workshops
- 2 Parallelkonferenzen
- 50 Demonstrationen von ESPRIT-Projekten
- 800 potentielle Antragsteller als Teilnehmer am "Proposers' Day".

Das ESPRIT-Programm und die gemeinschaftliche Forschungs- und Entwicklungspolitik, die sich in ihm ausdrückt, sind der positive Kontrast zu den Politikbereichen und Dossiers, die leider viel zu sehr die Schlagzeilen bestimmen und den Haushalt belasten.

Wenn ESPRIT zu den heute schon unbestreitbar erfolgreichen Faktoren einer gemeinschaftlichen zukunftsorientierten Politik gehört, dann verdanken wir das Ihnen. Sie haben auf die eine oder andere Weise, in dieser oder jener Funktion zum Gelingen einer Initiative beigetragen, die - vergessen wir das nicht - erst 1984 auf den Weg gekommen ist.

Ich freue mich, daß wir für die ESPRIT Konferenz 1987 vier Redner haben gewinnen können, deren hervorragender Beitrag zur Planung und Implementierung einer gemeinschaftlichen

Strategie im Bereich der Informationstechnologien und der Telekommunikation verdient, hervorgehoben zu werden.

Ich begrüße :

- Herrn Bertil HAARDER, Minister für Forschung und Technologie des Köningreichs Dänemark und amtierender Präsident des Forschungs-Ministerrates;

- Herrn Michel PONIATOWSKI, Minister a.D., Mitglied des Europaparlaments und dort Vorsitzender des Ausschusses für Energie, Forschung und Technologie;

- Herrn Cornelius VAN DER KLUGT, Vorstandsvorsitzender der Firma Philips,

- Herrn Jacques STERN, Vorstandsvorsitzender der Firma Bull.

Ich bin sicher, daß das Auditorium Ihren Ausführungen mit großem Interesse entgegensieht, ebenso wie ich selbst es tue.

Die ESPRIT-Konferenz 1987 erlaubt eine Bestandsaufnahme geleisteter Arbeit und einen Ausblick auf das, was noch zu leisten ist. Zunächst erinnere ich aber daran, daß sich die Gegebenheiten für die ESPRIT-Konferenz 1987 gegenüber den Vorjahren qualitativ verändert haben. Am 1.7.1987 ist die "Einheitliche Europäische Akte" in Kraft getreten. Sie eröffnet ermutigende Perspektiven - auch und gerade für die beiden Politikbereiche, die das Leitthema des heutigen Forums sind, nämlich "Technologie" und "Markt".

Lassen Sie mich auf den Aspekt "Technologie" eingehen.

Die Einheitliche Europäische Akte gibt der Kommission auf, für den Bereich der Forschung und technologischen Entwicklung ein mehrjähriges Rahmenprogramm zu erstellen, das sodann in spezifischen Programmen wie etwa ESPRIT durchgeführt wird.

Schon 1986 habe ich an dieser Stelle betont, wie dringend eine rasche Entscheidung über das Rahmenprogramm sei. Diese Entscheidung ist inzwischen - leider mit erheblicher Verzögerung - gefallen. Die Verzögerung ergab sich nicht zuletzt daraus, daß die Einheitliche Akte für die Verabschiedung des Rahmenprogramms Einstimmigkeit unter den 12 Mitgliedstaaten vorschreibt. Daher konnte das Veto eines Mitgliedsstaates eine rasche Beschlußfassung verhindern.

Die Verzögerung ließ sogar Zweifel aufkommen, ob etwa im Bereich der Informationstechnologien in Programmen der Gemeinschaft überhaupt ein Minimum an Kontinuität gewährleistet sei. Deshalb zögere ich auch nicht, kritisch zu bemerken, daß die für das Zustandekommen des Rahmenprogramms festgeschriebenen Verfahren kaum der Größe der Herausforderung entsprechen, denen wir im Bereich der industriellen Entwicklung und des weltweiten technologischen Wettbewerbs gegenüberstehen. Wir riskieren die Zukunft Europas, wenn wir den Schritt ins 21. Jahrhundert im Geist und mit Verfahrensweisen verfolgen, die dem 19. Jahrhundert oder einem orientalischen Markt mehr entsprechen als den Erfordernissen hochentwickelter Industriegesellschaften an der Schwelle zum nächsten Jahrtausend.

Das Forschungsrahmenprogramm ist angelegt als Beitrag der Gemeinschaft zum Technologieschub, den die europäische Industrie braucht, um den Wettbewerb mit ihrer Konkurrenz aufnehmen und bestehen zu können. Das gilt nicht nur für die Informations- und

Kommunikationstechnologien. Das Rahmenprogramm deckt die grossen Bereiche ab, die für die technologische Entwicklung unseres Kontinents von Bedeutung sind. Dazu gehören selbstverständlich die Informations- und Kommunikationstechnologien, Gesundheit und Umweltschutz, die Biotechnologie, die Nutzung des Meeresbodens und der Meeresressourcen, Aktionen im Energiebereich, der Einsatz neuer Technologien bei der industriellen Modernisierung - um nur die großen Kapitelüberschriften zu nennen. Entsprechend ihrer technologischen und industriepolitischen Bedeutung spielen die Informations- und Kommunikationstechnologien im Rahmenprogramm eine zentrale Rolle - auch hinsichtlich der Haushaltsansätze. Fast 40% des Gesamtvolumens des Rahmenprogramms sollen in diese Schlüsselbereiche fließen. Sie wissen, daß die Vorstellungen der Kommission hinsichtlich des Finanzvolumens für das Rahmenprogramm deutlich über dem lagen, was der Ministerrat akzeptiert hat.

Wir haben schließlich ein geringeres Volumen akzeptiert - für das Rahmenprogramm insgesamt ebenso wie für die zweite Phase von ESPRIT. - Wir haben es getan, weil wir fürchten mußten, daß eine weitere Auseinandersetzung um das Budget zur Unterbrechung bzw. zur Einstellung von Projekten, zur Entlassung von Mitarbeiten und damit insgesamt zum Verlust der dem Programm eigenen Dynamik geführt hätte. Dies konnten und wollten wir nicht verantworten - im Interesse der Gemeinschaft ebensowenig wie im Interesse derer, die in den Betrieben und Labors die Forschungs- und Entwicklungsarbeit leisten.

Jetzt geht es darum, die Einzelprogramme so rasch wie möglich durch den Rat zu bringen. Glücklicherweise gilt für die Verabschiedung dieser Einzelprogramme nicht mehr das Prinzip der Einstimmigkeit, sondern nur mehr das der qualifizierten Mehrheit. Hierdurch ist zwar das Vetorecht ausgeschlossen, gleichwohl ist die Verabschiedung der Einzelprogramme immer noch sehr zeitaufwendig - zu aufwendig, wie ich meine.

Was steht zur Beratung und Entscheidung durch den Ministerrat an ?

Natürlich zunächst und vor allem die zweite Phase von ESPRIT.

Wir hatten vorgestern Gelegenheit, dem Rat die Vorstellungen der Kommission für ESPRIT II zu präsentieren. Diese Vorstellungen wurden selbstverständlich erarbeitet auf der Grundlage zurückliegender Ergebnisse und Erfahrungen sowie unter Berücksichtigung der erkennbaren Tendenzen und Entwicklungen des Sektors, um den es geht.

Was sich bei ESPRIT II nicht ändern wird, sind jedoch die Prinzipien, die für ESPRIT I charakteristisch waren und die den bisherigen Erfolg des Programms ausgemacht haben:

- Orientierung an gemeinsam von Industrie und Kommission, also partnerschaftlich, formulierten strategischen Zielen;

- Beschränkung auf Forschungs- und Entwicklungsarbeiten im vorwettbewerblichen Bereich;

- grenzüberschreitende, industriell ausgerichtete Kooperation zwischen unabhängingen Partnern, jeder Größe, aller Mitgliedsstaaten,;

- 50%-ige Deckung der Projektkosten aus den Haushaltsmitteln der Gemeinschaft.

Als praktisch bedeutsame neue Komponente wird die von uns vorgeschlagene Öffnung zu EFTA-Partnern hinzukommen, durch die die Beteiligung von Partnern aus EFTA-Ländern an bestimmten Projekten möglich wird. Wir erhoffen uns hiervon eine fruchtbare Ergänzung und Abrundung der Arbeiten.

Ein zweites wichtiges Einzelprogramm, für das wir ein rasches Votum des Ministerrates brauchen, ist das RACE-Hauptprogramm. RACE soll der Beitrag der Gemeinschaft zum Entwurf eines Szenarios für integrierte Breitbandkommunikation am Ende dieses Jahrtausends sein. RACE ist eine komplexe Operation mit einer Vielzahl unterschiedlicher Partner und Interessen, die keineswegs auf Forschungs- und Entwicklungsarbeiten beschränkt sind. Im Jahr 1985/86 haben wir eine experimentelle "Definitionsphase" durchgeführt, deren Ergebnisse überaus ermutigend waren. Auch hier wurde durch die Verzögerung beim Rahmenprogramm wertvolle Zeit verloren, die es aufzuholen gibt.

Lassen Sie mich schließlich noch auf drei sogenannte Anwendungsprogramme verweisen, die - obwohl kleiner im Finanzvolumen - für die Gemeinschaft von erheblicher Bedeutung sind. Ich meine die Programme DELTA, AIM und DRIVE, die ebenfalls dem Rat vorliegen.

Diese Programme haben den Einsatz der Informations- und Kommunikations technologien in so unterschiedlichen Bereichen wie der Lehr- und Lehrntechnologie, der Gesundheitsfürsorge und dem Straßenverkehr zum Gegenstand. In allen drei Bereichen erkennen wir neue technologische Gegebenheiten und Entwicklungen, in allen drei Bereichen entwickeln sich Märkte, auf die wir uns einzustellen haben. Die Koordinierung und Konzentration der in der Gemeinschaft bereits laufenden Arbeiten ist geboten. Der Rat ist gefordert, einer Gemeinschaftsinitiative den Weg freizumachen.

Keins dieser Programme verträgt einen wesentlichen zeitlichen Aufschub, ohne daß erheblicher Schaden entstünde.

Ich weiß, sehr geehrter Herr Haarder, daß Sie als amtierender Ratspräsident die Dringlichkeit der Ratsentscheidungen über diese Programme sehen. Wir müssen die verlorene Zeit wieder aufholen und bedürfen dazu der aktiven Unterstützung des Rates. Niemand würde sich mehr freuen als alle hier Versammelten, wenn noch unter Ihrer Präsidentschaft der Durchbruch gelänge, den Europa braucht.

Sie, Herr Poniatowski, haben in Ihrem bemerkenswerten zweiten Bericht über "Die Antwort Europas auf die technologische Herausforderung der modernen Zeit" prägnant dargelegt, daß Europa sich einer strategischen Herausforderung gegenübersieht, deren Bedeutung über die technologischen und wirtschaftlichen Implikationen hinausgeht, weil sie auch politisch und sozial existentieller Natur ist.

Die weltweite technologische Herausforderung wird sich in den vor uns liegenden Jahren noch weiter verschärfen. Pessimisten fürchten, daß neben Japan und den USA auch Länder wie die Sowjetunion, Indien, China oder Korea in zunehmendem Maße ihr technologisches Potential in die Waagschale zu werfen.

Weit gravierender jedoch ist, daß der Wettbewerb um Technologien und Märkte zunehmend politisiert wird. Unternehmen und ganze Industrien, die sich am Markt durchsetzen oder behaupten wollen, werden zunehmend zur Zielscheibe politischer Bedrohungen und Pressionen. Umgekehrt gilt natürlich auch, daß immer häufiger Unternehmen und Industrien versuchen, solche politischen Waffen im Sinne ihrer eigenen Interessen zu mobilisieren.

Ich sehe derzeit leider nicht, daß das GATT in der Lage wäre, in diese fatale Beeinträchtigung des Welthandels regulierend einzugreifen. Von dieser Seite können wir keine Lösung der Probleme erwarten. Europa und Europas Unternehmen müssen einen anderen Ansatz suchen, um dieser Herausforderung zu begegnen. Dieser Ansatz kann nur im gesamten Verhandlungsgewicht der Gemeinschaft von 320 Millionen Bürgern und nicht von den einzelnen Mitgliedstaaten gefunden werden.

Unsere vorwettbewerblichen Forschungs- und Entwicklungsprogramme wie ESPRIT sind ein solcher Ansatz. Sie sind kein Selbstzweck. Wir haben sie immer verstanden als Beitrag zur Antwort Europas auf die strategische Herausforderung. Das "S" im Programmnamen ESPRIT steht für "strategisch".

Die Stärkung der technologischen Grundlage unserer Industrien, Diffusion und Anwendung der Technologien sind die Voraussetzung für industrielle Innovation. Innovation wiederum ist Basis für die Wettbewerbsfähigkeit einzelner Unternehmen wie sogar ganzer Volkswirtschaften auf immer schwieriger werdenden Weltmärkten. In diesem Sinn verteidige ich engagiert die gemeinschaftlichen Technologieprogramme. Gleichwohl betone ich mit Nachdruck, daß auch Technologieprogramme kontinuierlich daraufhin überprüft werden müssen, ob sie der übergeordneten Zielsetzung, die "Schaffung des gemeinsamen Binnemarktes" heißt, förderlich sind. An diesem Ziel hat sich die Kommission bei Konzipierung und Durchführung der Programme orientiert. Sie wird auch in Zukunft alles tun, um Widersprüche bzw. gegenläufige Entwicklungen zu vermeiden und Komplementarität der Maßnahmen zu sichern. Dies gilt u.a. auch für die Koordinierung mit der EUREKA-Initiative.

Forschung und technologische Entwicklung sind jedoch nur <u>ein</u> Element im Bemühen um die Schaffung des gemeinschaftsweiten Binnenmarktes. Auch auf die Gefahr hin, das zu wiederholen, was ich bereits im letzten Jahr hier an dieser Stelle gesagt habe, unterstreiche ich nochmals:

- der gemeinschaftsweite Binnemarkt erfordert die rasche Erarbeitung und Implementierung technischer Normen,

- der Binnemarkt kann nicht gelingen, ohne daß wir das öffentliche Beschaffungswesen liberalisieren, ohne daß wir Urheber- und Wettbewerbsrecht anpassen.

- wir müssen die reglementären Rahmenbedingungen harmonisieren und uns auf ein europäisches Patentabkommen einigen, das - wie Sie, Herr Minister Haarder wissen - bisher leider auch noch nicht die Zustimmung des dänischen Parlaments gefunden hat,

- der Binnenmarkt hängt von der raschen Anpassung unserer industriellen Strukturen ab.

Die Kommission ist hierbei der Motor. Sie muß es sein und will es auch sein. Hierzu steht nicht im Widerspruch, daß entscheidende Erfolge nur im Zusammenwirken mit den Regierungen der Mitgliedstaaten, mit der Industrie sowie mit Nutzern und Anwendern zu erzielen sind.

Der Telekommunikationssektor verdeutlicht die Komplexität und Interdependez der zur Lösung anstehenden Probleme. Viele von Ihnen werden wissen, daß die Kommission im Frühsommer dieses Jahres ihr "Grünbuch über die Entwicklung des Gemeinsamen Marktes für Telekommuniktaionsdienstleistungen und Telekommunikationsgeräte" vorgelegt und zur Diskussion gestellt hat.

Der Telekommunikationssektor steht exemplarisch für das Bündel von Problemen und Aufgaben, die ich angesprochen habe: Eine rapide technologische Entwicklung hat neue Geräte und Dienste möglich gemacht, neue Wettbewerber sind am Markt aufgetreten. Eine beeindruckende Dynamisierung der Märkte ist die Folge. Diese Märkte werden zunehmend globale Märkte und lassen das Bemühen um nationale Abgrenzungen und Eigenständigkeit zum naiven Wunschtraum werden.

Vor diesen Entwicklungen kann Europa nicht die Augen verschließen. Das Grünbuch der Kommission ist daher gedacht als Beitrag zu einer Diskussion, an deren Ende eine auf europäische Verhältnisse zugeschnittene Neuordnung des Telekommunikationssektors in der Gemeinschaft steht. Diese Neuordnung muß den Erfordernissen der veränderten Markt- und Wettbewerbsbedingungen entsprechen ohne zu mißachten, daß in unseren Gesellschaften Fernsprechkommunikation zu einem sozialen Grundbedürfnis geworden ist, das nicht zur Disposition des Marktes stehen darf. Sie muß zu einer Vereinheitlichung der Normen führen, die einerseits die Kommunikation ständig komplexer werdender Geräte und Systeme möglich macht und die andererseits Voraussetzung ist für die Entstehung ausreichend großer Märkte, von deren Grundlage aus Europas Industrie weltweit erfolgreich operieren kann.

Die Entstehung des gemeinschaftsweiten Marktes für Telekommunikationsgeräte und -dienste ist selbstverständlich keine Entscheidung, die durch einfache Willenserklärung quasi über Nacht zur Realität wird. Die Entstehung eines Europas der Telekommunikation kann nur das Resultat eines Prozesses sein, auf das wir zielstrebig mit langem Atem und mit großem Einsatz hinarbeiten müssen.

Ebenso kann auch die Entstehung der Europäischen Technologiegemeinschaft nur das Ergebnis einer kontinuierlichen Entwicklung sein, für die das ESPRIT-Programm durchaus Katalysatorwirkung haben kann. Wir behaupten nicht, mit dem ESPRIT-Programm und vergleichbaren Initiativen den Stein der Weisen gefunden zu haben. ESPRIT hat aber sehr wohl Modellcharakter für industriell ausgerichtete Forschung und Entwicklung auf vorwettbewerblicher Ebene in Europa.

Informations- und Kommunikationstechnologien sind der Schlüssel für die industrielle und wirtschaftliche Entwicklung Europas und für seine Selbstbehauptung in der Welt. Es ist kein Zufall, daß unsere Wettbewerber unter Einsatz nahezu aller Mittel gerade diesen Bereich an sich ziehen und dominieren wollen. Die staatlichen Hilfen und Subventionen, die allenthalben in diese Bereiche hineingepumpt werden, stehen in der modernen Wirtschaftsgeschichte ohne Beispiel da - wenn mann vielleicht die Rüstungsindustrie in Kriegszeiten ausklammert.

Folgen wir also nicht den Verführern, die uns glauben machen wollen, daß wir wirtschaftliche Leistungskraft und Wettbewerbsfähigkeit künftig allein durch Anstrengungen in den klassischen Wirtschaftszweigen erhalten können. Es gibt natürlich kaum mehr ein Branche, die nicht in ganz erheblichem Maße von Informations- und Kommunikationstechnologien abhängt. Wer in der Informationstechnik nicht mit an der Spitze steht, wird den weltweiten Wettlauf auf Kosten der eigenen Wirtschaftskraft verlieren. Ein Halbleiterabkommen zu unseren Lasten genügt!

Ich sagte bereits, daß die Informations- und Kommunikationstechnologien einen wesentlichen Teil des EG-Forschungsprogramms ausmachen. ESPRIT ist das größte Einzelprogramm, das in den vor uns liegenden fünf Jahren durchgeführt werden soll. Niemand hat vergessen, daß wir dieses Programm seinerzeit gegen erhebliche Widerstände durchkämpfen mußten, wobei wir uns stets auf die gute Zusammenarbeit mit der Industrie stützen konnten. Ihnen, Herr van der Klugt und Herr Stern, möchte ich an dieser Stelle nochmals dafür danken, daß Sie und Ihre

Kollegen aus Industrie und Forschung seinerzeit die Zeichen der Zeit richtig erkannt und mit uns eine europäische Strategie entwickelt haben.
Wir planen die Arbeit der kommenden Jahre. Dabei starten wir glücklicherweise nicht bei Null - im Gegenteil.

Lassen Sie mich Ihnen die wichtigsten Fakten in Erinnerung rufen. Seit Beginn des Programms 1984 sind im Rahmen von ESPRIT über 220 Projekte gefördert worden, an denen rund 450 verschiedene Institutionen beteiligt waren. Dazu zählen die großen 12 Firmen, die seinerzeit den Anstoß zur Entwicklung des Programmes gegeben haben, ebenso wie die zahlreichen Klein- und Mittelbetriebe, deren Leistungsfähigkeit in einer Vielzahl von Einzelbereichen beeindruckend ist, dazu zählen spezialisierte Forschungszentren ebenso wie Universitätsinstitute. Ich erwähne auch besonders die dynamische Rolle der kleineren Mitgliedstaaten.

Manch einem schien das für die erste Phase festgeschriebene Finanzvolumen von 1,5 Mrd. Rechnungseinheiten zu bescheiden, um zu nennenswerten Ergebnissen zu kommen. Dieser Einschätzung haben wir stets einiges entgegenhalten können:

Eine beachtliche europaweite Kooperation sowohl zwischen Industrieunternehmen als auch zwischen Industrieunternehmen und Universitäten und Forschungsinstituten ist in Gang gekommen, wenn auch gewisse strukturelle Besonderheiten des informationstechnischen Sektors die Kooperation nicht immer erleichtern. Dazu zähle ich zum Beispiel:

- die weiterhin immensen Aufwendungen für Forschung, Entwicklung und Produktion,

- die weiter unverändert raschen Verfahrens- und Produktinnovationen und

- die Probleme der erforderlichen "economy of scale", ohne die nicht kostendeckend produziert werden kann.

Über die Hälfte der 1984 begonnenen Projekte hat schon heute, nach drei Jahren, zu verwertbarer Technologie geführt - mit Ausstrahlung auf die Wettbewerbsfähigkeit unserer Industrie auf dem Weltmarkt.

Leider kann ich auf die beeindruckenden wissenschaftlichen und technologischen Erfolge, die als Ergebnis von ESPRIT I bereits vorliegen, nicht eingehen. Die Grundlagen für eine erfolgreiche Fortführung der Arbeiten sind so gelegt.

Nun, da wir für die zweite Phase von ESPRIT eine Verdopplung des Finanzvolumens planen, kann und muß sich der Impakt des Programms noch verstärken. Die für ESPRIT II vorgesehenen Ausgaben summieren sich auf über 20.000 Mann-Jahre über einen Zeitraum von 5 Jahren.

Niemand unterschätzt die Größe der Aufgabe, die noch vor uns liegt. Es ist meine feste überzeugung, daß wir sie nur gemeinsam bewältigen können. Wir brauchen eine koordinierte Generalmobilmachung all unserer Resourcen, um den Innovationsschub zu leisten, der Europa voranbringt. Niemand hindert uns daran, diese Bewegung in Gang zu setzen. Wir brauchen dazu "nur" den erklärten politischen Willen aller Mitgliedstaaten.

Die Kommission ist bereit und in der Lage, den Rahmen zur Verfügung zu stellen, innerhalb dessen die gemeinsamen Bemühungen organisiert werden können. Dies wird im Fall von ESPRIT II nach den Prinzipien und Verfahren geschehen, die sich in der Vergangenheit bewährt haben. Dazu zähle ich insbesondere das flexible Management und die geringen

Verwaltungsaufwendungen, die sich mit sehr gutem Gewissen an den Zahlen vergleichbarer nationaler Programme messen lassen.

Selbstverständlich müssen im Blick auf das Jahr 1992 auch die allgemeinen Rahmenbedingungen "stimmen", die die europäische Wirtschaft braucht, um sich in der Spitzengruppe der Welt zu behaupten. Ohne sie und einige komplementäre Politikinitiativen können die Ergebnisse von Forschung und Entwicklung nicht in wirtschaftlichen Erfolg umgesetzt werden - weder nach innen noch im internationalen Kräftespiel.

Die Gemeinschaft, wir alle sind gefordert, nicht im Blick auf eine vage Zukunft, sondern hier und jetzt und heute.

Die Kommission tut alles in ihrer Macht stehende, um zu erreichen, daß der Beschluß über ESPRIT II noch in diesem Jahr gefällt werden kann und die Arbeiten sobald wie möglich danach anlaufen. Wir wissen, daß unsere Partner in Industrie und Forschung dies auch als Notwendigkeit ansehen.

Die Gemeinschaft wird ihre Schwächen nur überwinden, ihre Ziele nur erreichen, wenn technologische und industrielle Kooperation weitergeführt und gestärkt werden. Nur auf dieser Grundlage wird es möglich sein, innovative Produkte und Dienste anzubieten, die auf dem großen Binnemarkt sowie auf den Weltmärkten bestehen können. ESPRIT hat gezeigt: Europa braucht auf keinen Erfolg zu verzichten, wenn es zuammenensteht.

Es ist ein schlafender Riese, wir alle werden aufgerufen und haben die Pflicht, ihn aufzuwecken.

Ich danke Ihnen.

OPENING ADDRESS

Karl-Heinz Narjes

Vice-President

Commission of the European Communities

Ladies and Gentlemen,

The ESPRIT conference is one of the engagements on my calendar that I particularly look forward to, because it brings me together with men and women who feel a sense of mission and who are prepared to play a part in determining the shape of our lives in the future. This comes as a welcome change from the attitude of the many in society who seem to pride themselves on wanting to maintain the traditional structures at the expense of the taxpayer and, ultimately, at the expense of the workers concerned, at virtually any price. That price is our future and our children's future.

It is therefore especially gratifying for me to be able to welcome some 4000 research scientists, engineers and businessmen and women from the information technology industry to Brussels this week. The ESPRIT conference is always an impressive event in terms of both quality and quantity. This year is no exception, with

- 17 workshops,
- 2 parallel conferences,
- 50 demonstrations of ESPRIT projects, and
- 800 potential proposers taking part in Proposers' Day.

The ESPRIT programme, and the common research and development policy of which it is the expression, stand in marked contrast to those policy areas and issues which, regrettably, far too often make the headlines and place an excessive strain on the budget.

If ESPRIT has already become one of the undeniable successes of a forward-looking Community policy, it is thanks to you. You have all in one way or another, in one capacity or another, contributed to the success of a venture which, when all is said and done, was only launched in 1984.

I am pleased to be able to announce that we have for the conference four speakers who have made truly outstanding contributions to the planning and implementation of a Community strategy in the field of information technologies and telecommunication.

Let me welcome

- Mr. Bertel Haarder, Minister for Research and technology of the Kingdom of Denmark and President-in-Office of the Council of Research ministers.

- Mr. Michel PONIATOWSKI, former Minister, and Member of the European Parliament, where he is Chairman of the Committee on Energy, Research and Technology;

- Mr. Cornelius VAN DER KLUGT, President and Chairman of Philips; and,

- Mr. Jacques STERN, Chairman and Chief Executive of Bull.

I am certain that everyone in this auditorium will be looking forward with the same keen interest as myself to what these speakers have to say.

The 1987 ESPRIT conference is an opportunity to take stock of what has been achieved and to look ahead to what has still to be done. First of all, however, I should point out that the context in which the 1987 ESPRIT conference is being held differs from that of previous years. On 1 July 1987 the Single European Act came into force. It opens up encouraging prospects - in particular for the two policy areas which form the main topic of today's discussions, namely technology and the market.

Let me deal first with the technology aspect.

The Single European Act gives the Commission the task of drawing up a multi-annual framework programme of research and technological development which is implemented, in turn, via specific programmes like ESPRIT.

Last year at this rostrum I drew attention to the urgent need for an early decision on the framework programme. In the meantime that decision has been taken - unfortunately not without considerable delay, which was due in part to the fact that the Single Act requires a unanimous decision by the 12 Member States for the adoption of the framework programme. A veto by one Member State was therefore capable of preventing a rapid decision.

Indeed, the delay raised doubts about the Community's ability to guarantee even a minimum degree of continuity in its programmes in the Information Technology field. This is why I have no hesitation in criticising the fact that the procedures laid down for the adoption of the framework programme bear scant relation to the scale of the challenge which faces us in the field of industrial development and international technological competition. We are gambling with Europe's future if we take the step into the 21st century in a frame of mind and with methods that are more suited to the 19th Century or to an oriental market than to the demands of highly developed industrialised societies on the threshold of the next millennium.

The research framework programme is intended as the Community's contribution to the technological boost which European industry needs if it is to take on and beat the competition. This is true not just of Information Technology and telecommunications. The framework programme covers a number of major areas which are important for the technological development of our continent. These of course - apart from information technology and telecommunications - include health and environmental protection, biotechnology, exploitation of the seabed and marine resources, measures in the energy sector, the application of new technologies to the modernisation of industry - to mention only the main headings. Information and communication technologies play a central role in the framework programme, commensurate with their technological and industrial importance, and that is reflected in their share of the budget. Nearly 40% of the total funding of the framework programme is earmarked for these key areas. As you also know, the level of appropriations proposed by the Commission for the framework programme was well above that which was agreed by the Council of Ministers.

In the end we accepted a smaller amount of funding both for the framework programme in general and for the second phase of ESPRIT in particular. We did so because the alternative was the prospect of further wrangling over the budget, with the attendant risk of the shelving of projects, the laying off of staff and a loss of the intrinsic momentum of the programme. We were not prepared to take that responsibility, since it was neither in the Community's interest nor in the interest of those people who are working in firms and laboratories in the R&D sector.

The important thing now is to push the specific programmes through Council as quickly as possible. Fortunately, unanimity is no longer required for the adoption of these programmes, only a qualified majority. But even though the Member States no longer have the right of veto, the adoption of individual programmes is still a very time-consuming business - too time-consuming to my mind.

What then are the matters currently before the Council awaiting a decision?

First and foremost, of course, the second phase of ESPRIT.

Two days ago we presented the Commission's proposals for ESPRIT II to the Council. Naturally these were drawn up in the light of results and experience to date and taking into account the likely trends and developments in the sector in question.

What will not change under ESPRIT II, however, are the principles which characterised ESPRIT I and which have been the key to the success of the programme so far, namely:

- keeping to strategic objectives formulated jointly by industry and the Commission working in partnership;

- concentrating efforts on precompetitive research and development work only;

- industry-oriented transfrontier cooperation between independent partners of all sizes, in all Member States;

- funding of 50% of the project costs from the Community budget.

A new element with important practical implications will be our proposal to widen our scope and provide the opportunity for partners from EFTA countries to take part in certain projects. We anticipate that this will usefully complement the work we are doing.

Another important individual programme on which we want to see an early decision by the Council of Ministers is the main RACE programme. RACE is intended to be the Community's contribution to the preparation of a scenario for integrated broadband communication by the end of this century. It is a complex operation involving a large number of different partners and interests which are by no means all confined to research and development activities. The experimental "definition" phase which we implemented in 1985/86 produced extremely encouraging results. But here, too, valuable time was lost owing to the unjustified delay affecting the framework programme, which now has to be made up.

Lastly, I should mention three "applications" programmes which - although they involve smaller amounts of funding - are of considerable importance for the Community. These are the DELTA, AIM and DRIVE programmes, which are also before the Council.

