# COMMISSION OF THE EUROPEAN COMMUNITIES

COMMUNICATION FROM THE COMMISSION TO THE COUNCIL

THE SECOND PHASE OF ESPRIT

# COMMUNICATION BY THE COMMISSION TO THE COUNCIL

## PREAMBLE

In presenting the Guidelines for the new Community Framework Programme of Research and Technological Development for 1987-1991 (COM (86) 129 final of 17 March 1986), the Commission has stressed the importance which it attaches to the themes of :

- industrial competitiveness and, through it, improvement in the employment situation;
- the quality of life;
- the realisation of a Researchers' Europe.

Numerous initiatives have already been taken by means of Community research and technological development programmes in order to strengthen industrial competitiveness. It seems essential to pursue these efforts without delay; this has resulted in the preparation of three of the following four communications enclosed, which indicate the initiatives that the Commission intends to take with regard to :

- the launching of the second phase of the ESPRIT programme
- the revision of the BRITE programme
- the revision of the Biotechnology programme.

The last one is equally relevant to efforts to improve the quality of life of citizens of the Community.

The fourth communication enclosed gives more details of how the Commission views the revision of the Stimulation programme on exchanges of researchers; in this case it demonstrates the intention to support wholeheartedly the efforts being made to achieve a true Researchers' Europe.

The presentation of these four communications aims at assuring to provide the necessary impetus for the actions already undertaken on these priority themes; these four future programmes provide a good example of the priorities set by the Commission.

It is further self-evident that, in the spirit of the "Single European Act", these four communications prejudge neither the result of the debate going on in the Council and the Parliament on the orientations of the Framework Programme nor the formal corresponding proposal which the Commission will present in July 1986.

Furthermore, these four documents do not prejudge the corresponding draft decisions which will be presented later on to the Council and to the Parliament.

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# 1. ABSTRACT

Information Technology is one of the fastest developing areas of industrial activities in the Western World. In 1985 the OECD markets for IT products totalled 440 billion ECU; expected growth rates are 15%-25% per year. This Communication describes the scope and content of the second phase of the 10-year ESPRIT programme (European Programme for Research and Development in Information Technology); it places this second phase in its context as a necessary element for European industry to achieve competitiveness in key high technology areas in the long-term. It follows on from the first phase, which began on 1st January 1984 with three main objectives:

- to provide European IT industry with the basic technologies to meet the competitive requirements of the nineties;
- to promote European industrial cooperation in precompetitive R&D in Information Technology (IT);
- to pave the way for internationally accepted standards.

ESPRIT is an essential element of the new Community Framework Programme of technological research and development 1987 - 1991 (COM(86) 129 final).

The second phase of ESPRIT will be in accordance with the orientations indicated by the Council in its Resolution of 8th April 1986.

The Communication is the first and immediate response to the Council's request, laid down in the Resolution of 8th April, to ensure that the Commission continues to provide an effective response to the increasing challenge in the information technology field. The EEC IT industry must take into account the substantial increase of resources being devoted to IT in the US and Japan, especially from public funding.

The industry involved and interested in ESPRIT has proposed, and at the same time has committed itself, to the raising of efforts devoted to R&D performed in a cooperative manner to a minimum level of 30,000 manyears over a period of five years. In order to achieve the overall

objectives and to maintain the current momentum of the ESPRIT Programme, the Commission, following broad consultation with industry and science, considers it necessary that the second phase of ESPRIT be started in 1987.

By selecting critical areas where effort is to be concentrated, the Community will ensure that a multiplicator effect will be created. The following specific technical objectives should be achieved:
- providing technological excellence as far as possible across the strategically important range of microelectronics and peripheral technologies and establishing a sustainable competitive position in selected areas;
- providing advanced technologies and tools for enhancing the productivity in system design;
- developing IT application technology, with particular emphasis on factory automation.

The second phase of ESPRIT will also include some basic research, aimed at stimulating activity in selected IT topics of strategic interest, such as molecular electronics. Finally, it will comprise accompanying measures, such as technology transfer activities, aimed specifically at encouraging the creative and vital role of SMEs. Furthermore, the second phase will allow the participation of partners from the EFTA countries in ESPRIT projects.

The Community framework permits ESPRIT to take advantage of the EEC general policies which aim at providing a coherent framework and a favorable environment in terms of internal market, common standards, and a common approach to trade policy which are prerequisite to the translation of R&D work into economic success.

In the light of the discussions of the Council and the Parliament concerning the guidelines of the Community Framework Programme of technological research and development 1987 - 1991, and the terms which will be adopted by the Commission with respect to the formal proposal of the Framework Programme, the Commission will establish and submit a draft Council Decision on the second phase of ESPRIT.

## 2. INTRODUCTION:  the reasons for the second phase of ESPRIT

IT is of crucial importance for the competitiveness of Europe and for its future economic development.

This importance is due to the pervasive character of IT:  the potentially unlimited scope of its applications covers most of the economic sectors.  It contributes to increasing overall productivity and, at the same time, reinforces the competitiveness of user industries and services.

Moreover, IT promotes major societal tasks.  It is increasingly applied, for instance, in the education system and the health system, and in transport.  IT creates new activities and services, and therefore new employment possibilities.

On 28th February 1984, the Council adopted the first phase ESPRIT (84/130/EEC).  The programme was conceived for a ten year period with three main objectives:
- to provide European IT industry with the basic technologies to meet the competitive requirements of the nineties;
- to promote European industrial cooperation in IT;
- to contribute to the development of internationally accepted standards.

For the first five-year phase of the programme an overall effort of 1500 MECU was foreseen, 50% of which (750 MECU) was to be borne by the research budget of the Community.  The programme is implemented by projects selected from public calls for proposals, and based upon a yearly up-dated workprogramme adopted by the Council.

