COST

EUROPEAN COOPERATION IN THE FIELD OF SCIENTIFIC AND TECHNICAL RESEARCH

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CROATIA
CZECH REPUBLIC
DENMARK
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GREECE
SPAIN
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SLOVAKIA
SLOVENIA
SWITZERLAND
FINLAND
SWEDEN
TURKEY
UNITED KINGDOM

COST
COLLECTED AGREEMENTS
VOLUME 7
1991-1992

GENERAL SECRETARIAT OF THE COUNCIL OF THE EUROPEAN UNION

COST SECRETARIAT

Collected Agreements
concluded within the framework of European cooperation
in the field of scientific and technical research

COST

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Foreword

This publication is the seventh volume of a collection which includes all the agreements concluded within the framework of European cooperation in the field of scientific and technical research, better known by its abbreviation COST.

This framework for scientific and technological cooperation, which was set in motion in 1969 at the initiative of the Council of the European Communities, involves the 12 EC Member States plus six of the EFTA countries (Austria, Finland, Iceland, Norway, Sweden and Switzerland) and Turkey.

Recently, the framework of COST was extended to incorporate a certain number of the Eastern and Central European countries (Croatia, the former Czechoslovakia, Hungary, Poland and Slovenia).

Next to the incorporation into COST of the abovementioned States, the traditional role of COST – acting as a bridge between EC countries and others – has been given new impetus by the involvement of non-COST partners on the basis of a project, for instance:

the Russian Baikov Institute in a COST Project in the materials field;

the Institute of Applied Geophysics of Moscow in COST Project 238 (in the field of telecommunications), in which the Bulgarian Academy of Science also participates.

As the range of COST participants widens, so does its range of research activities. These now include, *inter alia*:

1. Informatics
2. Telecommunications
3. Transport
4. Oceanography
5. Metallurgy and materials science
6. Environmental protection
7. Meteorology
8. Agriculture
9. Food technology
10. Medical and public health research
11. Social sciences

12. Forests and forestry products
13. Chemistry
14. Civil engineering

Initiatives which meanwhile led to projects in other areas, for example in fluid dynamics, are permanently under way. Another possible area may be neuroscience.

COST has always retained a privileged position *vis-à-vis* Community (EC) research programmes, while maintaining a wide range of autonomous activities. This split is reflected in the two categories of COST Projects adopted in 1989, namely:

Category A: Concerted action projects forming an integral part of a Community R&D programme, which are open on a multilateral basis to COST third-State participation;

Category B: Concerted action projects, not forming part of a Community programme, proposed by COST States or by the Commission. Individual COST States and the Commission may participate in these projects.

In broad terms, COST agreements arising from Category A take the form of an international convention in the classical sense, whilst those arising from Category B take the form of a Memorandum of Understanding, a unique instrument which has been developed by the COST framework itself. Since the vast majority of COST Projects are of the B category, this is the form of agreement which dominates the ensuing pages of this volume.

For those readers who are interested in COST activities in general, various publications have been made available to national coordinators who are responsible for informing potential participants about the COST framework. I hope, however, that this collection will, like its predecessors, meet the desires of those who wish to have a regular source of detailed information on agreements concluded within the COST framework. What I believe it shows in addition is that COST Projects continue to grow in number and that there is, indeed, increased interest in a mechanism which has proved its worth over the last 20 years.

I am sure that, as the number of COST countries grows and the old barriers of a divided Europe fade into the past, the bridge-building role of COST will be reaffirmed until long after the turn of the century.

N. Roulet
Chairman
Senior Officials Committee

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Model of Memorandum of Understanding for the implementation [...]

Subject: Draft Memorandum of Understanding for the implementation of a European research project on [...] (COST Project [...])

Delegations will find attached the text of the abovementioned draft Memorandum of Understanding as finalized by the Jurists/Linguists Working Party.

Memorandum of Understanding for the implementation of a European research project on [...]

(Cost Project [...])

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in a European research action on [...] reached the following understanding:

Section 1

1. The Signatories intend to cooperate in a Project to promote research into the [...].

2. The main objective of the Project is to [...].

3. The Signatories hereby declare their intention of carrying out the Project jointly, in accordance with the general description given in Annex II, adhering as far as possible to a timetable to be decided by the Management Committee referred to in Annex I.

4. The Project will be carried out through concerted action, in accordance with the provisions of Annex I.

5. The overall value of the activities of the Signatories under the Project is estimated at approximately [ECU ...] per Signatory at [19...] prices.

6. The Signatory will make every effort to ensure that the necessary funds are made available under their internal financing procedures.

Section 2

Signatories intend to take part in the Project in one or several of the following ways:

(a) by carrying out studies and research in their technical services or public research establishments (hereinafter referred to as 'public research establishments');

(b) by concluding contracts for studies and research with organizations (hereinafter referred to as 'research contractors');

(c) by contributing to the provision of a Secretariat and/or other coordinatory services or activities necessary for the aims of the project to be achieved;

(d) by making information on existing relevant research, including all necessary basic data, available to other Signatories;

(e) by arranging for inter-laboratory visits and by cooperating in a small-scale exchange of staff in the later stages.

Section 3

1. This Memorandum of Understanding will take effect for [...] years on its signing by at least five Signatories. This Memorandum of Understanding may expire on the entry into force of an agreement between the Community and the non-Community COST member countries having the same aim as that of the present Memorandum of Understanding. This change in the rules governing the Project is subject to the prior agreement of the Management Committee referred to in Annex I.

2. This Memorndum of Understanding may be amended in writing at any time by arrangement between the Signatories.

3. A Signatory which intends, for any reason whatsoever, to terminate its participation in the Project will notify the Secretary-General of the Council of the European Communities of its intention as soon as possible, preferably not later than three months beforehand.

4. If at any time the number of Signatories falls below five, the Management Committee referred to in Annex I will examine the situation which has arisen and will consider whether or not this Memorandum of Understanding should be terminated by decision of the Signatories.

Section 4

1. This Memorandum of Understanding will, for a period of six months from the date of the first signing, remain open for signing by the governments

of the countries which are members of the COST framework and also by the European Communities.

The governments referred to in the first subparagraph, and the European Communities, may take part in the Project on a provisional basis during the abovementioned period, even though they may not have signed this Memorandum of Understanding.

2. After this period of six months has elapsed, applications to sign this Memorandum of Understanding from the governments referred to in subparagraph 1 or from the European Communities will be decided upon by the Management Committee referred to in Annex I, which may attach special conditions thereto.

3. Any Signatory may designate one or more competent public authorities or bodies to act on its behalf in respect of the implementation of the Project.

Section 5

This Memorandum of Understanding is of an exclusively recommendatory nature. It will not create any binding legal effect in public international law.

Section 6

1. The Secretary-General of the Council of the European Communities will inform all Signatories of the signing dates and date of entry into effect of this Memorandum of Understanding and will forward to them all notices which he has received under this Memorandum of Understanding.

2. This Memorandum of Understanding will be deposited with the General Secretariat of the Council of the European Communities. The Secretary-General will transmit a certified copy to each of the Signatories.

ANNEX I

Model of coordination of the Project

CHAPTER I

1. A Management Committee (hereinafter referred to as 'the Committee') will be set up, composed of not more than two representatives for each Signatory. Each representative may be accompanied by such experts or advisers as he or she may need.

The governments of the countries which are members of the COST framework and the European Communities may, in accordance with the second subparagraph of Section 4(1) of the Memorandum of Understanding, participate in the work of the Committee before becoming Signatories to the Memorandum without, however, having the right to vote.

When the European Communities are not a Signatory to the Memorandum of Understanding, a representative of the Commission of the European Communities may attend Committee meetings as an observer.

2. The Committee will be responsible for coordinating the Project and, in particular, for making the necessary arrangements for:

(a) the choice of research topics on the basis of those provided for in Annex II, including any modifications submitted to Signatories by the competent public authorities or bodies; any proposed changes to the Project framework will be referred for an opinion to the Committee of Senior Officials on Scientific and Technical Research (COST).[1]

(b) advising on the direction such work should take;

(c) drawing up detailed plans and defining methods for the different phases of execution of the Project;

(d) coordinating the contributions referred to in subparagraph (c) of Section 2 of the Memorandum of Understanding;

(e) keeping abreast of the research being done in the territory of the Signatories and in other countries;

(f) liaising with appropriate international bodies;

(g) exchanging research results among the Signatories to the extent compatible with adequate safeguards for the interests of Signatories, their competent public authorities or bodies and research contractors in respect of industrial property rights and commercially confidential material;

(h) drawing up the annual interim reports and the final report to be submitted to the Signatories and circulated as appropriate;

(i) dealing with any problem which may arise out of the execution of the Project, including those relating to possible special conditions attached to accession to the Memorandum of Understanding in the case of applications submitted more than six months after the date of the first signing.

3. The Committee will establish its rules of procedure.

4. The Secretariat of the Committee will be provided at the invitation of the Signatories by either the Commission of the European Communities or one of the Signatory States.

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[1] Where appropriate, a COST technical committee may be mentioned instead of the Committee of Senior Officials.

CHAPTER II

1. Signatories will invite public research establishments or research contractors in their territories to submit proposals for research work to their respective competent public authorities or bodies. Proposals accepted under this procedure will be submitted to the Committee.

2. Signatories will request public research establishments or research contractors, before the Committee takes any decision on a proposal, to submit to the public authorities or bodies referred to in paragraph 1 notification of previous commitments and industrial property rights which they consider might preclude or hinder the execution of the Project of the Signatories.

CHAPTER III

1. Signatories will request their public research establishments or research contractors to submit periodical progress reports and a final report.

2. The progress reports will be distributed to the Signatories only through their representatives on the Committee. The Signatories will treat these progress reports as confidential and will not use them for purposes other than research work. In order to assess better the final data on the Project, the Signatory States are invited, for the preparation of the final report, to state the approximate level of spending at national level arising from their involvement in the Project. The final report on the results obtained will have much wider circulation, covering at least the Signatories' public research establishments or research contractors concerned.

CHAPTER IV

1. In order to facilitate the exchange of results referred to in Chapter 1, paragraph 2(g), and subject to national law, Signatories intend to ensure, through the inclusion of appropriate terms in research contracts, that the owners of industrial property rights and technical information resulting from work carried out in implementation of that part of the Project assigned to them under Annex II (hereinafter referred to as 'the research results') will be under an obligation, if so requested by another Signatory (hereinafter referred to as 'the applicant Signatory'), to supply the research results and to grant to the applicant Signatory or to a third party nominated by the applicant Signatory a licence to use the research results and such technical know-how incorporated therein as is necessary for such use if the applicant Signatory requires the granting of a licence for the execution of:

(a) work in respect of the Project;

(b) research and development work within the framework of the applicant Signatory's actions in the same field;

(c) research and development work within the framework of any associated European action undertaken subsequently and in which all or several of the Signatories may be prepared to take part.

Such licences will be granted on fair and reasonable terms, having regard to commercial usage.

2. Signatories will, by including appropriate clauses in contracts placed with research contractors, provide for the licence referred to in paragraph 1 to be extended on fair and reasonable terms, having regard to commercial usage, to previous industrial property rights and to prior technical know-how acquired by the research contractor in so far as the research results could not otherwise be used for the purpose referred to in paragraph 1.

Where a research contractor is unable or unwilling to agree to such an extension, the Signatory will submit the case to the Committee before the contract is concluded; hereafter, the Committee will state its position on the case, if possible after having consulted the interested parties.

3. Signatories will take any steps necessary to ensure that the fulfilment of the conditions laid down in this chapter will not be affected by any subsequent transfer of rights to ownership of the research results. Any such transfer will be notified to the Committee.

4. If a Signatory terminates its participation in the Project, any rights of use which it has granted, or is obliged to grant, to, or has obtained from, other Signatories in application of the Memorandum of Understanding and concerning work carried out up to the date on which the said Signatory terminates its participation will continue thereafter.

5. The provisions of paragraphs 1 to 4 will continue to apply after the period of operation of the Memorandum of Understanding has expired and will apply to industrial property rights as long as these remain valid, and to unprotected inventions and technical know-how until such time as they pass into the public domain other than through disclosure by the licensee.

Memorandum of Understanding for the implementation of a European research project on integrated space/terrestrial mobile networks

(COST Project 227)[1]

Date of entry into force of the Project: 25.3.1991
Duration: 24.3.1995

Contracting parties	Date of signing	Date of entry into force
CZECHOSLOVAKIA	31.7.1992	31.7.1992
ITALY	26.4.1991	26.4.1991
PORTUGAL	21.6.1990	21.6.1990
SWITZERLAND	3.7.1990	3.7.1990
ESA	26.7.1990	26.7.1990

The overall value is ECU 350 000 (in 1988 terms).

ANNEX II

General description of the project

1. Introduction

The first generation of the pan-European mobile cellular network is scheduled to go into operation in the early 1990s. It will be implemented gradually, starting with all capital cities of the countries of all CEPT administrations by 1993 including the principal airports, and then the transport routes between capital cities by 1995. In terms of geographical coverage, its deployment will spread over many years and will eventually stop short of 100%, leaving many lightly populated but extensive areas uncovered.

A satellite network for land-mobile communications could be implemented in parallel and would provide immediately the complementary coverage required to serve the whole of Europe as well as North Africa and the Near East. In an integrated space/terrestrial mobile network, it would be possible to entrust the satellite with certain functions such as localization of mobile subscribers and European-wide paging, which could be more efficiently carried out by satellite than by purely terrestrial techniques. Two types of networks can be identified:

(a) private closed networks which are required by business organizations such as road transport companies operating trucks all over Europe, or certain government agencies concerned with transport safety, the environment, etc.:

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

(b) public open networks (as required, for example, for public mobile telephony).