These programmes cover the use of information and communication technologies in such diverse areas as teaching and learning technology, health care and road transport. In all three areas we can identify new technological situations and developments; in all three areas markets are growing up to which we have to adjust and for which we must have the regulatory framework, infrastructure and standards ready in good time. This necessitates coordination and consolidation of the work that is already under way in the Community. The onus is on the Council to make the way clear for a Community initiative.

A significant delay in any one of these programmes would have very damaging effects which we can ill afford.

I know that you, Minister Haarder, as President-in-Office of the Council, appreciate the urgency of the need for Council decisions on these programmes. We have to make up for lost time and for this we need the Council's active support. No-one would be more pleased than those gathered here if the breakthrough which Europe needs were to be achieved during your Presidency.

Mr. Poniatowski, in his noteworthy second report on Europe's response to the modern technological challenge, makes the telling point that Europe is facing a strategic challenge, whose implications go beyond the technological and economic spheres, because it is also an existential challenge, both politically and socially.

The worldwide technological challenge confronting us will intensify further in the years ahead. In addition to Japan and the USA, countries such as the Soviet Union, India, China or Korea will also, to an increasing extent, be trying to flex their technological muscles.

A far more serious matter however, is the fact that competition for technologies and markets is becoming increasingly politicized. Firms, even entire industries, who want to gain a foothold or keep their ground in the market, are increasingly becoming the target of political threats and pressures. By the same token, of course, companies and industries are trying more and more to mobilize such political weapons to further their own interests.

Unfortunately, at the present time I do not believe that GATT is capable on its own of undoing the damage that has been done to world trade. We cannot expect a rapid solution to the problems from that quarter. Europe and Europe's companies must look for another response to the challenge which I have outlined. The response cannot come from the individual Member States - it must be backed by the collective negotiating strength of a Community of 320 million people.

Our precompetitive research and development programmes, such as ESPRIT, are a case in point. We have always considered them as part of Europe's response to the strategic challenge. The "S" in ESPRIT stands for strategic.

The strengthening of the technological base of our industries and the dissemination and application of these technologies are crucial to industrial innovation. Innovation in turn is fundamental to the competitiveness of individual firms, and even of entire economies, on the increasingly tough world markets. It is in this context that I resolutely defend the Community's technology programmes. At the same time I am bound to emphasise that even technology programmes need to be continually reviewed to check that they are still conducive to the attainment of that higher objective, namely the creation of an internal Community market. The Commission has been guided by that objective in the formulation and implementation of the programmes. It will likewise do its utmost in the future to avoid contradictions and conflicting trends and to ensure that measures complement each other. One area where this applies in particular is coordination with EUREKA.

Research and technological development, however, are merely one aspect of the efforts to establish a Community-wide internal market by 1992. Even at the risk of repeating what I already said here last year, I must once again underline the following points:

- the internal Community market requires the rapid preparation and implementation of technical standards;

- the internal market cannot succeed unless we liberalise the public procurement and amend copyright and competition law;

- we have to harmonize the regulatory framework and agree on a European patent convention which - as you know, Minister Haarder - the Danish Parliament has unfortunately also been unable to approve;

- the internal market depends on the rapid adjustment of our industrial structures.

The Commission is the prime mover in this process and it accepts that responsibility. But it is equally true that real success can only be achieved in collaboration with the governments of the Member States, with industry and with users. The one argument does not exclude the other.

The telecommunications sector demonstrates very clearly the complexity and inseparability of the problems to be solved. As many of you will know, earlier in the year the Commission submitted a discussion document in the form of its Green Paper on the development of a common market for telecommunications services and equipment. The telecommunications sector provides a good illustration of the interrelated set of problems and responsibilities to which I referred: rapid technological advance has led to the advent of new equipment and services, new competitors have appeared on the market. The markets have acquired an impressive dynamism as a result. These markets are increasingly becoming global markets and show up as naive and fanciful the stubborn attempts to draw national demarcation lines and to "go it alone".

Europe cannot afford to close its eyes to these trends. The Commission's Green paper is therefore meant as a contribution to a debate which will lead ultimately to a reorganisation of the telecommunications sector in the Community tailored to European conditions. This reorganisation must satisfy the requirements of the new market situation and conditions of competition, while taking full account of the fact that in our society telephone communication has become a kind of basic social need. It must lead to unified standards which, firstly, will make it possible for the increasingly complex equipment and systems to inter-communicate and which, secondly, are a pre-requisite for the growth of sufficiently large markets from which Europe's industry will be able to operate successfully worldwide.

Clearly, the establishment of a Community-wide market for telecommunications equipment and services is not something that is going to come about overnight as a result of a simple statement of intent. The creation of a Community telecommunications area can only be the result of a long process which will require a purposeful and determined effort on our part.

In the same way, the establishment of a European Technology Community has to be the result of an ongoing development, in which the ESPRIT programme fits well into the role of catalyst. We do not claim that the ESPRIT programme is the solution to all our problems. But the ESPRIT programme does serve as an excellent model for industrially-targeted precompetitive research and development in Europe.

Information and communications technologies are the key to Europe's industrial and economic development and to its stature in the world. It is no coincidence that this is the very area which our competitors are trying, using virtually every possible means, to capture and dominate. The volume of state aid and subsidies that have been pumped into these sectors from all sides is unprecedented in recent economic history, with the exception perhaps of the armaments industry during wartime.

So we should not listen to the persuasive arguments of those who would us believe that economic performance and competitiveness can only be maintained in future by concentrating on the conventional sectors of the economy. There are hardly any sectors now which are not heavily dependent on information and communication technologies.

Failure to be among the leaders in information technology will cost us the race, at the expense of our own economic vitality. A semiconductor agreement is enough to do the damage.

I made the point earlier that information and telecommunications technologies account for a substantial share of the Community's research programme. ESPRIT is the largest single programme due to be carried out over the next five years. The struggle we had to push this programme through against considerable resistance is still fresh in our memories. Throughout that period we were always able to rely on the excellent cooperation with industry. At this juncture I should like once again to thank Mr van der Klugt and Mr Stern for the way in which they and their colleagues in industry and research recognised the signs at that time and, jointly with us, framed a European strategy.

Now we are planning the work for the years ahead. Fortunately we are not starting from square one - on the contrary.

Let me remind you of the salient facts. Since the beginning of the programme in 1984, over 220 projects have been subsidised under ESPRIT, involving the participation of around 450 different organisations. These include the 12 major companies who provided the impetus for the development of the programme at the time, as well as many small and medium-sized businesses, whose record of efficiency in a large number of specific areas is impressive. These include specialised research centres and university institutes. I should mention especially the dynamic role of the smaller Member States.

The amount of 1500 million ECU allocated for the first phase was felt by many to be too modest to achieve anything worthwhile. We have always countered that view with the argument:

That cooperation on a significant scale, both among industrial firms and also between firms, universities and research establishments, has been set in motion throughout Europe, even if certain structural features peculiar to the Information Technology sector do not always make cooperation easy. I am thinking here, for example, of:

- the vast amounts which continue to be spent on research, development and production;

- the continuing rapid rate of innovation in products and processes;

- the problem of the necessary economies of scale without which manufacturers cannot cover their costs.

Over half of the projects started in 1984 have already led to usable technology after three years, with spin-offs in terms of the competitiveness of our industry on the worlds market.

Unfortunately, I cannot go into the impressive scientific and technological results which have already been achieved under the first phase of ESPRIT. Suffice it to say that the foundations have been laid for the successful continuation of the work.

Now, because we are planning to double the amount of funding for the second phase of ESPRIT, the programme will have an even greater impact. The appropriation set aside for ESPRIT II will finance a total of 20,000 man-years over a five year period.

No-one underestimates the scale of the task still facing us. I am firmly convinced that we can only accomplish that task together. We need a coordinated wholesale mobilisation of all of our resources in order to generate the impetus Europe needs for innovation. No-one is stopping us from setting this process in motion. "All" it takes is the declared political resolve of all the Member States.

The Commission is willing and able to provide the framework within which these joint endeavours can be organised. In the case of ESPRIT this will be based on principles and procedures which have proved their worth in the past. I am thinking here in particular of flexible management and the low administrative costs which compare favourably with the costs of similar national programmes.

Clearly, with an eye to 1992, the overall framework that the European economy needs to hold its own among the world leaders must also be right. Without that and certain complementary policy initiatives the results of research and development cannot be adequately converted into economic success, either internally or in the international arena.

The onus is on the Community - that means on all of us - and not at some undefined point in the future, but here and now.

The Commission is doing its utmost to secure a decision on the second phase of ESPRIT before the end of this year, and to ensure that work can begin as soon as possible after that. We know that our partners in industry and research regard this as a necessity.

The Community will only overcome its weaknesses and attain its goals if technological and industrial cooperation is continued and strengthened. That is the only basis on which it will be possible to supply innovative products and services which can hold their own both on the large internal market and on world markets. ESPRIT has demonstrated that Europe is capable of whatever it sets out do to, if it works together.

Europe is a sleeping giant and it is the duty of all of us to awaken him.

Thank you.

Jacques Stern
Président Directeur Général, Bull

Le projet ESPRIT, qui soulevait à la fois des espoirs importants mais encore plus de doutes dans l'esprit de beaucoup de gens - ce projet ESPRIT I se termine, et va être repris par un projet encore plus ambitieux, ESPRIT II. Cette période de transition est extrêmement favorable pour faire le point et fixer nos objectifs pour l'avenir.

Ce n'est pas devant une telle audience que je dois rappeler l'importance des technologies de l'information. Nous savons que sur le plan économique, elles représentent aujourd'hui le troisième marché mondial, et même si l'on observe une certaine diminution de sa croissance, ce marché reste de très loin le domaine du plus fort développement. Je suis persuadé qu'après une période relativement courte de ralentissement nous allons reprendre une vive expansion, car nous entrons dans une ère de la communication et de l'information où la société, en général, sera basée, bâtie autour de ces systèmes d'information.

Aucune entreprise aujourd'hui ne peut se passer de technologies de traitement de l'information; celles-ci sont à la base de la prospérité du monde occidental depuis la fin de la guerre et je dirai que même - peut-être paradoxalement - leur progrès et leur puissance sont à l'origine de la crise économique que traverse le monde occidental aujourd'hui, car ces technologies ont permis à l'ensemble de l'économie mondiale de se développer pour atteindre des tailles insoupçonnées il y a trente ans, sans remettre en cause ni les comportements humains, ni les organisations.

Et d'ailleurs John Von Neumann, qui est bien connu de la majorité d'entre vous, écrivait en juin 1955 que le progrès de ces technologies allait, dans les années 1980, amener une crise d'une telle ampleur que personne ne savait ni quand, ni comment, ni dans quel état le monde occidental en sortirait.

Or il sortira de cette crise par les progrès de nos technologies, par l'organisation de la société autour de ces technologies. C'est un nouveau monde qui doit se créer, s'organiser, se structurer, et nous voulons être présents dans cette évolution. Nous ne voulons pas la subir. Nous voulons la maîtriser, nous voulons la conduire, pour le plus grand bien de tous.

Quelle ambition ! Et est-elle justifiée après toute l'histoire de nos technologies telle que nous l'avons connue ?

Pendant trente ans l'industrie européenne n'a fait que décliner, perdre des parts de marché. Avant la dernière guerre mondiale, pratiquement les deux tiers du marché mondial des technologies de l'information étaient contrôlées par des sociétés européennes, françaises et britanniques. Au début des années 80, cette part de marché mondial était passée à environ 10% alors que l'Europe compte pour 30% du marché mondial.

Devait-on laisser une telle situation se prolonger ? Tout le monde y paraissait résigné; les Etats européens quant à eux se sentaient suffisamment confortés par des programmes informatiques nationaux. Il n'est pas étonnant qu'une initiative comme ESPRIT, lancée par la Commission au tout début des années 1980 ait recueilli à la fois tellement d'espoirs et tellement de doutes. Tant d'espoirs parce que les enjeux étaient importants, tellement de doutes car nous avons une qualité extraordinaire en Europe : celle de douter en permanence de nous.

De nombreux facteurs expliquent la situation de l'industrie européenne à l'aube de ces années. Les politiques nationales, en protégeant les entreprises nationales, les ont confinées à un marché local trop étroit et les ont empêchées de développer en Europe et dans les pays occidentaux un marché significatif. Aucune de ces sociétés, eu égard à la modestie de ses parts de marché, n'avait la capacité de financer convenablement l'effort de recherche et de développement qui était nécessaire pour être présent sur un marché mondial.

Il n'existait pas de marché européen. L'Europe reste encore aujourd'hui un amalgame de marchés nationaux avec des règles, des normes, des contraintes qui rendent difficile le déploiement de systèmes et de produits à l'intérieur même de son espace, alors que l'industrie américaine bénéficie d'un marché qui représente 50% du marché mondial, un marché uniforme, cohérent, homogène, qui lui permet d'absorber ses produits, ses technologies, ses compétences.

ESPRIT devait mettre un terme à ce déclin et faire en sorte d'aider l'industrie européenne à reprendre le dessus, sur son propre marché pour commencer.

Trois objectifs importants étaient fixés à ce programme:

- le premier, bien évidemment, était de faire en sorte que l'industrie européenne retrouve le niveau technologique nécessaire au développement de ses produits et de ses systèmes sur ses marchés et de l'aider à développer les technologies au niveau compétitif mondial;

- le deuxième était d'apprendre à l'industrie européenne à coopérer. J'allais dire : apprendre à l'Europe le sens de la solidarité industrielle, économique, culturelle, mais c'est trop ambitieux. Il fallait déjà, par petites étapes, apprendre à se connaître, à travailler ensemble, faire en sorte que l'industrie apprenne à collaborer avec les laboratoires publics et les laboratoires universitaires de recherche.

- le troisième, par la promotion de standards, consistait à développer les bases de coopération industrielle et commerciale en Europe et de l'existence du marché européen.

Qu'en est-il aujourd'hui ? Je crois que sans aucun doute possible, personne ne peut remettre en cause le succès d'ESPRIT.

Sur le plan économique, après toute cette phase de déclin de plus d'un quart de siècle, l'industrie européenne redresse la tête. Alors que parmi les vingt-cinq plus grandes sociétés d'informatique sur le marché européen, les entreprises européennes ne représentaient que 34,3% du marché en 1981, en 1985 elles gagnaient plus de deux points pour passer à 36,4%; et en 1986, la part des sociétés européennes parmi les vingt-cinq premières sociétés en Europe atteignait 42,5%.

Ce progrès qui tient certes pour une part au ralentissement du marché américain, et également en partie aux fluctuations du dollar, s'est produit sur un marché des plus concurrentiels. Existe-t-il en effet un marché au monde aussi ouvert à tous les produits, à toutes les techniques que le marché européen ? Sur le plan mondial, nos entreprises européennes représentaient en 1980 11,3% du chiffre d'affaires réalisé par les vingt-cinq premières sociétés mondiales; en 1985 ce ratio passait à 14,6% soit une croissance de plus de 3 points. Tels sont les résultats; imputables certes, à bien des raisons, mais on ne peut plus parler de déclin. Non seulement le déclin a été arrêté, mais l'industrie européenne a pu démontrer que par la coopération et les efforts engagés dans ESPRIT, elle retrouvait une croissance sur le plan mondial.

Dans le domaine technologique, certains projets issus d'ESPRIT représentent aujourd'hui des normes importantes dans le marché européen et fournissent les bases sur lesquelles vont se développer non seulement l'industrie européenne de l'information, mais toute l'industrie, toute l'économie européenne. Il en est ainsi du projet PCTE; environnement atelier de génie logiciel, qui devient la norme en Europe pour les ateliers d'ingéniérie en logiciel et qui intéresse aujourd'hui le Pentagone aux Etats Unis. Ainsi de ROSE, ce réseau de communication entre laboratoires de recherche associés au projet ESPRIT, basé sur le système UNIX et sur les standards de communication OSI. Ainsi de PODA, système permettant de démontrer la capacité d'échanger et de communiquer des documents entre des systèmes hétérogènes.

L'Europe a aujourd'hui à la fois les outils et les produits pour être présente sur la scène internationale. Dans le domaine des standards et de la coopération, les industriels européens ont été les premiers à assurer la promotion du modèle OSI pour l'interconnection de systèmes hétérogènes avec des protocoles définis par l'ISO et le CCITT. Dès 1983, les industriels européens formaient une organisation, SPAG, pour la promotion de ces standards, la définition de profils et de standards fonctionnels pour assurer l'intercommunicabilité de systèmes hétérogènes; SPAG se base sur des standards internationaux, car l'industrie européenne veut l'ouverture des marchés, veut la compétition; et non seulement avons-nous mené ce combat en Europe, mais nous avons voulu dès le départ y associer nos collègues américains et nos collègues japonais. Après l'initiative de SPAG, l'industrie américaine de l'informatique, des télécommunications, du logiciel, les grands opérateurs de réseaux de communication, les grands utilisateurs comme General Motors, Boeing, Kodak, Citicorp se sont associés dans une organisation similaire COS. COS et SPAG travaillent ensemble pour promouvoir ces nouveaux standards, faire en sorte qu'existent ces systèmes distribués permettant à des produits hétérogènes de partager des fichiers, des traitements, des communications.

Ce n'est plus un rêve, c'est une réalité, et quiconque s'opposerait aujourd'hui à cette réalité, s'exclurait du marché.

Dans le domaine des systèmes d'exploitation, il fallait à la fois définir un système d'exploitation qui soit un standard pour l'industrie européenne, en particulier dans le domaine de la recherche, qui facilite le portage d'applications développées par l'industrie européenne du logiciel, l'une des plus vivantes, des plus dynamiques, des plus puissantes aujourd'hui dans le monde, de manière à ce que ses produits puissent fonctionner aisément sur des matériels incompatibles. Très tôt les six principaux constructeurs européens d'ordinateurs se sont associés dans X-OPEN pour promouvoir une structure UNIX et des standards d'interfaçage de programmation et définir les nouvelles fonctionnalités que requiert le marché.

Aujourd'hui, d'autres sociétés européennes et américaines se sont jointes aux premières sociétés européennes pour promouvoir ces standards sur une base mondiale.

Dans un domaine plus restreint, notre compagnie BULL, très tôt, s'est associée avec ICL, Siemens, les trois principaux constructeurs de systèmes centraux en Europe, pour doter un laboratoire de recherche dans les techniques avancées d'intelligence artificielle, orientées sur la programmation logique. Aujourd'hui, tout m'autorise à dire que dans l'ECRC - initiative purement industrielle mais qui aurait été inconcevable si ESPRIT n'existait pas - nous avons certainement une des meilleures équipes du monde dans ce secteur. Les progrès réalisés, les résultats obtenus sont déjà exceptionnels et apparaîtront très rapidement dans les produits développés par ces constructeurs.

Voilà des inititiatives qui, aujourd'hui, nous permettent d'espérer en l'Europe. D'autres initiatives de caractère plus industriel, plus commercial, ont pu se développer dans le prolongement d'ESPRIT; il en est ainsi à titre d'exemples de l'initiative que nous avons eue, Olivetti et nous, de développer ensemble des automates bancaires; que Philips et Siemens ont eue pour le développement de technologies très avancées dans le domaine des technologies CMOS.

L'Europe de 1987 n'est plus l'Europe de 1980. ESPRIT I, c'est 220 projets, 250 sociétés en coopération, 170 laboratoires de recherche académiques, publics, travaillant ensemble et avec l'industrie, c'est un effet multiplicateur tout à fait considérable; c'est un vaste mouvement qui a déferlé sur l'Europe. Lorsqu'on regarde tous ces progrès, on ne peut aujourd'hui qu'espérer plus pour l'avenir.

Le doute n'est plus permis et le scepticisme doit faire place à l'ambition. ESPRIT II, nous le savons, est né dans la douleur mais ESPRIT II est là, et si ESPRIT I a permis un grand foisonnement de projets indispensables pour créer le mouvement à un moment où aucun passé de coopération n'existait en Europe, il a eu ses faiblesses auxquelles ESPRIT II doit remédier.

Nous nous réjouissons de tous les résultats positifs, qui l'emportent de très loin. Mais comment assurer une cohérence entre autant de projets, autant d'entreprises travaillant dans le domaine de la recherche précompétitive ? Combien de ces projets déboucheront sur des résultats exploitables, des produits qui trouveront un marché ? ESPRIT II doit avoir aujourd'hui d'autres ambitions et se concentrer sur les projets stratégiques pour l'Europe. Nous ne sommes plus simplement maintenant au stade où l'industrie européenne a à apprendre à travailler. L'industrie européenne doit maintenant, ensemble, reconquérir ce marché, et conquérir d'autres marchés.

Le problème n'est pas simple, entre un projet de recherche précompétitive mené par une organisation comme la Commission de Bruxelles et les projets EUREKA, beaucoup plus orientés vers le marché, mais avec toutes les difficultés que l'on retrouve dans tel ou tel pays pour réellement le mettre en oeuvre, sans une véritable stratégie industrielle européenne.

Comment faire ? Il serait souhaitable d'associer ESPRIT et EUREKA, de façon que l'industrie européenne reprenne le contrôle des domaines stratégiques, coopère non seulement au niveau de la recherche précompétitive mais que cette coopération débouche sur des produits, sur des marchés. Pour cela, il va falloir que nous acceptions qu'à l'exemple de ce qui se passe dans d'autres pays du monde, plus de responsabilités soient laissées à l'industrie concernée.

ESPRIT I a été révolutionnaire. Pour la première fois dans notre histoire en Europe, l'industrie a été consultée pour savoir ce qui était critique et stratégique pour elle. L'industrie a participé à la définition du programme ESPRIT I, a défini les domaines de coopération, mais la responsabilité de l'industrie a été moins élevée dans le choix des projets, des coopérations. Il faut faire en sorte que les sociétés qui auront demain la responsabilité de développer les technologies, de fabriquer les produits, de commercialiser et de soutenir ces produits sur un marché mondial, aient non seulement la responsabilité de définir les objectifs mais également celle de la mise en oeuvre.

Il faut que nous acceptions que les quelques grands industriels dans chaque secteur, qui auront une responsabilité de leadership, tant en Europe que sur le marché mondial, assument l'ensemble de leurs responsablités. C'est ainsi que cela se passe aux Etats-Unis et au Japon. A cet égard n'ayons aucune honte, aucun complexe : aux Etats-Unis comme au Japon l'effort du gouvernement est tout à fait considérable, sans qu'il y ait besoin de multiples réunions pour que douze chefs d'Etats se mettent d'accord sur un projet de recherche.

Aux Etats-Unis, 50% de la R&D sont financés par le gouvernement fédéral, soit à travers ses laboratoires, ses universités, soit par des financements à l'industrie, mais 75% de cette R&D sont réalisés par l'industrie. Dans le domaine de l'électronique civile, près de 70% des financements sont effectués par le département de la défense (68% en 1986 autour d'un nombre de projets très limité) et sur chacun de ces projets 90% des financements vont au maximum à quatre sociétés. Il en est de même au Japon, où à travers des projets comme les composants, les supercomputers, l'industrie japonnaise a pu se hisser parmi les premières sur le marché mondial sous le contrôle du MITI, avec un engagement des quelques sociétés qui allaient jouer un rôle moteur à l'échelle mondiale.

Nous devons en Europe nous concentrer pour une large part sur ces grands projets, autour des entreprises qui auront un leadership et leur donner la responsabilité d'associer dans l'effort de R&D, de fabrication, de commercialisation, l'ensemble des entreprises, petites et moyennes, ou plus importantes, plus spécialisées, l'ensemble des sociétés du logiciel, l'ensemble des laboratoires de recherche publics, pour contribuer à ce succès dans une cohérence, une détermination sans faille.

Parmi ces projets, certains méritent d'être mentionnés :

- Est-il acceptable que l'Europe n'ait pas une famille de microprocesseurs, alors que deux ou trois familles de microprocesseurs tous d'origine américaine aujourd'hui se retrouvent dans les micro-ordinateurs, les postes de travail, les mini-ordinateurs, ces produits de télécommunication? Doit-on accepter que l'industrie et l'économie européennes dépendent à jamais de deux ou trois fournisseurs américains?

- Est-il acceptable que l'industrie européenne soit totalement absente des systèmes périphériques magnétiques alors que ces produits représentent aujourd'hui une large part de revenus des entreprises informatiques et l'un des facteurs déterminants des performances et de la compétitivité des systèmes?

- Est-il acceptable, alors que les marchés existent, que l'industrie européenne n'ait pas de supercalculateurs scientifiques alors que ces supercalculateurs sont stratégiques non seulement pour la défense, pour la recherche mais aussi pour tous les secteurs économiques, que ce soit l'industrie aéronautique, l'industrie automobile, la chimie, la pharmacie, la banque.

Notre présence sur ces marchés dépendra de notre volonté commune d'y pénétrer. Une volonté à la fois de l'industrie et des pouvoirs publics. Il faut que la Commission de Bruxelles et les gouvernements européens soient bien conscients de leurs responsabilités qui ne se limitent pas à financer la R&D.

Il appartient par ailleurs à la Commission et aux gouvernements européens d'imposer sur l'ensemble de leurs marchés, dans tous les appels d'offre, pour l'ensemble de leurs besoins, ces normes internationales que notre industrie promeut et observe car si la puissance politique n'intervient pas, comment ces normes s'imposeront-elles ? Comment l'ensemble des utilisateurs pourront-ils être garantis dans l'avenir ?

Il faut que la Commission européenne et les gouvernements européens fassent en sorte que dans le système éducatif, dans nos laboratoires de recherche, les produits de l'industrie européenne soient très largement présents, car comment autrement bénéficier de toutes les retombées de la recherche et comment faire en sorte que tous ces jeunes que nous formons croient en l'avenir de nos technologies ?

Il faut que la Commission européenne et les gouvernements européens aident à l'ouverture de ce grand marché européen que nous attendons et par-dessus tout - et c'est pour moi la priorité - que très rapidement se mette en oeuvre un véritable réseau de communication en Europe, cohérent, homogène, uniforme, avec pour toute l'Europe, les mêmes règles de connectivité, de tarification, d'adressage et de numérotation avec les mêmes services.

L'industrie et l'économie européennes de demain se développeront autour de ces réseaux. Cela implique qu'on arrête cette cacophonie en matière de réglementation et de déréglementation. Pour aboutir à une réglementation européenne, en particulier pour cet élément essentiel que sont les infrastructures de communication, un organisme européen supranational s'impose.

L'Europe s'est construite dans le passé sur ses rivières, sur ses routes, ensuite sur ses voies ferrées et ses voies de communications aériennes; elle se construira demain sur l'ensemble des communications éléctroniques. C'est une haute responsabilité qui nous incombe et qui concerne non seulement les infrastructures mais aussi les services de valeur ajoutée. Et si nous manquons cette occasion, qui nous dit quand nous la retrouverons?

Aujourd'hui, plus que jamais, nous avons raison d'avoir confiance en l'avenir; l'industrie européenne a redressé la tête, elle sait maintenant qu'elle peut coopérer très largement, qu'elle peut conquérir des marchés.

Il reste à l'ensemble du monde économique à lui faire confiance, et sachez que nous, industriels européens, sommes parfaitement conscients des responsabilités que nous assumons, non seulement bien sûr vis-à-vis de nos clients qui sont la base de notre action, vis-à-vis de nos collaborateurs qui veulent comprendre où nous les menons et qui demandent à être motivés pour un avenir, mais aussi vis-à-vis de toute la jeunesse, et je tiens à ce que vous sachiez que nous avons tous sans exception, une totale détermination à faire en sorte que cette jeunesse ait devant elle, pour l'Europe, un projet ambitieux.

Jacques Stern

Chairman and Chief executive Officer, Bull

The idea of ESPRIT, which awoke at the same time great hopes and even greater doubts in many people's minds - this ESPRIT I is coming to an end and will be continued by an even more ambitious idea, ESPRIT II. This is a good moment to take stock and to decide our objectives for the future.

This audience needs no reminding of the importance of information technology. IT is the third biggest market in the world, and although we can see its rate of growth now diminishing somewhat, it remains by far the fastest-growing of all industries. I am convinced that, after a short pause, we are going to see further rapid growth, because we are entering an era of communication and information; all our society will be built around information systems.

No company today could function without information technology; information technologies have been the foundation of the prosperity of the western world since the end of the war. I would even say that - perhaps paradoxically - the progress and power of information technology have caused the economic crisis which the western world is undergoing today, because these technologies have allowed the world economy to develop on a scale unsuspected thirty years ago, without changing human behaviour or organisational structures.

Indeed John Von Neumann, whom most of you will know of, wrote in June 1955 that the progress of these technologies would lead to a crisis of such a scale that no one knew when nor how nor in what condition the western world would emerge.

In fact we will resolve this crisis by technological progress, by organising society around these new technologies. A new world must be created, organised, and structured, and we wish to participate in this evolution. We do not want to suffer it; we want to master it, to lead it, for the good of all.

This is an ambitious objective; is it an attainable one, bearing in mind the history of our relationship to technology?

For thirty years, the European IT industry has known nothing but decline and the loss of market share. Before the second world war, virtually two thirds of the world market in information technology was supplied by European companies, French and British. By the beginning of the 1980's less than 10% of the world market was supplied by European companies, although Europe represents 30% of the world market.

Was such a situation to be allowed to continue? Everyone seemed resigned to it. The European countries felt sufficiently comforted by their various national programmes. It is no surprise that at the beginning of the 1980s an initiative like ESPRIT, launched by the Commission, should have inspired so many hopes and so many doubts. So many hopes because the stakes were so high: so many doubts because here in Europe we have this extraordinary ability to cast doubt on everything we do.

There are many factors which go to explain the position of the European IT industry at the start of this period. National policies which protected national companies, had the effect of confining them to too narrow a market, and prevented the companies concerned from developing a significant market share in Europe and the western world. Given their limited market share, none of these companies had the financial resources to support adequately the R & D effort necessary for a presence on the world market.

There was no such thing as a European market. Europe was, and is still, a hodgepodge of national markets, with a variety of regulations, standards, and constraints which make it difficult to supply systems and products even within Europe. Meanwhile the American industry can develop its products, its technologies, and its skills on a market which represents 50% of the world market, and which is uniform, coherent and homogeneous.

ESPRIT had to put an end to this decline and help the European industry to become a winner again, first of all on its home market.

There were three important objectives to this programme:

- firstly, of course, to enable the European industry to reach the technological level necessary to develop products and systems for the European market, and to help it to develop technologies competitive at a world level.

- secondly to teach the industry to cooperate. I would like to say "to teach Europe the meaning of industrial, economic, and cultural solidarity", but that would be too ambitious. First we had to learn, step by step, to cooperate, to work together, to enable industry to work with public laboratories and university research laboratories.

- and thirdly, by developing and promoting standards, to develop a European basis of industrial and commercial cooperation, to create a European market.