The programme comprises pre-competitive research and development projects, carried out by the collaborative effort of Community undertakings, and contributes to the coordination of R&D activities carried out under the programmes of the Member States and of the Community.

ESPRIT's significance derives more from the importance of the IT sector than from the financial volume involved, which represents less than 0.5% of the total EEC budget and 8% of the total Member States' expenditure in this domain.

ESPRIT was defined in the light of the deteriorating situation of the Community in the IT sector: a large trade deficit, the small market share of Community companies world wide and in Europe, lack of common strategies by European industrial actors. Compared with the United States or Japan, industry structures were fragile or technologically dependent.

An assessment undertaken by the Community in conjunction with industry in the period 1982-84 proposed actions to overcome specific handicaps: scattered efforts, lack of university/industry cooperation, size of markets and enterprises due to fragmentation into national markets and the practice of national preferences resulting in insufficient economies of scale.

Deterioration of the competitive situation in IT was linked with increasing requirements for scale unattainable at national level, in particular large scale investments, coupled with very short product life cycles, as well as to the initiatives of US and Japanese competitors. These initiatives included the mobilisation of resources on a large scale, in particular by public R&D funding, promotion of inter-industry and industry/university cooperation in projects of common interest by public authorities.

In adopting ESPRIT the Community took into account the European backlog, and took advantage of US and Japanese examples by organising, at the Community level, a cooperative effort in precompetitive R&D and in standards preparation.

Compared with actions undertaken at national level the Community initiative ESPRIT provides added value by

- pooling scattered resources, both in manpower and financial terms;
- providing an increased choice of options;
- accelerating research and its exploitation, which is of particular relevance in a sector of fast technological development and short product life cycles;
- taking advantage of the EEC accompanying policies which aim at providing a coherent framework and a favorable environment in terms of market, common standards, and a common approach to trade policy which are prerequisite to the translation of R&D work into economic success.

In accordance with the provisions foreseen by the Council, the first phase of ESPRIT was reviewed in the second half of 1985. The review, which was conducted by independent experts, has shown that ESPRIT is well on its way to meeting its objectives. The Council, in its Resolution of 8th April 1986, has welcomed the considerable progress achieved in setting up transnational cooperation in the IT sector since 1984. This cooperation enabled the mobilisation of skills and the alignment of research in Community industry, universities and research centres towards common objectives. It has permitted, in particular, the participation of SMEs in more than half of all projects.

In spite of the short timespan since the programme was launched (2 years, whereas the objectives of ESPRIT refer to a 10 year perspective), it is already possible to state that this process has enabled the Community to produce significant results, and to encourage and stimulate promising technological and industrial cooperation within the Community.

The success achieved so far must be consolidated. Certain structural phenomena and trends characteristic of the IT sector remain valid: large scale investments necessary both for R&D and for production, short product life-cycles, crucial economies of scale, relative

weakness of Community industry in certain sectors of strategic importance in microelectronic and peripheral technologies and information processing systems.

Today, more than ever, it appears clearly that Europe will only achieve its objectives in this field and overcome its handicaps by continuing and strengthening technological and industrial cooperation which can build on the large common market, the rapid creation of which is one of the major objectives of the Community. This will require reinforcing Europe's technological capabilities, promoting the process of cooperation and introducing innovative products which meet the competitive requirements of the European and the world markets.

The second phase of ESPRIT must take account of the changing environment and developments which have occured since 1982-84, in particular, along the following four lines of approach:

a) ESPRIT has demonstrated that the Community can provide an efficient and coherent framework for the development of IT. It has strengthened the confidence of industry and the Member States in cooperative actions in precompetitive R&D undertaken at Community level.

   The participants in ESPRIT projects are willing to reinforce their cooperation, to increase their efforts and the scale of their investments. They are ready to accelerate the work in order to keep pace with the acceleration of technological progress and the increased efforts of the major competitors in this sector.

b) The EEC IT industry must take account of the increased resources being devoted to IT in the US and Japan. This increase is partially due to heavy governmental funding for R&D. Japan continues and appears to accelerate its major R&D programmes in the IT sector both in hardware and software, while in the US 40% of the funding of the US Strategic Defense Initiative (SDI) is estimated

to be devoted to IT. The allocation of these large public funds to IT industry may give rise to further distortion of the competitive balance in this sector.

c) In Europe itself new initiatives have been launched to which the positive climate for cooperation created by ESPRIT has contributed. The launching of the EUREKA projects demonstrates, in particular, the intention of political and industrial actors to extend their technological cooperation to projects which are close to the market-place, and open the projects to participants from non-EEC Member States.

d) Parallel to the progress achieved in the different technical areas per se (microelectronics, software, advanced information processing, etc.), Information Technology has experienced in recent years a kind of development typified by research into the more sophisticated integration of these technologies and tools, as well as their integration with data processing networks, telecommunications and consumer electronics.

This integration of technologies occuring at system and subsystem level permits forecasting a range of new advanced applications which will be of great interest from an economic and social point of view in the short and medium term.

The strategy of industrial actors in the US and Japan builds on technology integration and comprises an increasing convergence of activities in information processing and telecommunications.

The second phase of ESPRIT will be in accordance with the orientations indicated by the Council in its Resolution of 8th April 1986. It will take into account the recommendations formulated in the Mid-term review, the new initiatives taken both inside and outside Europe in the IT development area, the commitments already taken and confirmed by industry and research centres. The industry involved and interested in ESPRIT has proposed, and at the same time has committed itself, to the raising of efforts devoted to IT cooperative development to a minimum level of 30,000 manyears for a period of five

years. In order to achieve the overall objectives and to maintain the current momentum of the ESPRIT Programme, the Commission, in conjunction with industry, considers it necessary that the second phase of ESPRIT be started in 1987.