For data communications in satellite mobile networks, two standards already exist, namely the ESA-Prodat and the Inmarsat Standard C.

For digital voice communications, however, no standard is established yet. The project should follow the development of suitable voice systems with the aim of creating a European standard for satellite mobile networks which is compatible with existing terrestrial networks.

Efficient transmission techniques and reliable communications protocols should be developed and drawn up for the mobile satellite network as well as proper methods for the integration of both the satellite and terrestrial networks.

2. Objectives of the project

The main objectives of the project are to:

(a) coordinate and promote European research in the field of integration of satellite-based mobile systems and terrestrial mobile networks;

(b) identify and study in detail problems of the interconnection of terrestrial and satellite-based mobile networks for voice and data communications;

(c) develop mobile terminals compatible with space and terrestrial cellular networks.

3. Technical aims

The implementation of the concept of an integrated space/terrestrial mobile network requires study in the following areas:

(a) mobile terminals for voice/data communications,

(b) digital voice systems compatible with both satellite and terrestrial networks and their standardization,

(c) localization techniques,

(d) signalling techniques,

(e) network control,

(f) communications protocols,

(g) strategies of network evolution.

4. Form of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee by delegates who should be expected to:

(a) attend and contribute to meetings of the Management Committee (usually two to four meetings per year);

(b) be involved in an active programme fitting in with the objectives and time scale of the project;

(c) set up national working groups for specific items;

(d) be responsible for liaising between the Management Committee and national research groups in the participating countries;

(e) establish and maintain, in particular, close cooperation with COST Project 231;

(f) seek at least annually the advice of the Technical Committee Telecommunications

(TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects.

When necessary, the Management Committee may arrange working sessions for participating researchers, where results can be presented and discussed, on either an *ad hoc* or a regular basis.

5. Envisaged costs for the activity

The minimum overall costs per Signatory for a four-year period of the project are estimated as follows:

	Man-years	ECU
Management Committee work	0.6	40 000
Research work	4	280 000
Travel expenses	–	30 000
		350 000

(based on ECU 70 000 per man-year).

Memorandum of Understanding for the implementation of a European research project on simulation for satellite/terrestrial networks

(COST Project 228)[1]

Date of entry into force of the project: 16.1.1992
Duration: 15.1.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
DENMARK	12.6.1992	12.6.1992
GREECE	9.12.1992	9.12.1992
SPAIN	12.6.1992	12.6.1992
PORTUGAL	11.11.1992	11.11.1992
TURKEY	12.6.1992	12.6.1992

The overall value per Signatory is ECU 500 000 (in 1990 terms).

ANNEX II

General description of the project

1. Introduction

For the study and optimization of communications networks, computer simulation is an indispensable tool. In the past, special purpose simulation programmes have often been written for specific applications, with very little general applicability or reusability. Currently, much work is being performed towards the development of more general purpose software for the simulation of arbitrary networks. In this area, the techniques used and results obtained are of interest to a wide community of researchers and network designers.

The purpose of the proposed project is to stimulate cooperative research into network simulation techniques, such that simulation methodology and results which may be useful as input to further simulation work or which may themselves contain valuable information, can be shared between participants without unnecessary duplication of work. Comparison of results obtained within different organizations would be facilitated by having a common understanding of the simulation systems and methods employed.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

It is not the intention that a single software tool be jointly developed, but rather to harmonize efforts in other ways. For example, in a scenario where each organization involved agreed to a certain modularity in model development and to the interfaces between various software entities, any software or concepts developed, or results obtained by a particular organization, could be shared between all the participants. This approach would allow organizations with different areas of specialization (e.g. in channel modelling or network management) to benefit from each other's experience. Efforts could be put into the development of user-friendly software modelling tools, allowing a user to set up his model graphically, rather than applying a computer language-oriented approach. This could for instance make use of workstations running under operating systems which support window techniques efficiently. This philosophy allows easy use by an engineer familiar with networks and communications systems, but not necessarily the details of simulation or object-oriented programming.

The communications networks of interest are in particular satellite-based systems, terrestrial systems and integrated networks involving both. In the past, a large effort has been put into the development of simulation and modelling software for terrestrial networks, yet there is very little available which takes into account the specific properties of satellite channels (e.g. the delay and channel error characteristics of a satellite link). Potentially, cooperation between those organizations with extensive experience in simulating and designing terrestrial networks and those that are oriented towards satellites could prove very fruitful. The purpose of this project is to bridge the gap between these areas, and to provide tools for modelling satellite and integrated satellite/terrestrial networks.

2. Objectives of the project

The main objectives of the project are to:

(a) coordinate and promote European research in the field of methods for communications network simulation with special emphasis on satellite networks and the integration of space/terrestrial networks;

(b) identify and study in detail problems of satellite links and their properties and to implement suitable models for the simulation of communications networks;

(c) develop a harmonized approach to network modelling, and to standardize the interfaces between the software entities modelling the various blocks:

(d) develop user-friendly simulation tools and techniques.

3. Technical aims

The implementation of the concept of harmonized simulation systems for communications and (in particular satellite) networks requires study in at least the following areas:

(a) methods for characterization of the service provided to higher communications layers by the lower layers;

(b) modelling of various classes of user traffic;

(c) simulation/characterization of specific protocols and gateways;

(d) development of databases for macroscopic modelling of systems, and storing of accepted characteristics;

(e) methods for minimizing computation time;

(f) use of simulation for protocol verification based on existing development and tools;

(g) modelling techniques for specific elements of protocols;

(h) development of criteria for new protocols (e.g. leading towards standardization of protocols for integrated satellite/terrestrial networks).

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries;

(g) maintain contact with other relevant COST activities (COST 224, COST 226, COST 227, COST 231) and provide input to these projects as appropriate.

When necessary, the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

5. Envisaged costs for the activity

The minimum overall costs per Signatory for a four-year period of the project are estimated as follows:

	Man-years	ECU
Management Committee work	0.6	60 000
Research work	4	400 000
Travel expenses	–	40 000
		500 000

(based on ECU 100 000 per man-year).

Memorandum of Understanding for the implementation of a European research project on stereoscopic television

(COST Project 230)[1]

Date of entry into force of the project: 26.4.1991
Duration: 25.4.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
GERMANY	27.2.1991	27.2.1991
GREECE	9.12.1992	9.12.1992
FRANCE	27.2.1991	27.2.1991
ITALY	26.4.1991	26.4.1991
PORTUGAL	27.2.1991	27.2.1991
UNITED KINGDOM	27.2.1991	27.2.1991

The overall value is ECU 1 000 000 (in 1989 terms).

ANNEX II

General description of the project

1. The participants in the project will simultaneously undertake and coordinate research and development work with the aim of developing methods, standards and technologies to be used for pick-up and display devices and for coding and transmission of stereoscopic television (3D-TV) signals. They will exchange information and will compare results achieved.

2. Studies and research work to be undertaken in the framework of the project will concentrate mainly on:

2.1. Human factors research related to 3D-TV systems

2.1.1. Psychophysical research relevant to 3D-TV;

2.1.2. Development of methods and test materials for the subjective evaluation of advanced TV systems (HDTV and 3D-TV);

2.1.3. Determination of a 3D-TV production grammar;

2.1.4. Specific subjective benefits of advanced TV systems (3D-TV and HDTV);

2.2. 3D systems

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

2.2.1. Stereoscopic (glasses needed);

2.2.2. Autostereoscopic (without glasses);

2.2.3. Holographic (without glasses);

2.3. System components

- image pick-up devices;
- mixing and editing facilities;
- recording media (tape and disk);
- stereoscopic and multiviewpoint displays;

2.4. Coding, picture processing and transmission

2.4.1. Source coding techniques:

- conventional techniques applied to both channels of a stereo pair;
- disparity measurement between left and right channel of a stereo pair;
- investigation of the necessary definition (e.g. resolution) of those image parts which are not common to both images of a stereo pair;
- transmission of 3D-TV via a basic channel plus displacement information plus information which is not common to both images of a stereo pair;

2.4.2. Interpolation of intermediate views for displays with 'look-around capability';

2.4.3. Computer-generated holograms (on the basis of a stereo pair);

2.4.4. Investigations of source coding, picture processing and transmission techniques taking necessary headroom for the processing as described under 2.4.1 into account;

2.5. 3D-TV and HDTV

2.5.1. Comparison and interaction.

Project organization

3. The project would be organized into three separate working groups, one dealing with psycho-optics of human 3D vision, one dealing with technology problems, and one dealing with the signal processing aspects; all groups would report to and exchange ideas through the appropriate Management Committee. All tasks are distinctly discernible from one another but are nevertheless closely linked, for example the interpolation for a specific display.

Although very important, sound will not be dealt with in the project. The project is planned for a five-year period.

Appropriate forms of cooperation

4. The suggested form of cooperation is that Signatories are represented in the Management Committee by delegates who should be expected to:

(a) attend and contribute to meetings of the Management Committee (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(d) set up national working groups for specific items;

(e) be responsible for liaison between the Management Committee and national research groups in the participating countries;

(f) encourage links to other European research groups and especially COST projects in the field of stereoscopic television.

When necessary the Management Committee may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

Memorandum of Understanding for the implementation of a European research project on radio propagation effects on next-generation fixed-service terrestrial telecommunications systems

(COST Project 235)[1]

Date of entry into force of the project: 2.10.1991
Duration: 1.10.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	26.3.1992	26.3.1992
CZECHOSLOVAKIA	2.4.1992	2.4.1992
GERMANY	2.10.1991	2.10.1991
FRANCE	6.2.1992	6.2.1992
ITALY	23.2.1992	23.2.1992
NETHERLANDS	2.10.1991	2.10.1991
NORWAY	2.10.1991	2.10.1991
AUSTRIA	24.7.1992	24.7.1992
SWITZERLAND	22.5.1992	22.5.1992
SWEDEN	4.2.1992	4.2.1992
UNITED KINGDOM	2.10.1991	2.10.1991

The overall value is ECU 760 00 (in 1990 terms).

ANNEX II

General description of the project

1. Introduction

The COST framework has enabled very valuable collaborative studies to be made on aspects of radio propagation which may impair the performance of radio-communications systems at frequencies above 1 GHz.

COST Project 25/4, which operated from 1971 to 1978, concentrated on terrestrial radio-communications systems. It produced a more comprehensive database of radio propagation and associated meteorological data for Europe than would have resulted from indi-

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

vidual national efforts. It also unified the procedures for the comparison of results obtained and contributed to the advice now available in *CCIR Reports and recommendations.*

COST Project 205, which operated from 1980 to 1985, collated and assessed the results of European activities in the field of slant-path propagation at frequencies between 11 and 18 GHz. It produced a comprehensive database and assessed prediction models for the European areas which also contributed to *CCIR Reports and recommendations,* and to planning future European satellite systems in the above frequency range.

COST Project 210, which operated from 1984 to 1990, examined problems associated with prediction of interference levels between radio-communications services sharing a frequency band. The problem is particularly acute within Europe where a coordination area (within which the risk of interference between any new system and existing systems must be assessed before the new system can be accepted) may incorporate several countries of Europe, and this has considerable practical and administrative implications. Radio-communications of various sorts are a steadily growing industry within Europe, leading to increasing pressure on the limited resources of the radio spectrum, and an increasing need to reuse radio frequencies. Means of developing radio interference prediction and coordination methods had been seriously limited by a lack of suitable radio data, and COST Project 210 has been providing the missing information and procedures to predict reliably the distances outside which radio-communications frequencies may safely be reused. The final report of this project was presented in March 1991, and its results are being made available to the CCIR.

COST Project 235, with the objectives set out below, is felt to be the current priority area for collaborative research on radio-wave propagation in which COST should give a useful lead (see sections 4 and 6).

2. Objective of the project

The main objective of the project is to promote and coordinate European research in the specific radio propagation areas of:

(i) frequency-selective influences of the radio propagation medium on (the bandwidth of) future telecommunications systems;

(ii) flat-fade influences of the radio propagation medium on future (millimetre-wave) telecommunications systems;

(iii) influences of the radio propagation medium and terrain features on site shielding (and other interference reduction strategies);

and to produce appropriate prediction models to meet the needs of planning in Europe. The project is intended to have application to a number of terrrestrial fixed radio services involving point-to-point and point-to-multipoint; however, the results are likely also to have application to mobile services and Earth-space services.

3. Scope and time scale of activities of the project

In order to fulfill the objective of the project, the activities will include:

(a) the assessment of existing results and research being carried out;

(b) the coordination of new experiments, where appropriate;

(c) the harmonization of criteria for data collection in order to aid comparisons;

(d) the collection and analysis of data already acquired and data derived from new experiments;

(e) the development of new models and predictive techniques.

A four-year time scale is envisaged (1991–95) with expected completion of data results within three years.

4. Suitability of the COST framework for the project

From the experience gained in the coordination of the previous COST projects concerning radio propagation (COST 25/4, COST 205 and COST 210), the following benefits were found.

(a) The coordination of the extensive meteorological and radio propagation measurements carried out throughout Europe and the harmonization of the procedures for the comparison of the results obtained were unique features of the projects.

(b) Delegates of the participating countries were drawn from regulatory authorities, PTT-type organizations, universities and other research institutes. The successful collaboration was indeed noteworthy in view of this diverse representation.