What are the results? I think that it is impossible now to doubt the success of ESPRIT.

On the economic level, after this long phase of decline lasting a quarter of a century, things are looking up again for the European IT industry. Among the twenty-five biggest IT companies on the European market, the market share held by European companies was only 34.3% in 1981; in 1985, the Europeans had gained more than two percentage points to reach 36.4%; and in 1986 their share of the market reached 42.5%.

This is due partly to the stagnation of the American market, and partly to the fluctuations of the dollar; but it has happened on the most competitive of markets. Is there any other market in the world as open as the European one to every product and every technique? At a world level, among the 25 largest IT companies European companies had in 1980 11.3% of the turnover, and in 1985 14.6% - a growth of more than 3 points. These are real results; there are of course many reasons for them, but we can no longer speak of decline. Not only has the decline been stopped, but European industry has been able to show, through the cooperation and the effort involved in ESPRIT, that it could once again produce worldwide growth.

In the field of technology, ESPRIT projects have now developed important standards for the European market, laying a basis for the development of not merely the European IT industry but the whole of European industry, the whole of the European economy. Thus for example the PCTE project, a "workshop" environment for software engineering, which is becoming the standard in Europe for software engineering environments, and in which the Pentagon is now showing interest. Or again ROSE, the communication network installed between research laboratories involved in ESPRIT projects, based upon the UNIX operating system and the OSI communication standards. Similarly PODA, which allows the exchange of documents between different systems.

Europe today has both the tools and the products to make her mark on the international scene. In the field of standards and cooperation, European industrials were the first to promote the OSI model for interconnecting heterogeneous systems using ISO and CCITT standards. As early as 1983, the European industrials created the SPAG organisation to promote these standards, and to define protocols and functional standards to insure that heterogeneous systems could intercommunicate. SPAG is oriented towards international standards, because the European industry welcomes competition and open markets; not merely did we fight this battle in Europe, but we also tried from the start to bring our American and Japanese colleagues into the arena. After the SPAG initiative, the American computing industry - including telecommunications and software - the big American network operators, and the big American users like General Motors, Boeing, Kodak, and Citicorp all joined together in a similar organisation, COS. COS and SPAG now work together to promote these new standards, to enable the development of distributed systems allowing heterogeneous components to share files, processes and communications.

It is not a dream anymore, it is a reality, and today anyone who refuses to face this reality is excluding himself from the market.

As far as operating systems are concerned, we had to define an operating system to be a standard for the European industry, in the research area in particular, which would also help to ensure that applications developed by the European software industry - one of the most lively, dynamic, and powerful in the world today - could be ported onto different and incompatible systems. Very early on, the six main European constructors joined together in X-OPEN to promote UNIX and a common programming interface standard, and to define the new functionalities the market requires. Now other companies, both European and American, have joined the first European companies to promote these standards on a world basis.

In a more restricted field, BULL, our company, joined up very early on with ICL and Siemens, the three principal mainframe constructors in Europe, to establish a research laboratory in the advanced techniques of artificial intelligence, oriented towards logic programming. Today, I may safely say that we have one of the world's best teams in this area in the ECRC, which is a purely company initiative, but would have been inconceivable in the absence of ESPRIT. The progress accomplished and the results achieved are already exceptional and will very rapidly appear in products developed by these three manufacturers.

These then are initiatives which today allow us to hope for and believe in Europe. Other initiatives, of a more industrial, a more commercial nature, have developed as extensions of ESPRIT; for example we have the initiative of Olivetti and ourselves, developing cash dispensers together; or again the Philips/Siemens initiative on very advanced CMOS technology.

The Europe of 1987 is not the Europe of 1980. ESPRIT I has meant 220 projects, 250 companies and 170 public research laboratories working together; it has had an enormous multiplying effect in a huge movement which has surged through Europe. Studying all this progress can only make one more hopeful for the future.

Doubt is no longer possible, and scepticism must give way to ambition. ESPRIT II, as we know, had a painful birth, but now it has arrived; and although ESPRIT I brought forth this burgeoning of cooperation essential to start a movement in a Europe which had no history of cooperation, still ESPRIT I also had its weaknesses, weaknesses which ESPRIT II must correct.

We have every reason to be pleased with the positive results of ESPRIT I, and the overall balance is certainly very positive. Still questions remain: - how far were we able to ensure a coherent approach with so many projects, so many companies working in the area of precompetitive research? How many of these projects will lead to real products, to products which will find a place on the market? ESPRIT II must now change its objectives to concentrate on strategic projects at a European level. We are no longer at the stage where European industry has to learn how to function: European industries must now together regain their own market and conquer others.

It is not an easy problem to coordinate research projects led by an organisation like the Commission in Brussels with the EUREKA projects, much more market-oriented, but with all the difficulties of implementation encountered in this or that country, in the absence of a real European strategy for implementation.

What is to be done? The best thing would be to link ESPRIT and EUREKA, so that European industry could again take over strategic control and cooperate not merely at the stage of precompetitive research, but also on prod ct development. To achieve this, we will have to accept, as in other countries, that the industry be given more responsibility.

ESPRIT I has been revolutionary. For the first time in the history of Europe, the industry was consulted over what were the critical strategic issues. The industry participated in the definition of the ESPRIT I programme and defined the areas of cooperation, but in the choice of projects and joint ventures the industrial participation was more limited. We must ensure that the companies which will be responsible for developing the technologies, for manufacturing the products, for marketing and supporting these products on the world market - these companies should have the responsibility of defining not merely the objectives but also the execution.

We must accept that the small group of companies in each sector who have the responsibilities of leadership, both in Europe and worldwide, take on all their responsibilities. This is what happens in the U.S. and in Japan. And let's not be afraid or ashamed, in the U.S. as in Japan the role of the government is very substantial, and they do not need endless meetings for 12 heads of state to agree on a research project.

In the U.S., 50% of R & D is financed by the federal government, either through laboratories and universities or by financing industry, but 75% is carried out by industry. In the area of civilian electronics, nearly 70% of the financing comes from the Department of Defense (68% in 1986 for a very small number of projects), and in each of these projects 90% of the money goes to a maximum of four companies. Similarly in Japan: through, for example, work on components and supercomputers, the Japanese industry has been able, under the auspices of MITI, to raise itself to the level of the leaders in the world market. This has involved the commitment of the few Japanese companies capable of operating on a world scale.

In Europe we must concentrate to a large extent on these big projects led by the leading European firms. These companies must then be given the responsibility of involving all our enterprises, whether small, medium-sized, or large, specialised companies, software houses, and public research laboratories - all must be involved in the effort of R&D, of manufacturing, and of marketing, to work for success coherently and with unfailing determination.

Among these projects, some in particular I must mention:

- Is it acceptable that there should be no European family of microchips, when today two or three families of microchips - all of American origin - can be found in microcomputers, workstations, minicomputers, and telecommunications equipment? Should we accept that the European industry and economy will depend for ever on two or three American suppliers?

- Is it acceptable that the European industry should be totally unrepresented in the market of mass storage devices, bearing in mind that these devices represent today a large part of the computing market, and that they are a key factor determining the performance and competitivity of computer systems?

- Is it acceptable that the European industry should produce no scientific supercomputers, bearing in mind the strategic importance of these supercomputers, not merely in the fields of defence and of research, but for whole sectors of the economy, such as aeronautics, the car industry, chemistry, pharmaceuticals, and banking, and that the market is already there?

A real presence on these markets depends on a common will and purpose, a political will as well as an industrial one. The Commission in Brussels and the governments of Europe must be fully aware of their responsibilities, which are not limited to financing R & D.

Now it is up to the European Commission and to the governments of Europe, across all their markets, for all their needs, in all their calls for proposals, to insist on the international standards that the industry is busy promoting. For if the political power does not play its part, how will these standards ever be imposed? How can the users ever have a guarantee for the future?

The Commission and the European governments must ensure that the products of the European industry are widely used within our educational system and our research laboratories. How else can we benefit from all the spin-offs of research? How will the youth that we are training and educating come to believe in the future of our technologies?

The European Commission and the European governments must help to open up this big European market we are all awaiting. Above all - and for me this is the real priority - a real communication network must be implemented in Europe, coherent, homogeneous, and uniform, offering the same services all across Europe, with the same rules for connection, for pricing, and for the addressing and numbering system.

The European industry and economy of tomorrow will develop around this network. And this means we must put an end to the present cacophony of regulation and deregulation. To organise a proper Europe-wide regulatory system, especially in this essential element of communication infrastructure, a supranational European organisation is needed.

Europe was built in the past upon its rivers and its roads; later upon its railways and its air links. The Europe of tomorrow will be built upon its network of electronic communications. This is a great responsibility we have, and it holds not merely for the infrastructure developments but also for the value-added services. If we let this opportunity slip, who knows when the chance will come round again?

Today, more than ever, we can have confidence in the future: the European industry has raised its head again, and we know that it can mount large-scale cooperative activities and conquer new markets.

It is now up to the rest of the economy to trust the European IT industry; and you should know that we are thoroughly aware of our responsibilities. These responsibilities lie not only towards our clients who represent the basis of our efforts, and our personnel who want to understand whither we are leading them, and who must be motivated to work for the future; we also have a responsibility towards the young, and you should know that we all without exception share an absolute determination that the young people of today shall have before them an ambitious, European, future.

IT Forum ESPRIT CONFERENCE WEEK

BEYOND 1992

Mr. C.J. van der Klugt,

President And Chairman of the Board of Management
N.V. Philips' Gloeilampenfabrieken

The reports presented by scientists and engineers during this ESPRIT Conference should remove any doubts about European capability to capture a position at the forefront of technology research. Compared to the gloomy days earlier in this decade when Europe seemed destined to decline to second-rate status in the world technology competition, Europe is no longer dismissed as a has-been. We have regained our confidenc. And this confidence in our ability leads to achievements in conquering the frontiers of technology research.

Five years ago, it was predicted that Europe was on the road to becoming a secondary player in the world technology power game. We were supposed to become a place of souvenirs and museums where the Japanese would pass their vacations under the benign eyes of the supreme U.S. industrial power. It seems as if Europe has been able to reverse that estimate to a very large extent in a very short time.

Europe also has finally understood the importance of cooperating and the possibility of cooperating. When I hear Mr. Stern, I think of efforts made by industry more than 10, perhaps 20 years ago. Had they succeeded, goodness knows where we would now be in I.T. in Europe. It was too early. The connection between a strong technology base and the future position of our industries in global competition is now an accepted principle.

The EC has proved to be well positioned to foster a European infrastructure for basic technology development by increasing efficiencies, reducing duplication and stimulating exchange of the results. That infrastructure has been built as a result of a new partnership in cooperation between industries, universities and non-industrial research institutions.

ESPRIT as a Model for Cooperation

I would like to focus for a few minutes on how the ESPRIT programme is serving as a model for cooperation. Many examples of ESPRIT projects could be cited to illustrate how the infrastructure is successfully achieving efficiencies and accelerating the acquisition of technology expertise on a broad scale in Europe.

The research in the Parallel Processing Programme is an excellent example of sharing talent, cost and risk and of compressing development time. The form of cooperation we have chosen here is innovative indeed, and therefore can serve as a model.

Certainly no single company could have created and mobilised a European "Scientific Community" such as this project represents. The two summer schools and this year's international conference organised under the project's leadership demonstrates the multiplier effect of cooperation.

Another model for cooperation is the work of the Standard Promotion and Application Group (SPAG). The 12 companies participating under the ESPRIT umbrella have made great progress in developing the functional standards for communication and interaction between information technology equipment. SPAG is also working with its American and Japanese counterparts to develop international standards for functional standardisation and detailed specifications.

But although the companies participating in ESPRIT are spread all over Europe there has been criticism. To paraphrase one of Europe's leading newspapers, the same big companies are feeding at the table of subsidised handouts. I believe that some clarification is needed here. First, the point should be made that the EC funds only 50% of the cost of projects, the other half comes from the participating companies and institutions. They will therefore be contributing more than one and a half billion ECUs to the ESPRIT programme during the next funding period. In addition, the human resources committed to ESPRIT add further enormous contributions to the effort. Philips, for example, will have contributed 185 people to ESPRIT in 1987.

Speaking for Philips, we welcome any company of any size to join in the effort if it can contribute its share of resources and expertise. Participants must be selected on the basis of strengths and skills. That is and must always be the basis for cooperation.

Companies like Philips applying the research results of ESPRIT will become the disseminators of new technology skills to the suppliers or co-makers involved in production of advanced technology products. The diffusion of know-how throughout the industrial network can be foreseen as part of the efficiency of the infrastructure we are building. This should become more evident as the results of research are applied.

The ESPRIT model for cooperation has changed attitudes about working together. The shared process of ESPRIT leads to better decisions about what directions research should take, and - just as important - what directions not to pursue. It is also opening minds to European solutions not just for R&D, but also for further cooperation and standardisation in Europe.

But is there a Real Political Commitment to R&D cooperation in the EC?

Before I leave the subject of EC cooperation in R&D, I feel compelled to temper my words of praise about the accomplishments of ESPRIT with those of dismay about the lengthy and argumentative budget approval process for the framework programme.

Despite the efficiencies demonstrated by the programme models of ESPRIT, the foot-dragging in the approval process of the framework programme has not been reassuring in terms of member government commitment to the concept of cooperation in this area. The continual downgrading of the budget appropriation, from an original proposal of 10.3 billion ECUs to a final agreement of 5.6 billion ECUs, is in itself disappointing. Business simply cannot operate on an on-again off-again basis. Company plans have to be made well in advance for resource allocations. We are talking about the deployment of scientific manpower, which in turn directly impacts a company's long-term strategy.

Europe's companies, indeed Europe itself, cannot afford to allow such serious matters to become victims to short-term political thinking.

As a representative of industry, I would like to make a plea for a more aware attitude by governments of the long-term industrial planning process. The mobilisation of the 4,000 to 5,000 research workers participating in the framework programme does not happen overnight. Our strategic industries should not be burdened in these matters by government confusion and indecisiveness. Anyhow, today we are glad to have a 5 year programme in front of us now.

Finally, the RACE programme. This vital programme was discontinued for a year as a result of funding termination last December. I think this calls to question whether there is any real commitment by EC member governments to develop a unified market for telecommunications, something which has been described as an absolute necessity for this region. We urgently need to cooperate with serious intentions - not only for producers of telecom equipment, but also for the users, who will be affected for years by the standards and regulations we set, or fail to set, today. If governments are willing to make the short-term concessions necessary to bind our market together into a unified system, we will achieve the long-term benefits in the interests of all our people.

The Larger Picture: Technology "push" and Market "pull"

I have up to this point discussed the success of ESPRIT as a model for European technology cooperation. I have also made a plea for evidence of a stronger commitment from governments to the long-term support of cooperation in basic technology.

But research is just one part of the technology picture. Technology application also deserves our serious attention. Europe's most serious shortcoming, it is generally agreed, is its difficulty in developing and marketing products that can successfully compete on world markets. I would like to discuss the environmental conditions central to encouraging technology application.

What we need for launching new products is a receptive European common market. The obvious barriers to such a European market are well known. The EC 1992 White Paper covers many of these problems.

We have developed in ESPRIT a framework for cooperative R&D to achieve a technology "push", we must now broaden the scope of our efforts to create the essential market "pull". We should stop blaming nationalism for Europe's slow response to accepting and utilising new products and systems.

It is time to stop accepting nationalism as an immutable fact. We must accept the inevitability of a European common market. We must change our attitudes and get in step with the modern world. The balance between technology push and market pull must be brought more nearly into equilibrium. Both must be considerably strengthened.

Allow me to suggest the major elements for building an overall balance between technology push and market pull as a result of an improved macro-economic environment.

Briefly, we must:

- build a coherent advanced telecommunications infrastructure;
- bring education into the information technology era;
- foster a climate of entrepreneurism.

1.Building the Coherent Telecommunications Infrastructure

Europe-wide markets for the enormous array of equipment and services associated with telecommunications have the potential to be captured by European producers. This depends, of course, upon setting uniform standards and government cooperation in supporting open systems. It also means finding appropriate ways to coordinate computers and data processing equipment with telecom systems. The more rapidly we can cooperate in developing technology and systems in collaboration with government acceptance of transparency in these systems, the more quickly users will invest in new equipment and services. Access to our own European market will give producers the critical mass necessary to offer systems, equipment and services that are competitive globally. This fits in with my earlier remark, that the start of the RACE programme is therefore critical.

2.Education

We need to infuse our education system with bold, new approaches to preparing our citizens for participation in the information society. We will be unable to develop the tools of technology if we have insufficient numbers of highly educated people to fill our research laboratories, design and engineer new products and manage the production of sophisticated IT systems and products. These are the people we need to create technology push.

Computer literacy must be as widespread and as basic as the literacy of reading and writing. The information technology-literate population is the underpinning for market pull.

At the very least we should implement these actions in bringing our education system into the information era:

- promote educational mobility within the EC. Educational mobility is important for creating attitudes of a European scope amongst our population. At present fewer than 2% of our students at University level have education exposure in Europe outside their own country.
- education and training should be thought of as a lifelong process. Some experts consider our knowledge to be obsolete every five years. Therefore, educational institutions, businesses and governments must tailor their programmes and methods of operating to patterns of lifelong learning. Businesses themselves will be increasingly in the business of education.

3.Entrepreneurial Climate

We have talked exhaustively of the need for an entrepreneurial climate, which is essential to create the dynamics of technology push/market pull. One of the characteristics of the revolutionary transformations of the information era is that new ideas are springing up everywhere. These ideas fuel the explosion both of new businesses and of new directions for established businesses. They contribute to the vigor of the economy and the forward thrust of technology push and market receptivity. Some of the basic actions governments and businesses must take to encourage a climate for entrepreneurism are:

- creating sufficient availability of venture capital and appropriate financial instruments;

- liberalising of anti-trust laws to encourage cross-border activities. The resources for the successful technology application and marketing of new products for a global market will require cooperative, cross-border partnerships of all descriptions.

Our governments, with strong prodding by the EC, must revise their legal systems to be synergistic with today's commercial reality. It is interesting to note that a major point in President Reagan's recently presented platform for the rapid United States development of the superconductor called for revision of U.S. Federal Trade Commission rules. The intent is to allow for increased collaboration between companies to apply scientific research to marketable product.

Of course, the harmonised standards and regulations of a truly common European Market will give entrepreneurs a very large boost. New ideas should be as easily transferred from Munich to Edinburgh as American hi-tech innovations are transferred from Boston to Los Angeles. The faster the timetable for 1992 is implemented, the sooner Europe can offer a hospitable environment to the entrepreneur.

Global Partnerships

My final comments are directed towards the concept of global partnerships as a growing strategy for competitiveness on world markets.

One of the situations pushing European companies to develop non-European partnerships has been the slow response to new products by the European market. Market fragmentation has compelled companies needing large markets for survival to look outside Europe for cooperative alliances.

But there are also other reaons why global cooperation is stragically vital. Companies must have a presence close to the centres of excellence in Research and Development wherever they are located in the world. It is essential to have a window on the newest developments in technology research to extend the scope of expertise. To develop appropriate interfaces of technology, companies must be close to the users of advanced products, the so-called "leading edge" customers.

Production facilities must be stragically located in order to minimise production costs, to keep appropriate quality levels, and to be responsive to changes in currency values and the availability of components and economies of scale.

In short, Europe's companies are moving out from behind closed walls to the open windows of world development and opportunities. This includes binational cooperation, like the MEGA project of Siemens and Philips, cooperation within the EC like ESPRIT, as well as cooperation within "géographie variable" like EUREKA, and of course also international cooperation on a global scale.

As a result, many forms of cooperation with non-European partners are being created, and rightfully so. The purposes of these alliances are:

- market entry via the market channels of a non-European partner;
- global standardisation for products and systems;
- acquisition of technology expertise that complements the knowhow a company already has.

Philips selects non-European partners for these reasons (e.g. A.T.& T., Dupont, Matsushita). Bull, Olivetti, Siemens and Ericsson are also among the growing number of European companies forging non-European partnerships.

All these examples prove that cooperation is a natural development and an established phenomenon indeed.

Conclusion

In summary, I began my talk with the good news: Europe, through such efforts as ESPRIT, has demonstrated that it has the capability to meet the challenges of the information era. ESPRIT is a benchmark model for the collaboration efforts we are capable of mobilising for R&D in technology.

But then I presented what I consider the bad news: we are simply not doing enough. In large part, our political behaviour is incompatible with the realities of the information era. The Europe 1992 programme is fundamental to creating a common market. But it does not go far enough to create the market pull environment we need for economic strength. In order to stimulate the right climate of technology push and market pull, we must:

- build a coherent advanced telecommunications infrastructure;
- bring education into the information era;
- foster a climate of entrepreneurism.

Finally, we must more fully employ our population. This means investing in the sectors that have the potential to create the most jobs. A (McKinsey) report to the EC Commission stated that two million new jobs will be at stake by 1990 in the Information Technology sector. The report warns, however, that two million jobs could be lost if Europe continues its trend of dependency for IT on other countries. Some experts estimate that every new high-tech job stimulates the creation of 6 to 8 low tech or non-tech jobs. We could therefore be talking about 12-16 million jobs in total at stake in the very near future.

Furthermore, the responsibility rests with us whether our educational system deteriorates so much that our children and grandchildren will no longer be comparable in intellectual level with their age-groups from Japan and the United States. I believe we should take this thought home as well, because should that happen it would be a reason to be ashamed of the inefficiency and lack of performance of the great area which is Europe, which has proved that it can stand out amongst all peoples, and that it can be the biggest and most important economic unit in the world.

Ladies and Gentlemen, we all agree that such a challenge justifies our utmost performance and perseverance.

B. Haarder

President, EEC Research Council

As President of the Research Council I am very pleased to be given the opportunity of addressing this forum today.

I listened with great attention to Mr Van der Klugt's remarks - also his critical remarks - concerning the speed and what he may feel the lack of ambition on the part of the European Council. My message is that I think there is reason to be more confident as to the willingness of the Council to act more speedily and more ambitiously in the future. The day before yesterday, we produced some very promising results for research and technology in Europe. As you have heard we have taken a vital step in implementing the European Single Act by adopting a Community Framework Programme for the next 5 years.

We have established common positions on proposals for three specific programmes:

- medical research;
- research for developing countries, and
- the Telecommunication programme RACE.

I am sure you are all familiar with RACE, which is closely connected to the ESPRIT programme and has already had a very successful Definition Phase.

The day before yesterday at the council meeting we also had a first presentation and exchange of views on the proposal for ESPRIT phase II, a which is a cornerstone in the Framework Programme with a proposed budget of 1600 million ECU out of a total budget of 5.4 or 5.8 billion ECU depending on how you define it.

I can tell you that in the Council there was a positive spirit to go ahead and continue the very successful ESPRIT programme. When we approved the first phase of the ESPRIT programme in February 1984, we did not realize at that time what impact it would bring on the European scene.

It has been said this morning that over 400 organizations and over 3000 scientists are presently working under the ESPRIT programme. We have also learned that this work is producing results that belong to the elite of the world, and that the results in more than half of the projects started in 1984 have already been used in marketable manufacturing. I know from the Danish scene that several companies have already exported products, where some of the underlying R&D work came from participation in ESPRIT projects.

We all know that the ESPRIT programme and the RACE programme appear to be very large moneywise, but let's face it, the amounts are small when we compare them with the total amounts spent by the European industries in these fields, and especially when we compare thenm to the total amount spent in the USA and Japan. Nevertheless, the European Research Ministers fully back the Commission in its effort to further mobilise European talents for the benefit of all of us. After all, there is a substantial increase in ESPRIT II compared to ESPRIT I. By agreeing to coordinate our precompetitive research and thereby, to a great extent, avoiding costly overlaps - and the overlaps are the handicaps of the Europeans - thereby European society is better equipped to compete on the world scene today than we were when we started some years ago.

Now, as we stand on the threshold of phase II, I find it very important that the Commission is devoting more efforts to the important point of spreading or disseminating the results of the ESPRIT programme. The Commission has recently distributed over 10000 copies of resumés covering all ongoing ESPRIT projects. We welcome these initiatives, not only because of the information they provide for the readers, but also because of the visible effect it has on the public audience - the taxpayers, who are paying for it. If we want to get the Ministers to act more quickly, we also need to get the Ministers voters, those on whom the Ministers existence depends, we also have to convince them that it is worthwhile t go forward and spend more of the taxpayers' money.

My colleagues in the Research Council and I visited the ESPRIT exhibition last Monday, and it was my impression, that most of the projects deal with software, irrespective of whether the official subtitles are:

- microelectronics;
- office systems, or
- integrated manufacturing.

The Ministers enjoyed getting a glimpse of the ESPRIT exhibition - we had one hour; that's too short of course, but this exibition is one of the ways by which we can disseminate and spread the results of the ESPRIT programme. I noticed that almost the whole alphabet was used as acronyms for the projects - a great deal of ingenuity has been utilised not only for the projects, but also for the project titles! That is in fact where the ingenuity is really superb in Europe.

What have we learned from the ESPRIT programme ?

The Midterm Review from 1986 informed us, that the ESPRIT programme has a multiplying effect of about 3-4. This is simply because all partners in a project have full access to the results from the total project. If, for instance, a company does 25% of the work, it only pays half of its own cost, but it receives the results from the whole group. If one takes the added cost of collaborating across borders, administrations etc., a conservative estimate would give therefore a multipling factor of 3-4 for every guilder or whatever we spend on an ESPRIT project.

We have also been informed that Universities and research institutes are involved in three out of four ESPRIT projects and small or medium sized enterprises are involved in more than half of the projects. I think that this is very encouraging: first of all, it convinces all European countries that ESPRIT is for all the countries; secondly, we should remember that what we need in Europe is in fact not more University professors - even if they don't like to hear it, this is true. We need no more University professors; we have more than the Americans and twice as many as the Japanese: what we need is more cooperation between the universities and industry - more quality, less overlapping. We have too long a distance in Europe from the research stage to the application stage. This is where we have to improve in Europe, and therefore I find it so encouraging that in three out of four ESPRIT projects we have cooperaion between university institutes (and other public institutes) and private industry

In fact sometimes I like to compare our situation with recent developments in football. We therefore feel confident that the continuation of the ESPRIT programme or ESPRIT II, as it is also called, has every chance of becoming a success also. We have to ensure, that there is complete openness both in the planning and preparation of the future workplans. All countries should openly inform the Commission of its own programmes in order to avoid expensive overlapping.

What is ESPRIT II then ?

From what I have learned, the programme is about twice the size of the first phase of ESPRIT in financial terms. The work specified in the draft workprogramme will build on the resulting technological achievements from the first phase of ESPRIT. It is planned to spend about 40% on very large "Technology Integration Projects". The topics are the same as under ESPRIT I, but under slightly different headings.

I am very pleased to see that 3% or 50 million ECU is proposed to be allocated to Basic Research. The frontline topics suggested by the Commission are:

- molecular electronics;
- artificial intelligence and cognitive science;
- applications of solid state physics to information technology, and
- advanced system design.

For these projects, it is not a prerequisite that the partners be industrial, they might just as well be Universities or research institutes. The financial arrangement is also different.

As a Nordic Minister of Research, I am also pleased to see that it is planned that Nordic and the other EFTA countries should be able to participate in the ESPRIT (and other EEC) programmes at the project level. We should really try to take advantage of existing know-how and competence in Europe as a whole. We should also ensure that the ESPRIT programme remains a truly pre-competitive research programme and not a hidden product development programme. Thereby it can continue to complement the EUREKA programme, which is closer to the market.

I will close my contribution by concluding that the Danish Presidency has a positive impression as regards the first phase of ESPRIT. We believe that the proposal for a second phase is sound and provides a good basis for further work.

As Chairman, I can assure you that we will do our utmost to get the proposal endorsed - hopefully, we shall get agreement on a Common Position in the Research Council Meeting, on the 30th of November this year ! We are very satisfied that the Parliament has shown a most cooperative spirit and is working hard to ensure that their opinion is issued in good time.

L'ACTE UNIQUE EUROPÉEN, 1992 ET ESPRIT

Michel Poniatowski

President de la Commission de l'Energie, de la Recherche et de la Technologie du Parlement Europeen

L'Europe s'est donné un nouveau rendez-vous avec son avenir. Dans cinq ans, selon l'Acte Unique Européen, nous saurons si l'objectif majeur qu'elle s'est fixé, le Grand Marché unique de 320 millions d'habitants, sera ou non réalisé ou, ce qui est plus probable, s'il est engagé de manière irréversible.

Même si cette échéance commence à être prise en compte par les principaux acteurs de la vie politique, et surtout économique, (l'Europe des entreprises venant peu à peu renforcer et même de substituer dans certains domaines à l'Europe institutionnelle), je me demande parfois si les conséquences impressionnantes de cet objectif ont été pleinement mesurées par les gouvernements et les parlements qui l'ont adopté.

Pour parvenir à cette totale et libre-circulation des marchandises, des services et des hommes, qui caractérisera le Grand Marché Européen, c'est à l'harmonisation d'un ensemble considérable de dispositions d'ordre financier, fiscal, juridique, et réglementaire que l'on devra procéder, dispositions qui sont évaluées à plus de 300.

En France, aujourd'hui, les procédures d'harmonisation ne sont encore engagées que pour 70 d'entre elles.

Mais le plus frappant dans cette harmonisation est que ces mesures s'imbriquent les unes dans les autres et s'entraînent les unes les autres, créant un mouvement inéluctable qui, au-delà d'un certain point, deviendra irréversible. L'on ne pourra pas plus se retirer un jour de l'Acte Unique que l'on ne peut se retirer aujourd'hui de la C.E.E., sans se détruire et sans se ruiner.

Le problème est maintenant de déterminer le degré de résistance que nous allons éprouver, sa nature et le temps nécessaire à le surmonter, car l'Acte Unique signifie aussi la fin au plan national des corporatismes, des privilèges nationaux, des tolérances, des protectionnismes, dont les résistances vont être nombreuses et vives.

L'harmonisation des taux de TVA nous en fournit un très bon exemple. Cette mesure fondamentale pour la circulation des biens entraînera nécessairement dans tous nos Etats membres, pour compenser les variations de recette qui en résulteront, une refonte de la fiscalité directe, et de la fiscalité des entreprises.

La différence de fiscalité pesant sur l'entreprise et sur ses produits, notamment sur les produits technologiques généralement hautement taxés, est considérable. Un même article est vendu 30%, voire 50%, plus cher en Grèce qu'en Grande-Bretagne, en Italie qu'au Luxembourg.

Parmi ces impôts, taxes et droits d'accises, la taxe sur la valeur ajoutée joue un rôle sélectif directement perceptible par l'opinion publique : le même compact-disc supporte 33% de taxes en France et seulement 12% au Luxembourg.