In the second phase of ESPRIT, the current successful cooperative projects will be followed up and amplified at the level of industrial development, still on a precompetitive basis, so as to contribute to a lasting success for cooperative partnerships within the Community, and, when possible and appropriate, in association with partners from the EFTA countries.

The second phase will also see that the Community collaborative effort and the corresponding national efforts and initiatives such as EUREKA will reinforce each other by building on their complementarities.

By selecting critical areas where effort is to be concentrated, the Community will ensure that a multiplicator effect will be created. The following specific technical objectives should be achieved:
- providing technological excellence as far as possible across the strategically important range of microelectronics and peripheral technologies and establishing a sustainable competitive position in some selected areas;
- providing advanced technologies and tools for enhancing the productivity in system design;
- developing IT application technology, with particular emphasis on factory automation.

Attainment of these objectives is prerequisite for European manufacturers in IT and allied industries to achieve a self-reliant position for taking advantage of market opportunities in the medium and long-term.

The second phase of ESPRIT should also include concerted actions and actions in basic research, aimed at stimulating research in selected IT topics of strategic interest within an academic framework.

Finally, it should comprise accompanying measures, such as technology transfer activities, aimed specifically at encouraging the creative and vital role of SMEs.

In the light of the discussions of the Council and the Parliament concerning the guidelines of the Community Framework Programme of technological research and development 1987 - 1991, and the terms which will be adopted by the Commission with respect to the formal proposal of the Framework Programme, the Commission will establish and submit a draft Council Decision on the second phase of ESPRIT. It nevertheless considers it useful to put forward the present Communication in order to contribute to the knowledge of the Council on the present situation regarding the implementation of the ESPRIT Programme and to allow the Council to start discussions concerning the rationale and scope of the second phase of ESPRIT.

## 3. THE IMPORTANCE OF IT TO THE EUROPEAN COMMUNITY

3.1 Information technology is one of the fastest developing areas of industrial activity in the Western World. In 1985 the OECD market for IT products was some 440 billion European Currency Units (BECUs). (1) The IT industry's contribution to the GDP of the Western industrialized world was at least 8%. (2)

3.2 IT is not only a major industry in its own right but contributes significantly to the competitive status of most economic activities. Among sectors that rely heavily upon IT to maintain a competitive position are:
- banking and insurance
- telecommunications
- machine tool operations
- automobile industry and aeronautics
- medical and optical instrumentation.

The diffusion of IT into traditional industries, in particular in the manufacturing sector, is at the same time accelerating and providing a challenge to these industries.

3.3 IT is rapidly becoming a driving factor for social change. Integration of IT with other technologies has led to new applications and services in areas like education, transport and medicine.

3.4 The recent rapid global growth rates of the IT markets are expected to be maintained over the coming years.
Current annual rates of 15 to 25% will lead, by 1990, to figures like 100 billion ECUs for Integrated Circuits, 90 BECUs for Factory Automation and 400 BECUs for Data Processing and Office Automation. (3) (4) (9).

3.5 Although European National markets are a substantial segment of world demand, European suppliers are still in a weak position in several sectors.

By 1990 Europe is expected to be the largest single market for IT products and services amounting to 30% in the combined areas of Data Processing, Office Automation, Factory Automation, and Semiconductors while European suppliers, following current trends, will have a market share steadily declining from 23% in 1980, to 22% in 1985 and down to 21% in 1990 unless appropriate initiatives are taken now. (4)

In order to accelerate Europe's penetration of the IT market, the IT sector will have to achieve a sustained capability in a host of products based on maturing technologies. For instance, within microelectronics, complex application-specific chips containing up to 4 million elementary devices will have to be designed, manufactured and tested all within a few weeks. In information processing, systems will have to be built using drastically reduced resources currently required.

However, technical excellence in the enabling technologies is not an aim in itself, but only a necessary factor for enhancing the final systems. If Europe's penetration of IT market is to be accelerated, these systems will have to be used and integrated across a range of generic applications. To maintain its competitive position:

- the market share in factory automation should be increased considerably;

- considerably higher efficiency in new applications should be achieved.

3.6 IT is envisaged as the industrial sector which may best contribute to employment via its high growth rate.

Employment in the EEC in the Data Processing, Office Automation and Semiconductor industries has increased by 40% from 1980 to 1984 (4). Studies for the USA show a 142% employment increase in the computer industry, 50% in office equipment and 57% in electronic components industries over the last decade. (5) (6)

3.7 IT industry is facing a drastically speeded up introduction of new generations of technology and the need for much larger investments in R&D than ever before.

An average lead-time for innovation of 3 years is forcing decisions on new generations of products while the previous generation is still being launched. The minimum investment required for new microelectronics production line (200 MECUs) is quickly matching the total value of annual output in a typical plant. (7)

3.8 Spiralling R&D costs, increased industrial risks and scarcity of technical and human resources are now realities to be coped with. An estimated worldwide R&D expenditure in IT of 35 BECUs in 1985 is expected to reach 90 BECUs by 1990 (8). This is leading to heavy governmental funding for R&D. In particular, 40% of the funding for the Strategic Defense Initiative (SDI) in the US is estimated to be devoted to IT.

3.9 EEC IT industry must take account of the dramatically increased resources being devoted to IT in the US and Japan and of technological progress and focus its collaborative efforts upon selected targets which address a well defined range of applications. These targets include:

- the capability to provide complex application-specific integrated circuits, including random logic integrated circuits with up to 4 million gates on a chip;
- the quick and economic production of information processing systems, aiming at reducing the development costs of suitable system components (e.g. microprocessors, software-modules) to 10% of the current development costs;
- to take advantage of the prospects of factory automation, office automation and provide generic components for broad range applications of IT.