(c) The setting-up of a committee whose members were directly involved with the research and with its application ensured a highly productive framework for the dissemination and correlation of the experimental results, ideas and information.

(d) In some countries the form of cooperation established within the projects strengthened the technical and scientific effort available at national level.

(e) The technical results achieved through the cooperation satisfied high international standards.

The above benefits are of relevance to the proposed project and it can be expected that results of a comparably high standard will be achieved.

Having regard to the necessity for required cooperation between countries for the realization of new experiments and the necessity of coordinating data collection and analysis, a new COST project is considered to be the appropriate framework to achieve the objective.

5. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

6. Technical programme

The intended three main areas of activity are indicated in section 2. For the proposed project, the term 'millimetre wave' has been extended to cover the frequency band 10-300 GHz in order to bridge above and below 30 GHz and to cover the changing relative influences of absorption and scatter.

In order to provide the greater bandwidth, millimetric propagation studies have been conducted in a number of centres to develop a database for a variety of weather conditions, and prediction techniques have been developed which are suitable for various applications. At the lower end of the millimetre spectrum, short-range communications systems and direct distribution of TV signals are being actively considered for commercial systems. The high resolution achieved by small antennae, and the superior performance over infra-red systems in poor weather, make the higher frequencies near 100 GHz suitable for a variety of systems. The oxygen absorption band near 60 GHz could be used either for secure systems or where frequency reuse at very short distances is required.

Digital modulation of microwave systems has been employed for many years, but the requirement to have greater bandwidth has been frustrated to some extent by the lack of suitable propagation data, and consequent lack of prediction models. It is proposed that the results of specific studies within Europe be compared, as appropriate.

Several studies have been initiated recently into site-shielding problems, and others are understood to be at a planning stage. These studies are to be conducted in a number of European countries, and the results will be of consequence to shielding of terminals used in medium- and high-bandwidth digital systems, as well as in other systems. They will be especially applicable for planning spectrum reuse in the high spatial density of urban areas.

The first aspect of the project will be to examine current and recent activities in European organizations, and to produce a report. The next aspect will be to initiate any further studies that may be appropriate. The final aspect will be to comment on propagation constraints to digital transmission and to uses of millimetre wavelengths, and the use of site shielding (and other interference reduction measures). There is a clear need to bring together the many aspects, and for exchanges between those involved in the three areas outlined above. The three main topic areas are considered further now.

(i) Analysis of wideband effects, in particular the frequency-selective nature of fading, including time-variant situations for the system as well as for the propagation medium and path. The development of a propagation multipath channel model will allow proper evaluation of performance of high-capacity radio systems in different operational conditions (e.g. modulation choice, diversity reception, dually polarized operation, link parameters and climate). Considering the complexity of such modern radio-communications systems, the resulting model must be such that the proper design of fading simulators should be possible using this model. Older propagation data, to be supplied, and new and better forthcoming data from currently running experiments will form the basis for the testing and development of a new and powerful European multipath propagation model; important here is the availability of simultaneously-measured propagation and system parameters. Furthermore, the question of how to extend the propagation model from one hop to a long radio circuit over tandem radio sections will be studied.

(ii) Investigation of applications of the millimetric wavebands to medium- to wide-bandwidth systems including networks (of both star and tandem configurations). Several atmospheric phenomena impact on such systems and will be studied. Gaseous absorption imposes range limitations but could be exploited in applications requiring multiple frequency reuse, while gaseous dispersion may restrict the available bandwidth. The effects of hydrometeors, especially precipitation, including absorption, scattering and dispersion, will impact on systems reliability and need to be modelled

accurately, while atmospheric turbulence can introduce rapid scintillation of signals which may affect digital systems in particular. An examination will therefore be made of data and current measurements; models will be developed to describe these phenomena and to assess the suitability of the 10-300 GHz frequency range for radiocommunications systems.

A brief study will also be made of the relative merits (and diversity operation) of millimetric, infra-red and optical wavebands.

(iii) Examination of limitations and optimum use of interference reduction techniques, especially site shielding, in situations where, increasingly, the radio terminals have to be placed in urban areas giving rise to interference and near-field interactions. Estimation of terrain scatter and path loss for varying obstacle-to-receiver distance under line-of-sight and trans-horizon illumination conditions is another important aspect of the prediction process required to determine the effectiveness of using site shielding in interference reduction on terrestrial and Earth-space links. In line-of-sight systems, the coordination distance could be influenced by the application of countermeasures such as power control and it is therefore useful to consider and assess the effects of such measures.

7. Envisaged cost of the activities in the project

At present, an active research programme is already under way in some countries. However, there is a need for additional experimentation in new topics and in different areas of Europe. Signatories are expected to promote active national involvement by means of appropriate funding. A minimum level of funding for each Signatory should be ECU 760 000 at 1991 prices (including costs of manpower) during the period of the project.

This should include funds for the work of the Management Committee, in particular, to cover the following:

coordination of national efforts,

preparation of contributions to the Committee meetings,

travel expenses.

Typically, at 1991 prices, a breakdown for the four-year period might be as follows:

	ECU
Manpower for experimentation:	
two man-years x ECU 160 000	320 000
Manpower for Management Committee:	
two man-years x ECU 160 000	320 000
Instrumentation	80 000
Travel expenses	40 000
	760 000

Memorandum of Understanding for the implementation of a European research project on multimedia telecommunications services

(COST Project 237)[1]

Date of entry into force of the project: 13.2.1992
Duration: 12.2.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	13.2.1992	13.2.1992
DENMARK	13.2.1992	13.2.1992
GERMANY	13.2.1992	13.2.1992
FRANCE	13.2.1992	13.2.1992

The overall value is ECU 1 000 000 (in 1990 terms).

ANNEX II

General description of the project

1. Introduction

Multimedia services and terminals are studied in numerous projects, as for instance within RACE, RISE (R&TD in integrated service engineering), ACE, Esprit and other European Community actions. Especially items such as:

- user needs,
- user interface,
- tools for service design,
- service management,
- services prototyping,
- terminal design,
- application pilots,

are included in these projects. There is nevertheless a need to analyse 'multimedia services' concepts in the COST framework because:

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

(i) the COST environment provides the opportunity of attracting establishments not included in the RACE work;

(ii) COST can analyse the objectives with a longer perspective;

(iii) the non-industrial approach can support the RACE work by producing complementary results.

2. Objective

The project objective is to perform research in multimedia techniques and to study their application to a distributed multimedia information service, based on available technology, using appropriate existing public telecommunications networks and services. The results of the project will be demonstrated in a selected application for the research community.

3. Description

The project has the following main aspects.

(a) To analyse the multimedia projects and services already in course of development and/or implementation and the impact of a distributed multimedia information service (DMIS) on the telecommunications facilities. The DMIS will be based on public networks (like ISDN) and services (e.g. DTAM MHS, Telefax, Videotex, etc.). Broadband services could at the beginning perhaps be implemented only by cable TV networks and in local area networks, later integrated to wide area networks, etc. The service could include a combination of voice, audio, text, structured data, graphics, still pictures and video.

(b) To determine the DMIS functions. These should be based as much as possible on public information available from the RACE, ESPRIT, etc. communities. The following functions should at least be considered:

- local information processing, storage and retrieval;
- communication, distributed processing and database access;
- synchronization between data types.

(c) To choose a particular application and its corresponding user interface. The user interface could be based on window techniques in an existing multiprocess terminal. Special care should be taken to ensure that the user commands and protocols in the chosen interface are, as far as possible, coherent and adaptive. Interworking with a future range of modular terminals belonging to the same family should also be considered.

(d) To implement the research prototype environment at a suitable number of places.

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries.

Cooperation to projects COST 226 and COST 211 ter and to the proposed CO-TECH is envisaged.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

5. Work programme

The following tasks should be performed.

5.0. Analysis of current projects in the multimedia domain.

5.1. Selection of application and specification of the service requirements, configurations and functions for this application.

5.2. Agreement on suitable networks and services for the prototype multimedia information service implementation. Suitable local services should also be considered.

5.3. Choosing and adapting the terminal (workstation or PC) set-up.

5.4. Determination of the user interface (presentation, dialogue, commands, etc.). Adaptation to the chosen application.

5.5. Study and prototype implementation of functions and information sources needed for realizing the multimedia information service.

5.6. Study of a real application environment for pilot testing. Adaptation of the prototype to this application environment.

5.7. Testing of the environment and feedback from pilot usage.

Memorandum of Understanding for the implementation of a European research project on prediction and retrospective ionospheric modelling over Europe (PRIME)

(COST Project 238)[1]

Date of entry into force of the project: 7.3.1991
Duration: 6.3.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CZECHOSLOVAKIA	31.7.1992	31.7.1992
DENMARK	24.7.1991	24.7.1991
GERMANY	7.3.1991	7.3.1991
GREECE	24.7.1991	24.7.1991
SPAIN	7.3.1991	7.3.1991
FRANCE	6.2.1992	6.2.1992
ITALY	6.11.1991	6.11.1991
NETHERLANDS	7.3.1991	7.3.1991
POLAND	23.10.1992	23.10.1992
SWEDEN	17.12.1991	17.12.1991
TURKEY	17.2.1992	17.2.1992
UNITED KINGDOM	7.3.1991	7.3.1991

The overall value is ECU 400 000 (in 1990 terms).

ANNEX II

General description of the project

1. Introduction

The ionosphere, which is the region of ionized atmosphere that exists primarily at heights of 50 to 1 000 km above the Earth's surface and is produced by solar-ionizing radiation and energetic particles precipitating from the magnetosphere, has a profound effect on radio-wave propagation. Whilst on the one hand it provides the means of global communication at HF via successive ionospheric reflection, often with minimal losses, its extreme spatial and temporal variability leads to substantial differences in received signal characteristics. Not only are raypaths continually changing but amplitudes also fluc-

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

tuate. There are systematic diurnal, seasonal and solar-cycle variations which depend on geographical position, but also large irregular variations which limit radio circuit optimization.

Circuit design in concerned with the selection of transmitting and receiving sites, the choice of operating frequency bands, transmitter power, types of antenna and modulation. Use is made of propagation prediction structures to quantify system reliability over the intended period of operation and its dependence on different design parameters.

Frequency management involves inspection of propagation predictions to select the best frequency on a given occasion from among those assigned, licensed and available. Radio service planning is coordinated internationally under the auspices of the International Telecommunications Union (ITU) and includes compatibility analyses with internationally adopted propagation predictions applied to co-channel and adjacent channel transmissions.

Propagation predictions are also required for the interpretation of data collected by over-the-horizon radar and passive sensing systems where target locations need to be estimated. The ionosphere too can have a significant effect on Earth-space links depending on frequency and types of signal involved. Factors such as refraction, group delay, dispersion, Faraday rotation and absorption can be quantified with propagation predictions.

An important element of all propagation predictions is an ionospheric model. This should relate to all the propagation paths and apply to the period of operation. In practice, long-term models based on monthly median conditions, together with some statistical indication of day-to-day variability, suffice for design and planning.

Retrospective models for specific occasions are needed for post-event studies, for example in the diagnosis of system deficiencies. Forecast models are wanted for frequency management. An important need for radar and sensing systems is to have models for individual days averaged over periods of around 10 to 15 minutes corresponding to data integration times.

A distinction is drawn between ionospheric modelling, which involves specifying the variations of electron density with the height and geographical position for a given epoch, and ionospheric mapping, which is concerned with the geographical variations of individual parameters of the height profile. Hence maps form a component of models.

In the past, international mapping development has been coordinated via working groups of the International Radio Consultative Committee (CCIR) of the ITU and the International Union of Radio Science (URSI). Whilst URSI is still active in profile development, there is currently no ongoing programme of work in mapping within either organization.

The CCIR has adopted global long-term ionospheric maps based on a numerical fit to limited vertical-incidence sounding data from past epochs, but these lack spatial structure for many applications. They suggest approaches to try to perturb these maps on a daily basis, either by extrapolation from previous data sets, or by establishing correlations with precursor or geophysical disturbance indices, but existing operational procedures for daily or shorter-period predication are of limited accuracy and questionable value.

Conventional sources of mapping data are from established vertical-incidence sounders. These could be supplemented by other techniques including information from oblique incidence links. For all requirements it is necessary to interpolate/extrapolate spatially among the measurements and in the case of predictions also to project in time.

Some success has been achieved in recent years with the use of thermospheric wind theory at middle latitudes to provide better spatial interpolations than are possible by standard numerical methods. None the less, it is evident that the current generation of maps and associated models should be improved.

The European region offers a unique opportunity to review what is possible with present-generation models and to try to develop better models for different applications. Specifically, Europe has the best available data set of past vertical-incidence soundings going back over many years, and, despite the closure of a few sounders, one of the most dense networks remains.

There are also plans to establish additional sounders. Furthermore, Europe is an area free from the complications that arise at high latitudes, due to particle precipitation, and at low latitudes where there are marked ionization gradients, ionization irregularities and considerable variability associated with the movements of the so-called 'equatorial anomaly'. Techniques developed for the European theatre may be adaptable for use elsewhere.

2. Objectives of the project

The main objectives of the project are:

(a) to investigate the feasibility and to develop the potential for generating improved prediction and retrospective models of the ionospheric electron density over the European area bounded between latitudes of 35°N and 55°N and longitudes of 10°W and 30°E (see Figure 1) in order to meet established needs of radio-system designers and users;

(b) to produce sample retrospective sets of such models.