Les Etats comme la France, à forte imposition indirecte, devront réduire leurs ressources fiscales de cette nature et seront obligés, soit de réduire fortement les dépenses de l'Etat, soit de relever leurs prélèvements directs; et vous voyez les conséquences que peut avoir une décision politique augmentant les impôts sur le revenu au bénéfice des impôts indirects réduits. C'est une politique très courageuse. De même, l'imposition des sociétés tendra à s'appliquer sur les taux les plus bas pratiqués dans la Communauté. Les pertes ou les transferts fiscaux qui en résulteront seront considérables. Ces pertes sont évalués en France à environ 100 milliards de francs sur lesquels les récentes et importantes baisses ne représentent que 8 milliards de francs.

Au bout du compte, que constaterons-nous ? Un obligatoire alignement des différents taxes et prélèvements dans tous les Etats de l'Europe communautaire, ce qui, politiquement, signifie la perte de la maîtrise nationale de certains équilibres économiques et de certaines politiques financières.

Cette harmonisation est complexe et, en dehors des problèmes techniques, se heurtera, n'en doutons pas, aux résistances des administrations nationales, surtout financières qui sont les plus conservatrices de toutes. Mais, une fois réalisées, les modifications seront irréversibles et aucun Etat membre ne pourra s'y soustraire.

Donc, que ce soit 1992 ou un peu plus tard, le Grand Marché sera la réalité économique de la prochaine décennie. Cela ne suffit pas cependant car ce Grand Marché peut devenir un Grand Marché livré aux produits américains ou asiatiques et non à une industrie européenne compétitive.

En ce sens, l'un des enjeux les plus redoutables de cette compétitivité se situe dans la haute technologie.

C'est pourquoi nous devons être en mesure de chercher, de concevoir et de produire, ensemble, cette technologie. Aucun de nos Etats européens n'a les capacités techniques et financières de réussir à long terme et seul dans une entreprise dépassant une certaine ampleur.

Mais cet avenir communautaire, nécessaire, n'est pas sans nuages, en particulier dans le domaine de la recherche et de la technologie.

Je ne vous apprendrais rien en évoquant les difficultés qu'a rencontrées le programme-cadre d'actions communautaires de recherche et de développement technologique pour être adopté par le Conseil des Ministres, après près de neuf mois de tergiversations.

Malgré les promesses et les engagements du Conseil des chefs d'Etat à Milan affectant à ce programme-cadre 6% du budget de la Communauté, soit 16 à 17 milliards d'ECUs sur 5 ans, nous nous sommes trouvés avec un résultat infiniment moins satisfaisant.

En effet, le Conseil, à cause de la position prise par un gouvernement sur les douze, n'a pu se mettre d'accord que sur une dotation globale sur 5 ans de 6,5 milliards d'ECUs, au lieu des 16 milliards esquissés au Conseil des chefs d'Etat à Milan. Ce montant de 6,5 milliards ne dépasse pas 2% du total des budgets de recherche nationaux européens, montant d'ailleurs inférieur à celui que de nombreuses entreprises multinationales consacrent à leur recherche et développement. Encore cette position n'a-t-elle été adoptée que sous la ferme pression du Parlement et de la Commission.

Même trop faiblement doté, comme nous le considérons, ce programme-cadre de recherche est cependant un instrument stratégique entre les mains de la Commission pour la réalisation du Grand Marché.

L'action de la Commission et du Parlement concernant les normes européennes pour les différents matériels technologiques va dans le même sens de l'attaque et de la défense du marché.

C'est la raison pour laquelle le Parlement européen et sa commission de l'énergie, que j'ai l'honneur de présider, soutiennent vigoureusement les actions communautaires de recherche et technologie et je dois dire que c'est avec une réelle satisfaction que nous avons enregistré les résultats très encourageants de l'exécution du programme ESPRIT, qui souligne à quel point des progrès sensibles peuvent être rapidement obtenus sous de telles impulsions même avec des moyens limités.

Mettre en prise directe la recherche, la technologie et le marché semble la stratégie européenne la plus efficace pour renforcer la compétitivité de nos entreprises.

La principale difficulté réside peut-être dans le fait que nous devons vivifier la base technologique d'un marché qui sera presque aussi ouvert vers l'extérieur que il ne le sera à l'intérieur.

Et c'est un bien, car si nous devions confiner l'Europe dans un protectionnisme qui agirait comme un tranquillisant, nos entreprises ne tarderaient pas à en supporter les conséquences sur le plan de leur compétitivité extérieure et en définitive intérieure.

Je note d'ailleurs que la plupart des programmes de recherche de la Communauté prévoient des modalités de coopération avec des entreprises de pays tiers européens. Ceci est en effet la sagesse.

Les Etats membres de la Communauté européenne ne peuvent ignorer nos partenaires pays membres de l'AELE autrichien, suédois, suisse, norvégien ou finlandais. Tout d'abord, parce que nous avons des liens économiques très étroits de voisinage avec eux, mais également parce qu'ils disposent de compétences technologiques tout à fait remarquables. Je ne citerais que le suédois ASEA pour la robotique ou les laboratoires pharmaceutiques suisses, que nous ne saurions ignorer et dont nous avons besoin.

Mais cette coopération et la participation aux programmes de recherche communautaire qu'elle peut impliquer doit avoir le même sens, la même signification pour ces pays et leurs entreprises que pour nous. Elle ne saurait se limiter à une opportunité pour certaines de ces firmes souvent multinationales de mieux pénétrer le marché communautaire ou d'être mieux informées de l'état de la recherche communautaire. Les liens qui doivent s'établir à travers cette coopération, je le répète, indispensable, doivent avoir un contenu politique précis pour les pays membres de l'AELE. Même si pour des raisons politiques diverses, ils ne font pas partie de notre ensemble communautaire, ils ont le même destin que nous et que l'Europe communautaire soit technologiquement faible, ils en supporteront directement les conséquences.

La solidarité institutionnelle du continent européen sera un jour un concept politique, mais cette solidarité est dès à présent une obligation économique. Les véritables concurrents, rivaux économiques pour eux comme pour nous, restent les Américains et la constellation du Sud-Est asiatique et aussi, peut-être, à plus brève échéance que nous ne le croyons, dans certaine domaines les pays nouvellement industrialisés et même la Chine ou l'URSS, qui pourraient nous réserver quelques redoutables surprises. Retardataire en technologies de l'information, l'URSS a 7 ou 8 ans d'avance en matière spatiale.

L'avenir culturel et économique de l'Europe et sa puissance politique sont liés au dynamisme de la recherche, de l'application et de la commercialisation de sa technologie.

Ne pas le comprendre, c'est se résigner à la décadence.

Or, nous avons tous les moyens de nous affirmer et de gagner. Nous avons les hommes, l'argent, les connaissances et les structures nécessaires pour que l'Europe s'impose comme une force dominante.

Monsieur Stern nous rappelait tout à l'heure que nous savions aussi nous battre, et réoccuper notre marché européen des technologies de l'information par example. Seul sujet de l'inquiétude - l'éducation. Inquiétude sur sa quantité, inquiétude sur sa qualité. En quantité, au Japon et aux Etats-Unis sortent des écoles secondaires environ 78% dans un cas, 82% dans l'autre, d'élèves en mesure de suivre des études d'enseignement supérieur. En Europe, le chiffre va de 27-28% (je ne dirai pas quel pays) à 38% - la moitié du Japon et des Etats-Unis. Et en qualité la aussi le niveau est bien en deça de ce qu'il devrait être. Qualité, quantité, et aussi coordination - si nos industriels, nos chercheurs, nos scientifiques doivent pouvoir travailler ensemble facilement, librement, il y a à partir de l'enseignement universitaire la nécessité d'avoir un programme coordonné - au moins un tronc commun de l'enseignement scientifique. Les circonstances, en effet (c'est ici que je suis aussi optimiste que les orateurs qui m'ont précédé) - les circonstances nous favorisent en Europe. Le temps, en quelque sorte, a suspendu son vol. La Pax Americana-Sovietica que nous avions observé depuis Yalta n'est plus. Il n'y a plus de super-puissances.

L'URSS éprouve toutes les difficultés inhérentes à une indispensable mutation. Les USA affrontent les conséquences commerciales de leur dèsiquilbre dans ce domaine, de leurs difficultés monétaires et financières, et le Japon, au contraire, connaît des difficultés commerciales pour raison inverse, et parce que le yen est trop fort.

Le monde est en profonde transformation, mais si les ébranlements de la plupart des autres zones sont négatifs, les ébranlements qui secouent l'Europe sont positifs et touchent à son édification sous toutes ses formes non seulement technologiques mais militaires, économiques et monétaires.

Nous voguons ainsi plus librement que d'autres avec le vent du changement.

Sachons en profiter, et ne pas trop douter. ESPRIT est la preuve qu'il ne faut pas douter.

THE SINGLE EUROPEAN ACT, 1992 AND ESPRIT

Michel Poniatowski
Chairman of the Committee on Energy, Research and Technology of the European Parliament

Europe has made a new appointment with its future. In five years, according to the Single European Act, we shall know whether or not the major objective which it has set itself, namely the creation of the large single market serving 320 million citizens, has been achieved or, as seems more probable, whether the process which will lead to the attainment of this goal has been irreversibly set in motion.

Even though account is now being taken of this deadline in leading political and, more particularly, economic circles (as commercial Europe begins to support - and even replace - institutional Europe in certain fields), I sometimes wonder whether the difficulties and dramatic consequences associated with this objective have been fully evaluated by the governments and Parliaments responsible for its definition.

To ensure the free movement of all goods, services and persons, which will be the distinguishing feature of the large European market, it will be necessary to harmonise a considerable number - estimated at more than 300 - of financial, fiscal, legal and regulatory provisions.

In France, the necessary harmonisation procedures have been initiated in respect of only 70 of those provisions.

Nevertheless, the most striking aspect of this need for harmonisation is that the measures involved overlap and create a reciprocal stimulus, thereby producing an inevitable momentum which, beyond a certain point, will become irreversible. One day, it will be as impossible to withdraw from the Europe created by the Single Act as it would now be to withdraw from the Community without experiencing national decline and ruin.

The problem now is to establish the degree and type of resistance which can be expected and the amount of time required to overcome it since, at national level, the Single Act will mean the end of corporatism, national privileges, favouritism and protectionism, resistance to which will be widespread and vigorous.

The harmonisation of VAT rates provides an excellent example. In order to offset the resulting differences in revenue, this crucial measure for the movement of goods will inevitably entail a reorganisation of direct and corporate taxation in all the Member States.

The difference in the levels of taxation borne by enterprises and their products, particularly technological products which are generally highly taxed, is considerable. The same article can cost 30%, and even 50%, more in Greece or Italy than in the United Kingdom or Luxembourg.

Among these direct and indirect taxes and excise duties, VAT plays a selective role clearly perceived by the public; for example the tax on the same compact disc is 33% in France compared with only 12% in Luxembourg.

Countries like France, with a high level of indirect taxation, will be obliged to reduce their tax revenue from this source and either significantly lower public spending or increase direct taxation; moreover, the potential political consequences of a decision to increase income tax in order to offset a reduction in indirect taxation are obvious. This would be an extremely courageous policy. Similarly, companies will tend to be taxed at the lowest rates prevailing within the Community. This will lead to considerable tax losses of transfers. In France, these losses are estimated at approximately 100,000 million FF , of which the recent spectacular reductions account for only 8 000 million FF.

In the final analysis, what will happen? A compulsory alignment of different taxes and levies will take place in all the Member States entailing, from the political standpoint, the loss of national control over certain economic mechanisms and financial policies.

This harmonisation process will be complex and, in addition to technical problems, will inevitably encounter resistance on the part of national administrations, particularly among financial authorities who tend to be the most conservative. Nevertheless, the changes once introduced will be irreversible and their consequences will be unavoidable for all the Member States.

Consequently, whether in 1992 or somewhat later, the large market will constitute the economic reality of the next decade. In itself, however, this is not sufficient, since this large market could be surrendered to American or Asian products rather than offering those of a competitive European industry.

In this context, high technology will be one of the most crucial elements at stake. That is why we must be in a position to identify, design and produce this technology together.

None of the Member States possess the technical and financial resources required for long-term independent success in any venture of more than a certain scope.

On the other hand, this necessarily common future must not be regarded as problem-free, particularly in the field of research and technology.

You are well aware of the difficulties surrounding the adoption by the Council of the Community framework programme of activities in the field of technological research and development after almost nine months' equivocation.

Notwithstanding the promises and commitments made by the Heads of State and Government at the European Council meeting in Milan concerning the allocation of 6% of the Community's budget, or 16-17 000 million ECU over five years, to this framework programme, the position arrived at is far less satisfactory.

This is because the Council could agree on a total allocation of only 6 500 million ECU over five years instead of the 15-16 000 million mentioned in Milan, as a result of the position taken by one Member State. This figure of 6 500 million is barely equivalent to 2% of the total research allocations of the Member States, and is less than the sums devoted to R&D by many multinationals. Moreover, even this amount was only approved as a result of strong pressure from Parliament and the Commission.

Even with what must be regarded as these grossly inadequate resources, this framework programme of research remains a strategic instrument in the hands of the Commission for the creation of the large market, which must never become a large market for non-European products.

The action taken by the Commission and Parliament with regard to European standards in respect of a variety of technical equipment is fully in line with this approach to the establishment and protection of the market.

That is why the European Parliament and its Energy Committee, of which I have the honour to be Chairman, strongly support Community projects in the field of research and technology; in this connection, I should like to mention the genuine satisfaction with which we noted the extremely encouraging results obtained under the ESPRIT programme; these show the extent to which significant progress can be rapidly achieved given such stimulus, even where resources are limited.

The establishment of direct links between the research and technology sectors and the market would appear to be the most effective strategy which Europe could adopt with a view to improving the competitiveness of its enterprises.

The principal difficulty may derive from the need to maintain a strong technological base for a market which will be almost as open to the outside world as it is internally.

This challenge should be welcomed since, if Europe were to create a tranquillising protectionist system, our enterprises would soon feel the consequences for their foreign and, ultimately, internal competitiveness.

I should also point out that most Community research programmes provide for cooperation with enterprises in the rest of Europe. This is a sensible provision.

The Member States cannot ignore our Austrian, Swedish, Swiss, Norwegian or Finnish partners in EFTA. This is not only because we maintain extremely close economic links with these neighbours, but also because of the remarkable technological skills at their disposal. By way of example, I need only refer to the Swedish company ASEA in the field of robotics or the Swiss pharmaceuticals laboratories, whose activities cannot be ignored and whose cooperation we require.

Nevertheless, this cooperation and the participation in Community research programmes to which it can give rise must have the same significance for these countries and their undertakings as for us. It must not merely provide an opportunity for certain outside firms, which are frequently multinationals, to achieve greater penetration of the Community market or to learn more of the status of Community research. The links to be established through this cooperation which, I repeat, is indispensable, must have a clearly-defined political content for the EFTA countries. Even if, for a variety of political reasons, they are not members of the Community, we share a common destiny and they would be directly affected by the consequences of a technologically weak Community. The solidarity of the European continent, which will one day be a political concept at the institutional level, is already an economic necessity. The real competitors, their economic rivals as much as ours, are the Americans and the South-East Asian countries together, perhaps sooner than we think in certain fields, with the newly industrialised countries and even China or The Soviet Union, which may have some nasty surprises in store for us.

For example, although it is behind in information technology, the Soviet Union has a lead of seven or eight years in space.

Europe's cultural and economic future and its political importance are linked to the dynamism of its research and the application and commercialisation of its technology.

To fail to appreciate these facts would be to accept decline.

Nevertheless, we possess all the resources required for self-assertion and success in the form of the individuals, finance, know-how and structures which will enable Europe to become a dominant force.

Mr. Stern has just reminded us of our ability to compete and, for example, reconquer the European information technology market. Education represents the only point of concern, since doubts exist with regard to both its quality and quantity. As regards quantity, approximately 78% and 82% of Japanese and American schoolchildren respectively are qualified to go on to higher education on leaving secondary school. In Europe, the figure is between 27-28% (I won't identify the country) and 38%, i.e. half the corresponding Japanese and American number. The quality of European education also leaves a great deal to be desired. Quality, quantity and coordination - if our industrialists, researchers and scientists are to be in a position to cooperate easily and freely it will be necessary to introduce a coordinated programme from university level, providing at least a common basis for scientific education. Circumstances (and here I feel as optimistic as the preceding speakers) are working to Europe's advantage. Time has, so to speak, interrupted its flight. The Pax Americana-Sovietica which prevailed after Yalta no longer exists.

There are no more superpowers.

The Soviet Union is experiencing all the inherent difficulties associated with indispensable change. The USA is confronting the commercial consequences of its trade deficit in this domain, and its monetary and financial difficulties, whilst Japan is affected by commercial problems for the opposite reason and because the yen is too strong.

The world is going through a period of profound transition, but whereas the upheavals in most other regions are unwelcome those taking place in Europe are beneficial, affecting all aspects - the military, economic and monetary as well as the technological - of its creation.

As a result, we can ride the winds of change more successfully than others.

Let us take advantage of this situation and refuse to allow ourselves to become prey to excessive doubt. ESPRIT provides the proof that doubt is unfounded.

ESPRIT IN 1987

Jean-Marie CADIOU
Director
Information Technologies - ESPRIT

I would like to begin by taking a step back, and reviewing the various stages we have gone through since the beginning of ESPRIT.

When ESPRIT started, on 28 February 1984, a considerable amount of preparation had been done. Yet, in a sense, this was still mostly on paper. We did not really know how much of this was hope, and how much would become reality. After all, we were moving into uncharted territory: a 50%-funded large-scale effort, involving full transborder industrial cooperation. These boundary conditions had no precedent in Europe, nor indeed anywhere else in the world. So when the call for proposals went out, with only six weeks to go to the deadline, we held our breath and awaited the results with considerable anxiety. How was the IT community really going to respond to this challenge?

Well, as you all know, the response was overwhelming: we received almost two billion Ecus worth of proposals, more than five times what we could afford to fund.

So we selected the best of the proposals, they turned into projects, and the projects started. But were these projects going to be viable? Would the teams from different partners actually work together in the projects, or would they fail to agree, and go in different directions? Would the different company cultures prove to be too much of a handicap, or could that be overcome? Would industry and universities find common ground to work together? In other words would cooperation work, or would it turn out to be one of these ideas which is only good on paper?

The Pannenborg report did provide an answer. A questionnaire sent to all participants in the projects was to return with a clear vote of confidence: 97% of the respondents thought that the cooperation was indeed working well. I reported this during the 1985 IT Forum, the theme of which was precisely "cooperation".

But the feeling of relief we got from this positive answer did not last very long, as the next question became all too obvious: if cooperation worked, would this work lead to actual results?

Well, one year later, at the 1986 IT Forum on "Building Momentum", I was able to give an encouraging report as early results began to appear. This was confirmed in the Progress and

Results report which we published later that year: the cooperation was producing results, with both a multiplier and a speed up effect, far exceeding the inevitable overheads.

Now there is another hurdle to cross, and a major one at that. To know whether ESPRIT really works, we must assess the impact of the results obtained. How are these results transferred and integrated into the industrial cycle? In what way do they contribute to the "competitiveness" objective of the programme?

While it is too early to expect a complete and definitive answer to that question at this stage of the programme, it is quite proper to begin to address it, especially in the light of this year's IT Forum theme, "Technology and Market", and that is what I shall do in the rest of this talk.

Most of the 227 ongoing projects are of five years total duration and only about half of them (111 to be precise) have passed their three year mark. To assess the impact of the projects we looked at each one in turn, and identified significant results according to the following three categories:

- results which have provided a key contribution towards a product or service
- results that have been transferred and are used by another company, or another division of the same company - that is by others than the project team
- results that contribute to standardization (either directly leading to a standard, or implementing an emerging standard, or both)

In total we found 143 such results, coming out of 108 projects (see slide S-1):

- 71 towards products (of which 27 are already commercialized - a very short cycle indeed)
- 44 technology transfers
- 28 standardization results

At this stage of the program this is certainly quite encouraging, but this needs to be watched carefully on an ongoing basis.

Let me now illustrate these somewhat dry statistics with a few concrete examples, necessarily limited because of time, and also because there are so many being demonstrated right here on this site - and much better than I could describe with words.

Let me first mention 'Supernode' (see slide S-2). This project is aiming at the "minisupercomputer" range, namely providing near supercomputer performance, but at a fraction of the cost. In just over two years this project has produced impressive progress. The floating point transputer, which was developed in this project, is capable of processing 1.5 Million Floating Point operations per second (in full double precision 64 bit words), all on one chip, and that is one of the most powerful chips on the market today.

Now to actually build a 'Supernode' out of these transputers, which are the building blocks of the machine, you need to put a very large number of them together (maybe 320 or more) suitably interconnected so they can work efficiently in parallel. In fact total reconfigurability has been achieved up to a thousand transputers, and intermediate prototypes are running with excellent efficiency on real applications. You can see some of them running at the demonstration here in the exhibition, and this stand is quite impressive - worth the journey, I would say.

Next, I would like to talk about Gallium Arsenide technology. One of the problems in developing this technology, as compared to silicon, is getting access to a source of high quality, industrial, GaAs ingots. Till now, this has not been available in Europe on an industrial scale. Project 1128 (see slide S-3) has now established such a source. 3-inch and 4-inch ingots have been grown (the current state of the art is about 2 inches) and the quality of these ingots is higher than anything commercially available from Japan.

Now what is interesting (see slide S-4) is the interaction between this project, 1128, and other projects, notably 843, which involves all the major European actors in GaAs, and aims at producing GaAs Integrated Circuits, in particular high speed memories. Roughly speaking, 1128 supplies the wafers 843 needs to build the circuits, and in turn 843 gives 1128 feedback: detailed specifications, quality assessment, and so on. Thanks to this interaction there is now in Europe an early source of such wafers about one year ahead of what is commercially available on the world market, and this is of course available to other ESPRIT and RACE projects as well.

I would now like to talk about projects which have an impact on standardization, in the broad sense of the word, because that is one of the most important ways in which ESPRIT can contribute to the goal of an integrated European market by 1992. Systems interoperability is the key to market integration in IT.

One such project is PCTE (Portable Common Tool Environment) in the Software Technology area (see slide S-5). This project aims at providing standard software interfaces to ensure software tool portability and interoperability. Started by a few major companies, led by Bull, PCTE is now gaining wider and wider acceptance. There are 26 other ESPRIT projects mobilized around PCTE. Several national programmes and EUREKA projects have adopted the PCTE interfaces, which are now controlled and maintained by an independent Management Board on which are represented computer manufacturers, software companies and major users, including two US companies as observers, DEC and Hewlett-Packard. PCTE is now ripe for formal standardization, and we are taking the ECMA/ISO route.

In the Office systems area (see slides S-6 and S-7), there are 11 projects making a major impact on more than 16 standardization activities, in all the areas where it makes sense: Open Distributed Architecture, Communication, File Servers, Office Document Architecture, and Man-Machine Interfaces. I do not have time to go into all the details, but let me assure you that the overall impact is substantial.

Turning to Computer Integrated Manufacturing this slide (S-8) tries to represent the domain. We have the overall CIM Architecture at the centre, a communications layer around it, and at the next layer the different phases of production. Going clockwise from the top, we have first design (product design and development) then planning, and then manufacture (factory automation). Standardization and interoperability are obviously critical in CIM; otherwise integration cannot take place. There are four key ESPRIT projects with a strong standardization character in CIM: the Open Systems Architecture one at the center (Project 688 - AMICE), the CNMA project in Communications (I will come back to CNMA in a minute), CAD*I - (Computer Aided Design Interfaces) in Product Design, and project 623 in Robot Integration.

Let me briefly describe the CNMA project (see slide S-9). The aim of this project is to establish standard protocols for interworking networks on the shopfloor. This project has produced impressive results: a full multi-vendor manufacturing cell was demonstrated at this year's Hannover Fair - unfortunately the demonstration is much too large to be brought onto this site! Industrial pilots are now being installed in three production plants. These include a brand new BMW plant at Regensburg, fully wired with 35 kilometres of fibre optic cable, linking 600 connection points using the CNMA protocols, and the Airbus A320 plant at British Aerospace in Salisbury, where CNMA techniques will be used to design and produce the Airbus wing.

Having presented some of the impact achieved by ESPRIT projects, I would now like to look at three global indicators which have changed significantly over the last three or four years, and which represent concrete instances of some of the ideas presented by the previous speakers.

When ESPRIT was being prepared, one of the main structural problems identified in Europe was the lack of alliances between European IT companies. They seemed to seek US partners much more than European ones. Now (see slide S-10) the situation has completely changed. The number of international intereuropean alliances has jumped by a factor of seven. This does not of course count links in ESPRIT projects; it refers to company agreements in the commercial sector such as joint ventures, mergers, marketing alliances, and so forth.

Another significant fact is the increase in total R&D expenditure (see slide S-11; figures are given in percentages of company turnover in order to eliminate the effects of exchange rate fluctuations.) R&D expenditure can be taken as an indicator of confidence, and we can see that European IT companies' R&D expenditure has gone up from 7.7% to 9.2% in the last 3 years. European companies now spend more in percentage terms on R&D than their US competitors (the Japanese figures are much too low - they must come from different accounting rules). Incidentally, total investment by European IT companies - another confidence measure - has also grown, from 6% to 9%; it is now up to the levels of Japanese and US companies.

Also looking at the growth rate of the top 20 Data Processing companies in the world (see slide S-12), we see that European companies are doing very well indeed (5 out of the top 10).

Now I do not claim that the whole situation is satisfactory - there are other indicators that are more worrying - nor of course that ESPRIT is the sole reason for these improvements. Michel Carpentier in a minute is going to give you a much fuller picture of the situation. What I am saying is that the situation is improving, and that ESPRIT is playing its part in this improvement.

Therefore there is every reason to continue a strategy which appears to be going in the right direction. ESPRIT was conceived as a 10 year programme, and all the indicators suggest that a sustained and amplified effort of that duration is necessary to achieve the objectives of ESPRIT. The second phase of the programme has been prepared accordingly (see slide S-13).

I would like to conclude with a word of caution, perhaps in contrast to previous speakers. As ESPRIT moves into its second phase we are going to have to cross very much the same hurdles that we crossed in the first phase, but now they will be twice as high, and we should not take it for granted that the answers will necessarily be the same. Underestimating this change of scale would be a major mistake. A completely new challenge is ahead of us. ESPRIT II is not simply a continuation of ESPRIT I. New projects must be formed - not just old ones continued; new partners must be found. But with the creativity and determination that made ESPRIT I a success, ESPRIT II can be one too.