# 4. THE FIRST THREE YEARS OF ESPRIT

## 4.1 ESPRIT

The ESPRIT Programme, comprising pre-competitive research and development projects in Information Technology, was launched in response to the call from industrial partners and the rest of the research community for a concerted and coordinated effort to improve European technological base in the sector. This concern is reflected in the three overall objectives set for the Programme, which have already been indicated:

- providing European IT industry with the basic technologies to meet the competitive requirements of the nineties;
- promotion of European industrial cooperation in precompetitive R&D in IT;
- contribution to the development of international standards.

## 4.2 Management of the Programme

The cornerstone of the ESPRIT programme is the periodically updated workprogramme, the technical content of which is prepared in consultation with specialists drawn from all sectors of the IT research Community, both industrial and academic. The workprogramme results in call for proposals. After the pilot phase and since the beginning of the programme, there have been two major calls for proposals, one in 1984 and the second in 1985. A further call is currently underway in 1986. At the end of 1985, there were 173 projects at work, comprising 448 different participating organisations (263 industrial entities, 104 universities and 81 research institutes). The total number of people at work on these projects is expected to be 2000 in the course of 1986.

The resulting approximate distribution of Community contribution to the five technical areas (in MECU) allocated so far for support of projects, assuming that they run to their planned completion, is as follows:

| Subprogramme | Year of Call for proposals | | Total | Percentage of total |
| | 1983/84 | 1985 | | |
| --- | --- | --- | --- | --- |
| 1. Microelectronics | 85.5 | 76.5 | 162.0 | 24.2 |
| 2. Software technology | 72.9 | 56.6 | 129.5 | 19.3 |
| 3. Advanced Information Processing | 89.8 | 65.0 | 154.8 | 23.1 |
| 4. Office systems | 82.6 | 54.6 | 137.2 | 20.5 |
| 5. Computer Integrated Manufacturing | 45.2 | 41.2 | 86.4 | 12.9 |
| Total | 376.0 | 293.9 | 669.9 | 100.0 |

## 4.3 ESPRIT Mid-Term Review

In accordance with the ESPRIT decision, the Commission initiated a review to assess the Programme. A report was drawn up in 1985 by an independent high level body, known as the ESPRIT Review Board. The views expressed and opinions of the organisations interviewed were collected, and used as the basis of the conclusions derived.

4.3.1 <u>Summary conclusions of the Review</u>

The main conclusions of the report, which was presented in October 1985 and transmitted to the Council on 27th November 1985, can be summarized in the following way:
- ESPRIT has been successfully established and is well on its way to meeting its original objectives;
- Certain changes in proposal evaluation, project management and communications between participants were suggested;
- ESPRIT and national programmes were regarded as being complementary, and no major conflicts were identified;
- For the future development of ESPRIT the Board recommended that the emphasis should continue to be on precompetitive R&D, the research areas be consolidated and restructured and that focussed technology integration projects should be added to the programme.

The Commission invited the Council to hold a policy discussion on the basis of the Mid-term Review, as a result of which the Council adopted a resolution on 8th April 1986. This may be summarized as follows:
Having noted the report of the ESPRIT Review Board, the Council
- re-emphasised its commitment to the ESPRIT Programme;
- welcomed the considerable progress already achieved in the area of transnational co-operation in the field of information technology;
- reconfirmed the main objectives of the ESPRIT Programme;
- and requested the Commission to ensure, in its implementation of the ESPRIT Programme that, in scope and flexibility, it continues to provide an effective response to the ever-increasing challenge in the information technology field.

### 4.3.2 Role of SMEs

It was concluded that ESPRIT was laying the ground for technology transfer, and encouraging small and medium sized enterprises to participate. Over half of ESPRIT projects count the participation of at least one SME. In fact, SMEs do more than 25% of the work in 60% of the projects in which they are present, attesting to their vitality and the key role they play in technology transfer. In the case of some small industrial and academic organisations ESPRIT work often accounted for the greater part of their research activity. Without ESPRIT such organisations would not have the funds available for significant research activity nor would they be able to benefit from international collaboration.

### 4.3.3 Intellectual Property Rights

The question of the Industrial (Intellectual) Property Rights (IPRs) will have a far-reaching influence on the exploitation of ESPRIT technology.

By and large the ESPRIT Review found that the relevant basic rules concerning IPR's and joint liabilities are, in general, adequate to the needs of industry. This is particularly so for the smaller companies, whose interests need to be safeguarded.

In many instances collaboration agreements have been reached by consortia members covering liability and exploitations. At the present time no modifications to existing provisions are deemed necessary.

### 4.4 Dissemination of results

Specific technical progress of ongoing ESPRIT Projects (as of September 1985) is described in detail in the two volumes of "ESPRIT '85 Status Report on Continuing Work" edited by the

Commission and published at the beginning of 1986. In addition, the Commission, following a request by Council in its meeting of 8th April 1986, intends to prepare by October 1986 a supplementary report taking account of developments since the presentation of the Mid-term Review. This supplementary report will, in particular, contain further descriptions of the concrete technical results achieved by then.