Assuming a successful outcome of the project, the next phase of work would involve the synoptic production of model sets and near real-time dissemination of these to selected radio users and interaction with the users in order to:

(a) optimize the form of the model sets to satisfy requirements;

(b) investigate and quantify the degree of practical improvement achieved compared with the use of models generated in accordance with present techniques and data.

3. Proposed research activities

The work will be arranged under five topic headings and will continue within each of these areas throughout the duration of the project. Not all organizations will wish to participate in all topic areas, but the project as a whole is seen as a common activity directed towards a single goal:

(a) vertical sounding – carrying out synoptic daily/hourly ionospheric measurements (VI) and routine scaling of the associated ionospheric characteristics, together with more rapid sequence soundings on selected coordinated campaign days;

(b) oblique sounding – carrying out selected soundings (OI) and associated data analyses, developing autoscaling techniques and comparing measurements with model results;

(c) spatial correlation studies – establishing techniques for spatial interpolation between data sets;

(d) temporal correlation and prediction techniques – investigating approaches to forecasting, either from past data sets, or in terms of external precursor information;

(e) ionospheric mapping and modelling – developing optimum numerical techniques and producing representative model sets.

The vertical and oblique-sounding groups will provide data to be used by the spatial correlation and forecasting groups. Their results will then yield new information for use by the mapping and modelling group. The interactions between these different groups are shown schematically in Figure 2.

4. Suitability of the COST framework for the project

The following benefits are anticipated:

(a) the establishment of viable combined teams with sufficient size and resources to achieve the desired objectives, whereas at present no one country has the necessary available trained staff effort;

(b) the channelling of resources towards common goals of value to all;

(c) the generation of a single standardized European ionospheric database for use in national studies;

(d) although requirements exist for worldwide models, the middle-latitude European ionosphere is best suited for first studies of this type because it is relatively benign and has the geographically densest network of existing ionospheric sounders;

(e) a framework is provided for coordinating effort within the participating countries where delegates are drawn from PTT administrations, universities and other research centres;

(f) strengthened technical and scientific effort becomes available at national level in some countries;

(g) the setting-up of a committee whose members are directly involved with the research ensures a highly productive framework for the dissemination and correlation of results, ideas and information;

(h) the transfer of technology from those countries with a more extensive ionospheric research background to engineers and scientists in countries relatively new to this field of study;

(i) the creation of an infrastructure for the collection and validation of ionospheric data and the synoptic production of model sets for radio users in an operational extension of the project.

5. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (typically three meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

6. Technical programme

6.1. Vertical sounding

Work will be concerned both with the assembly of databanks of past measurements and with collecting new data. A variety of different types of ionospheric sounding instruments have been and are in use within Europe. Some data are available only as film records; others as paper records. Not all useful past data have been analysed. Whereas some standard scalings are available only in printed bulletins, in other cases they have also been produced in computer-readable form.

In generating a PRIME databank, particular attention will be paid to content and to data verification. The aim will be to add to the databank once established and keep it current. It will be interrogated in different ways to identify the most appropriate data sets to serve the varying needs of the other PRIME groups.

One particular difficulty with standard soundings is that they take a minute or less to collect and are carried out systematically only once an hour. In this regard they represent under-sampled effective snapshots of the ionospheric state.

Within an hour, variability due to the presence of travelling disturbances can be considerable. The changes are especially great at dawn and at dusk. It is planned to supplement studies of past data sets with new more frequent soundings on selected days with sounding intervals of 5 or 7½ minutes.

6.2. Oblique sounding

Although conventional sources of ionospheric model data come from vertical-incidence sounders, the additional use of oblique sounders offers the possibility both of testing the accuracy of the models that have been developed and of providing additional equivalent mid-path information. Specifically, oblique links can be established fairly readily on a time-share basis with vertical soundings between pairs of stations of the same manufacture, given the necessary beamed antennas and recording arrangements.

It is planned to take separate soundings over paths between two transmitting installations and a single receiver. Recording schedules will be chosen to yield results representative of the different diurnal, seasonal and solar-cycle features.

Records will be stored in a digital database which may form a part of the database of vertical soundings. Other past European data sets will also be examined. As for vertical sounding, there are international rules for the scaling of oblique-incidence soundings. Initially, scaling will be undertaken manually but there is merit in acquiring an autoscaling capability, either self-generated or by making use of procedures already under commercial development.

The two principal investigations that will be carried out are the comparison of maximum observed frequencies with ray-tracing estimates derived from model electron-density distributions and the development of a preferred technique for inverting the oblique-incidence measurements to equivalent mid-path electron-density profiles.

6.3. Spatial correlation studies

Following techniques developed in meteorology, calculations will be made of the correlation distances of deviations of electron density from the local median value under different conditions. Analyses will be carried out over different time periods to determine any systematic trends such as those with season or magnetic activity, with comparisons both in terms of local and universal time.

In particular, correlation distances will be compared when using instantaneous hourly values and medians for successive soundings over different fractions of an hour.

Ways of relating correlation coefficients to weighting functions by which first estimate values are changed by measured values will be considered, including different approaches to first estimate determinations and iteration techniques to match to multiple measurements.

In any operational modelling procedure a dynamic approach to correlation distance determination seems preferable using nearest past measured values. How such a scheme could be implemented will be studied. A new survey will be made of available options to model profile specification.

6.4. Forecasting and temporal correlation studies

There are three possible approaches to short-term forecasting:

(a) extrapolation from past measurements,

(b) establishing a correlation with precursor indices, and

(c) monitoring solar-terrestrial phenomena in advance of their effects being detected in the ionosphere.

Several options to past measurement extrapolation exist with different weighting arrangements. These will be studied to see if any general trends emerge, particularly to examine any dependence on whether days are magnetically quiet or disturbed.

Correlations of electron-density departures from the monthly median on individual days with magnetic disturbance indices will be established for varying time-lags between disturbance and ionospheric response.

The extent to which use can be made of satellite particle-flux detection data, VLF phase change data and interplanetary scintillation data likely to become available will be considered.

6.5. Ionospheric mapping and modelling

Mapping and modelling will parallel the work on spatial and temporal correlation. Specifically, the aims will be to formulate appropriate numerical techniques to represent, in the most accurate and efficient way, structures that have been generated.

Spherical-harmonic analysis procedures adopted in current CCIR maps will be modified for regional mapping and compared with alternate grid-point value storage techniques to establish their relative merits.

Consideration will be given how best to express electron-density height-profile data. Whether these will be in terms of a separate mapping of the individual profile parameters, as a height grid, or involving families of coefficients is yet to be determined. Finally, a representative selection of models will be generated.

7. Envisaged cost of the activity in the project

At present, in some countries an active research programme is already under way. However, in others there is a need to expand the size of the existing teams. Most of the work is concerned with data analysis, making use of existing computing facilities, but some equipment procurement is needed for the oblique-sounding experiments. In particular, one new transmitting installation, new receiving antennas and recording arrangements are required.

Since the results of these experiments form an important component of the project as a whole in validating the generated ionospheric models, costs are to be borne equally by all Signatories independent of the equipment locations.

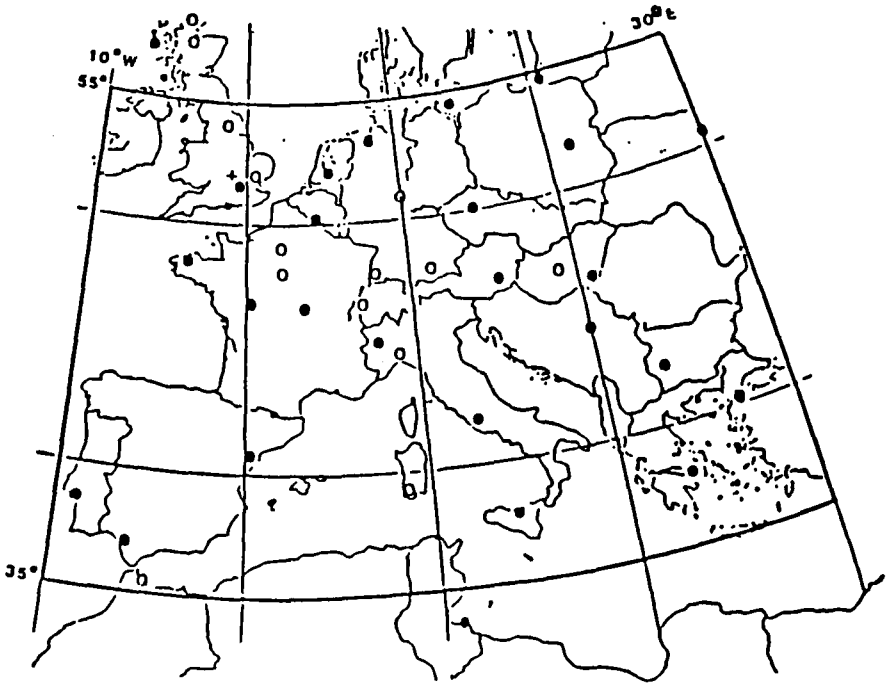
Signatories are expected to promote active national involvement by means of appropriate funding. The level of funding for new experimentation (equipment expenditure) will be shared between Signatories. This funding is appropriate for the installation and operation of two transmitting and one receiving stations.

In addition, funding should be made available for the work of the Management Committee. In particular this includes:

coordination of national efforts,

preparation of contributions to the Committee meetings,

travel expenses.



- • Stations in current operation
- ∘ Stations in former operation

Figure 1: Prime areas and locations of vertical-sounding stations

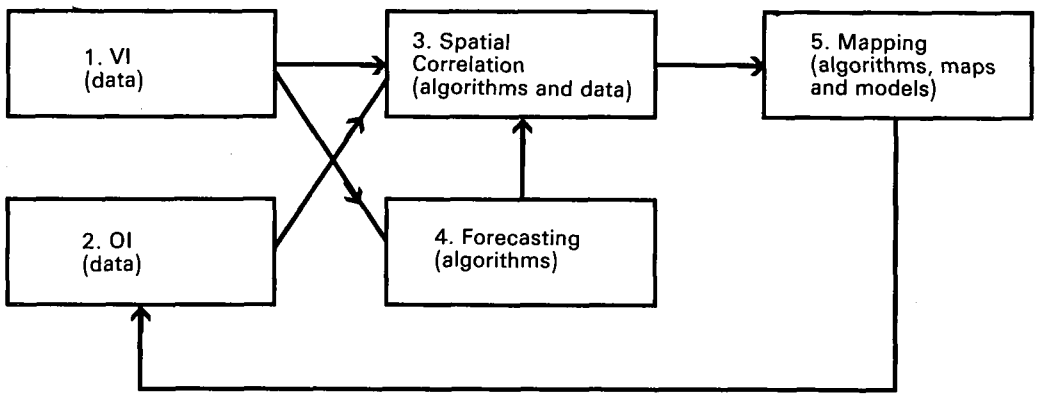


Figure 2: Interactions between the different groups

Notes:

(a) The spatial correlation group uses both VI and OI data to formulate algorithms;

(b) the forecasting group uses a variety of data sources (including VI data to formulate algorithms);

(c) sample mapping data and modelling sets are produced by the spatial correlation group using VI and OI data (retrospective maps) and forecasting algorithms (forecast maps);

(d) the mapping group develops mapping algorithms and applies these to the mapping and modelling data sets that have been produced by the spatial correlation groups;

(e) maps and models are tested by the OI group.

Memorandum of Understanding for the implementation of a European research project on ultra-high capacity optical transmission networks

(COST Project 239)[1]

Date of entry into force of the project: 12.6.1991
Duration: 11.6.1996

Contracting parties	Date of signing	Date of entry into force
CZECHOSLOVAKIA	2.4.1992	2.4.1992
DENMARK	24.7.1991	24.7.1991
GERMANY	7.3.1991	7.3.1991
SPAIN	12.6.1991	12.6.1991
FRANCE	6.2.1992	6.2.1992
IRELAND	18.9.1991	18.9.1991
ITALY	3.3.1992	3.3.1992
NETHERLANDS	12.6.1991	12.6.1991
NORWAY	18.9.1991	18.9.1991
PORTUGAL	15.7.1992	15.7.1992
SWITZERLAND	29.4.1992	29.4.1992
SWEDEN	12.6.1991	12.6.1991
UNITED KINGDOM	12.6.1991	12.6.1991

The overall value is ECU 500 000 (in 1990 terms).

ANNEX II

General description of the project

1. Purpose

The purpose of the project is the coordination of the national efforts to propose, model and analyse innovative ultra-high capacity optical transmission networks that are potentially capable of taking full advantage of the bandwidth of optical fibres and components.

2. Objective

In the past 10 years, optical transmission systems have been taking the place of copper cables in the trunk and junction network. Substitution in point-to-point transmission sys-

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

tems is, however, only the first step in the utilization of the tremendous potential that optical fibres and devices offer in terms of bandwidth and information capacity. The low-loss region of the optical fibres spans more than 10 THz and the basic physics of many optical devices have typical time constants in the subpicosecond range.

As the deployment of the optical fibres is penetrating further and further in the user area, a better and more economical use of these potentials will require the development of suitable components, systems and new network configurations. Large research efforts are devoted today to these subjects. Transmission techniques, lending themselves to new network concepts, are beginning to be established that make use of optical amplification, optical switching and optical multiplexing.

In the frequency domain, this is done with coherent techniques or microwave subcarriers, while ultrafast optical pulses, colour coding, etc. are used in the time domain.