PROJECTS' RESULTS
(as of Sept. 1987)

227 ongoing projects

- Mostly of 5-year duration
- 111 have completed their 3rd year

108 Projects have produced significant results

- 71 results contribute to products or services
- 44 results have been transferred outside the project
- 28 results contribute to standardization

SUPERNODE

(P 1085)

RSRE
APSIS
INMOS
THORN EMI
TELMAT
UNIV. OF GRENOBLE
UNIV. OF SOUTHAMPTON

OBJECTIVE

- Low cost high performance multiprocessor system (~200K $ ~250 MFLOPS)

APPROACH

- Concurrent operation of large number of processors (16 nodes x 20 processors configuration running by end 1987)
- Flexible architecture, using a switching network
- Development of software for selected applications

RESULTS

- Floating point transputer developed
- Total reconfigurability over 1000 transputers
- 5 x 8 Processor configuration implemented, running at 95% efficiency on image/scientific applications

LARGE DIAMETER SEMI-INSULATING GaAs WAFERS

(P 1128)

PHILIPS—LEP   WACKER CHEMITRONICS
UNIV. LOUVAIN (UCL)

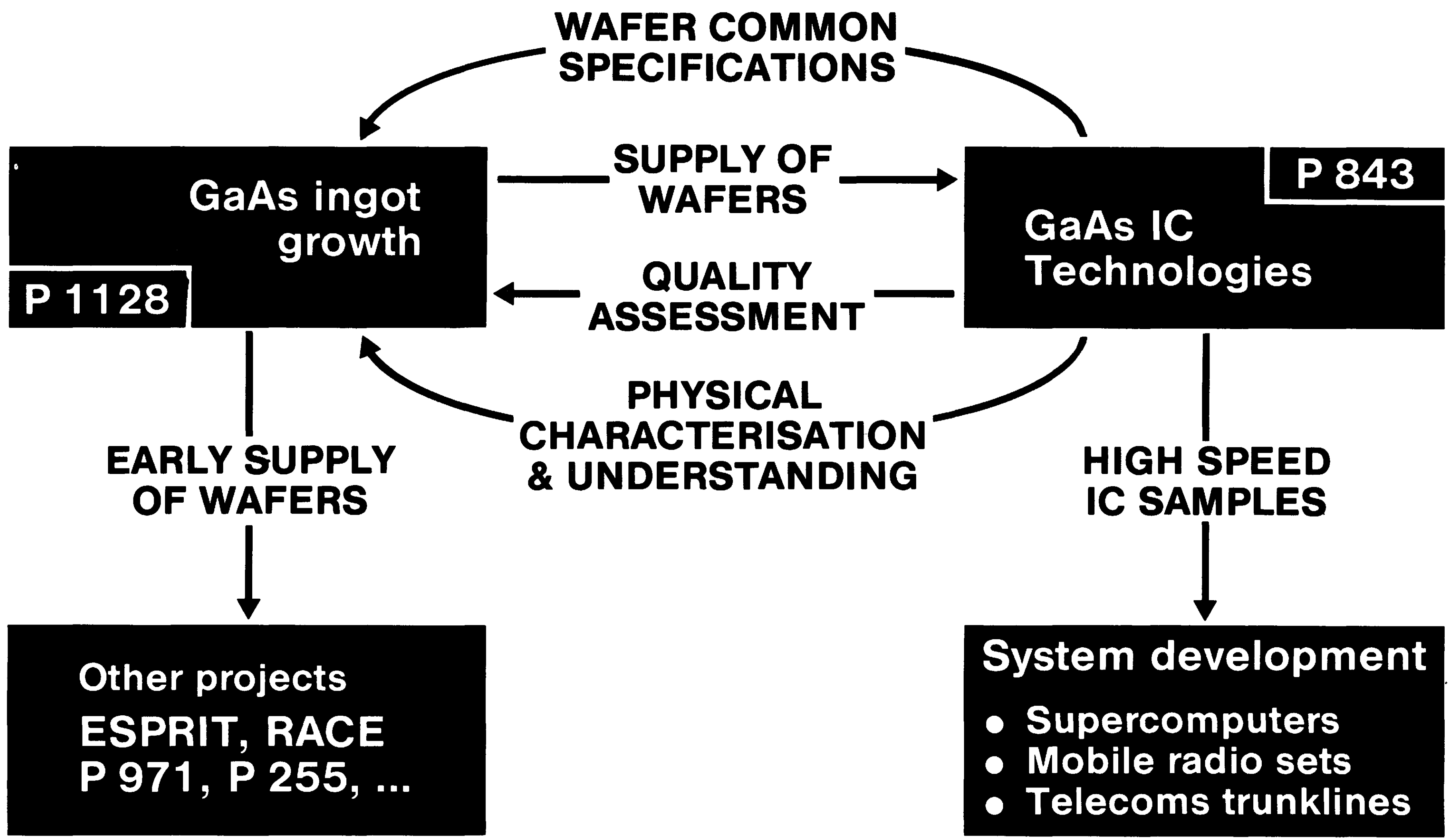
OBJECTIVE

- Growth of large diameter (~3") GaAs ingots for manufacturing LSI circuits

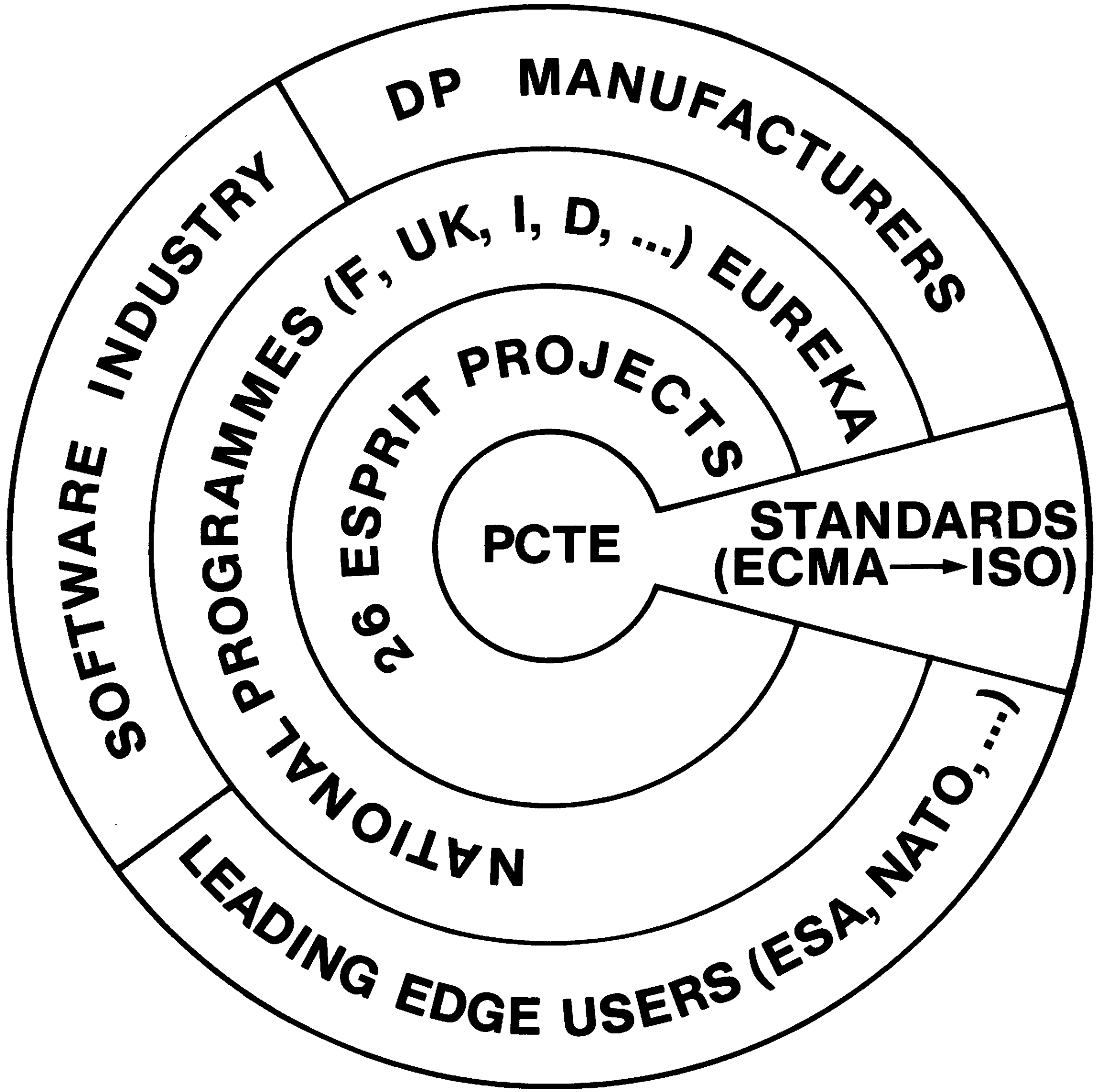
RESULTS

- Successful growth of 3" and 4" diameter ingots
- Construction of machine capable of growing 20 kg ingots
- Wafers with 2x improved uniformity compared to commercially available substrates
- Resulting wafers are used by P 843 to produce GaAs high speed memories

GaAs TECHNOLOGY

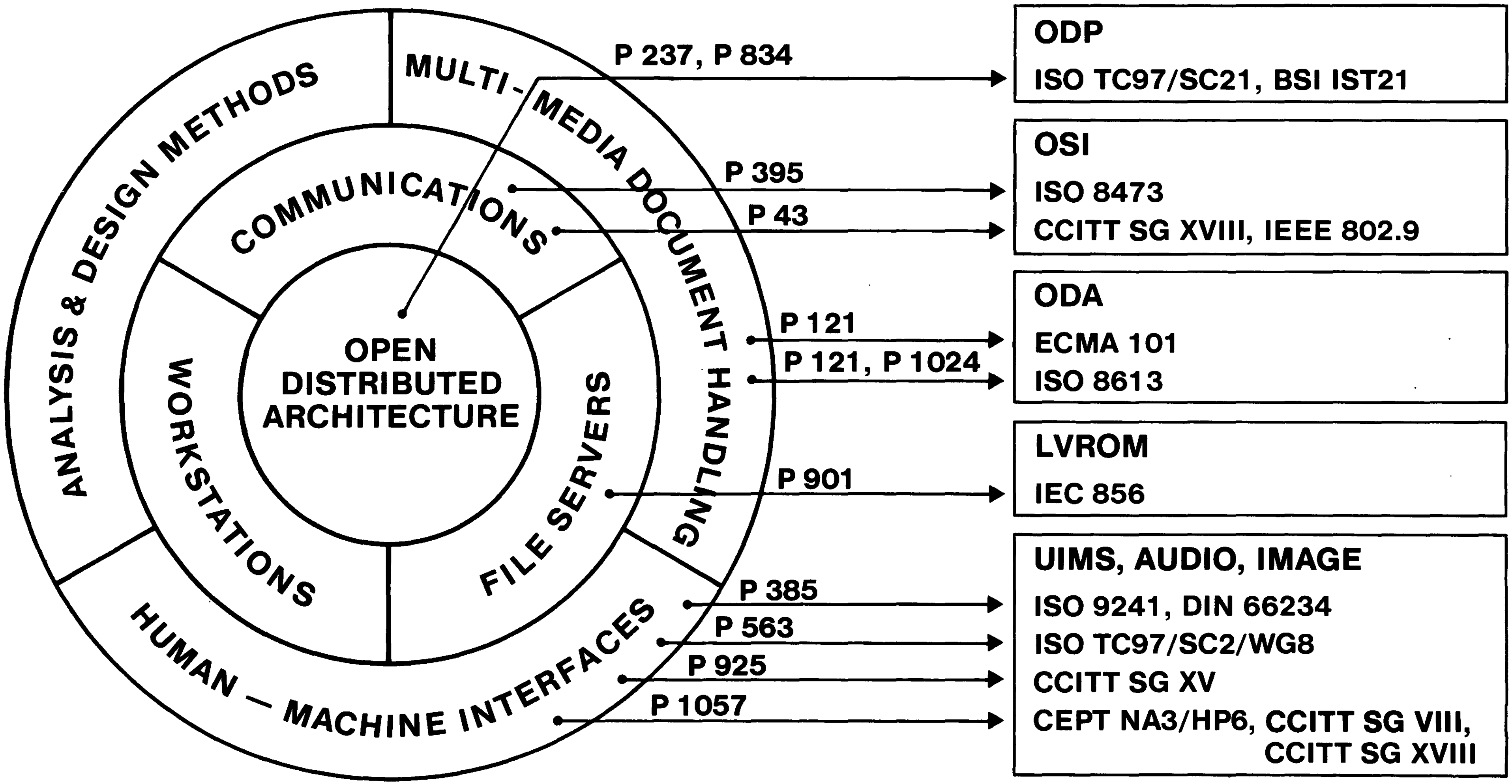


PCTE — IMPACT



PCTE
26 ESPRIT PROJECTS
NATIONAL PROGRAMMES (F, UK, I, D, ...) EUREKA
DP MANUFACTURERS
SOFTWARE INDUSTRY
LEADING EDGE USERS (ESA, NATO, ...)
STANDARDS
(ECMA→ISO)

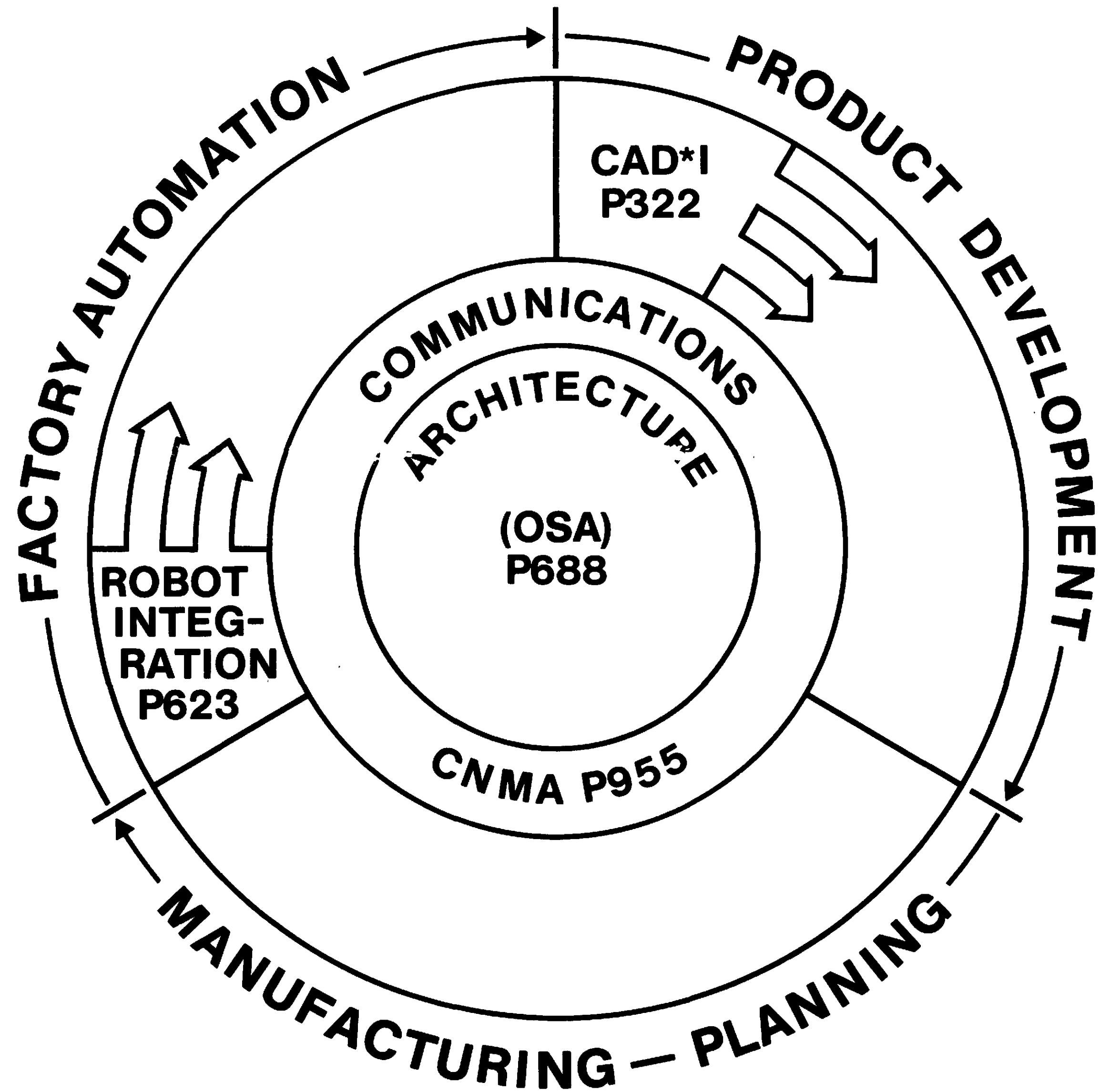
OFFICE SYSTEMS — IMPACT ON STANDARDS



OFFICE SYSTEMS — IMPACT ON STANDARDIZATION

	Direct impact on :	Early implementation of :
OPEN DISTRIBUTED ARCHITECTURES		
P 237, P 834	ISO TC97/SC21, BSI IST21 (ODP)	
COMMUNICATION NETWORKS		
P 73, P 169		IEEE 802.X (OSI)
P 395	ISO 8473	IEEE 802.X (OSI)
P 43	CCITT/XVIII, IEEE 802.9	
FILE SERVERS		
P 901	IEC 856	
DOCUMENT & MESSAGE HANDLING		
P 121	ECMA 101 (ODA)	
P 1024	ISO 8613 (ODA)	
P 28, P 295, P 367, P 395		ODA
P 73		CCITT X400 (MHS)
HUMAN-MACHINE INTERFACE		
P 385	DIN 66234, ISO 9241	
P 563	ISO/TC97/SC2/WG8	
P 925	CCITT SGXV	
P 1057	CEPT NA3/HP6, CCITT SGVIII, CCITT SGXVIII	

CIM — IMPACT ON STANDARDIZATION



CNMA : COMMUNICATIONS NETWORK FOR MANUFACTURING APPLICATIONS

BRITISH AEROSPACE	SIEMENS	CGE-TITN
BMW	BULL	FRAUNHOFER II TB
PEUGEOT	OLIVETTI	ICL
AERITALIA	GEC	ELF
	NIXDORF	

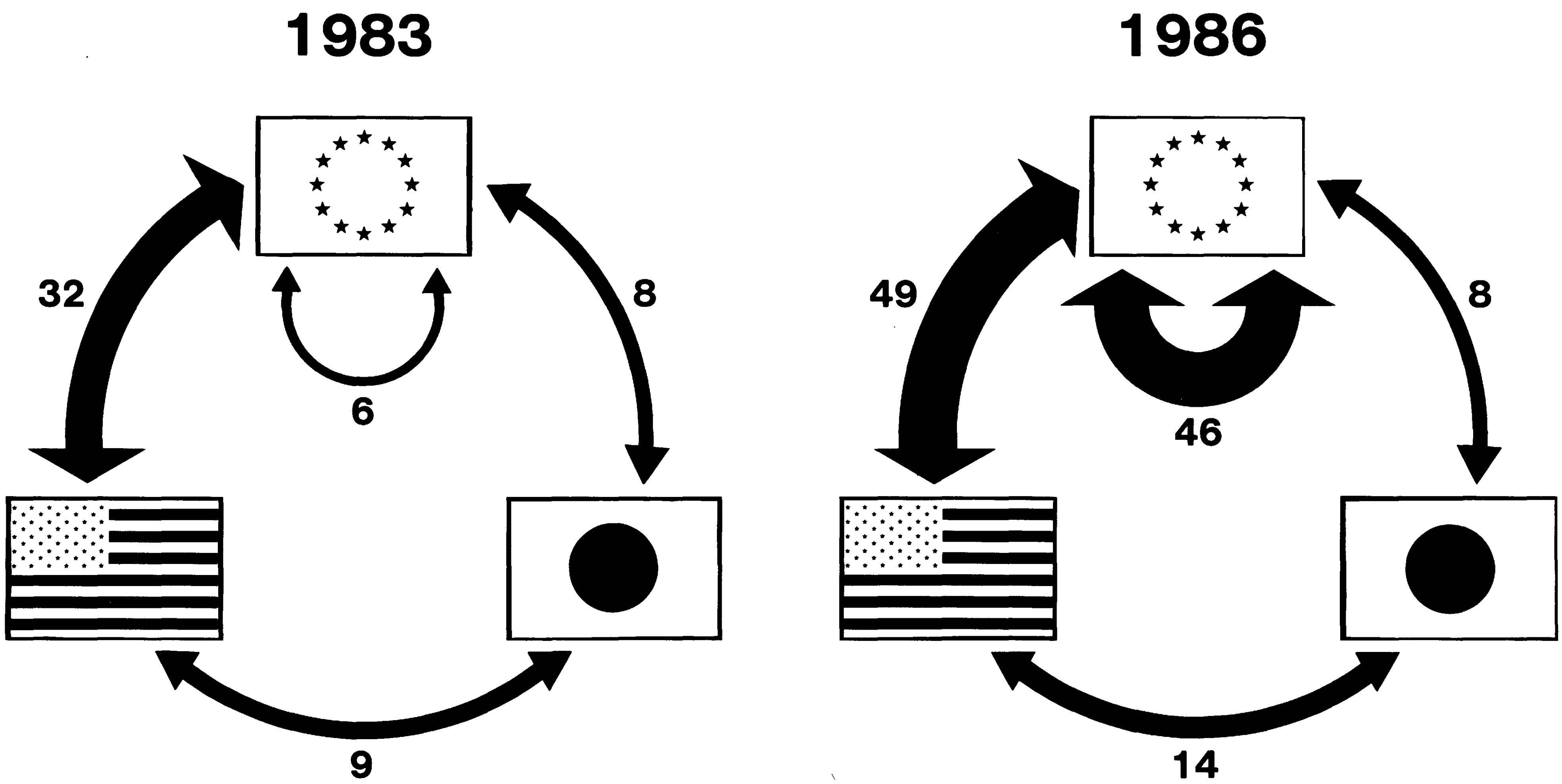
OBJECTIVE

- To select, implement and demonstrate existing and upcoming communications standards in real production environments

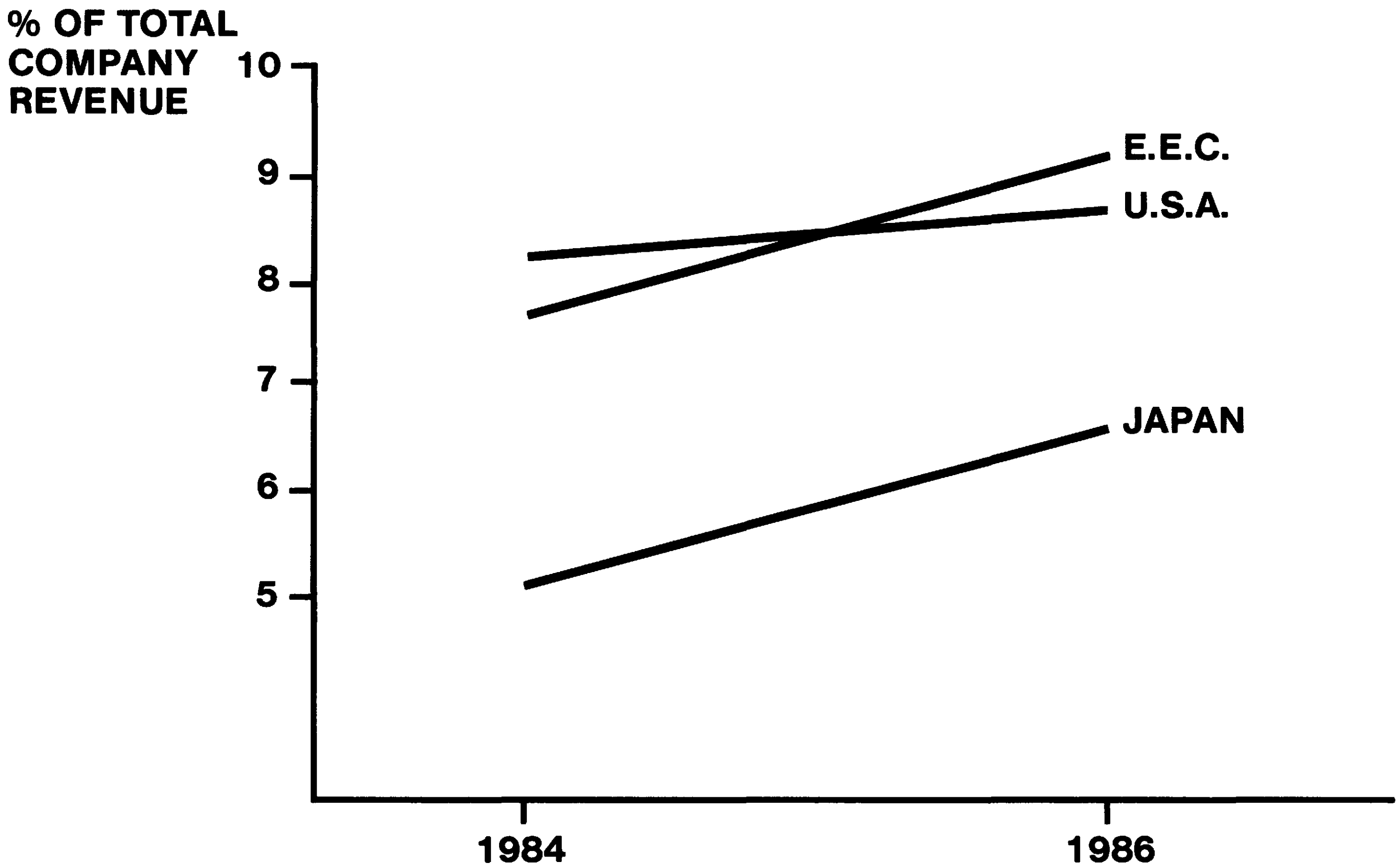
RESULTS

- Implementation guide for communication protocols published
- Full multi-vendor application, demonstrated at Hannover fair (April 1987)
- Industrial pilots being installed in three plants (BMW, British Aerospace, Aeritalia)
- CNMA representation at ENE (Baltimore 1988)

CROSS BORDER ALLIANCES BETWEEN IT COMPANIES



TOP 20 DP COMPANIES
R & D EXPENDITURE



SOURCE : DATAMATION

TOP 20 DP COMPANIES

Ranked by 1984 - 1986 average yearly DP revenue increase (in national currency)

1	OLIVETTI			28.4 %
2			TOSHIBA	22.3 %
3	NIXDORF			17.4 %
4			NEC	16.5 %
5		DEC		16.2 %
6	SIEMENS			15.6 %
7	BULL (*)			14.4 %
8			HITACHI	14.3 %
9			MATSUSHITA	12.5 %
10	ICL			12.2 %
11		XEROX		10.6 %
12			FUJITSU	10.1 %
13		HP		10.0 %
14		NCR		9.3 %
15		ATT		8.3 %
16		IBM		5.8 %
17		WANG		5.1 %
18	PHILIPS			4.3 %
19		APPLE		4.1 %
20		CDC		– 4.7 %

Unisys not included
(*) not including HIS

Source : Datamation

ESPRIT PHASE II

- Time Frame 1988 — 1992
- Total cost = 3.2 BECU
- 30% of EEC's IT resources in precompetitive R & D
- Effort concentrated on 3 areas :
  - — Microelectronics + peripheral technologies
  - — Information processing systems
  - — IT application technologies
- Limited Basic Research Actions
- Full European Dimension

SYNTHESE

M. Michel Carpentier
Directeur Général de la DG XIII
Telecommunications, Industries de l'Information et Innovation

A l'issue de cette matinée consacrée aux relations entre le développement technologique et le grand marché - qui nous a permis d'entendre les points de vue, les espoirs mais aussi les préoccupations de responsables et de décideurs économiques et politiques de tout premier plan, et avec M. J.M. Cadiou de faire le point sur l'état d'avancement et l'avenir du programme ESPRIT - il me revient le périlleux honneur de faire la synthèse des interventions en présentant quelques réflexions sur le rôle, dans la construction européenne, de la Communauté technologique, dont la création a été décidée au Conseil européen de Milan, en même temps qu'était lancée la Conférence intergouvernementale qui devait aboutir à l'Acte Unique, ainsi que l'idée de l'initiative EUREKA.

Je crois qu'il est ressorti des très brillantes interventions que nous avons entendues trois constatations et deux questions sous-jacentes auxquelles les réponses qui seront fournies paraissent fondamentales pour l'après 1987.

1ère constatation

1987 est une année importante pour l'Europe dans la mesure où nombre d'événements et de décisions publiques et privées témoignent d'un réveil de l'Europe, si toutefois responsables économiques et autorités publiques et politiques savent inscrire leurs efforts dans la durée, et dans une vision globale orientée vers le long terme.

Je citerai bien sûr les succès d'ESPRIT, l'adoption - enfin - du programme-cadre, le lancement prochain de RACE et la poursuite de BRITE et les progrès enregistrés en matière de stratégie et de démarche concertée dans les télécommunications, la confirmation d'EUREKA et, très certainement, l'adoption en novembre d'un programme pluriannuel ambitieux pour l'Agence Spatiale Européenne. A ceci s'ajoute bien sûr, et ce n'est pas le moins important, un mouvement de fusions, de regroupements, de coopérations et de transnationalisations accrues, qui a affecté la plupart des entreprises européennes du secteur des TIT au cours des derniers mois.

Bref, il apparaît de plus en plus clairement et ceci a été confirmé par les interventions de MM. Stern et Van der Klugt, que les Européens commencent à miser de plus en plus sérieusement sur le renforcement de la coopération technologique à l'échelle européenne, et sur la restructuration de l'outil industriel dans la perspective de 1992.

2ème constatation

Malgré les efforts déployés au niveau technologique et malgré les succès remportés notamment à travers ESPRIT, la situation de l'Europe dans le domaine des Technologies de l'Information et des Télécommunications continue à rester préoccupante.

D'abord, parce que si certaines signaux montrent que l'industrie européenne "remonte la pente", certains clignotants restent au rouge, si l'on en juge par l'évolution des parts de marché ou par la dégradation du solde commercial notamment dans le secteur de la production de composants micro-électroniques.

Ensuite et ceci explique-t-il cela, parce qu'une partie notable de l'opinion publique et parfois des responsables politiques ne semble pas encore avoir perçu toute l'importance des enjeux impliqués par la diffusion des technologies et des industries de l'information et de la communication.

L'incroyable lenteur des discussions sur le programme-cadre et le chipotage auxquelles elles ont donné lieu témoignent que des progrès considérables restent à faire pour faire prendre conscience aux responsables de nos économies et de nos finances que le raisonnement économique doit désormais intégrer davantage la dimension technologique. Cette prise de conscience trop timide constitue à mes yeux un handicap sérieux pour l'Europe.

3éme Constatation

1992, c'est à la fois une chance et un défi. C'est en même temps une échéance toute proche. C'est donc dès aujourd'hui qu'il faut se préparer pour tirer pleinement parti des chances qu'offira la réalisation du grand marché et pour relever les défis qu'entraînera son accomplissement.

La mise en place du marché intérieur va en effet offrir des opportunités considérables à tous ceux qui sauront penser et agir européen, c'est-à-dire organiser leur stratégie, leurs alliances industrielles, leur capacité d'écoute et d'anticipation des besoins d'un marché unifié mais diversifié de 320 millions de consommateurs.

La réalisation de l'objectif 1992 va entraîner un bouleversement des règles du jeu et des habitudes anciennes, qui doit se traduire par des modifications considérables des comportements, d'ordre économique mais aussi d'ordre culturel, bouleversement qui impliquera la recherche de nouveaux équilibres au sein de la Communauté.

Faute d'une telle anticipation, le grand marché européen pourrait, dans un premier temps, être principalement utilisé par nos concurrents extérieurs, puis, une telle situation devenant rapidement insupportable, se disloquer progressivement sous les effets d'un néo-protectionnisme.

Dès lors, dans ce contexte, caractérisé à la fois et de manière un peu contradictoire par :

- le maintien d'une situation difficile de l'Europe dans le domaine des Technologies de l'Information et des Télécommunications,

- les perspectives très encourageantes ouvertes par les prémices d'un réveil technologique européen,

- l'échéance désormais très proche de 1992,

il me semble que l'on ne peut éviter de se poser deux questions fondamentales :

A. Les succès d'ESPRIT et d'autres programmes ou initiatives de coopération technologique sont-ils suffisants pour permettre à l'Europe de rétablir la situation dans le domaine des Technologies de l'Information et des Télécommunications ?

B. Comment pouvons-nous réussir le plus efficacement l'objectif de réalisation du grand marché européen dont j'ai esquissé très rapidement le caractère global et les enjeux multiples ?

A. ESPRIT est-il suffisant pour nous permettre d'atteindre nos objectifs ?

1. ESPRIT constitue indéniablement, du fait des succès rencontrés pendant la première phase, une bonne illustration de ce que les Européens peuvent réussir en coopérant dans un cadre approprié.

   A l'actif de la première phase d'ESPRIT, trois avancées très importantes ont été fréquemment citées ce matin :

   En premier lieu, la création d'une communauté technologique européenne fondée sur l'association de chercheurs venus de l'industrie et de l'université, qui ont réalisé des projets concrets et bien ciblés, développé une confiance mutuelle, ressenti la fierté que procure le succès obtenu en commun, pris conscience qu'une collaboration entre personnes de nationalités, de cultures, d'éducations, de langues différentes était non seulement possible mais fructueuse.

   En deuxième lieu : en trois ans, ESPRIT fournit des résultats tangibles, ainsi que l'attestent la bonne cinquantaine de démonstrations qui vous sont présentées et dont les effets ultérieurs sur la production de produits-services et processus innovants sont prometteurs.

   Enfin, je citerai le rôle direct joué par ESPRIT dans la préparation des normes, et son rôle indirect dans la création de nouvelles structures industrielles de grande importance et dans le lancement d'autres initiatives d'associations, telles que RACE et BRITE dans le cadre communautaire et EUREKA dans un cadre intergouvernemental.

   Les motifs de ce succès sont à trouver dans la volonté des acteurs industriels et scientifiques de réussir, le caractère stratégique et la sévérité des choix opérés, la concordance et la cohérence des initiatives technologiques, économiques et politiques menées par la Communauté, l'absence d'interventionnisme bureaucratique de la Commission, qui a su jouer le rôle de modérateur, d'interlocuteur entre pouvoirs publics nationaux et partenaires industriels et scientifiques.

2. ESPRIT n'est et ne peut être cependant qu'un élément d'une stratégie globale de R&D à moyen ou long terme.

   D'abord parce que, compte tenu de la convergence croissante des technologies et des systèmes, l'effort entrepris dans les technologies de l'information doit être poursuivi et complété par des travaux dans le domaine des télécommunications, de l'électronique grand public, des nouveaux services de l'information, etc.