4.5 Conclusions of the Council Meeting of 8th April 1986

Following its policy discussion on the Programme, the Council made some specific recommendations on the future of ESPRIT. These may be summarized as follows:

- whilst the precompetitive nature of future research and development should be safeguarded, the potential industrial application and economic impact of its results should increasingly be emphasised;
- within the context of the technological objectives of the programme, and whilst seeking to reinforce its strategic character, closer attention should be paid to the specific requirements of SMEs and research institutes;
- a concentration of efforts and resources should be sought by greater recourse to more ambitious projects;
- the structure and composition of consortia should be kept under review;
- the funding arrangements for the programme should be kept under review with a view to establishing the optimum contribution to be made by the Community to different types of organisation and projects;
- the complementary nature of research and development at the national and Community levels should be enhanced by cooperation and a better exchange of information;
- the Commission should ensure that the ESPRIT Management Committee has access to all relevant information;

- the Commission should develop a comprehensive strategy for the dissemination of information and research results;
- guidelines should be set defining the criteria and modalities for the access of organisations from EFTA countries to ESPRIT;

The Commission will take these specific recommendations into account in its proposal and in the implementation of the second phase of ESPRIT.

## 5. THE SECOND PHASE OF THE PROGRAMME: CONTINUITY AND NEW DIRECTIONS

### 5.1 ESPRIT overall objectives

The situation developed in the IT industry market, the horizontal character of IT in influencing several parallel industrial and service sectors, as well as the last three years of cooperation experience from the first phase of ESPRIT and the opportunity to build on the results already established, all concur to formulate the ESPRIT approach which at one and the same time offers continuity with the first phase of the Programme while focussing the efforts and injecting new and essential elements.

Therefore ESPRIT should continue to aim at the same objectives, which are described in detail in section 4.1. At the same time, more emphasis should be put on IT application technology and technology transfer, in particular vis-à-vis SMEs. The second phase should also be complemented by a few selected topics of basic R&D.

### 5.2 The ESPRIT approach

As a natural consequence of these overall objectives, the following approach has been defined for the form and content of the second phase of the Programme:

(i)  The second phase of the Programme should continue precompetitive R&D in areas where building on gains made during the first phase will enable critical mass efforts already established to be maintained;

(ii)  further R&D projects should be started in areas of exceptionally promising technological developments;

(iii) consolidate cooperation both across IT sectors and between manufacturers and users so that better developed synergy will have a strong and lasting effect downstream, creating a multiplicator effect and spawning productive collaborative efforts;

(iv) enlarge scope of programme, by use of a demand-driven strategy focussing on enabling technologies which could be used across a broad range of applications. Whereas ESPRIT provides generic technologies, other Community programmes (e.g. RACE, DELTA) pursue specific application-driven objectives building on ESPRIT, where applicable;

(v) actions which favour the creation of enhanced capabilities in basic research in IT in the long-term;

(vi) continue work in preparation of international standards of European origin;

(vii) promote the transfer of technology in the IT sector with particular emphasis on the capabilities and the needs of SMEs.

(viii) take full advantage of the European dimension by admitting the participation of organisations established in EFTA countries.

5.3 Enhancing the technology base:  a demand-driven strategy

A programme aiming at the competitiveness of EEC IT industry must be selective and focussed on those sector which offer the best business opportunities or provide the basic technologies needed for establishing a competitive position in the most promising market segments.  The orientation of the second phase of ESPRIT will be based on a demand-driven strategy creating a multiplicator effect in the areas concerned.

While ESPRIT activities will continue to focus on R&D on the precompetitive level, they need to be seen as elements in the demand-driven strategy. The efficient integration of IT into application systems is regarded as the ultimate goal of economic relevance where the role of IT is that of directly supporting and interfacing the user's activities in business, production and other fields, and where a R&D programme such as ESPRIT can prepare the ground for success on the precompetitive level. Application-specific programmes (RACE, DELTA) can build on these technologies.

By relating to the demand-creating strategically relevant areas, we can simultaneously ensure that:
- a growth potential and synergies with other industrial sectors will be guaranteed. Factory automation and integration of information technologies in the office and home environment are regarded as the locomotive areas to be taken account of by the second phase of ESPRIT; other selected application sectors would play a test-bed role for technology integration;
- a multiplicator effect will be created, so the R&D will stimulate much greater investment and production activity by companies downstream, where the EEC industrial and commercial potential already exists. Therefore the focus has been directed to enabling technologies, in particular advanced microelectronic and peripheral components and information processing systems design.

Taking account of the demand-driven strategy, the following specific technical objectives will be addressed:
- providing a sustainable capability in advanced components;
- producing technologies and tools for systems design;
- enhancing the ability to use and integrate IT.

Special emphasis will be put on focussed large technology integration projects suitable for achieving these objectives. Technology integration projects would act as practical

manifestations of the concrete results being produced by the Programme, especially serving as a vehicle for technology integration, still on a precompetitive level.

## 5.4 Providing a sustainable capability in advanced components

Basic components and related technologies are the basis for building systems and developing applications. Semiconductors (and in particular ICs) may be considered as a key sector for spurring the IT industry towards a competitive position.

The importance of the components sector has been increasing rapidly. It represents a large market by itself; it encompasses a large share of the technological innovations in the IT field and shows a rate of technological development superior to that of other IT segments.

Work in this area will have to be addressed primarily at improving the competitiveness of the Community Microelectronics industrial sector so as to enable it to provide the IT industry with full system capability through access to up-to-date functional components and subsystems based in particular on state-of-the-art semiconductor technology. To this end and in support of developments of application systems, it will encompass besides selected peripheral technologies the provision of the technological capability to design, manufacture and test application specific integrated circuits (ASIC) in a "system on a chip" concept.

The sector will comprise in particular work in:

## SEMICONDUCTOR DEVICES

Silicon will represent the backbone of the semiconductor industry in the next decade but the use of compound semiconductors as GaAs or InP is expected to become increasingly relevant notably in large computer systems.

To ensure adequate capabilities within the European companies, R&D will be devoted to the development of:

- **High density integrated circuits**: The goal is to provide random logic IC's, including up to 4 million gates for use in particular where a high degree of parallel processing is possible as, for instance, in processor arrays or systolic arrays. To this end it will be necessary:
  . to develop user friendly CAD systems, including automatic layout and design verification tools (advanced silicon compilers);
  . to develop low power high density processes, including the optimisation of an automated flexible manufacturing line for high yield production.