Many different schemes have been proposed and are under study in the laboratories: some of them rely on relatively mature technology while others still require intensive study and may be considered to be in the early research stage (three dimensional space switches, optical memories, etc.). By far, the most extensively studied schemes are based on the use of frequency division techniques, whether coherent or not. But also in the simplest cases, a large amount of work has still to be done in order to clarify which impact these new techniques will have on network concepts and, on the other hand, which requirements on the systems and components will be determined by the network strategy. A need thus arises to put together the competences on optical communications technology and those on network design, in order to propose and analyse innovative solutions for the transmission networks that are made possible by the optical techniques.

From the above considerations, a twofold objective for the project is derived:

(a) to study, from the theoretical and the experimental point of view, various possible local and core transmission network schemes with the aim of evaluating their respective technical potential;

(b) to develop the models and software tools that are necessary for analysing and comparing the proposed network configurations.

3. Study method

The study will be focused on the most innovative uses of the optical technologies in network design. It will encompass the different components, systems and techniques aimed at the realization of advanced ultra-high capacity transmission networks.

The five-year programme will include:

(a) identification of advanced key components and of the properties relevant to their use as devices in transmission, multiplexing, routing and switching;

(b) theoretical and experimental studies of transmission systems suitable for wide- and ultra-wide-band networks;

(c) wavelength domain studies, including:

- experimental systems and field demonstrations,
- technologies for transmission,
- technologies for switching,
- theory and modelling of WDM systems,
- wavelength management and standards;

(d) time domain studies, including:

- experimental systems and field demonstrations,
- technologies for transmission,
- technologies for switching,
- theory and modelling of TDM systems,
- frame structures and standards;

(e) identification of problems and limitations of existing and planned networks and study of how new ultra-high capacity optical technology can technically benefit the network operator and user;

(f) study of ultra-high capacity transmission network configurations, based on innovative optical switching techniques;

(g) network studies, including:

- local and core networks,
- network modelling (availability, resilience, protection strategy, etc.),
- new services,
- applications studies of optical technology,
- existing and new architectures,
- network evolution.

The close coordination with COST Project 240, 'Techniques for modelling and measuring advanced photonic telecommunications components', will be pursued through joint meetings. This will ensure cross-fertilization between network and component activities.

The activities on systems may conveniently include those activities of COST 215 that have not been fully pursued at the end of the project, such as studies on coherent techniques and long-haul optical communications. The network studies, being addressed as truly innovative ultra-high capacity network concepts, do not overlap other existing COST or EEC projects.

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries;

(g) keep close coordination with related optical projects in general and COST 217 in particular.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

Memorandum of Understanding for the implementation of a European research project on techniques for modelling and measuring advanced photonic telecommunications components

(COST Project 240)[1]

Date of entry into force of the project: 25.4.1991
Duration: 24.4.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CZECHOSLOVAKIA	2.4.1992	2.4.1992
DENMARK	23.1.1992	23.1.1992
GERMANY	25.4.1991	25.4.1991
GREECE	25.4.1991	25.4.1991
FRANCE	5.3.1992	5.3.1992
IRELAND	4.7.1991	4.7.1991
ITALY	7.4.1992	7.4.1992
NETHERLANDS	5.6.1991	5.6.1991
NORWAY	18.9.1991	18.9.1991
PORTUGAL	23.7.1992	23.7.1992
SWITZERLAND	17.5.1992	17.5.1992
SWEDEN	25.4.1991	25.4.1991
UNITED KINGDOM	25.4.1991	25.4.1991

The overall value is ECU 400 000 (in 1990 terms).

ANNEX II

General description of the project

1. Purpose

The purpose of the project is the amalgamation and coordination of national efforts to model advanced photonic components and to develop and implement measuring techniques for the experimental determination of photonic device characteristics relevant to applications in high-capacity, fibre optic communications systems.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

2. Objective

The objective of the project is twofold:

(i) development and application of modelling methods for key optical wave-guide components for use in fibre optic telecommunications networks. It is intended to model straight wave guides, bend guides, couplers, power splitters, switches, lasers, detectors and combinations thereof and also to compare the calculated results with measurements.

(ii) implementation of experimental techniques that offer the capability to measure with accuracy and reproducibility the properties and parameters of novel active and passive photonic components incorporating optical wave-guide structures. The focus is on those properties that are related to the wave guides as an essential part of the component and that are of basic importance for the operation of the components in advanced fibre optic communications systems.

3. Technical aim

The technical aim of the project encompasses:

(i) the characterization of optical network wave-guide components determined by a (possibly complex) refractive index. This could even include multiple quantum well structures. Optoelectronic components such as switches and modulators (e.g. semiconductor, polymeric and possibly other materials) might be considered as well. The component modelling aims at the translation of the numerical results into a parametric description in terms of analytical expressions;

(ii) the design of laboratory measuring techniques suitable for the characterization of active and passive wave-guide structures made of semiconductors, glass-semiconductor or other material combinations and the performance of extensive interlaboratory measurements on selected components with the aim of testing the applicability of these techniques.

(iii) the evaluation of the results of the modelling and of the measuring effort and their cross-correlation with the aim of obtaining device structures with characteristics most suitable for application in high-capacity fibre communications systems;

(iv) the reporting and publication of the results of the study and the interaction with similar studies, if any, performed by groups outside the COST project;

(v) the close coordination with COST Project 239 on 'Ultra-high capacity optical transmission networks' which will be pursued through joint meetings. This will ensure cross-fertilization between network and component activities.

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries;

(g) keep close coordination with related optical COST projects.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

5. Study method

The study will focus on novel components incorporating optical wave guides as essential parts that are modelled and manufactured so as to take maximum advantage of the unique capabilities offered by the mechanisms for light generation, routing, modulation, switching, amplification and detection in materials used in integrated optics.

Since most of the photonic components under consideration are in an early stage of development and not yet easily available, the methods for designing and measuring them are a matter of debate. Accordingly, the work has to start by identifying the structures that offer a substantial probability of playing an important role in advanced fibre optic systems, such as integrated optic combinations of wave guides for switches, amplifiers, wavelength multiplexers, light-pulse generators and detectors.

Selected structures that are being or will be manufactured as laboratory items will be modelled aiming at obtaining the caracteristics for the application envisaged. Parallel to this work, the measuring techniques will be investigated by first identifying the relevant parameters that characterize the structures and by designing the electro-optical methods for their determination.

Finally, the most suitable modelling and measuring methods will be presented and corroborated with results on typical components. The subsequent work will address the question of interlaboratory comparative measurements of selected wave-guide devices.

At the end of the project, detailed information on the key parameters of wave-guide components and on the inter-relationship between these parameters will be available. This information will be corroborated with the predictions from the modelling effort. The results are expected to be of particular interest both to the experimentalist and designer of high-capacity fibre optic communications systems and to those involved with the technology and manufacture of modern photonic components.

Memorandum of Understanding for the implementation of a European research project on the characterization of advanced optical fibres for the photonic network

(COST Project 241)[1]

Date of entry into force of the project: 16.1.1992
Duration: 15.1.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
CZECHOSLOVAKIA	2.4.1992	2.4.1992
DENMARK	6.2.1992	6.2.1992
GERMANY	16.1.1992	16.1.1992
SPAIN	13.2.1992	13.2.1992
FRANCE	13.2.1992	13.2.1992
ITALY	14.4.1992	14.4.1992
NETHERLANDS	16.1.1992	16.1.1992
PORTUGAL	2.7.1992	2.7.1992
SWITZERLAND	11.12.1992	11.12.1992
SWEDEN	9.4.1992	9.4.1992
UNITED KINGDOM	16.1.1992	16.1.1992

The overall value is ECU 700 000 (in 1991 terms).

ANNEX II

General description of the project

1. Purpose

The purpose of the project is the cooperation and the coordination of national efforts to develop accurate and reliable methods for the theoretical and experimental characterization of advanced optical – active and passive – fibres, with a view to their introduction in the new photonic network.

[1] The texts of the Memorandum of Understanding and Annex 1 are given on page 13 of the model.

2. Objective

Optical fibres have opened up a new era of telecommunications, permitting versatile transmission of extremely large amounts of information over very long distances, as well as their efficient distribution.

This new scenario is further evolving while new developments, such as active fibre amplifiers and non-linear effects, are rapidly moving from the laboratory to practical applications, entirely directed towards an all-optical phonotic network.

This indicates the need for coordination of both theoretical and experimental activities in the various countries of these new optical fibre effects.

In view of the above considerations, the objective of the project will encompass modelling and measurement aspects so as to enable each participant entity to produce comparable results concerning the characterization of active and passive fibres for the photonic network.

3. Technical aims and study methods

The study will be focused on the identification and measurement of the key parameters for fibre characterization with a view to its introduction in the photonic (possibly, in the end, all-optical) network, in the following areas:

(a) active fibre amplifiers:

- study of the active fibre characteristics (absorption and fluorescence spectra, dopant and index profiles, saturation, non-linear properties, etc.);
- study of the fibre amplifier characteristics (gain, efficiency, noise, etc.);

(b) passive fibres:

- study of linear properties (polarization, dispersion, etc.);
- study of non-linear properties (soliton propagation, Raman scattering, four-wave mixing, etc.);
- study of limitations set by non-linear effects on the conventional linear transmission.

The working methods will include:

- theoretical and experimental interlaboratory comparisons;
- joint experiments;
- exchange of results;
- workshops and technical meetings;
- reporting and publication of the most relevant results.

Activities may conveniently address those questions raised by the conclusions of COST Project 217.

Close coordination with COST Projects 239 and 240 will be pursued in order to ensure cross-fertilization with the corresponding network and component activities.

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries;

(g) keep close coordination with related optical COST projects.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

Memorandum of understanding for the implementation of a European research project on methods for the performance evaluation and design of multiservice broad band networks

(COST Project 242)[1]

Date of entry into force of the project: 15.5.1992
Duration: 14.5.1996

Contracting parties	Date of signing	Date of entry into force
CZECHOSLOVAKIA	7.10.1992	7.10.1992
DENMARK	13.5.1992	13.5.1992
GERMANY	18.6.1992	18.6.1992
GREECE	21.10.1992	21.10.1992
SPAIN	7.10.1992	7.10.1992
FRANCE	13.4.1992	13.4.1992
IRELAND	17.9.1992	17.9.1992
ITALY	22.7.1992	22.7.1992
HUNGARY	11.12.1992	11.12.1992
NETHERLANDS	13.4.1992	13.4.1992
POLAND	11.9.1992	11.9.1992
SWITZERLAND	8.10.1992	8.10.1992
FINLAND	13.4.1992	13.4.1992
SWEDEN	15.5.1992	15.5.1992
UNITED KINGDOM	10.9.1992	10.9.1992

The overall value is ECU 500 000 (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

The replacement of multiple dedicated telecommunications networks by a universal multiservice network capable of fulfilling all the users' needs is a recognized objective in the evolution of telecommunications. Such integration is assumed to be economically and technically viable in the near future. The notion of a multiservice network encompasses both the narrow-band and broad-band ISDN defined by CCITT, and extends to realiza-

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

tions in which voice, data and video services might be integrated at all network levels. The need for research in Europe on the implied network design issues, in support of these developments, was recognized in the creation of COST Projects 214 and 224 on 'Methods for the planning and evaluation of multiservice telecommunications networks' and 'Methods for the performance evaluation and design of asynchronous and synchronous multiservice networks' respectively.

During the period between 1985 and 1991, COST projects 214 and 224 have enabled participants to gain an excellent understanding of the new teletraffic and planning problems introduced by networks with multiservice capabilities. Based on this research and confrontation of ideas, it has been considered desirable by the Signatories of the COST 224 Memorandum of Understanding to continue their collaboration in this field, with, however, the need for a new Memorandum of Understanding to refocus objectives and identify the currently most interesting subjects for research.

During recent years, a significant development of research results supports the importance of continued and more sustained collaboration within Europe on the performance evaluation and design aspects of multiservice networks. RACE phase 1 projects have demonstrated the technical and economical viability of B-ISDN within a relatively short time scale. Asynchronous techniques are investigated for network development and ATM has been adopted by CCITT as a target for network evolution. A number of performance and network capacity problems introduced by the implementation of ATM have been investigated by COST 224. This work has resulted in a large number of contributions to conferences and seminars as well as substantial influence on work within various RACE work packages.

In the present project, it is intended to continue consideration of queuing models and the difficult problem of traffic control in a network exploiting statistical multiplexing. The equivalent capacity approach developed in COST 224 will be used in investigating optimal network architectures and routing strategies. It also remains to investigate different grades of service formulations appropriate in a multiservice environment. In addition to networks based on ATM, it is intended to consider alternative designs arising notably in the field of very high speed local and metropolitan area networks.

The project presented here is intended to address end-to-end performance and network capacity problems for further asynchronous techniques such as DQDB and FDDI-II was well as design and network architecture for multiservice networks applying results obtained so far in COST 224. Details of the objectives and intended scope of the project and the proposed method of collaboration are set out below. The group of engineers and researchers brought together by this project will provide expertise in teletraffic and network design of great importance to parallel European activities concerned with technological developments and international standardization such as Eurescom, CEPT/CAT/PSR, RACE, ETSI, etc.