Ensuite, parce que la Communauté dans son ensemble doit s'efforcer d'accroître sur une longue période le montant des ressources qu'elle consacre à la R&D, si elle veut rester dans la course. Face aux Etats-Unis et au Japon, l'Europe doit à la fois combler son retard quantitatif et améliorer l'allocation des ressources affectées à la R&D.

Pour réaliser ce double objectif, il faut réunir quatre conditions :

(a) premièrement, renforcer en Europe la part affectée aux travaux de R&D menés en coopération transnationale. Les conclusions du récent rapport réalisé pour le compte du Commissariat français au Plan, et présidé par M. de Robien, sont à cet égard très claires : seule une politique concertée des Etats membres et de la Communauté peut rééquilibrer à terme les échanges commerciaux de l'Europe dans les Technologies de l'Information et des Télécommunications et sauvegarder l'indépendance industrielle du continent;

(b) en deuxième lieu, il faut mettre en oeuvre au niveau européen des stratégies plus concertées de développement technologique, comportant l'identification de priorités claires, notamment dans les domaines d'application des Technologies de l'Information et des Télécommunications. Tel est l'objectif des nouveaux programmes : AIM, en ce qui concerne la santé, DELTA, en ce qui concerne la formation, DRIVE, en ce qui concerne la sécurité routière, TEDIS en ce qui concerne l'utilisation accrue des communications électroniques, ainsi que du programme d'action relatif au développement de nouveaux services et d'un marché de l'information;

(c) troisièmement, il faut également mieux coordonner les efforts accomplis dans un cadre coopératif (Communauté, EUREKA, Agence Spatiale, etc) et au niveau des programmes nationaux;

(d) enfin, il convient d'accroître en Europe la mobilité des étudiants et des scientifiques, et de resserrer les liens université-industrie. Les initiatives de la Communauté, telles que SCIENCE, COMETT et ERASMUS, constituent l'accompagnement indispensable des programmes technologiques.

3. La technologie ne peut être considérée indépendamment de l'environnement économique, social et culturel dans lequel elle opère: ESPRIT ne peut échapper à cette règle.

ESPRIT, tout comme les grands programmes technologiques, ne peut réussir que si nous arrivons à intégrer sa stratégie et ses résultats dans un cadre plus vaste et plus ambitieux, prenant en compte le développement technologique, le marché dans ses diverses composantes et l'exigence d'une cohésion accrue de la Communauté.

B. C'est là que la réponse à la première question "la réussite d'ESPRIT est-elle suffisante pour redresser la situation européenne dans les Technologies de l'Information et des Télécommunications" rejoint les éléménts de réponse que je voudrais maintenant apporter à la question : "Comment réussir le plus efficacement l'objectif de réalisation du grand marché ?"

Je crois en effet que l'Europe ne réussira pleinement le pari du grand marché que si elle veille, tout en assurant l'unification du marché intérieur, à renforcer parallèlement et de manière cohérente :

- l'accroissement de l'effort de RDT sans lequel il ne peut y avoir d'amélioration durable de la compétitivité,

- la définition de nouvelles "règles du jeu",

- et un effort soutenu d'intégration et de solidarité interne et externe de la Communauté.

Ce tryptique "recherche, marché, cohésion" constitue les trois grands axes autour desquels doit s'organiser la volonté commune de relance de la construction européenne, telle qu'elle s'exprime dans l'Acte Unique Européen.

Après avoir beaucoup parlé du développement technologique, je voudrais insister maintenant sur les aspects marché au sens large et cohésion interne et externe ainsi que sur les relations réciproques qui doivent s'établir et se renforcer entre les trois éléments du tryptique : *recherche, marché, cohésion*.

La réalisation du grand marché tout d'abord.

Elle n'est pas et ne peut être - à mon avis, je n'engage que moi - une simple opération de déréglementation. Il serait illusoire de penser qu'il suffirait de remplacer le protectionnisme national douillet, dans lequel s'est complue trop souvent l'industrie européenne, par un libéralisme européen naïf et sans règles du jeu pour que nos difficultés économiques disparaissent comme par enchantement.

Ce type de libéralisme n'existe au demeurant nulle part. Le Gouvernement et le Congrès des Etats-Unis interviennent massivement, tant au niveau des aides financières qu'ils apportent à l'industrie en matière de R&D que par les marchés publics réservés, notamment en matière de défense, par une diplomatie active en matière commerciale, par les restrictions qu'ils apportent aux transferts de technologies ou aux associations avec les industries étrangères pour des motifs présentés comme liés à des nécessités de sécurité.

Quant aux acteurs économiques et politiques japonais, ils savent utiliser toutes les facettes d'un protectionnisme culturel naturellement ancré dans les moeurs de ce grand peuple.

L'objectif du grand marché, ce sout la mise en place, à l'échelle continentale, d'un cadre plus ouvert, plus dynamique, offrant aux opérateurs économiques le bénéfice des économies d'échelle, d'une coopération transfrontière accrue, d'une plus grande transparence du marché et d'une plus grande égalité dans l'accès aux marchés publics et aux consommateurs privés dans les autres Etats membres. C'est également l'établissement de règles du jeu à usage interne et externe, et une forte volonté politique commune de faire assurer le respect de ces règles.

Le grand marché unifié c'est, en particulier dans les Technologies de l'Information et des Télécommunications, quatre éléments indissociables :

(a) la transparence et de plus grandes certitudes sur l'avenir pour les opérateurs économiques comme pour les consommateurs. Cette transparence exige des normes communes et des visées stratégiques convergentes guidant l'action des entreprises, des opérateurs publics et privés, ainsi que la demande des consommateurs : la définition des stratégies concertées dans la Communauté en matière d'évolution vers le RNIS et de mise en oeuvre de la téléphonie mobile de deuxième génération permet d'unifier les conditions d'offre des produits et des services correspondants et de stimuler la demande.

(b) Deuxième élément : l'optimisation des structures industrielles. La nécessité de constituer rapidement - par alliance, coopération, fusion, ... - de grands groupes européens susceptibles de faire face à la concurrence internationale et d'assurer le poids d'investissements de R&D et de production considérables, est très généralement reconnue. L'optimisation des structures industrielles n'est pas cependant uniquement une question de taille. Cette dernière ne joue pas forcément, il s'en faut, pour l'ensemble des industries de l'information et de la communication. Il me paraît à cet égard dangereux d'opposer PME-PMI et grandes entreprises.

L'optimisation des structures concerne ou peut concerner également en effet :

- le recentrage des firmes sur les activités dans lesquelles elles sont les meilleures,

- l'accès à la transnationalisation et à la présence sur les marchés des autres pays ce qui requiert une capacité d'adaptation à d'autres cultures d'entreprises ou de consommateurs,

- l'utilisation de méthodes de gestion renouvelées du personnel et de la production mettant l'accent sur l'amélioration de la formation, le renforcement des activités de veille technologique, l'écoute et le suivi de la clientèle, le marketing, etc,

(c) 3ème élément de ce nouveau cadre régulateur qu'est l'établissement du grand marché : la stimulation de la demande et de sa capacité à influencer le jeu des opérateurs économiques, en ce qui concerne la définition des produits, l'adaptation des stratégies commerciales, etc..

Il n'y aura en effet de grand marché que si ce dernier est le lieu d'une demande forte, résonnante et diversifiée, à l'échelle continentale.

Une demande forte suppose d'apporter des améliorations considérables aux conditions d'accès des utilisateurs professionnels et domestiques aux produits et aux services nouveaux, grâce notamment :

- à l'adoption de normes communes garantissant la compatibilité et l'interopérabilité,

- à la mise en place des infrastructures de base permettant d'utiliser dans des conditions similaires les nouveaux produits, services et équipements informatiques, télématiques et audiovisuels. D'où l'importance que nous attachons aux progrès réalisés en matière de stratégies concertées dans le domaine des télécommunications ou de l'évolution vers la télévision à haute définition;

- à l'harmonisation des conditions d'accès aux réseaux de télécommunications, en particulier des principes de tarification qui conditionne la réalisation d'un marché unifié des services télématiques, qui elle-même influencera la propension à acquérir et à utiliser les nouveaux équipements et services. D'où l'initiative prise par la Commission de rédiger un "livre vert" sur le marché des télécommunications, dont on mesure d'ores et déjà l'influence.

La demande en Europe ne sera réceptive à l'innovation et à l'offre de produits et de services nouveaux qu'à la condition de surmonter certains obstacles psychologiques et culturels chez les utilisateurs. Il y a là un effort particulier d'amélioration de l'insertion des nouvelles technologies dans des contextes concrets de travail et de loisirs, un souci permanent de recherche et de convivialité maximale des interfaces débouchant sur la mise au point d'outils performants adaptés aux besoins sociaux les plus diversifiés. Tel est l'objet au delà et en complément d'ESPRIT de programmes tels que DELTA, DRIVE, AIM, etc. que j'ai déjà mentionnés et de l'amélioration de la coopération entre la Commission et les partenaires d'Eureka.

Enfin, la demande doit être davantage interactive avec l'offre qui doit renforcer sa capacité d'écoute des utilisateurs et d'analyse des besoins.

Je crois à la nécessité d'un meilleur équilibre dans la définition des travaux de RDT entre le pilotage par l'amont (par l'offre technologique) et le pilotage par l'aval (réaction aux stimulations ou aux insatisfactions de la demande), pour parvenir à promouvoir une offre de solutions aux problèmes des utilisateurs. Ce meilleur équilibre doit être trouvé au niveau des entreprises par une meilleure symbiose entre les départements de production, de commercialisation et de recherche.

(d) Enfin, il serait illusoire de croire qu'il sera possible de réaliser les transformations économiques requises par la réalisation d'un marché intérieur européen sans un dialogue entre partenaires politiques, économiques et sociaux qui s'attaque le plus directement possible aux problème de l'emploi. La Communauté compte actuellement seize millions de chômeurs. Répondre à ce problème en se bornant à rappeler les transformations sociales qui se sont produites au 19è siècle et en affirmant que les nouvelles technologies créeront demain de nouveaux emplois est évidemment insuffisant.

La mémoire historique des misères supportées par certaines catégories sociales au cours de la première révolution industrielle est encore vivace dans les esprits. D'autre part, s'il est vrai que de nouveaux emplois encore inconnus aujourd'hui verront vraisemblablement le jour, il n'apparaîtront qu'à moyen terme et exigeront de nouvelles qualifications. Il faut donc mettre en place une stratégie qui permette, à moyen et long terme, de préparer les transitions inéluctables et, à court terme, d'éviter des réactions qui risqueraient d'être d'autant plus vives qu'elles seraient justifiées non seulement par des raisons objectives mais par l'impréparation et l'absence de réflexion commune sur les mesures à prendre pour limiter la crise présente et préparer l'avenir.

Je terminerai ma description du tryptique "*recherche, marché, cohésion*". au coeur de la démarche de la Communauté par l'évocation du pilier cohésion.

La cohésion interne n'est pas un supplément d'âme ajoutée in extremis dans l'Acte Unique. Il s'agit bien plutôt d'un élément qui aurait été indispensable pour réussir l'objectif de la relance de la construction européenne, sous son double aspect de cohésion interne et de cohésion externe.

Cohésion interne tout d'abord parce que l'accentuation des disparités au sein de la Communauté freinerait vite, pour des raisons politiques et économiques, le processus d'intégration.

La réalisation du grand marché ne peut se limiter aux 130 millions d'habitants de la Communauté résidant dans les zones considérées comme les plus favorisées et laisser de côté 40% de la population de nos douze pays [1] : ce serait affaiblir gravement l'indispensable capacité de résonnance et de réceptivité maximale dont nos industriels ont besoin. La réussite de l'objectif 1992 requiert par ailleurs la mobilisation de l'ensemble des potentialités technologiques et entrepreneuriales existant en Europe.

Ni les pays les plus industrialisés qui ont des régions défavorisées de plus en plus nombreuses (zones d'industries traditionnelles et d'agriculture en déclin,) ni les pays dits moins favorisés qui ont des niches scientifiques et industrielles intéressantes, ne peuvent penser régler les disparités régionales par des fonds structurels qui seraient considérés comme des fonds de "croix rouge" ou de tiroirs caisses.

C'est pourquoi la réforme des Fonds Structurels, leur articulation autour d'objectifs programmatiques, la recherche du développement intégré, la mise en place du programme STAR en faveur du développement des télécommunications dans les zones moins favorisées de la Communauté revêtent une telle importance.

La cohésion externe, c'est-à-dire l'affirmation par la Communauté de points de vue et d'intérêts communs vis-à-vis des pays tiers, n'est pas moins essentielle dans un monde où le progrès technologique est devenu un élément primordial des rapports de force politiques et économiques.

J'ai déjà rappelé l'activité diplomatique de nos principaux concurrents.

La Communauté dispose institutionnellement de pouvoirs importants en matière commerciale, en particulier l'article 113 du Traité CEE, et se doit de parler d'une seule voix dans les enceintes internationales et dans les négociations bilatérales. Il reste cependant bien du chemin à parcourir pour éviter des surenchères nationales où des hésitations à appliquer l'adage "l'union fait la force", hésitations que nos partenaires commerciaux savent habilement exploiter.

Telles sont, Mesdames, Messieurs, les constatations et réflexions que m'ont inspirées les interventions remarquables que nous avons entendues ce matin.

La question qui reste posée est de savoir si les Européens auront la capacité de réaliser l'oeuvre immense à laquelle ils sont confrontés dans les délais très courts qui leur sont imposés. La réponse appartient à vous tous, à nous tous.

Puisse le succès d'ESPRIT s'étendre à cette vaste entreprise dont dépend très largement l'avenir de notre Europe.

(1) chiffre correspondant à la population résidant dans les zones actuellement couvertes par le FEDER.

SUMMARY

Mr Michel Carpentier,
Director General of DG XIII,
Telecommunications, Information Industries and Innovation

After a morning spent in discussing the relations between technological development and the single market, which has given us an opportunity to hear the views, hopes and also concerns of top-level business and political leaders and policy-makers and, together with Mr J M Cadiou, to review the progress and future of the ESPRIT programme, I have the formidable honour of summarising what has been said and giving some ideas about the role to be played in the construction of Europe by the Technology Community, decided by the European Council in Milan at the same time as it launched the intergovernmental conference that was to lead to the Single Act and the idea of the Eureka venture.

The outstanding contributions we have heard seem to me to have highlighted three facts and two underlying questions, the replies to which are of fundamental importance for the post-1987 period.

First fact

1987 is an important year for Europe because there have been many events and public and private decisions pointing to the resurgence of our continent provided our business leaders and public and private authorities prove capable of working consistently with an overall perception of the long-term goals.

I must of course mention the successes of ESPRIT, the adoption - at last - of the framework programme, the forthcoming launching of RACE, the continuation of BRITE, the progress towards a strategy and concerted approach in telecommunications, the confirmation of Eureka and of course the adoption in November of an ambitious multi-annual programme for the European Space Agency. Last but not least, a growing trend towards mergers, amalgamations, cooperation and transnationalization in which most of the European companies in the information technology and telecommunications sector have participated in the past few months.

In brief, it seems increasingly obvious, as confirmed by Mr Stern and Mr Van der Klugt, that the Europeans are starting to bank more and more seriously on the strengthening of the

Europe-wide technological cooperation and restructuring of industrial machinery for the 1992 target date.

Second fact

Despite the technological effort and the successes gained with ESPRIT, Europe's situation in the field of information technology and telecommunication is still extremely disquieting.

Firstly because, although there are signs that European industry has turned the corner, some warning lights are still flashing to judge from the trends in market shares and the deterioration in the balance of trade, especially as regards the production of microelectronic components.

Secondly (and one may account for the other), because a significant proportion of public and even of political opinion does not yet seem to have realised just how much depends on the dissemination of information technology and the information and communication industries.

The interminable discussions and dithering about the framework programme show that much still has to be done to bring home to those responsible for our financial and economic affairs that economic arguments must henceforth give greater weight to the technological dimension. This short-sightedness is to my mind a serious handicap to Europe.

Third fact

1992 is both an opportunity and a challenge. It is also a rapidly approaching deadline. We must therefore start to prepare now if we are to take full advantage of the opportunities that will be offered by the single market and rise to the challenges we shall meet in completing it.

The completion of the large market will offer substantial opportunities to all those capable of thinking and acting European, in other words organising their strategies and industrial alliances, and developing the capacity to anticipate and respond to the requirements of a single but diversified market of 320 million consumers.

To meet the 1992 target it will be necessary to revolutionise the rules of the game and overturn age-old practices, which will call for radical changes not only in economic but also in cultural behaviour, making it necessary to seek new balances within the Community.

If we fail to anticipate these needs the single European market might in the first instance be exploited mainly by our outside competitors and then, with the situation rapidly becoming intolerable, gradually fall apart under the pressures of neo-protectionism.

Against this background marked by three main characteristics which are to some extent contradictory:

- the continuing difficulties Europe faces in information technology and telecommunication,
- the very encouraging prospects opened up by the signs of a general awakening in European technology,
- the rapidly approaching deadline of 1992,

it seems to me that two fundamental questions are inevitable:

A. Will the successes of ESPRIT and other technological cooperation programmes or ventures be enough to enable Europe to redress the situation in information technology and telecommunications?

B. How can we most efficiently succeed in the objective of creating a vast single European market, the global nature and many challenges of which I have very briefly outlined?

A. Is ESPRIT sufficient to allow us to reach our objectives?

1. To judge from the successes achieved in the first phase, ESPRIT is without any doubt an excellent illustration of what Europeans can do through cooperation, given an appropriate framework.

   To the credit of the first phase of ESPRIT, three major breakthroughs have frequently been mentioned this morning:

   Firstly the creation of a European technology community based on the association of researchers from industry and academia who have together carried out well-designed practical projects, developed mutual confidence, experienced the pride that comes from joint successes, and learnt that cooperation between people of different nationalities, cultures, education and language is not only possible but fruitful.

   Secondly, in three years ESPRIT has produced tangible results as evidenced by more than fifty demonstrations presented to you, which hold out encouraging prospects for the future production of innovating processes, products and services.

   Finally the direct role played by ESPRIT in the preparation of standards and its indirect role in the creation of extremely important new industrial structures and in the launching of other cooperative initiatives, such as RACE and BRITE within the Community and Eureka in an intergovernmental framework.

   The reasons for this success lie in the determination of the industrialists and scientists involved to succeed, the strategic nature and stringency of the choices made, the coordination and consistency of the technical, economic and political initiatives taken by the Community and the absence of any bureaucratic interference on the part of the Commission, which has successfully acted as a middle man between the national public authorities and the industrial and scientific partners.

2. ESPRIT, however, is and can be only one element in an overall medium- or long-term R & D strategy.

   Firstly because, with the growing convergence of technologies and systems, the information technology effort must be extended and supplemented by work in the fields of telecommunications, consumer electronics, new information services, etc.

   Secondly because the Community as a whole must endeavour to increase over a long period the resources it devotes to R & D if it wants to stay in the race. Europe must regain the ground lost to the United States and Japan and improve the allocation of R & D resources.

   To achieve this double objective four requirements must be met:

(a) First, the share of resources going to transnational R & D cooperation in Europe must be increased. The conclusions of the recent report produced for the French Commissariat au Plan under the Chairmanship of Mr de Robien are very clear about this; only a coordinated policy by the Member States and the Community can in the long run restore Europe's balance of trade in information technology and telecommunications and preserve the industrial independence of the continent.

(b) Secondly better-coordinated technology development strategies including the identification of clear priorities, notably in IT and telecommunications application areas, must be implemented at European level. This is the objective of the new programmes AIM for health, DELTA for training, Drive for road safety, Tedis for the increased use of electronic communications, and the action programme on the development of new services and an information market.

(c) Thirdly coordination between cooperative initiatives (Community, Eureka, European Space Agency, etc.) and national programmes must be improved.

(d) Finally the mobility of students and scientists in Europe must be increased and university-industry links strengthened. Community initiatives such as SCIENCE, COMETT and ERASMUS form an indispensable complement to technological programmes.

3. Technology cannot be considered independently of the economic, social and cultural environment in which it operates: ESPRIT cannot escape this constraint.

   Like all major technology programmes, ESPRIT can only succeed if we manage to integrate both the strategy and the results in a broader and more ambitious context, covering technological development, the market in all its multiple aspects and the requirement for greater cohesion in the Community.

B. Here the reply to the first question "Will the successes of ESPRIT be enough to redress the situation in IT and telecommunications" links up with the reply I would now like to give to the question "How can we most efficiently succeed in the objective of creating a vast market?"

I believe that Europe will only fully succeed in meeting the challenge of the single market if, in parallel with internal market unification, it can systematically and consistently:

- Strengthen the R&D effort without which there can be no lasting improvement in competitiveness;

- Define new regulations;

- Make a sustained drive towards integration, internal cohesion and a united Community.

These three elements - research, market, cohesion - must constitute the main pillars of the Community's common determination to relaunch the construction of Europe as expressed in the Single European Act.

After dwelling as length on technological development, I shall now move on to the market aspects in the widest sense of the term, the need for internal cohesion and a united front, and the reciprocal relations that have to be established and strengthened between the three elements I mentioned above: research, market and cohesion.

First, the creation of the single market:

This is not and cannot be - and here I am expressing a person opinion - just a deregulation operation. We would be deluding ourselves to believe that the cosy national protectionism which has all too often feather-bedded European industry could merely be replaced by a naive European liberalism in order to make our economic difficulties vanish in a puff of smoke.

This type of liberalism does not in reality exist anywhere. The United States Government and Congress intervene massively both through the financial aid they give industry for R & D and by way of reserved public contracts, especially for defence, active commercial diplomacy and the restrictions they impose, allegedly for security reasons, on the transfer of technology or on associations with foreign industries. As for Japanese business and political circles, they successfully turn to their advantage all aspects of a cultural protectionism naturally rooted in the customs of this great people. The aim of the single market is to establish on a continental scale a more open and dynamic framework offering the benefits of economies of scale, increased cross-frontier cooperation, greater market transparency and greater equality in access to public contracts and to private consumers in other Member States. It also involves drawing up rules of the game applying both within the Community and to its external relations and calls for a common political determination to ensure that these rules are observed. The vast single market, in particular for IT and telecommunications, involves four elements that are inseparably linked:

(a) Transparency and a greater certitude about the future for both the business community and consumers. This requires common standards and convergent strategies guiding not only the decisions of commercial companies and public and private service suppliers but also consumer demand: the definition of coordinated strategies in the Community for progress towards ISDN and second-generation mobile telephony will harmonize conditions for the supply of the corresponding products and services and will stimulate demand.

(b) The second element: optimisation of industrial structures. There is general recognition of the need to set up rapidly - by association, cooperation or merger - large European groups able to face up to international competition and make the necessary heavy investment in R & D and production. However, optimisation of industrial structures is not solely a matter of size. The size factor does not necessarily apply to all the information and communications industries - far from it. It seems to me to be dangerous to set small and medium-sized firms against large companies in this context.

    The optimisation of structures also involves or may involve:

    - Strategic realignment of firms towards activities which they do best;

    - Access to transnationalization and to the markets of other countries, which calls for the ability to adapt to firms or consumers of different cultures;

    - The use of modernised management methods for personnel and production with emphasis on improved training, the strengthening of technology surveillance, listening to customers and responding to their needs, marketing, etc.

(c) The third element in this new regulatory framework offered by the single market: encouragement of market pull and its capacity to influence the business community as regards product definition, adaptation of sales strategies, etc. There will be no single market unless it benefits from a strong, resounding and diversified demand on a continental scale.

Strong demand means that considerable improvements must be made to the conditions of access to new products and services for professional and domestic users, mainly through:

- The adoption of common standards guaranteeing compatibility and interoperability.

- The establishment of basic infrastructures allowing the new IT, computing and audiovisual products, services and equipment to be used under equivalent conditions - hence the importance attached to the progress made in coordinated strategies for telecommunications or for the move towards high-definition televisions.

- Harmonisation of the conditions of access to telecommunications networks, in particular charging principles, vital to the achievement of a unified IT services market, which in turn will influence the propensity to acquire and use the new equipment and services. This is why the Commission has drafted its "green paper" on the telecommunications market, the influence of which can already be seen.

Demand in Europe will be receptive to innovation and the supply of new products and services only if certain psychological and cultural barriers can be overcome in users. Here a special effort is required to make the new technologies part of our working and leisure lives, constantly bearing in mind the need to seek maximum user friendliness of interfaces so as to develop efficient tools suited to the wide variety of social requirements. In addition to ESPRIT, this is the purpose of programmes such as DELTA, Drive and AIM, which I have already mentioned, and the aim behind the improved cooperation between the Commission and the partners in Eureka.

Finally, there must be more interaction between demand and supply, which must improve its capacity to respond to users and to analyse requirements.

I believe that a better balance is needed in the definition of RTD work between supply push (available technology) and demand pull (reaction to stimulus or lack of satisfaction on the demand side) in order to promote solutions to user problems. At company level, this must be sought through better relations between production, marketing and research departments.

(d) Finally there would be no hope of achieving the economic changes required by the construction of a European internal market without consultations between government, employers and labour to tackle the employment problem head-on.

The Community now has 16 million unemployed. Obviously we cannot just look back at the social changes in the 19th century and say that the new technologies will create new jobs.

Memories of the hardships suffered by certain social classes during the first industrial revolution are still too fresh. In any case, although it is true that some new jobs as yet unknown probably will be created, this will only be in the medium term and they will require new qualifications. We must therefore devise a strategy that will enable us in the medium and long term to prepare for the inevitable changes and in the short term to avoid reactions which will be all the more violent if they are justified not just by objective reasons but also by a lack of preparation and failure to examine together the measures to be taken to limit the present crisis and prepare for the future.

I shall end my description of the three elements "research, market and cohesion" at the heart of the Community's approach by discussing cohesion.

Internal cohesion is not just a pious afterthought added to the Single Act. It is an element essential to the successful relaunching of the construction of Europe from the double viewpoint of internal cohesion and a united front.

Internal cohesion first because any accentuation of the differences within the Community would rapidly put the brake on the integration process for political and economic reasons. The achievement of the single market cannot be confined to the 130 million Community inhabitants living in areas regarded as prosperous and leave out 40% of the population of our twelve countries [1]: this would seriously weaken the maximum capacity in terms of market size and receptiveness needed by our manufacturers. To meet the 1992 target it is necessary to mobilise all the technological and entrepreneurial potential existing in Europe. Neither the highly industrialized countries which have increasingly numerous depressed regions (where traditional industries and agriculture are now in decline) nor the less well-off countries which have valuable scientific and industrial niches can hope to tackle regional disparities by structural funds seen as little better than relief aid or indiscriminate handouts.

That is why it is so important to reorganise the structural funds, concentrate them on planned objectives, seek integrated development and set up the STAR programme for the development of telecommunications in the less favoured areas of the Community.

A united front means the affirmation by the Community of its common interests and positions to non-member countries and is no less essential in a world where technological advance has become fundamental to the political and economic balance of power.

I have already spoken of the diplomatic activities of our main competitors.

The Community has extensive institutional powers in commercial matters, in particular Article 113 of the EEC Treaty, and should speak with a single voice in international fora and bilateral negotiations. However, we have a long way to go before we can put an end to national rivalry and reluctance to apply the adage "united we stand, divided we fall", a reluctance which is skillfully exploited by our trading partners.

Ladies and Gentlemen, these are the findings and ideas inspired by the outstanding contributions we have heard this morning. We still do not know whether the Europeans will succeed in the immense task they have set themselves within the very tight deadline. The outcome depends on all of you, all of us. May the success of ESPRIT be carried over into this vast undertaking on which the future of our Europe so heavily depends.

(1) This figure represents the population living in the area covered by theERDF

INTRODUCTION TO THE AFTERNOON SESSION

Prof. N. Szyperski
Chief Executive Mannesmann Kienzle GmbH

Ladies and Gentlemen

It is a real pleasure for me to chair this afternoon's session. We shall be giving you some ideas as to what the ESPRIT second phase contains. It is a special pleasure, of course, to have our distinguished speakers here today, who I shall introduce to you in the course of the presentations, but as I understand the objectives and some of the basic philosophies of the ongoing process to start the second phase of ESPRIT, there are at least three outstanding ideas that continue the work of ESPRIT I.

First, most of the work we would like to do together should be "demand-driven". "Demand-driven" is a very tricky expression because, quite often, you have to offer something in order to create the demand. Nobody should rely on the idea that some people should go out and ask others what the demands are, so that we know what we have to do. "Demand-driven" is actually not a set impression but it is an approach, which means that you have to start (and that is the second point) with applications and with imagination as far as applications are concerned.

And so to the second point: application-oriented is something most of us, I think, can really accept as a basic philosophy for the next few years in ESPRIT. However, if you are trying to be "demand-driven" and application-oriented it is even more necessary to think of basic research based on other activities. If we look at the order of our presentations, we have the order of the subprogrammes of ESPRIT I. That means we start with micro-electronic components and I am very happy that Dr. Grundy will present and deal with this subject. Then we shall move on to information processing systems. Dr. Hauser will present this. As a third application area that both office information systems and we would now like to stress integrated application systems. Prof. Tsichritzis, sitting on my right, will speak on this topic, so I can just continue along the row of speakers. I have met Prof. Hirsch already, so I am quite sure that he is the right person here at the right time and will deal with a second application area: computer integrated manufacturing (CIM). Prof. Randell will discuss the new aspect as far as ESPRIT is concerned: Basic research in ESPRIT II.

If I were to arrange the speakers in order, it would be in relation to the three objectives. I would like of course to start, with applications in the administrative and service area and with applications in the manufacturing area. Then we would come to systems and components, which must be researched in order to build our systems.

Basic research is not needed for only one of these three areas, applications, systems or components, but for all three of them. The basic research we need in information technology is fundamental and should support applications, systems and components. Quite often we all misunderstand the term basic research in the basic sciences. We then look mostly into the field of components and we neglect the basic research aspect of systems and applications.

I shall now hand you over to the speakers.

MICROELECTRONICS TECHNOLOGIES

D. Grundy,
Ferranti Electronics Ltd

Good afternoon.

As an introduction to my talk this afternoon I would first of all like to remind you of one of the key factors in the new ESPRIT work programme. I am now the second speaker to emphasise this because the Chairman has already made the point, and I am quite sure I will not be the last. So significant do I believe this aspect to be that I wish to register my personal input. I refer to the item "enhancing the technology base", a demand-driven strategy. I quote directly from the work programme: "while ESPRIT activities continue to focus on R&D and information technology at the pre-competitive level, they need to be seen as elements in this demand-driven strategy. The efficient integration of IT into application systems is regarded as the ultimate economic goal where the role of IT directly supports and interfaces the user's activities in business, production and other fields, and where an R&D programme such as ESPRIT on the pre-competitive level can prepare the ground for successs. By relating to demand-creating strategically relevant areas, the programme can simultaneously ensure that a growth potential and synergies with other industrial sectors are guaranteed. Factory automation and integration of information technologies in the office, business and home environment are regarded as the locomotive factors to be taken into account by the second phase of ESPRIT."