- **High speed integrated circuits**: The aim is to fabricate devices for use where processing of large quantities of information in real time cannot be assured by parallelism as for instance in supercomputers or telecoms front end processors. The target performance will be:
  . operation between 5 and 10 GHz clock frequency or gate delays less than 50 ps;
  . complexity greater than 10.000 gates.

  The main activities towards this goal are:
  - development of a very fast process (both silicon bipolar and GaAs fet technologies are the most likely candidates);

- special CAD tools to optimise circuit speed;
- special packaging techniques for GHz operation.


- **Multifunctions IC's**:  The goal is to build a complete system on a chip with digital and analog functions, operating over a wide range of speeds.  Complexity up to 1 million transistors, minimum achievable gate delay of 50 ps, power control and non-volatile memory capability will have to be implemented to meet the requirements of peripherals (display and LAN control, memory management), telecoms equipments (voice and image processing), factory and office automation (intelligent sensors and actuators).

In order to enhance the performances of very large information systems, optoelectronic ICs will be developed and used for instance to optically interconnect distributed processors.


The main activities to be pursued are:
. tuning of manufacturing processes for dedicated application
. adaptation of CAD tools to mixed functions, such as analog-digital device design.

Throughout the execution of the programme, a special emphasis will be given to definition of standards both on the software side (data exchange, tool portability between CAD system and manufacturing equipment) and on the mechanical side to meet requirements for higher degree of automation and flexibility.

PERIPHERAL TECHNOLOGIES

This section of the programme is aimed at ensuring that Europe develops the specific technologies necessary to play a leading role in future peripheral systems developments and hence ensures a significant share in the world market place.  A list of topics requiring immediate action are those of magneto-optic and optical

mass storage and retrieval systems, non-impact printers, displays, devices incorporating logic elements in conjunction with sensors, transducers, etc. (so called "Smart Devices").

5.5 Producing technologies and tools for systems design
(information processing systems)

The main objective of this sector is to provide the capability of producing systems (of similar complexity to those produced now) with drastically reduced resources. A key objective is to develop and support tools which address the development of highly complex systems and should provide a reduction in the development costs of system components (e.g. microprocessors, real-time software modules) to 10% of the current development costs.

The R&D activities to be pursued fall into four complementary subareas:

- **System design and production**
  This area addresses the process from the definition of the requirements of an IT system, through to its manufacture, distribution and maintenance. Activities include:
  . Evaluation of methods and tools, guidance in method introduction and product evaluation metrics.
  . Integration and rationalisation of Integrated Programming System Environment interfaces, project support environments and knowledge-based techniques.
  . Reusable system components, automated generation of high quality programs for real-time systems, formal techniques and methods.

- **Knowledge engineering**
  This area includes the development of systems which help reasoning and decision making uder conditions of uncertainty and incomplete information. Activities include:

. Knowledge acquisition, learning and adaptive systems, knowledge representation, knowledge manipulation and validation of knowledge-based systems.

. Natural communication processing and user interaction mechanisms.

. Integration of knowledge engineering techniques into systems design.

## - New system architectures

This area includes, notably, parallel architectures aimed at overcoming system limitations and at supporting modular construction. Activities include:

. Parallel architecture and interconnection of cooperating processors, programming and verification techniques.

. Distributed systems of semi autonomous components.

. Specialised architectures for signal processing and knowledge based information subsystems.

## - Signal processing systems

This area addresses the need to cope with the complexity of processing signals of varied physical nature (eg. temperature, pressure, image, natural voice). Activities include:

. Formal description of information flow, symbolic manipulation.

. Preprocessing, feature identification, classification, error correcting methods.

. System components for signal processing, real-time systems.

. Advanced technologies for multi-sensor signal processing systems.

## 5.6 Enhancing the ability to use and integrate IT

The main objective of this sector is to enhance European capabilities in the integration of IT into systems able to be used in a broad range of applications and to validate the results in selected, realistic environments.

The R&D activities to be pursued fall into three complementary subareas:

- **Factory Automation**

  The objective is to expand the share of Community IT vendors in the market for factory automation to the level of domination in the home market, and to achieve significant penetration in non-EC markets.

  In parallel, it is expected that the rapid uptake of these IT-based technologies would induce a completion of the modernization process in a wide range of manufacturing industries.

  The area will include discrete parts, continuous and semi-continuous production in a variety of manufacturing environments, and the different levels of automation needed by small and medium-sized enterprises need to be taken into account.

  The establishment of Open Systems concepts to support multi-vendor operation is an important means of achieving the objective of the area.

  Specific technical goals include:
  - taking advantage of leading edge IT developments in factory automation;
  - reduction in the cycle time of concept-design-production by 50%;

- reduction in manufacturing system downtime by 50%.


Activities include:
- Open System Architectures supporting integration strategies;
- CAD/CAE and product modelling systems;
- unified support systems for logistical and real-time control of factory operations;
- distributed manufacturing systems;
- advanced robotic and handling systems;
- IT support for shop floor sub-systems.


- **Office and Integrated Information Systems**
This area addresses systems integration R&D for selected applications. Application domains include office environment and the domestic environment.


Activities include:
- multimedia office systems;
- integration of data acquisition, monitoring, control subsystem into office systems for a range of selected innovative applications (eg. integrated enterprise, laboratories, etc.);
- monitoring, control, information systems for the domestic environment.


Work will be focussed on technology integration aspects and projects.


- **Subsystems**
This area addresses the integration of basic IT components into subsystems. The major goal is to provide low cost technologies and large scale applicability. Particular emphasis will be put on modularity and fail-safe aspects.