2. Objectives of the project

The main objectives of the project are:

(a) to coordinate and advance European research in the field of methods for the performance evaluation and design of primarily terrestrial based broad-band multiservice networks, the term multiservice being taken to imply the integration of multiple bit rate services comprising, for example, data, voice and video;

(b) to identify the specific performance and network design problems entailed by proposals for broad-band multiservice networks;

(c) to provide solutions to these problems in the form of mathematical models, computer tools or optimization algorithms together with quantified evaluations wherever appropriate;

(d) to influence the design of multiservice switching systems and network architectures by determining optimal traffic control and resource allocation procedures and by evaluating alternative solutions;

(e) to provide a basis for further integration of European research activities in the field of telecommunications.

3. Technical aims

The following is a list of topics identified as appropriate for research within the project:

(a) development of queuing models to evaluate end-to-end performance in broad-band multiservice networks;

(b) investigation of traffic control strategies for variable bit rate services considering notably the relationships between traffic description parameters, admission control and possibilities for parameter enforcement;

(c) considerations of network design and routing strategies for broad-band multiservice networks exploiting the flexibility of the virtual path and virtual connection concepts;

(d) evaluation of the latest proposals for very high speed (Gbit/s) local and metropolitan area networks;

(e) investigation into the problems of interconnecting multiservice networks of different design, notably concerning their allowed bit rate and information transfer principles (cells/packet, connectionless/connection oriented).

The study of these topics will require a continued evaluation of service characteristics with a view to establishing plausible traffic hypotheses.

4. Appropriate form of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

5. Working procedure

The Management Committee will propose 'tasks' to be accepted for execution by Management Committee members, on behalf of the Signatories, after agreement on content and required resources (notably manpower). The notion of the execution of tasks here implies the following:

(i) a 'task' is a proposal for a problem to be solved or a job to be accomplished in a period no longer than the time between three consecutive Management Committee meetings; it should be accompanied by an estimation of manpower involved;

(ii) a task, accepted for execution by a member of the Management Committee, is reported on as agreed between the Committee and the responsible party;

(iii) tasks may be executed by individual participants in the project or by *ad hoc* working groups formed by several participants; in the latter case, Signatories should facilitate the organization of any necessary meetings.

In so far as considered necessary, the Management Committee may arrange working sessions for participating and invited researchers, where results may be presented and discussed, either on an *ad hoc* or regular basis.

6. Technical programme

The technical programme will be carried out over the lifetime of the project. During this period, research results will be presented to the Management Committee at its meetings, approximately four times a year, and if decided appropriate at annual seminars. Such seminars will be opened to a wider participation of experts on invitation by the Management Committee.

The research activities appropriate to the scope of the project are expected to be executed in the following logical progression:

(i) problem definition: specific performance and network design problems will be identified and accepted as tasks by the Management Committee;

(ii) solutions to accepted tasks will be sought in the form of mathematical models, computer tools or optimization algorithms with quantified evaluations wherever appropriate;

(iii) applications of the solutions will be sought in the design of multiservice telecommunications systems and network architectures by determining optimal traffic control and resource allocation procedures and by evaluating alternatives.

It is recognized that some problems have already been identified (for example in COST Projects 214 and 224), and others may not be identified until late in the project. The project activities are thus not all expected to follow the above logical progression in step with each other. The Management Committee will exercise ongoing coordination over the conduct of the technical programme.

7. Envisaged cost of the activities in the project

The overall cost per Signatory for a four-year period of the project is estimated as follows:

	Man-years	ECU
Work of the Committee	0.5	50 000
Initial research work	2.0	200 000
Coordinated research work	2.0	200 000
Travel expenses		50 000
Total	4.5	500 000

Memorandum of understanding for the implementation of a European research project on electromagnetic compatibility in electrical and electronic apparatuses and systems

(COST Project 243)[1]

Date of entry into force of the project: 8.12.1992
Duration: 7.12.1996

Contracting parties	Date of signing	Date of entry into force
GERMANY	21.10.1992	21.10.1992
GREECE	21.10.1992	21.10.1992
SPAIN	21.10.1992	21.10.1992
FRANCE	9.12.1992	9.12.1992
ITALY	8.12.1992	8.12.1992
UNITED KINGDOM	9.12.1992	9.12.1992

The overall value is ECU 600.000 (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

Interest in electromagnetic compatibility concerning both current and new circuits, apparatuses and systems, continues to grow in electrical energy systems, power control, electronics and informatics. Both industrial applications and the management and delivery of services have emphasized the problem of their functional coexistence in the present electromagnetic environment.

Current systems and those under development are both sources and victims of electromagnetic interference. They cover a wide range of the electromagnetic spectrum from the lower frequencies to the higher ones including millimetre and submillimetre waves.

Some examples of the potential hazard and interference sources of man-made electromagnetic fields include electricity transmission and delivery systems, industry process control plants, mobile terrestrial and maritime transport systems, radio/TV broadcasting systems, telephone networks, radar and remote sensing apparatuses and systems.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

Moreover, it is known that the performance, reliability and availability of these systems can be seriously degraded if the design does not take full account of the effects of the undesired noise emitted by the system itself and/or by its subsystems.

In addition, the integration in small volumes of control devices, data storage and computer devices has drastically increased the need for much more sophisticated design procedures which are better suited to the functional coexistence of such apparatuses and systems.

Another cause of electromagnetic interference is the wider use of fast rise/fall time digital signals, connected with faster data transmission rates.

Finally, the protection and security of information transmission have been found to be compromised by the presence of undesired signals radiated and/or conducted in situations of inter-/intra-system compatibility.

All of these examples, including those existing in hospital practice, suggest a worsening of this situation. It is therefore believed that cooperating research activity in electromagnetic compatibility could be of interest for the European Communities and could be a worthwhile topic for an integrated COST project. The goal of the project is to produce and coordinate the necessary basic scientific information and the modelling and evaluation techniques.

2. Objectives of the project

The main objective of the project is to coordinate and advance European research into electromagnetic compatibility in electrical and electronic apparatuses and systems, in particular carrying out research into various current and new fields of application, and undertaking a large-scale exchange of information on the experience and results obtained.

The principal advantages of international collaboration in this area are the comparisons that can be made between a number of different situations and the international standardization of systems facilitated by joint planning in early design and software centralization.

The organization of the project with the activities for the exchange of scientific and technical information described in section 3 and an open symposium at the end of the project period should assist participating countries to acquire a basis of up-to-date software and technology to find better solutions for their specific industrial applications, and to evaluate and orient their research and development efforts in the electromagnetic compatibility area.

In conclusion, more rapid progress may be achieved in this way than by individual, uncoordinated efforts.

3. Structure of the project

It is proposed to divide the project into two basic areas and one subsidiary area.

3.1. Source characterization

All the mathematical (including numerical) modelling, evaluation tools and technical provisions which can characterize and control the interfering source(s).

3.2. Equipment (passive behaviour of) evaluation

All the mathematical (including numerical) modelling, evaluation tools and technical provisions which can characterize and control the equipment suffering interference.

3.3. Development of measurement techniques

To validate theoretical models, control the emitted fields and evaluate the products.

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually two meetings annually);

(b) be involved in an active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

It is envisaged that, during the available project time scale of four years, each Signatory will be responsible for the development of the electromagnetic research activities and/or software routines to be integrated in the framework of the activities described in section 5.

5. Technical programme

The technical programme for each of the areas indicated in section 3 is described below:

5.1. Source characterization

5.1.1. Near field modelling of simple sources

5.1.2. Effect on sources of local environment (boundary conditions)

5.1.3. Statistical description of cumulative sources (local scale)

5.1.4. Statistical description of cumulative sources (environment scale)

5.2. Equipment (passive behaviour of) evaluation

5.2.1. Modelling of internal (to equipment) fields

5.2.2. Modelling of internal coupling

5.2.3. Prediction software comparison by assessing typical reference conditions

5.2.4. Shielding modelling: materials and structures

5.3. Development of measuring techniques

5.3.1. Non-conventional measurement set-up: TEM (transverse electromagnetic) cell, reverberating rooms

5.3.2. Non-conventional measurement procedures: bulk current injection

5.3.3. Non-conventional measurement situations: large scale (environment characterization), medium scale (room-size conditions)

5.3.4. Shielding exprimental evaluation: materials and structures

5.4. Technical visits and workshops

Technical visits will be arranged to provide an opportunity to visit both State and/or external research establishments. A technical workshop will be held at the end of the project to highlight the progress achieved in the area of electromagnetic compatibility.

(a) Technical visits in Europe

These visits are organized during the MC meetings in the project member countries. They constitute one of the key aspects of the project and cover visits to laboratories and test facilities.

(b) Technical contacts outside Europe

In view of possible interesting advances in electromagnetic compatibility outside Europe, it is supposed that the MC members will be closely connected with non-European centres of excellence in the area (e.g. in North America and Japan).

(c) Technical workshop

This workshop will provide a forum for the project participants to present the project work to the technical community and to receive and discuss external contributions in the area of electromagnetic compatibility.

5.5. Final report

A final report covering all the activities of the project will be jointly written and circulated in the participating member States.

Memorandum of Understanding for the implementation of a European research project on the biomedical effects of electromagnetic fields

(COST Project 244)[1]

Date of entry into force of the project: 7.10.1992
Duration: 6.10.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	11.11.1992	11.11.1992
CROATIA	19.10.1992	19.10.1992
CZECHOSLOVAKIA	7.10.1992	7.10.1992
GERMANY	7.10.1992	7.10.1992
GREECE	21.10.1992	21.10.1992
SPAIN	7.10.1992	7.10.1992
FRANCE	9.12.1992	9.12.1992
ITALY	8.12.1992	8.12.1992
HUNGARY	11.12.1992	11.12.1992
SWITZERLAND	7.10.1992	7.10.1992

The overall value is ECU 1.5 million (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

One of the preconditions of a common European area is the free movement of people and goods and equality of living and working conditions. In the area of electromagnetic (EM) fields, this should lead to common European standards for EM exposure protection and common European standards for EM source control.

Most COST countries have standards which regulate EM exposure, but they are characterized by:

- differences in permitted exposure levels;
- differences in coverage of the EM spectrum;
- differences in the permitted exposure time;

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

- differences in technical standards for EM field sources.

Differences are particularly evident between Western countries and East European countries. By opening COST to the full participation of East European countries, this becomes an additional argument for establishing the proposed coordination in the area.

Controversial results of ongoing research in the area are the consequence of:

(a) questions about the definition of hazard (irreversible change in biological functions as observed at the organ or system level) and hazardous EM effects (thermal and biological effects, medical effects, long time-low power effects, etc.);

(b) methodological differences in collection, processing and interpretation of results;

(c) different technical conditions in experimental investigations and control of working conditions in epidemiological investigations;

(d) the need for multidisciplinary research (medicine, biology, electrical engineering, etc.) which supposes an excellent coordination of work through long time periods with a correct interpretation of results;

(e) numerous investigations exist at the level of *in vitro* studies and biological trials (however, comparison of the results is difficult, due to a lack of standardization of the presentation of protocols and results). In addition there are relatively few epidemiological studies.

It can be seen from the literature that although there have been many partial scientific trials, there is no global approach because of multidisciplinarity, the long-term research required, the many man-years needed and the need for significant amounts of money.

In view of the fact that research is under way in all the European countries, coordination of such research will result in a global view of the problems and complementary research programmes. As each country will finance its part of the programme, COST cooperation is most favourable.

With regard to the decision of COST cooperation to open up towards East European countries and the high level of scientific work within these countries, it would appear that the COST framework, by its design, will ensure the gathering of research at national levels as quickly as possible and will ensure a complementary concentration of man-years and laboratory and experimental resources.

The project will be under the Technical Committee Telecommunications (TCT) umbrella because:

(a) the main systems utilizing EM fields are in the area of telecommunications;

(b) the main sources of EM pollution are connected to the area of telecommunications;

(c) all research levels require the control of technical conditions, which must ensure the common method and control of parameters;

(d) telecommunications encompass both the sources of EM fields and users of research results;

(e) there are many professionally exposed people working in the area of telecommunications;

(f) most occupational standards refer to the working conditions of telecommunications personnel and experts, and the technical characteristics of the equipment have been tested from the point of view of the exposure of the general population to EM fields; all the aspects should be carefully considered, in particular telecommunications aspects and especially mobile systems;

(g) the technical and scientific approach to the problem of EM exposure protection has not been sufficiently represented.

2. Objectives of cooperative research

The objective of the project is, based on ongoing research in the area, to obtain a general insight into the state of the art in the area of EM field effects and standards in all COST countries.

The general objectives of the projects are:

(a) to create European coordination for research in the area;

(b) to coordinate and promote national research activities at European level;

(c) to stimulate multidisciplinary collaboration between experts in different fields: medicine, biology, electrical engineering, etc.

On the basis of the general objectives, some specific objectives can be identified:

(a) to establish a system and European network for continuously coordinated research in the area of the biomedical effects of EM fields and interactive repercussions on the corresponding standards;

(b) to ensure that new European standards in the field of protecting the general public and professionally exposed personnel against EM exposure have scientific bases;

(c) to ensure that new common European standards in the field of the technical characteristics of EM sources have scientific bases.

3. Content of the project

The content of the project will be finalized after the first Management Committee (MC) meeting. Preliminarily, three phases are envisaged.

I. Planning phase (6 to 12 months)

The planning phase will start with the first MC meeting. In the planning phase, concentration will be on the topics below:

(a) selective analysis of the literature in the area concerning project objectives and the preparatory phase for a common database;

(b) selective analysis of existing standards in the area;

(c) identification of research teams and ongoing research work in the area with respect to complementarity in complex research;

(d) preparing a workshop, which would enable collection of the results, definition of the level of research, application of results and experience of ongoing research to present standards.