It is this real world emphasis of the ESPRIT programme that appeals particularly to me. Talking about the real world, with ESPRIT I we have been predominantly concerned with digital technology. We are now talking real world and this involves linear technology. If we look at the real world and the form of information inputs that we are dealing with, there are physical quantities such as light, heat, sound and motion, and electric fields are required to be transduced into electrical signals that we can cope with; these are converted by things like photodiodes, thermistors, microphones, plates and antennae. If we further take a look at the outputs of our digital system, then once again if we want to look at an electrical signal in terms of light, we are dealing with cathode ray tubes. If we want to deal with heat, we are looking at resistive loss. If we are dealing with sound, then we are looking at loud speakers, piezo electric resonators, and for motion we are dealing with electric motors. Once again as for the inputs with electric fields we are dealing with antennae. This time we are transmitting rather than receiving. That is the real world and the ways in which signals originate and that is the problem that has to be addressed.

Everyone knows that digital processing is best. No arguments. It is best because it gives virtually unlimited accuracy, limited only by the number of bits one wishes to put into a word. There is no question of long term stability and computationally we have an extremely flexible system. All these are very well understood. If we contrast that with linear processing then of course in the early days we had a phase of analog computers but these had limited accuracy, their long term stability was very questionable, and computationally they were very unflexible. Against this backgound, the architecture for today's systems tends to be something like that expounded below. This is very much simplified and only rarely can a real problem be partitioned into exactly this shape.

What we have basically is a digital processing central core, with analog to digital conversion of the inputs, digital to analog of the outputs. So the idea is that very quickly the real world signals are converted from analog, followed by digital processing and, if necessary, we reconvert them back into analog. Of course if one wishes, digital inputs can go directly through the system. The first phase of product emergence, co-incident with ESPRIT I, has seen chips which contain linear and digital circuitry and these have been fairly simple. In my own experience I would like to just give you some examples of the kinds of things that we have dealt with. First of all, we have something most of us are familiar with in our homes, this is a Black and Decker drill and the function of the chip in this situation is to provide constant speed. The speed of the drill is set for a given material and then that speed has to be maintained constant as the material is drilled. This is done by whole plate sensing of the rotation of the chuck with thyristor control. The chip goes in the middle. Having introduced electronics we have been able to produce anti-snatch facilities which stopped the drill jerking very quickly to speed. In addition, it can easily be reversed for screw driver action. The next picture shows the control module itself and just where the chip fits. This is a very real world example.

Next, moving on to the prestigious Leica R4 camera, here we are dealing with measurement of light. The problem is to measure the light moving through the lens and to turn this into a computed exposure setting and to follow this with a mechanical operation of lifting the mirror operating the shutter and so on. Even more in the home, from the TV series Sesame Street, we have a character from the toy industry, this is Big Bird and the function of the chip in this toy is to synchronise the limbs of the toy, the mouth and the eyes to an audio track. The body of the bird contains a twin-track tape, one track carrying audio information and another track containing the synchronising information. Moving now to the medical world, here we see a very compact means for measuring the sugar content in blood. The aim of this product is to aid diabetics in administering the correct amount of insulin. Once again we are using a mixture of linear and digital functions. Finally, in this sequence, I show a pocket television in which the whole of a monochrome receiver is included on one chip. The digital content is highly sophisticated and needed to enable the chip to switch to any television standard anywhere in the world and, in addition to that, the sideways mounted electron gun wwould produce a very non-linear raster if something wasn't done about it, so that the chip contains a 10 bit multiplying digital to analog converter to correct for this. In addition to all of that, the chip has to contain the usual functions of I.F. amplification, sound output time bases, EHT generation. All of that is a mixture of linear and digital technology, and it is all on just one chip.

I have been showing you some of the products from the last generation. I would now like to explain how these were fabricated. First of all, the technology used was bi-polar and this is an extremely simple technology because you will appreciate that the cost of this kind of product has to be extremely low. A simple process was used, and the way that that was applied to produce these products was by means of the Ferranti ULA, the Digilan ULA. Here we see a blank wafer, a blank chip without interconnection I should say. In the middle we have the digital content, these are gates and in the periphery we have a rich mixture of linear components including power transistors, capacitors, resistors of various sizes; everything one needs to produce linear circuits. The customisation is made simply by a one layer metallisation of that basic blank silicon chip.

That was the first generation, that was around the time of ESPRIT I. We are now looking to the future and what has to happen next. First of all, let's take a look at the process requirements. These are the numbers, the specification numbers relating to the silicon that we think will be needed for the next cycle. First of all, we believe we are looking for chip operation of one gigaherz, that means a clock applied to the chip will typically be at one gigaherz for such things as cellular radio, direct broadcast by satellite, cordless telephones all sorts of applications we are looking for one gigaherz.

We want high speed, but along with this as usual we want lower power consumption. It is always difficult to quantify, it should be zero of course, but realistically, gate currents of less than 1 microamp at 1 Megaherz. Better than that if possible, but we think that is something reasonable to aim for. We have talked about communication. Of course, that means low noise. So ideally what we are looking for is less than 1 nanovolt per route cycle with negligible I/F content. On top of all that we would like all of that technology to work with a supply of 1 volt because real world applications have to work from batteries. That is silicon technology.

I have to turn to the actual design and the definition of the product. In addition to performance, the next thing that the consumer usually wants is for his design to be absolutely correct the first time it is made. That's true for linear and digital circuits or combinations of them, at any complexity level. It doesn't matter, the customer wants it to be right at the first time. Presently, this is always possible for digital circuits; someone argued that we are not quite there but I think overall that the evidence is that our industry can produce digital circuits correctly the first time. The technology we want to talk about is compiled ASIC's (application specific integrated circuits), and the main aim of this technology is to solve the problem of getting these designs right first time. One can split a design into physical and electrical problems. For the electrical problems, to get it right first time, we are involved in simulators. Digital simulators are available. Most of the main companies have their own proprietary one, and you can cope with that problem. In the case of linear simulation, you will always get back to SPICE. SPICE is very slow. It is very good but it isn't possible to "SPICE" circuits with tens of thousands of transistors. The best solution to this problem so far, in our opinion, is to use something developed at RSRE (which is the Royal Signals and Radar Establishment in the UK). This was developed some years ago and it is called ELLA, and this enables one to simulate systems at the behavioural level. It lets you cope with gates, flip-flop registers, whole micro-processors even, ROM and RAM and so on. In addition to that it does have a most important facility for linear circuits and that is an ability to split a level into many discrete steps. This means that one can perform functional simulation at least at a fairly coarse level. Our experience with this has been very good.

Turning to the physical area, most areas in our experience occur in random logic, and the solution to this problem are undoubtedly silicon compilers. There is a lot of debate about the rights and wrongs of silicon compilers but certainly in designing digital logic, in our experience they are very good and we can get designs 100% correct. Fortunately there are also tools available for linear technology and one approach that is possible, and the one that we are currently taking - even though in the future we will see others - is to take linear designs that have already been production-proven on a particular manufacturer's technology. If, for example, you look at the way our process has developed (and other people, I am sure, have the same experience) if we go back to 1971, when we were dealing with 5 micron feature sizes and if you compare it with 1986 we are dealing with 1.5 micron and what has happened is that the circuits have progressively shrunk, but nothing else fundamental has changed. What that means is that designs over the years can be put into today's technology and this is particularly important for linear circuits because linear circuits are really a work of art. A lot of modern protagonists of design would say: "That's not true", but my experience is that a good linear design takes a lot of getting right and once you have got it right it is very attractive to stick with it and transfer it down your technology families. That is the approach that we will take over the next period.

If you look at the products that are available and if you are looking at our standard catalogue in FERRANTI, you can see something like 60 analog digital to converters based upon successful approximating tracking, flash converters, D/A converters up to 100 megaherz, voltage references, low noise amplifiers, comparators, voltage controller amplifiers, radio frequency amplifiers, delta signal modulators; it goes on and on. These designs have been proven. I strongly suspect that the industry, if it has the facility, will choose to take this approach to building linear functions into mixed mode chips.

The next thing I would like to do is to just very quickly take this through a couple of examples of this so-called compiled ASIC technology. Here we see a chip associated with a magnetic tape drive, a computer peripheral, and in the middle we have the silicon compiled logic content (about 2000 gates), here we have a compiled read-only memory (ROM) and up in the top section of the chip we see an 8-bit digital to analog converter with 1% linearity, a 4 bits with 1% on a voltage controlled oscillator and in the middle there with an ability to work at 16 megaherz. All of that chip enables the computer scientist to make a fantastic step forward. The aim is always to produce smaller and smaller equipment, and to consume less power of course, and to aim for more reliability. Predominantly though, the cost savings that this kind of chip achieves are very significant.

The next chip I would like to show you is part of a single chip pager, this is an important component in future communication systems. Here we see once again a compiled logic for the digital decoding content, these gates were from a low voltage supply, at 1 microamp current, so it is a very low-powered core and around the periphery of the chip we have a VHF/FM receiver. You can see the R/F amplifier, mixer, limiting amplifiers, the local oscillator and then output interfaces. So using that chip it is possible to build a complete radio pager from one chip. These are just two examples, and many more will come. I believe these are the real world examples that silicon has to get into. We obviously have got to use the digital technology. We somehow have got to get the linear ingredients in there and very soon we expect to see the exponential growth rate normally associated with our industry on this kind of products.

I would like to conclude there. I do hope I have made the point that we are emphasising the need to get silicon into the real world soon.

Thank you.

INFORMATION PROCESSING SYSTEMS

H. Hauser,
Olivetti

Good afternoon, Ladies and Gentlemen.

It is a great pleasure to talk to you this afternoon about information processing systems. This of course is a bit of a grand title and when I first thought about what I might tell you about information processing systems I thought about the definition of the specialist which I am sure you all know of. The specialist is somebody who knows more and more about less and less until he knows everything about nothing.

I feel that vice presidents of research in big companies have the opposite problem. They have to cover a larger and larger area, they have to know less and less about more and more until they know nothing about everything.

I thought rather than telling you nothing about everything, I will pick five topics in information processing systems that I consider particularly important. My first point will be to put ESPRIT I and ESPRIT II on a rather grander historical perspective covering the last 30 years and the next 20. Then I will be talking a little bit about the new architectures that we can expect to stem from this historical perspective. My third point will be that in order to have innovation in ESPRIT II we really need to take full advantage of small and medium-sized companies. Point No. 4 is that the number of the really successful products of the next five to ten years will heavily draw on a high degree of integration. Point No. 5 is a problem that I am sure you are all aware of which is the problem of complexity and my sixth point is to draw conclusions from that and I will end up with a little dream I have.

So going to a historical perspective and as I said I have drawn a fairly large scale diagram here. Starting in 1950 the power of computers which had just been introduced round 1950 were in the hundreds of instructions per second. Now I think I have plotted here a million mips on the y axis which is a million instructions per second and 1950, 1975 and the year 2000 on the x axis. We have made tremendous progress since 1950, we are around here and the progress has been from, say, 300 instructions per second which was the performance of Professor Wilkes's EDSAC in Cambridge, the first European computer, to about 5 mips for inexpensive computer systems. When I talk about this graph I really talk about computers under 10.000 pounds, sort of personal computers. Note that there are two interesting forks that were coming across in the next few years. The first fork which is happening right now is the split between complex instructions set computers and reduced instructions set computers, CISC and RISC for short.

Some people think that there is a big debate ranging as to whether the RISC approach or the CISC approch is better. In my mind there isn't really any debate necessary - I think there is a clear winner and that is the RISC approach. We will see an increasing gap between the two technologies opening up over the next few years because I think the intrinsic advantage of the RISC approach is about a factor of 3 or 4. However, all this pales into insignificance compared with the next fork that we also are witnessing at the moment and I think it will soon become rather important and that is the fork of incorporating parallel processes into inexpensive computer systems. Of course these two discontinuities give companies like Olivetti a tremendous chance to gain market share because if somebody is out with a new product based on these new architectures one can make an impact in a market that one hasn't made an impact in before. So just to remind you that the new architectures which I believe will be rather important are the RISC architectures and we will see a tremendous development in RISC chips all over the world in particular in silicon houses and silicon customs, silicon facilities like RISC machines because they are so small. The ACORN RISC machine for example, which I have a close involvement in, prized itself in implementing the entire computer on 25 thousand transistors. This is a tenth of a 286, 386 or 68000 microprocessor, both of which belong to the complex instruction set computers. So you have a factor of 10 decrease in the number of transistors. We are proud of how few transistors we put on a chip rather than how many. Now this gives you a great flexibility in terms of what you do with the other 90% of the silicon area that is now left over. And of course a number of new architectural opportunities open up. For example you can put rather large caches on chip than on a CISC computer. You can put a floating point unit on the same chip as INMOS have shown with their T800 so excellently. And you can also think of new memory management architectures, etc.

The other point I would like to make with respect to these new architectures is a problem that I sometimes find visiting European laboratories rather than American or Japanese laboratories. And that is although people believe that at the research stage they really have a world-beating technology it is sometimes very difficult to generate the spirit and the belief in themselves. It is almost as if "well if it comes out of Europe it can't be any good". I think an increased belief in ourselves and our ability to translate these leading-edge technologies into products is in order and I am sure ESPRIT II can help a lot to translate good ideas into products.

My next point is the point about the link between innovation and small companies. A recent study done by the Financial Times of London has shown that small companies are no less than 24 times more innovative than large companies. This is a rather surprising result to some but it isn't particularly surprising to me who has spent his last 14 years in the Cambridge environment. Some of you know that Cambridge is probably the only area in Europe that has a similar characteristic to Silicon Valley and Highway 128 on a significant scale. There are now some 500 small companies surrounding Cambridge University with a combined turnover of about 2 billion dollars. So something has happened in Cambridge, mainly based on small companies, that is rather successful.

I would like to tell you the model that we have at Olivetti of how new ideas finally end up as mass products. New ideas as you all know normally originate in universities or corporate research laboratories. If these new ideas are evolutionary ideas they quickly make it into the big companies and big companies translate it into mass products and everything is just fine. More often than not, though, these new ideas are revolutionary. They clash with the culture in big companies; they cannot be absorbed easily by the structure that exists. An intermediate step is introduced where small companies take these new ideas, make new products out of them and run with them. And let me just give you a few examples of this model. The personal computers that all of you know of of course did not, despite people believing the contrary, appear in IBM labs first. Small companies like Apple Computers, Commodore and ACORN, (I am pleased to say) in the UK, really invented personal computers and made the first usable products out of them. The same thing is true with PC operating systems. It was Digital research with CPM and Microsoft with MS-DOS that made the running in this field. Another example are daisy-wheel printers where Diablo and matrix printers where Syntronix were the product champions. A very good example is also Josephson junctions where as you know IBM and some of the big semi-conductor houses in Japan had teams of hundreds working on Josephson junction problems and without a single product to show. A small company called HYPRESS in the Boston area has in the last year produced a 70 gigaherz scope based on Josephson junction technology. Last but not least the connexion machine producing a marvelous new parallel computer is another example of this area.

So how can we integrate small and medium sized companies into ESPRIT II to an even greater extent than we have done in ESPRIT I? We all know that of course there is already a good relationship between big companies and small companies as a normal supplier/purchaser relationship. But I think we can do better than that. The thing that I would propose is a shared strategy. What small companies are good at is that small companies are very innovative. They normally have small teams of people with excellent expertise in a particular area. We also know that big companies of course are very good at marketing products, especially mass marketing products, because their names are recognised in the market and they have the necessary distribution channels to sell the products. But what small companies are bad at though is once they come up with a new idea, once they master the technology, they often do not have a clear direction, a clear long-term strategy because they can't spend all the millions of dollars that we spend on strategic thinking, on doing market studies, etc. I think a lot could be gained by big companies simply stating their strategy to small companies, saying look this is the way we want to go, this is where we see the major markets, please contribute to this strategy either by doing certain projects for us or by producing products on a speculative basis and then selling them through our channels. I think this ability of big companies without being a big brother giving directions to small companies, not necessarily with any money changing hands is something that can be done very cheaply because big companies just need to get up and say it and that could have major benefits to the community.

My next point is a point on integration. During ESPRIT I, as you all know, a number of very successful projects have been started in a number of specific areas. ESPRIT II introduced a new idea to European research funding; that was the idea of TIPs , of Technology Integration Projects. Now this integration is very necessary especially in the multimedia office of the future and let me just give you our Olivetti vision of what such a multimedia workstation might look like. We have called it the EPOC, which stands for the Experimental Personal Office Computer, and this is a model of the EPOC. As you see, this computer is really very different from the standard PC that you have in your offices at the moment. The most striking difference is the display. We believe that flat panel displays will take over in due course, not just because a flat pannel display of course is flat and therefore you can see the other person on the other side of the desk without having a CRT in front of you, but also because it takes up the same position on the desk as a piece of paper. And therefore you can sensibly cover it with a transparent graphics tablet and you can start writing on your display in the same way that you write on a piece of paper, which means that this flat panel display covered with a transparent graphics tablet can become your electronic paper. You can receive letters that get displayed on the display and then you can annotate that display in the traditional way as you would on a piece of paper. I think this is a very important point because nobody in this world, not even President Reagan, will be able to pass a law to say that on the 1st of January 1990 we will all stop using paper and we will all start using electronic mail. There will be a necessity to deal with paper for a considerable period of time to come and therefore I think a scanner, a built-in scanner, with each of the computers in your offices, is a key device. Whenever you have a piece of paper on your desk that you would like to pass into your computer for storage or for electronic mail purposes, you ought to be able to do it there and then without having to go to your secretary to tell her to scan things. We've also built-in a printer with a fax resolution printing capability. This, combined with the telephone of course, gives you a fax facility which is another key element of the office of the future.

Now I come on to one more important part of the Technology Integration Projects. Although a Technology Integration Project, as perceived by ESPRIT II of course, is a large project that goes on for about four years, I think it is very important that we do not wait until the end of the fourth year to take advantage of this research but during the course of the development of our ideas towards the final vision at the end of four years whenever there is a piece of technology that is worth spinning out I think we ought to spin it out into our companies and we ought to base products on these ideas so that they can be marketed. I was very pleased to hear from both Jacques Stern and C.J. van der Klugt this morning, presidents of Bull and Philips respectively, that they both see this as a key point to attack the European market and increase the market share of European companies even further. I was also very pleased that they made the same point on small companies that I have just made. So "spin-off" is our key.

Still on the subject of integration you see that the EPOC really is an integration project both in hardware terms where we integrate the CPU, the scanner, the printer, the local area network, telephone, fax and video all in one inexpensive box for about 5.000 dollars; but of course it is equally important to integrate all the pieces of software and integrate databases and knowledge-based bases, have a good software engineering environment, and take advantage of very elegant results that have already appeared during ESPRIT in the Artificial Intelligence area. There is no way we can succeed in the integration projects without designing on silicon. About a year ago in my first speech to the Board of Olivetti I said that I believed that there would be two types of computer companies in five years' time, those that have learned how to design on silicon and those that are dead. In this year that has passed I have not changed my mind, with one exception. I don't think it will take five years. So looking at what designing on silicon can give us, I believe there is no other way to achieve the price performance that we need to gain over the next few years in our products. Secondly, designing on silicon gives us access to very vast processes and processors. I think 50 mips is achievable with a RISC architecture probably within the next two years. There is really a fantastic increase in the performance of computers. Number three: it gives us the freedom to incorporate new features inexpensively. If you think of a new feature the market place might want from you that has become very trendy, to incorporate it as an extension to an existing chip often costs a negligible amount, whereas if you were to implement it through a standard chip set it would probably cost you a lot of money. Until now designing on silicon was a black art. You had to have silicon wizards to design on silicon. Fortunately the software boys have invented silicon compilers and it has become a lot simpler to convert engineers who have designed with standard parts to designing on silicon. And indeed in Olivetti for example we have a big programme to convert some 400 design engineers to become silicon designers. However, we must understand, and people must be aware of the fact, that this is a big cultural change for any company. In Olivetti this was comparatively easy because we have just matured from a typewriter company - mainly an electromechanical company - to a computer company, so Olivetti is no newcomer to change. It was actually rather easier than I expected to convince Olivetti management that such a major initiative is necessary.

My next point, still with respect to integration, is software productivity. The first slide that I showed you, which was the exponentially increase in power that we can expect from computers, unfortunately does not have its analogue in software. Software productivity is not going up exponentially. In fact we are lucky if it goes up linearly. What we find of course is that as we give software people more and more power some of their excuses go away: they have always told us that they don't have enough memory, if only they had another megabyte their software would run beautifully; we always heard that there isn't enough power in the hardware, if only they had another five mips their programs would run beautifully. I think the thing that we will see is when we hand over all those parts to software people, basically software programmers don't know how to write very large software programs efficiently and with a high degree of success like the "first time right" success in silicon. There is this large difference in maturity between the hardware design methodology and the software design methodology. This of course is intrinsic and has a lot to do with the much greater complexity of software projects. For a company like Olivetti (and I think most big companies are in the same boat), this again means a big cultural change from mainly a hardware-dominated company to becoming a software company. Neither the best hardware nor the best software is going to produce a really successful product in the market place, it really is the right balance between hardware and software. So we need a systems approach to design, we need harmony between all the hardware parts, the CPU, the operating system, the LAN and the peripherals; and we need a much higher level of integration than the one that we have had so far. We need to make peripherals part of our standard computers as I have shown you in my vision of the EPOC. Of course the reason why these products do not exist at the moment is that there are still some very serious hurdles to be overcome and we must be innovative in our approach.

I now come on to my last point which is the point of complexity. There are a lot of different types of complexity. There is product complexity, both in hardware and software, there is complexity associated with running a project above a certain size, and of course there is all the complexity involved in supporting the product at different stages of its life-cycle. What do I mean by product complexity? Basically the semi-conductor industry is now working on chips with up to a million transistors (and I don't mean 1 megabit DRAMS by that). Some software companies are now beginning to think of how to cope with software that has 10 million lines of code. Last week I was at Bell Laboratories - as you know AT&T is closely associated with Olivetti - and listened to the people who had to look after the 2 million lines of code that AT&T has for the 5/ESS switch. It is a major problem: 2,000 people working on the maintenance of this program. They can recompile those 2 million lines of code only once a week, so just imagine a program that during its life-time probably gets recompiled maybe 200 times. It is really very different from the way you attack a small program where you might well recompile a dozen times during a day. Project complexity: companies like the Olivettis of this world (and I think we are all in the same boat) have realised that the only way of getting good teams together is to move the mountain to Mahomet and set up laboratories in centres of excellence. So we, like other people, have laboratories in Silicon Valley; we have a laboratory in Cambridge, England; we have got five laboratories in Italy - and one of the real problems of course is how do you make these people work together on one and the same project. It is difficult but I think it is worthwhile and it is the only way we can do it. Project complexity is very very important and a difficult problem to solve. Of course it is also a difficult problem because of the number of people that we must combine in the same project from different disciplines. I have already mentioned all the different peripherals and CPU's and operating systems that we need to integrate. What is the solution to the problem of complexity? Basically, tools of all kinds. We need system CAD tools, we need reusable components; lots of people are thinking about the possibility of going from the specification of the problem directly to silicon or directly to a program. The man-machine interface is another key problem area that ESPRIT II will make major contributions to. I am thinking about the multimedia dialogue that we need to set up between people and the computer, both in terms of the different input devices, keyboard, voice, graphics tablets, etc., and the corresponding output devices. We need to avail ourselves of the new techniques that come from knowledge engineering and the AI field.

I would like to conclude by saying that following my first slide, my feeling is that the next 10 years are going to be the most exciting years in the history of computer science because never before have we had such a steep gradient, such a steep increase of computing power as we are going to have over the next 10 years. I believe that new architectures - both RISC architectures and parallel architectures - will give us unprecedented hardware performance. I have made the point that I think small companies and medium sized companies can contribute a lot to innovative designs in ESPRIT II; and my fourth point was that we need to integrate very heavily, both integrate on silicon and integrate in systems, for success in the next generation projects and my last point was that complexity really needs tools to overcome it.

To sum up, ESPRIT I in a way was the courting period, in which we all got to know each other and I think ESPRIT II ought to be the period of results - the relationship ought to have some children. One of them, I hope, will be the GIPS machine, the giga-instruction per second machine, that I think will be possible for less than 10,000 dollars in the next ten years. I have been very fortunate that I was involved in the design team for the BBC microcomputer, of which we sold 1 million pieces. I was also very fortunate that I could be involved in the design of the ACORN RISC machine, which is the first RISC computer that gives us a dollar a mips, so for one dollar you get a one mips performance - this is a world first. I hope that in the future, Ladies and Gentlemen, I will have some involvement in this GIPS machine, which will give us a 1,000 mips and I hope that it will be a machine which is proud of its designers.

Thank you very much.

THE INTEGRATED OFFICE

Prof. D. Tsichritzis
University of Geneva

Good afternoon, Ladies and Gentlemen.

Since Herman Hauser talked about office information systems, maybe I should really be talking a little bit about information processing systems to get even with him. Anyway my job is like a public relations professional of Madison Avenue. I have to take an old cliché like Office Information Systems and give it a new image. Except the task is much easier because we are dealing not only with a new image but with a new producti. The are Office Information Systems has been renamed Integrated Application Systems.

Office Information Systems as an area usually brings to mind a combination of standard tools like electronic mail, wordprocessing, spreadsheets, databases and graphics. It is a very bland type of image, representing a very bland type-of environment. Such an environment is very important for practical applications but it is nôt what one would call "high technology".

The basic goal of Office Information Systems is to try to combine, install and utilise the available tools properly. People in the field have a lot of problems with heterogenous systems.For instance, they have to marry MS-DOS, Unix, MVS, VMS and other systems. They also have problems with heterogenous networks. They have to deal with ETHERNET, Ring networks, PABX's, global networks. They also have problems with training and support of their users. There are also some co-existence problems between the computer centers and Office Information Systems. After all, most computer centers existed before office information systems came into the company. These are the basic problems that people have out in the field. ESPRIT I was a research programme, and had nothing to do with current practical problems.

In ESPRIT I, in this subprogramme area we were trying to do four things. First of all, we tried to increase functionality. For instance, we tried to provide more tools for specification of office procedures and their automatic implementation. We tried to provide more tools for dealing with multimedia, at least with text and data and some ways of linking images and audio. Second, we tried to do work on models for office systems, specifications of requirements and analysis of these models. Third we worked on the integration. Integration can be at different levels: hardware integration, making the boxes talk to each other; software integration making the programs talk to each other and finally user interface integration to provide a common user environment for several tools. Finally in ESPRIT I we worked on standardisation candidates, for example in document architecture.

As a measure of success, what are the achievements that one can claim with regard to ESPRIT I? I hasten to add that this is a personal opinion! If I were with a company like IBM, I would say that this is not standard IBM policy, so this is not standard European Commission policy.

I think that the first achievement was the spreading of expertise. Quite definitely ESPRIT I produced a lot of reports, a lot of papers and a lot of conferences. As a direct result of this activity, that if there is a conference in Europe in Office Information Systems, the quality of the papers is as good or better than the quality of the equivalent conferences in the United States.

ESPRIT I projects also produced some prototypes and we saw some emerging standards. We had some systems that actually worked. Two other achievements were very important for the overall ESPRIT programme: first, cooperation among Europeans. Europeans for a very long time were using the Unites States as a common ground to talk to each other They just started talking to each other, usually a necessary precondition for co-operation, which is very nice. The second achievement of ESPRIT I is cooperation between universities and industry. Again, this is a personal opinion. For a very long time, universities thought that industry was not interesting, and industry was always thinking that universities were irrelevant; and I think that this attitude is changing slowly.

Let us now address ESPRIT II. In ESPRIT II: the title of the area has changed into integrated application systems. You may ask what's in that title change? Well, the word "integrated" is highly significant, the absence of the word office means a lot; and, frankly, the first thing that we are seeking in ESPRIT II is to get rid of some sort of office stereotype. Most people, when they think about offices, they think about clerical work. So when they think about Office Information Systems, they think about systems to support some kind of clerical work. They have an image of clerks doing standard functions like typing, mailing, and so on. I think that the area of Integrated Application Systems is free from that kind of paradigm. Integrated Application Systems bring new functionality and new tools. Applications can be developed from a new platform.

One may ask "what's an office?" An office is a working environment. It can be an office in a factory, it can be an office in the field, it can be within your car if you have certain ways to communicate with the outside world. Frankly, an office is an area where a person dealing with intellectual activity can do his work. So the office stereotype is changing in Integrated Application Systems. The emphasis is on intellectual support, not tools for pushing paper around. That is very important because all of a sudden we see a lot of the techniques in artificial intelligence and knowledge engineering being very important in this area. The term "integrated" means that we have to blend personal and organisation systems. In many places there are still two kinds of systems: there is a system that supports the individual in his work and there is a system that supports the organisation in what the organisation should be doing. An integrated approach to the application means that what is good for the person is good for the organisation, and what is good for the organisation is good for the person The systems should really gracefully co-exist, and complement each other.

The next area in ESPRIT II which is very important is dealing with multimedia objects. "Multimedia" is part of our life. It is videos, TVs, commercials, etc. Most of our computer systems do not utilise multimedia objects. The only thing they give is some sort of icons and windows; they have some sound capability but very limited. I think that we are going to see an expansion of multimedia capability, not for any other reason than because people are willing to pay for it. People wanting multimedia in the user interface are willing to pay because it makes life easier; especially people who are highly paid and who don't have enough time to read big manuals. There is a lot of work right now and there will be a lot of work in ESPRIT II about multimedia messages. One can imagine a multimedia object like a short TV commercial which encapsulates some sort of message and travels around in the networks. Multimedia support is a functionality that you also use in a meeting and viewing the meeting. During and after the meeting you can have a multimedia presentation of that meeting which can help people co-operate, work more effectively with each other and recall what is said by means of a full video and voice log. Finally video, which used to be thought of as some sort of exotic device, is going to be a very integral part of all office systems of the future.