Activities include:

- workstations for multiple application purposes;
- storage and processing subsystems for stand-alone and distributed systems;
- local network systems and related basic services;
- user interfacing subsystems (eg. visual, vocal, manual);
- integrated subsystems interfacing the physical environment (eg. vision and environment understanding, laboratory data acquisition, monitoring and control, robotics subsystems).

## 5.7 Creating enhanced scientific capabilities

Industrial cooperation in precompetitive R&D is the prerequisite for achieving ESPRIT aims and objectives, as has been fully demonstrated by the first phase of ESPRIT. Although industrial cooperation in R&D is the key action, complementary actions are needed to support the competitiveness of IT in the long term. Improving the use of scientific R&D capabilities by cooperative efforts is therefore an objective of the ESPRIT Programme during its second phase.

It is expected that universities and research institutes will continue to be active in industrial projects, but there remains the necessity that present and future efforts in precompetitive research with commercial applications should be supplemented by promoting research into IT at a more fundamental level without immediate direct applications. Basic research is also an important element for the training of the highly qualified manpower which is urgently needed by IT as well as other industrial sectors. This type of research is mainly carried out in universities and in public or private research institutes.

One of the benefits of the ESPRIT programme so far has been the breaking of geographical isolation of certain institutions. It is expected to build on this for the continued participation of academic institutions, and it is envisaged that a few selected

European centres of excellence in IT should be encouraged to become international in their orientation. Such centres would preferably be based on existing activities and would also build on efforts developed at European level.

The Commission will support actions covering research in areas of strategic interest with the framework of the second phase of ESPRIT, provided that:
- the European dimension can be guaranteed by an ambitious common work programme to be agreed by leading experts,
- the best organisations in that field can be attracted, and are sufficiently motivated by the task to willingly work to this common work programme in a reasonable manner.

There will be strong focus on promising selected research areas, which have not yet reached maturity, and where therefore Community action could provide visible impetus.

The work areas include:
- Molecular electronics;
- Artificial intelligence and cognitive science;
- Human factors engineering;
- Applications of solid state physics to IT;
- other areas of basic research which may be defined in future workprogrammes.

## 5.8 Promoting Technology Transfer

ESPRIT has been laying the ground for technology transfer, mainly by means of information dissemination activities and the wider access to results which is permitted. The future information dissemination activities can build on experience gained and results achieved during the first phase of the programme. These activities include inter alia the organization of regular information exchange fora in the context of the annual ESPRIT Technical Week, special interest groups and workshops on specific topics addressing a technical audience. These events combine

reporting of results, general information exchange, identification of topics of common interest and preparation of potential collaboration, be it inside or outside the Programme.

The principle of ensuring that as wide an audience as possible gains access to ESPRIT results is translated into the provisions relating to property rights. These are summarised below (cf. 6.1.3).

The Commission will also examine favourably awareness schemes related to ESPRIT at national or regional level which include a training component.

With regard to management planning, information dissemination activities will conform to the following objectives:

- to promote the application of ESPRIT results by the Community industry;
- to increase public awareness of, and support for, the ESPRIT programme;
- to promote the use of up-to-date and reliable information in the planning of the programme;
- to promote the exchange and sharing of technical and market information in order to optimize the use of ESPRIT resources.

To meet these objectives, the following mechanisms will be utilized:

- a clearinghouse to ensure availability of information to the ESPRIT Community and public at large, and to handle individual queries;

- yearly ESPRIT Technical Week, workshops and special interest groups.

- publications including an annual report on ESPRIT and an ESPRIT
  Newsletter and publications from projects;

- surveys and studies on technological and market trends in the
  IT sector.

## 6. MANAGEMENT OF THE SECOND PHASE OF ESPRIT

### 6.1 Management of work programme

#### 6.1.1 Responsibilities

The Commission will continue to ensure that the programme is properly performed. The advice and consultation of experts from industry and the academic world will continue to be provided by an ESPRIT Advisory Board. The ESPRIT Management Committee will assist the Commission in the execution of the programme.

In parallel with this formal management structure, the Commission will pursue consultations with industry and whenever appropriate with academic and research institutions, organized in such a way that large and small IT firms as well as users and academic and research institutions will continue to be requested to express their views and suggestions to the Commission on all major matters related to the content, structure and execution of the programme.

#### 6.1.2 Project selection and evaluation

Participation in projects in the ESPRIT programme will be open to all companies, irrespective of size, universities and other educational establishments, research establishments and interested individuals within the European Community and, under certain conditions, to organisations established in non-Member States.

The projects will have to be in conformity with the workprogramme and involve the participation of at least two industrial partners established in different Member States of the EEC, each contributing significantly to the project.

Proposals will as a rule be submitted in reply to an open invitation published in the Official Journal of the European Communities.

The Commission will perform a fair and independent evaluation of proposals. Due regard will be given to industrial, technical and scientific considerations. Proposers will be invited to consult pre-published evaluation criteria.

The evaluation will be performed under appropriate conditions in order to ensure confidentiality, particularly with regard to financial information.

In evaluating the technical project description and work programme of the proposals, the Commission shall seek opinions where necessary of appropriate industrial and scientific experts and from the Member States' administrations.

6.1.3 Contract management

The contractors shall have full technical and financial responsibility for the management of the projects. The Commission shall continue to improve the management methods to ensure the efficient execution of individual projects.

In the second phase of the Programme, the same basic rules relating to property rights will apply. These may be summarized as follows:

The guidelines for these projects are that ownership and the right to exploit any information and industrial property rights resulting from the work under any contract (foreground information) will normally reside with the contractors. The detailed arrangements between the

contractors participating in the same projects will be left to the interested parties to agree, the Commission only ensuring that competition rules are not infringed. Whatever the arrangements between these contractors, they must ensure that each participant in the same project, for the whole duration of the project and for the purpose of fulfilling its share of the work, has guaranteed and privileged access to the results of the work done by the others."