The summary of ongoing research would be analysed in, at least, the following areas:

- biophysical mechanisms and tissue modelling (cell and molecular level);
- *in vitro* studies;
- biological trials with animals;
- biomedical application;
- epidemiological research;
- simulations on models (phantoms);
- measuring methods and equipment for control working and experimental conditions;
- development of new scientific equipment, especially dosimetry-oriented equipment;

- techniques for control and/or reducing EM exposure – existing standards.

II. Research phase (30 to 36 months)

On the basis of the workshop recommendations, the MC will have a clear picture concerning:

(a) results which constitute a sound basis for common European regulations;

(b) controversial results which should be considered by new coordinated research;

(c) new areas in which the new research should be stimulated.

Special attention will be concentrated on, for example:

(a) interpretation of the research results and their estimation according to *in vitro* experiments, biological trials and epidemiological research;

(b) resonance effects on organ, cellular and molecular levels;

(c) 'window' effects (frequency, level, exposure time);

(d) performing experimental studies on animals for extrapolation to man;

interspecies' scaling factors must be considered;

(e) some additional research work which should be oriented to better understanding of local, regional and whole-body thermo-regulation;

(f) more precise and better controlled long-term, low-level laboratory and epidemiological studies, etc.

On these bases, the MC will set up a final research plan and programme with an appropriate time scale and will stimulate coordinated work on problems identified by the MC.

It will establish a database of existing research work in the area and its science potential.

The research phase will finish with a European conference to ensure the contribution of non-signatory countries and research institutes, according to the MC decision. In preparation for this conference, it would be possible to organize a few workshops or seminars in selected areas.

The MC will decide about dissemination of the results, or a part of the results, to the non-signatory countries.

III. Working-out phase (six months)

On the basis of the previous results, the MC will produce documents which could be used for:

(a) a new common European standard in the field of protection against EM exposure;

(b) a new common European standard on technical characteristics of EM field sources;

(c) installing a reference 'network of excellence' of the institutions in the area;

(d) the definition and introduction of a monitoring system for occupationally exposed persons, particularly in the condition of long-term exposure to low intensity EM fields (beneath thermal effects);

(e) the definition of uniform parameters to follow the health status of occupationally exposed persons;

(f) the identification of white spots in the area;

(g) further stimulus for research in the area of protection measures, means and personal dosimeters.

A final publication, monograph or book should be prepared with the results of the work and also guidelines for the application of the standards as well.

4. Appropriate forms of cooperation

The suggested form of cooperation is that Signatories are represented in the Management Committee (MC) by delegates who should be expected to:

(a) attend and contribute to meetings of the MC (usually four meetings annually);

(b) be involved in a active programme fitting in with the objective and time scale of the project;

(c) take responsibility for specific items of the project;

(d) seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the project and other related COST telecommunications and tele-informatics projects;

(e) set up national working groups for specific items;

(f) be responsible for liaising between the MC and national research groups in the participating countries.

When necessary the MC may arrange a working interlaboratory comparison of results, technical meetings, workshops, laboratory visits and staff exchanges, etc. in order to achieve a rapid exchange of information.

Except for coordinated work between national research teams and institutions in the signatory countries, the MC will also take care of coordination:

(a) with projects in other fields in the COST framework (especially environment and medicine);

(b) with the other organizations and associations in the field, such as WHO, IRPA, EBEA, URSI, etc.;

(c) with the institutions responsible for standardization, such as CEN/Cenelec, ETSI, CCIR, etc.

Some feedback effects could be expected through dissemination of research results via, for example, the Proteas database.

5. Organization of the project

The project will be organized by the MC.

The MC is responsible for the acceptance of phase reports and the final report, for arranging seminars, conferences, workshops and research coordination between national teams. On the basis of the seminar on the state of the art in the participating countries, the MC may decide to what extent cooperation should be established between national projects, for example in the form of joint projects, and whether comparative research projects could be initiated in some particular selected areas.

The MC should stimulate the exchange of experts and young scientists between the national teams. It will set the reference terms for the exchange of existing and new knowledge, ensuring that the main results of the national projects are made available internationally by establishing common databases and, possibly, using the Proteas communication channel. The MC will take the initiative in publishing books and research monographs on selected topics, containing contributions from several participating countries.

Memorandum of Understanding for the implementation of a European research project in the field of express delivery services

(Cost Project 314)[1]

Date of entry into force of the project: 18.4.1991
Duration: 17.4.1994

Contracting parties	Date of signing	Date of entry into force
FRANCE	8.4.1991	8.4.1991
IRELAND	18.4.1991	18.4.1991
NETHERLANDS	18.4.1991	18.4.1991
SLOVENIA	17.11.1992	17.11.1992
SWITZERLAND	18.4.1991	18.4.1991

The overall value is ECU 300 000 (in 1989 terms).

ANNEX II

General description of the project

Review and discussion of the research project on express delivery services in Europe by the COST 314 Technical Subcommittee on 11 April 1989 led to the substantial definition of its scientific objectives, expected results and the conditions for its implementation. A preliminary draft report, examined on 20 June 1989, and the written recommendation sent in by several national representatives at the end of 1989, served as the basis for this report.

With the help of the recommendations from the national representatives it proved possible, first, to tackle the questions on the agenda for the first meeting (telex of 15 March 1989) that had to be answered before proceeding to 'project definition' and are dealt with in what follows and, second, to draw up a programme of work.

1. Objectives

The objective is to observe and analyse the manner, causes and consequences of the development of express delivery services in Europe by European and other firms.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

This development arises both from a change in the nature of the demand for transport ('just-in time' transport and faster movement of goods) and from supply-side initiatives, with the quality of services improving. The result is rapid growth in traffic and intensive restructuring among service-providers.

2. Information status

The change is so recent in origin, so rapid and so unprecedented, that express delivery services pose first of all a problem of information, all the more so because their specific nature is not grasped by the usual run of transport statistical systems (which put the emphasis on heavy goods and used indicators of little significance in this connection).

At the present stage, leaving aside trade information, which is incomplete and often confidential, information on express delivery services is sparse: apart from fragmentary data, the press publishes very few review articles and, as far as is known to the Subcommittee's members, no book or thesis on the subject has been published.

The systematic gathering of information, both quantitative and qualitative, from publications or interviews will therefore provide a useful reference for scientists, administrators, policymakers and trade circles. The members of the Committee will also endeavour to provide any statistical information available to them in their respective countries.

Lastly, an understanding of transport in fields other than express delivery services will provide effective support for the study of those services.

3. Grounds for the research and results expected

The development of express delivery services poses scientific and policy problems which are both part of general economic trends and specific to transport.

In general terms the development of express delivery services is undoubtedly beneficial in certain respects: improvement in quality of service, fall in relative price levels, and traffic growth to meet expanding demand.

One might, however, wonder whether there is not a risk of excessive concentation occurring in the industry, and a trend towards oligopoly. Another matter is the possibility that European firms may be driven out of this market. Are these fears groundless? Should they prove to be so, research will have rendered an inestimable service by showing the problem to have been inexistent.

With regard to transport, the technical and economic problems solved by express delivery services are of particular interest: market segmentation, organization of modal complementarity, structure of transport networks (hubs and spokes), role of computers and computerization, package standardization, handling mechanization, standardization of procedures and rate structures, the respective advantages of interchange agreements between networks and integration into a single network, etc.

The more political matter of serving the European territory must be addressed. Will express delivery services be provided to all regions or will the stronger metropolitan areas be given preference, thus accentuating the relative disadvantages of peripheral and isolated areas? The environmental questions (night operations at airports and safety) will also play a role.

Regulation, which is particularly stringent and complex in the transport field, is another problem which arises. Are national regulations, and European regulations, a form of *de facto* protection for European firms – or on the contrary – and perversely do they handi-

cap them *vis-à-vis* outside competitors (which are American and Australian for the time being)?

To the extent that express delivery services help to foreshadow trends which will later spread to other sectors of the transport industry, a study of these services and research into the mechanisms by which they are organized and the consequences of that organization will therefore act as an advance warning system for the transport sector and present a vantage point from which to monitor national and European transport regulations and policies and their effects, both good and bad.

The research plan will, firstly, permit the most relevant subjects to be identified, and thereafter, permit appropriate investigations and action.

4. Conditions for carrying out the research, task of the COST 314 Committee, and timetable

(a) Research

Research will be initiated by a project now being launched, and known as the Eurotrans Research Club. It receives funding from the French Government (Ministry of Transport and National Planning Office) and involves six European research teams from Spain, France, Italy, the Netherlands and Germany. Other research teams could provide useful support.

As soon as this project is put in hand the COST 314 Committee will be briefed on it: the Committee will be able to facilitate participation by other researchers, monitor and assess the results, and derive from them:

(i) a supplementary research programme, either to investigate some of the subjects in greater detail or to extend its scope;

(ii) areas of discussion for action, or recommendations.

(b) Tasks

It is therefore too soon to draw up a final list of the tasks of the future COST 314 Committee. However, discussions during the working sessions have brought to the fore several main points to which particular attention should be paid, possibly meriting specific investigative work, namely:

(i) the relevance and future of the distinction between national and European and international express delivery systems;

(ii) the role of SMEs, given the trend towards the technical integration of transport chains;

(iii) the role of postal services in the development of express delivery;

(iv) the role of airlines and the development of air freight;

(v) the development of the new information technologies in the field of express delivery services, and in particular electronic date interchange (EDI), and their implications for relations between service firms involved in a delivery and relations with their customers;

(vi) the emergence of new services linked to express delivery;

(vii) the simultaneous development of services and rates.

Programme of work

The programme could therefore begin with work on the main points listed below. These may include the more specific economic and policy questions mentioned earlier, which may be put forward by researchers or national representatives working on COST 314. They include:

(i) analysis of the present situation in Europe (placed in a world context) as regards the demand for transport, the supply of services and methods of regulations;

(ii) an estimate of future European markets (domestic and international), an assessment of future supply (including a special examination of the role of the various parties) and a review of the relevant legal conditions;

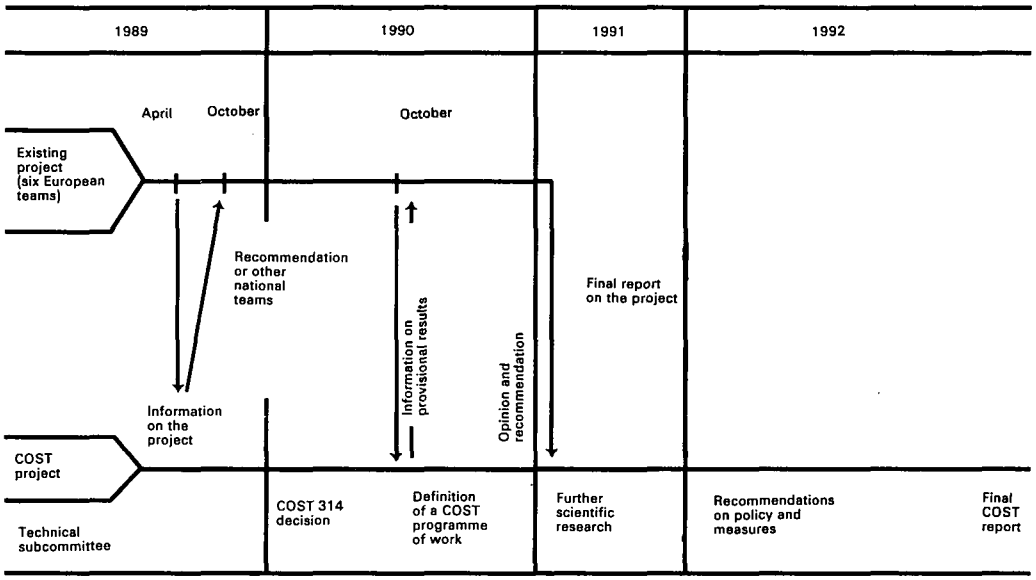
(iii) the impact on:

- the economy in general, the practices of a few representative forwarding agents,
- land-use planning and the environment, etc.;

(iv) conclusions and recommendations.

(c) Timetable

The organization plan and timetable for the project as a whole are as follows:



The outline arrangements are therefore already in place. They can be reinforced by opinions and proposals from the Committee's members, and by the additional resources which will be supplied. Analysis of express delivery services will contribute to the scientific understanding of, and scope for policy action on, one of the most advanced sectors of European transport and for that very reason it proves most useful as an example.

5. Duration of the project

Three years.

6. Estimation of the cost

About ECU 300 000.

Memorandum of Understanding for the implementation of a European research project in the field of large containers

(COST Project 315)[1]

Date of entry into force of the project: 18.4.1991
Duration: 17.3.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
SPAIN	8.5.1991	8.5.1991
FRANCE	18.4.1991	18.4.1991
IRELAND	18.4.1991	18.4.1991
NETHERLANDS	18.4.1991	18.4.1991
PORTUGAL	12.3.1992	12.3.1992
SLOVENIA	17.11.1992	17.11.1992
SWITZERLAND	4.7.1991	4.7.1991
SWEDEN	15.6.1992	15.6.1992
UNITED KINGDOM	18.4.1991	18.4.1991

The overall value is ECU 500 000 (in 1990 terms).

ANNEX II

General description of the project

Preparatory meetings on 15 December 1989, 6 February 1990 and 21 March 1990 of the Technical Subcommittee of COST 315 have resulted in the definition of the scientific objectives of the research project.