The next aspect to be considered is automation. A lot of people, even initially, were talking about office automation. If you look at the systems that we have today they are practically not automated at all. There are better tools, but they are the equivalent of power tools. So rather than having a hand driven screwdriver, you have an electric or compressed air driven power screwdriver. So you have a power drill, but you don't have a system which makes holes itself. It is not a system that replaces the user in terms of doing something. If you want to deal with automation, what you really have to do is to use agents which are programmed agents, programmed actors which have been pre-defined. They are inside the system and they act on the users behalf. so it is not like giving you a better user interface to ask questions about the systems database, or follow the stock market and give better tools to buy (and maybe more important soon) and sell stock. It is really to enable you to construct a programme object that buys and sells the stock for you while you don't really DO anything except monitor its progress. In essence, the only thing you are interested in is not what it is doing, the only thing you are interested in is whether it makes or loses money for you. This means that you have to be able to describe, define and implement autonomous objects like that which can really operate in a distinctive environment. they can run around the network and they do things for you from very simple jobs like for instance carrying messages around and asking questions to very complex logical operations like for instance negotiation. It must circulate and negotiate and then be able to make a proposal for you to consider. The same kind of thing you have to link to aspects of factory automation. We are quite some way behind from what is happening in the factory, and from what is happening in the services. If you think about it, while what is currently talked about in future office information systems, is just tools, they have robots that do the job for you. You just watch what they are doing. We hope that sometime in the near future the same thing will be present in an office environment and the same thing will be present for almost everybody dealing with intellectual activity. At the same time these systems dealing with the service aspects will deal with the automation of intellectual activity, and will be linked with the other systems just as they do with a manual activity nowadays. There is a reason - at least in my opinion - for this lag. In robotics for industrial automation, one can observe a person and because you can see what a person is doing you can perhaps build a robot that does practically the same thing. In the intellectual world, you don't explicitly see what the person is doing. Because you don't see, you don't understand too well, and because you don't understand it you cannot define it and if you cannot define it you can never implement it.

The other area where Integrated Application Systems will be active is to deal with fragmented input system knowledge. We are getting into an age where the nice applications (of which there are not enough!) are no longer relevant. We are running out of very well understood, well-defined applications. We have a lot more mixed application problems, we also have a lot more messy problems to deal with - but these tend to be real problems that people want solutions to, so they need to be addressed. That means that knowledge for instance, especially in an office environment, is not monolithic, there isn't a huge knowledge base that we are dealing with, but it is fragmented, there are pieces of it that people have, that experts have and some of these pieces are inconsistent. We cannot deal with them in the more or less natural way we deal with computer based knowledge based systems. For instance, if you take any logical approach and you do inferencing on it, if you are not very careful as logic is absolute and as you probably have inconsistency it's going to blow up in you face. We have to deal with cooperation between different expert systems, because pretty soon it is not going to be a problem of having one expert system but having a dozen different expert systems, each telling you to do something different. Which means that you have to arbitrate, which means that if you, yourself, do not have the right tools to arbitrate you probably will be better off to get the facts on which the expert systems were taking the decisions and try to make up your mind, rather than to be presented with multiple choices, having absolutely no idea about the context in which these choices were being made. We have to be able to do arbitrage between these inconsistencies in knowledge bases and know what is good, what is bad, what is true and what is not so true. It is not necessarily false but we don't know.

Finally, we will enter an era that implements all these automatic activities and what we have to do is to coordinate them, and the way we have to coordinate them is extremely difficult. It is almost like saying that you are the head of an orchestra and everybody is playing an instrument, and maybe they are doing it right and you job is to make sure that all of them are producing the right kind of music - but no one sees the score! It is not sufficient that each one will have to endeavour to play his part in a good way. So we are getting into patterns of behaviour which tell us how these autonomous, automatic, programmable objects which can encapsulate intellectual activity should be working with each other.

Another thing which is very important is the complete life cycle. We used to have in computer science a very nice cycle to deal with well-defined problems. We would do requirements analysis of systems, we implemented, we integrated, we tested. That was simple and beautiful. Except that it doesn't work really well in applications that are very badly defined. Instead, what we had to do fast prototyping. We had to use things, then we had to throw most of them away and we had to be able to adapt the retained ones significantly. If you do not have an application which is well defined, and office information systems is one kind of application like that, there are many others you cannot get right in terms of requirements specifications. This is not necessarily because you do not understand it, it is because it is badly defined to begin with so you'll never be able to get it right. So you get it "more right" only by stepwise evolving, which means that some of the ideas coming from artificial intelligence to be able to make systems that seem to work right, even if you don't properly understand how they work, become very important.

A few comments about what should be happening in ESPRIT II. What are the possible mistakes that can be made? The first thing is that in a lot of the projects, even in their own definition, there is a rather long period of survey of the state of the art. That is unacceptable. ESPRIT has already, through no particular individual fault, incurred a certain delay. We cannot afford really to spend another year to study the state of the art. If we want to have successful proposals leading to useful projects we are supposed to know what the state of the art is. In addition, while we are studying the state of the art, the state of the art moves. The other people, the competition out there, are not really going to freeze the state of the art for you to study for a year. What we should be doing is to get through conferences and workshops - in almost every conference there is always a couple of Japanese, I am sure even in this audience, to follow what is going on. We should be doing the same to be able to know the state of the art even before we make a proposal for a project.

The next point is something that is both an advantage and a disadvantage at the same time. Europeans like thinking very much. They are deep thinkers, they like to do a lot of modelling, they like a lot of formal specifications. There is nothing terribly wrong with that. As a matter of fact this kind of work should be going on, and especially should be going on in the area of basic computer science that I hope Brian Randell will be talking about. Except in certain areas, like some of the application systems that I have in mind, like office systems for instance, it should be realised that you cannot model something which is inherently not well defined. If you try to model it then you will have limited success. Sure, you should try to do it initially, but you should not really dwell too much on it. What Europe should be doing is to build things. I think this is something which we should be talking about when we think about ESPRIT II, there have to be results. The results should not only be reports, because good as reports are it is not possible to live off selling reports. You have to got to sell products eventually. Before you can sell products you have to have prototypes and actually the best way to sell a particular idea is to have a prototype which encapsulates this idea. Everybody will then want to believe you.

The other thing which can be a problem is standardisation. It is very important especially on the European scene and there is nothing wrong with that. People should agree to do it and the big companies should get together and try to propose acceptable standards. Except, again, most of the standards lately are coming at a very fast pace in different ways from companies of North America. What these people are doing is that they build a good product, they have a lot of satisfied customers, they license the ideas of that product, they let everybody else work on that and before we can turn around we have a de facto standard on our hands, and Europe then can only follow the lead. That is happening very quickly now. I think that as important as standards are, and people should be working on them, the ESPRIT vehicle should be used for getting standards in the other way, that is for having two or three companies working together producing a very good system or at least a very good proposal, then licensing that to North America or to Japanese, or in fact anybody who wants it, and then after that we would get a similar de facto standard, in the way we want.

ESPRIT II directly or indirectly addresses most of these issues. So I personally have no criticism. In addition, I don' think we should be interpreting what the definition of what a product is too strictly. There is no way that the Commission or anyone else, can enforce or define excellence. What we have to do is to believe in our own projects to do the right thing and produce the right results in our projects. So we should not really just strictly do what the definition of the prodjects is but we should do better than that. For that matter it is not only important to do as well as North America or Japan. What is important is to do the best Europe can do, because be certain that the competition are trying to do the same thing. Usually if our only worry is to compete with them or to catch up with them, we will never succeed. We have to believe that we can do something much better and we have to go ahead and do it. In the end, and this is an example of what almost all Europeans would agree upon, is the meal that counts, not how well you follow the recipe, or how many cooks prepare it.

I would like to finish with a final image. This is an image which involved 20 million rays from a ray tracing, which took about an hour on a big IBM machine (to compute the image). This is in essence going back to Herman Hausers dreams. If this dream is going to produce a one GIPS machine, let me tell you, if I need to produce one of the frames that I need to do real-time animation and I need one hour with an IBM 3090, I can use this GIPS machine. To produce enough frames to do real-time animation and to create something which is called artificial reality and to try to explain what goes on a system to the user so that the user can understand it, I can make very good use of that GIPS that you give me.

Thank you.

COMPUTER INTEGRATED MANUFACTURING

Prof. B. E. Hirsch
University of Bremen

Good afternoon, Ladies and Gentlemen.

My presentation is about the sub-programme Computer Integrated Manufacturing or, in short, CIM, which, besides Office Systems, is one of the two application areas in ESPRIT I. ESPRIT is not only dedicated as you know to seeing that the basis of the information technology industry in the European Community becomes broader based, but ESPRIT also aims to promote the diffusion of IT enabling technologies into application areas which are the key to the competitiveness of Europe's industry as a whole. One of these is the manufacturing sector where the application of IT is leading to Computer Integrated Manufacturing. CIM is a promising market, growing steadily between 15 % and 25 % per year. As these two industries, IT and manufacturing, are the most important basic production sectors of our emerging information society, IT and manufacturing will have to find a development path in which they successfully join forces, and this means an orchestrated and sustained effort towards true CIM. Otherwise Europe's industry as a whole will lose strength. In order for us to appreciate what is involved in this joining of forces, let me sketch a rough picture of the respective developments of the two sectors. In the past, both sectors, IT and manufacturing, have grown different internal traditions and production structures. In Europe, both have been successful so far - but separately.

Let us look at manufacturing first. In Europe, a strong machine tool industry composed of mostly small to medium size enterprises, so called SME's, have evolved. Most of them are highly specialised in a technological process niche. In partnership with their clients, the manufacturing companies, they have gradually developed today's complex system of production chains. The outstanding structural characteristic of this system is the multiple vendor/single end-user constellation in which the users configure shop floors with equipment from a multitude of suppliers. This constellation is one of the great strengths of European manufacturing, because in it a twofold accumulation of know-how takes place: firstly, accumulation of specialised knowledge in technological processes mastered by dedicated machine tool development. For SME's in this case it is the machinery vendors. Secondly, accumulation of high level know-how in configuring such machines in accordance with own product needs by the manufacturer and the users.

In contrast to the manufacturing industry, the information technology industry tends towards producing more universal IT equipment. This leaves more of the adaptation job to the customer of IT enabling technologies. The sketchiness of this characterisation probably does an injustice to the IT industry, but the point I want to make is that the two industries are rather differently structured parents of their common child, CIM. Their future developments must adapt to each other, as current national standards differ significantly all over Europe. They need support on a European scale to prevent divergent developments and subsequent structural mismatch and to create the prerequisites for competitiveness with the other industrial regions of the world. For instance, in Japan this is effected by the traditional close cooperation between government and industry. In the USA, the large internal market with its homogeneity in norms and standards offers the opportunities for industrial cooperation far above the necessary critical mass. To achieve the same critical mass with the European Community, especially for the sake of the overall dimensions of SME's, we have to combine the national forces in the various national research and development programmes. This refers not only to the main industrial actors in the European scene. To complete the cast we must bring in the research institutes, either university-based or independent. The CIM sub-programme in ESPRIT offers them the unique opportunity to participate in multi-national industry related R & D. This is most fortunate, because the research institutes provide badly needed interdisciplinary groups which enrich the innovative capacity of this precompetitive programme considerably. Moreover, CIM thinking is thus brought into the universities, so that ultimately industry will recruit better trained engineers from them.

ESPRIT I, the first five year phase of the ten year main programme, was implemented after a preceding 1983 pilot phase of just 30 or so small projects over the action areas, by means of three public calls for proposals in 1984, 85 and 86. The CIM sub-programme of ESPRIT has several advantages for the cooperative R & D approach which I have just described. IT vendors engaged in the programme can exploit their working relationships with end-users and thus extend their potential market penetration. Users engaged in the programme can fashion and influence the relevant IT developments by introducing their experience based requirements to anticipate emerging recommendations, guidelines, and standards and thus ensure their product and investment strategy. Universities and research associations can help to prepare vital new lines of CIM applications derived from the most advanced European basic research. Up to now an effort of 1,700 persons/year was allocated to 36 current CIM projects with a Community contribution of more than 90 million ECUS, equal to about 14 % of the total budget of ESPRIT I. About 150 different partners are involved in the CIM sector. Unfortunately there is not enough time to review the 36 ongoing projects individually. However the Directorate General has made available a brochure with all Project Synopses in June 1987. Looking at these 36 CIM projects it can be demonstrated that there is steady progress in each individual project and that the targets are satisfactorily met. Nearly 90 % of all projects are currently on schedule in the CIM sector. All in all the CIM sub-programme has got off to a very good start. In its short existence it has gone a long way in helping to assess where CIM stands today in Europe, to estimate CIM's market potential, and to start badly needed collective innovation processes. To summarise, the CIM sub-programme relates meaningfully to existing and future markets, contributes to Europe's opportunities in CIM, promotes the accumulation of know-how in and between the involved industry and R & D institutions. It creates new and promising patterns and partnerships for collective innovation in the precompetitive stage. It has begun to influence, and in some cases drive directly, standardisation activity. It has built up a sizeable research and development capacity that has progressed substantially alone the learning curve towards effectiveness in transnational European R & D collaboration.

I now come to the planned contribution of CIM in ESPRIT II. The work programme of ESPRIT II is available for the year 1988 as a draft released in July 1987. ESPRIT II will consolidate and extend the results achieved in the first phase with a strong emphasis on strategies, tools, methods, and components for building multi-vendor systems. Compared with ESPRIT I, Phase II will concentrate on larger integrating projects which can act as test beds and "pull through" research results. There will be a greater consideration for the needs of SME's. ESPRIT II will reflect the universal acceptance of the "open systems" concepts and will extend theses concepts to the total enterprise model. The programme will also be expanded to include the process industries.

The programme of work is divided into the following research and development topics: Manufacturing Systems Design and Implementation, Product Design and Analysis Systems, Management and Control of Manufacturing Processes, Robotics and Shop Floor Systems, and cutting across there, CIM Architecture and Communications. CIM Architecture and Communications will play the most prominent role. The strategy is to pursue an approach to integration, based on the concept of Open Systems Interconnection (known as OSI). That means non-proprietary architectures, based on the principle that components must be able to interconnect and interwork within a coherent, comprehensive, and complete framework which is itself capable of supporting systems evolution. The results will be made available progressively to Community manufacturers and systems builders. A sound foundation is laid by three ongoing major projects which have already gained international recognition as major contributors to CIM standards. These are Project 322 CAD*I, dealing with CAD interfaces, and Project 955, Project 688, CIM-OSA CNMA (Communication Network for Manufacturing Applications). These three projects will have a guiding relevance for the ESPRIT II CIM proposals.

Let me briefly describe what project 322, CAD*I is all about: the main cost of a product is determined at the design state in terms of its geometry, tolerances, and other product description data. These data are often duplicated by other divisions of the manufacturing enterprise. ESPRIT Project 322 is developing a set of interfaces which will facilitate the free flow of geometrical data between different CAD systems and will also permit CAD systems to be interfaced with other Computer Aided Engineering systems. Artificial Intelligence (AI) methods applied to the design process have been analysed and the concept for an AI interface derived. CAD*I specifications concerning CAD geometry and product analysis data were published by Springer Verlag in the newly created ESPRIT Report Series, in 1986. The CAD*I standard interface is due to be accepted by a major standardisation organisation ISO by the end of 1988. During the next five years, an extension of Project 322 is planned to integrate manufacturing, planning, and scheduling activities to the central design process. The emphasis of this work will be placed on the interface logic for wide spread application.

The objective of Project 688, CIM-OSA, is an Open Systems Architecture for Computer Integrated Manufacturing. Migration paths will be provided for the evolution of already installed CIM sub-sysstems. The architecture will concentrate on the ISO Open Systems Interconnection layer 6, the presentation layer, and layer 7, the applications layer. Key concepts have already been established. The first draft of the consistent architecture specification is available. During the next five years, this work will embrace the strategic and organisational activities of a manufacturing enterprise. The expanded scope will allow for more detailed definition of CIM-OSA for specific application areas, for example, automotive machine tools, electronics, and process industries. Intermediate and final results will be available in the public domain and are being used as input by European representatives to ISO TC (Technical Committee) 184.

The third very important project is, in this context, the CNMA Project 955. This project, which started in January 1986, addresses factory communications. As a key component to the overall systems architecture, the project selects, implements, and demonstrates profiles of existing and upcoming communications standards in real production environments. This is extending, for example, the present MAP developments. A phase one implementation guide was published in October 1986, communications software has been developed and tested and was successfully demonstrated with application software modules and mechanical equipment like robots, machine tools, and conveyor systems as a multi-vendor installation at the 1987 Hannover Fair. Fully operational factory communications methodologies will be available by early 1988. The project will support a strong European influence on the development of the relevant international standards. During ESPRIT II, this work will be extended over a further period of 4 years, leading to a more detailed definition of communications networks for specific application areas. A final milestone will be the establishment of a CIM-OSA-CNMA integrated architecture. There is already a close working relation between these two projects (P955 and P688), with several partners in common.

I will now proceed to describe very briefly the other four areas of CIM in the second phase of ESPRIT, beginning with Manufacturing Systems Design and Implementation. In this area at least 2 projects have already addressed specific aspects of integration in the manufacturing area. Project 812, "Experimental Centre for System Integration in CIM", and Project 1199, "Human Centred Computer Integrated Manufacturing Systems" - which will show where the use and development of human skills within a CIM environment can be more effective than the conventional total automation approach. However, now the stage has been reached where more significant test beds for the whole spectrum of industrial automation are required. For maximum impact a limited number of so-called Technology Integration Projects, called "TIPs" for short, will be undertaken. They require large scale industrial effort only available within the European Community dimension. The innovations planned in real production environments will provide a challenging test bed for advanced information processing, micro-electronics and software technologies. Each of the implementations will provide opportunities oriented towards the needs of small manufacturers. Distributed control systems with parallel processing capabilities will be important in discrete parts manufacturing as well as in continuous process industries. Although the two application areas differ in technological background and response time requirements, the strategies for assigning tasks to different functional entities are very similar and therefore also the general approach for designing and implementing their respective distributed control systems. The design systems will be Knowledge-Base-Systems (KBS) supported, in order to offer design alternatives. They will support the specifications, testing, and implementation of requirements with respect to reliability, fault tolerance, fail-safe degradation, and security.

The third topic deals with structured methods and interactive support tools for the design and evolution of CIM systems. They will follow the modelling techniques developed by the CIM-OSA Project 688. The topic "Product Design and Analysis Systems" is based on the requirement that design become a more integral part of the whole CIM process. Traditionally the influence of the downstream factors on product design has been highly dependent on the expertise of individual designers. To get the full benefit of IT integration and to ensure the fitness of the design for automated manufacture, a more formalised influence on the design process is needed. The requirements of CIM must be integrated into a product modeller so that this system handles all product oriented information. The product model is therefore the basis of future design and analysis systems. The application of AI techniques in mechanical and electrical design is seen to support the more creative aspects of design. Thus the accumulated experience of several designers and information from product modelling and prototype testing can be captured and reused to assist subsequent designers.

The topic "Management and Control of Manufacturing Processes" addresses the evolution from large centralised manufacturing control systems to a mixture of distributed and central control. By integrating planning and physical control systems which have previously been considered as separate, the emphasis will be on facilitating just-in-time manufacture and systems which allow the data captured during process operations to interact with higher level dynamic scheduling and planning tools. Dynamic scheduling and process planning systems, based on the principle of delegation of decision-making to the lowest possible level, give predictive abilities to allow rescheduling early enough to absorb changes in requirements or machine failures. Distributed systems have to overcome the present situation where physical control of technological and manufacturing processes are characterised by individual islands of automation. Here it will be necessary to develop special hardware and distributed parallel computing control systems and to restructure control algorithms to form a processing infrastructure for quasi real time manufacturing planning through functional control and operational control of shop floor equipment. Advanced monitoring and diagnostic tools for machines and processes are also addressed here. The tools should use advanced software techniques including AI to deal with uncertain inputs from man and machine. The aim should be operation in real time to maximise system reliability and availability.

The integration of "Robotics and Shop Floor Systems" for the handling of materials, parts, and tools is currently one of the major problems faced by both vendors and users. With the development of advanced manipulators and their programming and simulation, applications which involve unstructured environments, restricted access, confined working spaces, and those needing multiple arm systems will be addressed. Vision systems for industrial automation will be developed based on advances in image analysis. The main objective is to achieve flexibility with respect to different tasks within the same production environment. Regarding mobile robots, the main modules to be developed must be capable of supporting a range of application domains, including operations in hazardous environments. Possible test-bed domains include factories, process plants, mining, quarrying, tunnelling, under-water construction sites, and agriculture. As this topic advances, sensor systems for process control, a new generation of integrated intelligent sensors and other advanced systems will be developed for process industry applications.

Now let us look at what effort will be dedicated to this ambitious CIM work plan of ESPRIT II. With approx. 3,500 persons/year, the work volume has doubled in comparison to ESPRIT I. Moneywise, the effort has tripled, bringing the CIM share in the total ESPRIT II budget up to beyond the 20 % level. Note also that the highest share is allocated to A type projects and to Technology Integration Projects. In addition to regular programme management tasks, the CIM segment has developed an infrastructure activity called CIM-Europe, which is designed to foster interaction between ESPRIT projects and co-workers in the field. CIM-Europe is based on 8 Special Interest Groups dealing with topics as diverse as architectures, artificial intelligence in manufacturing, human factors designed for automation, control and management for production systems, production systems design and engineering, advanced robotics and vision, and shipbuilding. The activity is based on conferences and internal workshops. The CIM-Europe series of ESPRIT Special Interest Groups was launched in September 1985, and its first public event was a technical workshop as part of SITEF in Toulouse in October of the same year. In May 1986 there was a conference on Production Systems, Design, Engineering, Management and Control in Bremen, West Germany. This was followed by a workshop in Athens, Greece, on Artificial Intelligence in Computer Integrated Manufacturing. In May 1987, CIM-Europe held its annual conference in Knutsford, Cheshire, in the UK, jointly supported by the United Kingdom Department of Trade and Industry. The last major event was the workshop on Robotics and Heavy Structure Manufacturing organised in Bilbao, Spain.

Given the level of progress reached in ESPRIT I, we have all reasons to expect that ESPRIT II will also get off to a very good start.

Ladies and Gentlemen, I thank you for your kind attention.

ESPRIT BASIC RESEARCH ACTIONS

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Introduction

It is my privilege and pleasure today to have the task of presenting, and explaining some of the thinking behind, the plan for significantly extending ESPRIT's remit so as to cover support for basic research in selected areas of Information Technology. To date ESPRIT has concentrated on industrial pre-competitive work in its efforts to strengthen Europe's information technology industry, by promoting cooperation in research and development, technology transfer and international standards. This, the Fourth ESPRIT Conference, has provided much further evidence of just how successfully ESPRIT has undertaken these tasks, and also of how it has encouraged fruitful cooperation between companies in the different Member States; and across what is sometimes a most unfortunate divide between European industry and academia.

One of the sources of ESPRIT's success has been the valuable reservoir of knowledge and expertise that European academic and research institutions have built up through their past, and present, information technology-related basic research, i.e. research which can lead to future advances even if it has no immediate (visible) commercial applications, being so-to-speak "upstream" of current applied research and development. This is hardly surprising. High quality fundamental research, in information technology and related areas, has over the years led, and is continuing to lead, either directly or indirectly to developments of great practical and commercial significance to the information technology industry. The teams engaged in such work are also a most important source of well-trained research personnel for industry, as well as for academic and research institutions. Moreover, many of the researchers, though by no means all, have become closely involved with ESPRIT, either directly or via the consultancy assignments they undertake for industry. Needless to say, therefore, if ESPRIT's success is to continue it is clearly vital that this reservoir be replenished, and indeed be significantly augmented.

Europe can be proud of the fact that, ever since the very first electronic computers, a growing number of its academic and research institutions have become internationally recognised for their research in many, if not all, areas of what we now term information technology. Unfortunately, though understandably, national research funding agencies, in much the same way as the CEC, have found it necessary to concentrate much of their limited budget on research and development projects of evident and direct commercial applicability. Thus they can provide only a limited and fragmented source of support for these basic research groups, particularly compared to that available to their American, and also their Japanese, counterparts. Even the very best European basic research groups are thus, for no fault of their own, in grave danger of failing behind their rivals elsewhere. One very regrettable consequence, which is compounding the situation, is the large and growing tendency for high quality research staff, at both senior and junior levels, to leave European academic and research institutions and cross the Atlantic, in search of better working conditions, from which all too few of them ever return. In addition, at junior levels, many leave for industry prematurely, without a Ph.D. or immediately afterwards, before they have become fully autonomous researchers.

Just two statistics should suffice to portray the seriousness of the situation. First, in 1984 and 1985, for example, US computer manufacturers, aided by very favourable tax laws, made donations valued at over $300 million to support basic research in US university computing science departments alone. (This of course merely supplemented the massive support available from US government agencies such as NSF and DARPA.) Second, the gap between the average size of leading basic research groups in Europe and the USA has been estimated as being up to a factor of five - and the gap in their resourcing levels is equally dramatic.

When one also takes into account the various major basic research initiatives that the American and Japanese governments have launched in recent years, it is clear that a serious threat is posed to the continued health of European basic research - and hence to the long-term future of European pre-competitive research and development in information technology, and to our whole information technology industry.

For these reasons, and also with the equally important motive of further increasing the involvement of Europe's leading basic research groups in all facets of ESPRIT's activities, it has therefore been decided to augment the ESPRIT programme of support for industrial pre-competitive research and development with a series of Basic Research Actions. These Actions constitute an entirely new initiative, aimed at supporting collaborative long term fundamental research in selected areas, and at encouraging and maintaining effective cross-fertilisation between this research and industrial pre-competitive research and development. It is envisaged that these actions will lead to a valuable integration of European Basic Research in IT, European world leadership in more fields than is presently the case, increased interdisciplinary work and a stronger training infrastructure for training researchers.

The ESPRIT Basic Research Actions will therefore both supplement and complement relevant national activities, and to this end will be closely coordinated with such activities. Moreover, it is vital to ensure that academic and research institutions continue to contribute vigorously to the main, pre-competitive, work of ESPRIT. Therefore the Basic Research Actions must not interfere with this most valuable synergy, but instead complement it by bringing into the ESPRIT framework even more strong teams whose work is clearly upstream from ESPRIT's pre-competitive research and development.

Selection of Areas

The planned Basic Research Actions are intended to be oriented towards areas which meet two main criteria:

(1) Firstly, there must be a reasonable likelihood that research in the area will lead, albeit not necessarily immediately, to very important advances in topics of major relevance to ESPRIT. Thus the Basic Research Actions will be designed to be upstream of some, if not all, of the

strategic areas of Microelectronics, Information Processing Systems, and IT Applications that have been selected for the programme of pre-competitive research and development outlined in the ESPRIT II Work Plan. There will not however be a 1:1 correspondence between Basic Research Actions and strategic areas or sub-areas; basic research on one subject may well feed into a wide range of future pre-competitive research and development projects, just as these projects feed into downstream competitive efforts, such as will take place within the Eureka programme.

(2) Secondly, the Basic Research Actions must relate to topics in which Europe has well-established active researchers, of major international repute, i.e. who have fully demonstrated, and who clearly still retain, an ability to undertake and to lead research of the highest quality. This new ESPRIT initiative is intended to enable, indeed to spur, such researchers to lift their sights and to collaborate, where appropriate with colleagues from differing disciplines, in defining and pursuing appropriately challenging long term objectives. In some cases this will involve setting up what is in essence a single large scale collaborative fundamental research action. In other cases an action could consist of a number of distinct, but well coordinated, relatively small-scale projects focussed on an agreed overall goal.

To this end, the Basic Research Actions will specify programmes of fundamental research which address topics in the areas of Microelectronics, Computer Science, Artificial Intelligence and Cognitive Science such as:

- Optical computing, electronic properties of organic materials, quantum electronics, low-temperature electronics.

- Non-standard approaches to logic, formal methods in software engineering, functional, logical and object-oriented programming languages, distributed algorithms and protocols, integrity, security, reliability.

- Learning, knowledge representation, inference, problem solving, speech recognition and production, natural language understanding, translation, dialogue, higher-level vision, perceptual-motor coordination, robotics, autonomous systems, human-computer interaction.

However, it should be noted that this list of topics is not exhaustive, and will be dynamically revised in the light of experience, and of changing circumstances, as the new initiative progresses.

Implementation

Consortia, which must include academic and/or research institutions from at least two different Member States, will be invited to submit proposals for actions in the selected topic areas. Direct industrial participation will be encouraged but not required, and participation of organisations from EFTA countries will be feasible, along the lines laid down for ESPRIT II. As indicated earlier, these proposals could take the form of a plan for a single large scale, possibly multi-disciplinary, collaborative project, or alternatively a plan for organising and coordinating a number of distinct activities, at various institutions, focused on an agreed and well-defined overall goal.

The methods by which proposals are judged and by which the resulting activities are monitored will follow accepted scientific peer review practices, as used by leading scientific research-funding organisations. However, selection criteria will include, as well as the scientific merits of the proposed research and the capability of the teams involved, (i) long-term relevance of the work to ESPRIT goals, (ii) any associated plans for producing highly-trained research personnel, and (iii) plans for arranging appropriate interactions with relevant ESPRIT projects.

Support can be up to 100%, covering such items as

- infrastructure for cooperative effort
- research fellowships
- support for prominent scientific visitors from academia or industry
- early transfer and implementation of expertise.

It should be noted, however, that the above list is not necessarily exhaustive, since it is wished to avoid casting in concrete the modalities of support, but instead to allow enough flexibility for adjusting to the needs of (especially) the multidisciplinary projects.

To further stress the importance of ensuring that the rest of the ESPRIT Community, and indeed Europe as a whole, obtains full benefit from such Basic Research Actions, each consortium will be required to place significant emphasis on such academia and industry, means of early dissemination of preliminary results, etc. Full use should, of course, also be made of ESPRIT networking facilities.

It is envisaged that the Basic Research Actions will reach their full scope gradually, launching 10-15 actions in the first two years. Based on an average man year cost of 60 KECU, the cost of each action is estimated to require between 3 and 7 MECU of Community support. The present plan is that the first call for proposals for ESPRIT Basic Research ACtions should take place in early 1988, following the call for proposals for the main pre-competitive part of the programme. An appropriate information package will be available in time and sectorial workshops are planned for late October and early November to prepare the ground.

Concluding Remarks

Once the ESPRIT-supported basic research projects have established their success, as I have every confidence that they will, industry and national programmes are expected to take over most of the financial support of the continuation of the work. Such developments would signal the start of a new and stronger organisation of cooperative basic information technology research in Europe. This will help to ensure the continued health and international competitiveness of this research, and that its results can be available to be fed into future applied research and development efforts, something that will I believe augur well for the future of the whole European information technology industry. I thus am most proud to have been involved, with many research colleagues, and with members of the ESPRIT Directorate, in the planning of this new initiative, and as I indicated at the start, to have been accorded the privilege of introducing it to the ESPRIT community gathered here in Brussels for this Fourth ESPRIT Conference.