In order to benefit from the overall synergetic effect that a Community action is designed to favour, access for a project team to foreground knowledge generated by another team working on a different project within the ESPRIT framework shall also be arranged under privileged conditions in so far as such information enables better or quicker results to be obtained from the project which needs it.
Furthermore, to promote improved competitiveness in Community industry as a whole, it is necessary that other industrial companies in the Community which did not participate in a specific project, but which have the ability to use its results and wish to do so, should have the opportunity to acquire the rights. The terms should be negotiated on a commercial basis taking into account the contributions of the originating parties as well as those of the Community. To this end, if the originating party does not wish to exploit part or all of the results of the research without a legitimate reason, there will be adequate provisions to ensure that the Community can require him to grant licence either to exploit the results of his work or to carry he research work further.

## 6.2 Coordination with other programmes

The ESPRIT Mid-Term Review found that the Programme was complementary to national programmes in the IT sector. Under the second phase of ESPRIT, it is recognized that a continuous need

will exist to ensure the systematic coordination between such programmes and ESPRIT. The Commission will continue to offer a framework and suitable fora for such coordination. It is also necessary that there should be full coordination with any EUREKA projects in the IT sector.

The EUREKA declaration of principles, adopted by the European Foreign Affairs and Research Ministers at their meeting in Hannover on 5-6 November 1985, specifies that "EUREKA projects are not intended to replace existing European technological cooperation, such as the programmes of the European Community, nor its subsequent development. On the contrary, the purpose is to extend or supplement this cooperation."

Whilst the Community will pursue R&D projects in Information Technology within the framework of the ESPRIT Programme whose objectives, structure, criteria and priorities have been defined in conjunction with the administrations and industry of the Member States as a whole, EUREKA projects will for the most part be undertaken on the initiative of individual companies desirous of closer association with one another. These companies will themselves assure the management and control of the projects including, for the most part, financial support. These projects will mainly relate to the joint development of advanced technologies close to the market or of infrastructures of transnational interest. The Commission will ensure coherence and, as far as possible, cooperation between individual EUREKA projects in the IT field and current or scheduled ESPRIT actions, and thereby establish the complementarity which is necessary for a coordinated approach at Community level to be realized and for duplication of resources to be avoided.

It will moreover participate in the organisation of industrial
seminars relating to both ESPRIT and EUREKA projects and provide,
as it is the case with the information communication system, those
facilities developed within the ESPRIT framework which may prove
to be useful for the development of the EUREKA initiatives.

In a broader context, ESPRIT is one specific programme in the
overall Community Framework Programme of technological research
and development 1987 - 1991. Particular relationships exist and
coordination will be assured with programmes such as RACE, DELTA,
DRIVE, as well as BRITE. The Commission undertakes to prevent any
overlaps and unnecessary duplication of efforts with such
programmes. This will be ensured when defining the detailed scope
of these programmes and maintained throughout their implementation
phases.

## 6.3 Participation of organisations established in non-Member States

The Commission, aware of the strong interest expressed in
particular by industry in the EFTA countries for broadening the
cooperation in technological research and development, intends to
extend the criteria for participation in the second phase of
ESPRIT to accommodate them. For the first phase of the Programme
companies, universities and research institutes from EFTA
countries can participate in ESPRIT projects as subcontractors if
this is judged beneficial to the individual projects.

Since it is of overall strategic interest with respect to the
competitivity of European IT industry as a whole and in the spirit
of the Framework Agreements on R&D Cooperation currently being
concluded with individual EFTA countries, for the second phase it
is suggested to admit such organisations from these countries to
submit proposals and to be signatories to ESPRIT projects.

The selected organisations would have to cover the totality of their own costs (plus, as appropriate, a participation in the operational expenses).

Projects with participation by above-mentioned organisations from the EFTA countries will, of course, have to comply with normal Community programme criteria, i.e. at least two industrial partners from two different Member States will also be required to participate. Normal Community contract conditions, in particular regarding property rights, will also apply. As for access to and exploitation of foreground and background information in the same or parallel projects, organisations from non-Member States will be treated in the same way as other organisations participating in ESPRIT.

## 6.4 Scale of required efforts

In the preceding sections, an outline of objectives, scope and management of the second phase of the ESPRIT Programme has been presented. The scope and content of the Programme was defined in conjunction with representatives of the Community IT industry and science. One important point to arise from these consultations was the repeated expression of willingness, on the part of industry, to devote substantially more of its resources to collaborative R&D. The size of the ESPRIT effort ought to be such as to reflect this willingness and offer ample opportunity for industrial concerns to build on cooperation within the Community framework.

In estimating the total volume of effort, the Commission has been guided by the intent of industry to increase the scale and the scope of its collaborative R&D. In this respect the foremost necessity at Community level is to achieve critical mass efforts, defined as the minimum manpower needed to reach ESPRIT objectives in due time. New activities comprising an overall estimate of

30,000 manyears of R&D work, coupled with the 10,000 already covered by the first phase, will ensure this critical mass effort.

The main elements which have been taken into account to obtain these critical mass figures are:

- the present level of existing human resources in the areas selected;
- present and future levels of overall investment in R&D in IT worldwide and in Europe, and the resulting requirement to ensure that ESPRIT funding reaches a significant percentage in the overall R&D effort at the precompetitive stage;
- present and scheduled public supported funding of collaborative R&D in USA and Japan.
- present and scheduled programmes in Member States on which ESPRIT can build by ensuring synergy and complementarity.

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