It should be pointed out that this project has a special character because of the short time that is available and the undertakings that the Commission of the European Communities has made to contribute to the project. These circumstances are caused by the fact that the ongoing work in standardization of new containers aims at a decision on new standards in the summer of 1991. Before that decision is taken, draft conclusions of COST 315 should be available.

1. Objectives

The objectives of the research project are to carry out an inventory, analyse and evaluate the impact of increasing dimensions of containers on the economy, environment, infrastructure and safety of the countries that participate in COST 315, taking into account the overall effect in Europe and its trade partners in the rest of the world.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

2. Information available

The impact of larger containers was the subject of many documents presented at the seminar organized by the United Nations Economic Commission for Europe (ECE) (13 to 16 November 1989).

In these papers the different aspects of larger containers were considered by national experts and interested parties of the transport world. Moreover, the Commission presented at the first meeting of the Technical Subcommittee of COST 315 a report on the same subject.

Nevertheless, there is still a lack of statistical data and a clear inventory of existing laws and standards. Therefore the first stage of the project will be to carry out an inventory of this kind of information.

3. Grounds for the research and results expected.

The growing concern of governments, especially in Europe, about new container uses that may be introduced by the International Standard Organization (ISO) led to statements of the transport ministers of the European Communities and of the European Council of Ministers for Transport (ECMT) in which it was made clear that such new standards could not be fixed without taking into account the European situation.

At the meeting of ISO TC 104 in London in June 1989 and the seminar on the increasing dimensions of containers organized by the UNECE in Geneva (13 to 16 November 1989), it appeared that developing countries were also very concerned and it was decided that new standards should only be fixed after a worldwide evaluation of the impact on the economy, environment, safety and social factors. This worldwide study will be coordinated by the UNECE. The Commission of the European Communities proposed COST 315 in order to coordinate the studies that should be made at a European level. In these studies the relations of Europe with its trade partners overseas will also be analysed.

4. Organization of the project, tasks of the COST 315 Committee and timetable

(a) Organization of the project

The project will first carry out an inventory of the existing statistics, laws and standards. This collection of information will serve as a basis for the following geographically oriented studies.

The main part of the study has been broken down into working modules for countries or larger geographical areas.

In each of those modules the impact of increasing dimensions of containers is assessed according to a variety of areas:

safety in traffic,

economics of transport,

environmental impact,

quality and capacity use of infrastructure,

effects on the national economy.

The project should include:

(i) contribution of the participating countries along the well-defined structure of the working modules;

(ii) assessment of contributions made by third parties (consultants) covering the other working modules;

(iii) assessment of the final report and drafting of the final conclusions to be used at the decision-making procedure for new standards.

In section A below a functionally orientated project structure plan is presented.

The Commission will undertake working modules 1 to 7 (working blocks I and II).

The participating countries are invited to contribute to carrying out the working modules 8 to 23 for their own area. Moreover, the evaluation of national reports and the drawing-up of summaries for each of the four relevant modes of transport, which comprise the main results of the national reports, should be coordinated.

The following participating countries have volunteered to carry out such coordination:

France for rail transport;

Germany for inland navigation;

The Netherlands for road transport;

The United Kingdom for maritime transport.

(b) Tasks

The tasks of the Cost Committee will be:

(i) collation of the respective country reports;

(ii) supervision of the results of the different studies;

(iii) discussion and approval of the final draft report and the accompanying conclusions/recommendations.

(c) Timetable

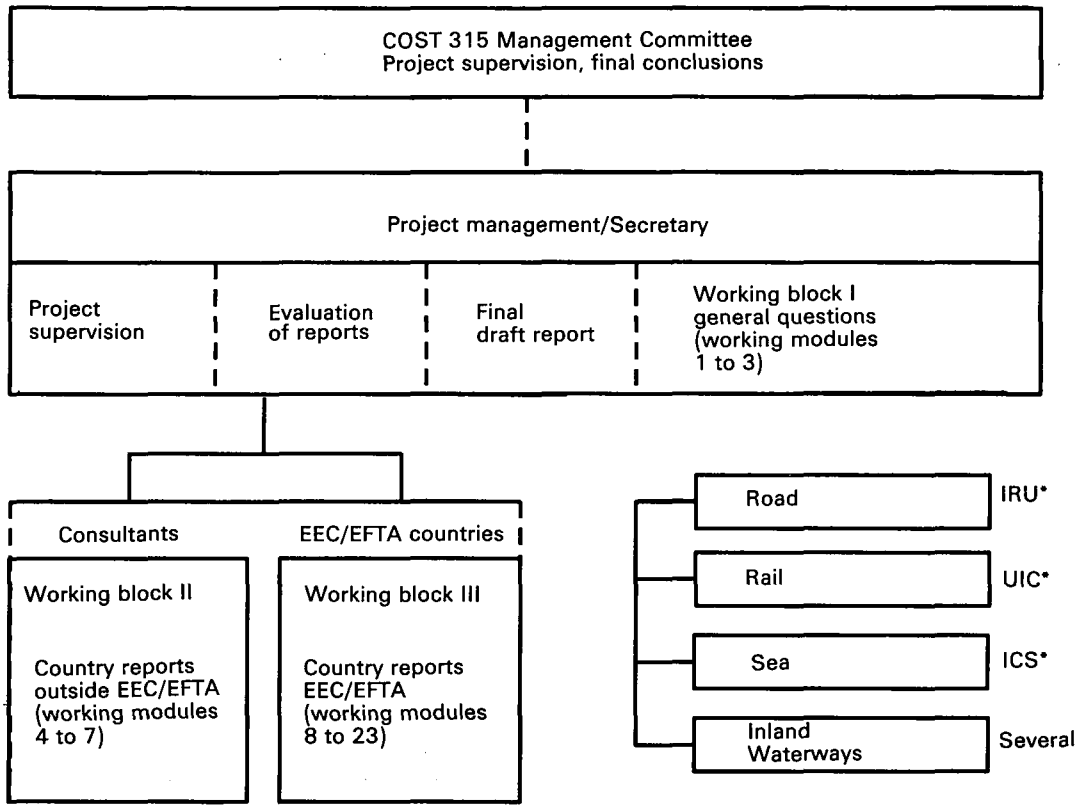
The timetable of the project is set out in section B.

5. Duration of the project

Two years and three months.

6. Estimation of the cost

About ECU 500 000.



* IRU = International Road Transport Union
UIC = International Union of Railways
ICS = International Chamber of Shipping

Figure 4: Project structure plan (functionally orientated)

B. TIMETABLE

	1.6.90		31.11.90	1.6.91		1.4.92	
Study I (project management)	____	+ ____	+ ____	+ ____	+ ____	+ ____	+
Study II (statistics, laws, regulations)	____	____	____	+			
Study III to VI	____	____	____	+ ____	____	+	
Contributed country reports	____	____	____	____	____	+	
Coordinators (road, rail, sea, inland waterways)						____	+
COST 315 meetings		°		°		°	
Publication of the final report							+

+ Reports

Memorandum of Understanding for the implementation of a European research project in the field of the socioeconomic effects of the Channel Tunnel

(COST Project 317)[1]

Date of entry into force of the project: 4.7.1991
Duration: 3.7.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
DENMARK	4.7.1991	4.7.1991
SPAIN	4.7.1991	4,7,1991
FRANCE	4.7.1991	4.7.1991
IRELAND	4.7.1991	4.7.1991
SWITZERLAND	4.7.1991	4.7.1991
UNITED KINGDOM	18.12.1991	18.12.1991

The overall value is ECU 800 000 (in 1990 terms).

ANNEX II

General description of the project monitoring the economic effects of a fixed Channel link

I. General background

The special COST 312 meeting on 27 and 28 November 1989 concluded that a COST working party should be set up from 1990 to examine the socioeconomic effects of the Channel Tunnel.

Without obscuring the need for close cooperation between the working parties dealing with traffic flow and economic effects, it seemed necessary to distinguish clearly between the two groups' work for two reasons:

(i) they call for different fields of expertise: predominantly statistical in one case and predominantly economic in the other:

(ii) the delegations to these two groups may differ: analysing traffic flow is of concern mainly to Channel countries, while developing a methodology for analysing infrastructure's economic impact may be of interest to countries not directly concerned by the Channel Tunnel's impact (e.g. Switzerland, Denmark, Greece).

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

On the basis of the conclusions of the special meeting on 27 and 28 November 1989, the COST Technical Committee decided on 15 February 1990 to set up a technical subcommittee to define the objectives, work programme and work schedule of a new COST project.

COST 317 is thus to study the socioeconomic impact of the fixed Channel link.

II. General objectives and difficulties of the research

The socioeconomic effects of transport infrastructure such as the Channel Tunnel are not limited to the direct economic impact of changes in the conditions under which the transport market operates, in terms of prices, time-saving and capacity. When impact is measured using traditional methods of economic analysis, the scale of knock-on effects tends to be underestimated.

These traditional methods of assessment of infrastructure projects presuppose that the economic changes linked to the projects are marginal. This hypothesis of economic calculation is probably not suitable in the case of the Channel Tunnel. The increased competition which it will bring to the transport market should have an effect on productivity.

It seems that infrastructure tends not to initiate development, but rather to stimulate it, acting more as a catalyst. It alters the parameters of the economic decision-makers' spatial perception with regard to the location of plant or new activities. These effects go far beyond the realm of transport economics. They will be difficult to identify and measure.

This demands an approach to assessing socioeconomic impact which is systemic, not mechanistic, and integrates the notions of networks and spatial polarization.

The expansion of the motorway and high-speed rail networks, of which the Channel Tunnel is a missing link, will lead to a great increase in traffic, the development of interconnections and growing spatial polarization around the networks' main points of entry and exit. This trend is especially pronounced in the high-speed rail sector. It is less obvious in the case of road and motorway networks.

The results of research into the direct and indirect effects of transport infrastructure tend to show that economic activity gradually polarizes around the major cities and points on the major networks. This could lead to a two-tier area comprising:

(i) the area around points on the major networks of transport infrastructure, the major international cities and certain important regional centres. Owing to their great accessibility, it would be possible to move people and goods quickly and cost-effectively between these points;

(ii) an ordinary, second-class area where network access, in terms of time, transport costs and access to services, is more expensive. However, the logic behind the single market tends to encourage new transport infrastructure only where potential demand appears sufficient to guarantee a return on investment. Moreover, the mainly private sector financing of the Channel Tunnel exemplifies this economic and financial logic.

The study of the Channel Tunnel's socioeconomic impact must therefore focus not only on the regions at either end, but must also specifically cover the impact of spatial polarization. The study's scope must not be defined solely by the Tunnel's geographical dimensions. A system of classifying European regions will have to be established on the basis of the foreseeable impact of the Channel Tunnel.

Monitoring the impact of the Channel Tunnel will require a clear view of the problems associated with studying economic change. Amongst the changes which may be observed, a dinstinction will have to be made between:

(a) those which are the consequence of overall economic change such as the completion of the single market;

(b) those which may be attributed to the entry into service of the Channel Tunnel and its attendant infrastructure.

Therein lies the main methodological difficulty of the work proposed in the framework of this research. However, as we emphasized above, we must not become enmeshed in a quest for the mechanical links between cause and effect.

Defining a suitable methodology for monitoring will therefore form an essential part of the study. This should be the main result of the first phase of the study (stages 1 and 2 of the work programme).

Such a methodology developed in the case of the Channel Tunnel should be appropriate for other infrastructure projects.

Any monitoring study depends on the clear definition of the current state of change and trends before the infractructure comes into service. A body of data suitable for coherent analysis will therefore be required beforehand.

Without embarking on massive data-gathering disproportionate to the resources available for this study, it is essential to be able to check the relevance and reliability of the indicators available or likely to become available against easily accessible basic data. The measurability of the expected effects is a major concern. Two concerns warrant emphasis:

(1) the search for coherence and compatibility between the indicators used in the different countries covered by the study;

(2) the preservation of, and the continuity of gathering, basic data for constructing indicators.

Changes in the structure and organization of passenger and goods traffic should be a vital indicator. Close cooperation will therefore be necessary with studies carried out under COST 312.

The changing structure of the links in the transport chain may therefore lead to the development of new transport hubs likely to act as catalysts in the setting-up of new activities.

The qualitative study of traffic will have to be supplemented by monitoring trends in the location of new activities and the property market. It is likely that the effects on the property market of advance buying are already visible, thus making monitoring a matter of urgency.

The application of these indicators will be supplemented by restricted qualitative surveys to increase understanding of the logic and strategies of the different groups concerned.

There is also the possibility that thematic studies may be carried out when significant changes (including the impact of anticipatory measures) come to light.

These more applied works will be carried out during the second phase of COST 317 (stages 3 to 6 of the work programme).

They will also include the results from other research activities about the follow-up of Channel Tunnel impact, and in particular those to be carried out by DG XVI (Regional Policies).

III. Work programme

The work programme is connected with the problems and the methodology mentioned above. It endeavours to integrate the results of COST 312 and, where possible, those of other entities: the Commission's DG XVI, EMCT, the European Science Foundation, etc.

The work programme comprises two phases and six stages.

Phase 1

1. A critical survey of the main studies and research carried out in Europe on the economic impact of major transport infrastructure. The COST 312 seminar on 27 and 28 November enabled basic material

to be gathered for taking stock of the state of the art in this field. A critical analysis has yet to be carried out. This critical survey will also aim at the theoretical basis of the work.

2. Carefully defining the problems associated with, and a methodology tailored to, the Channel Tunnel in the light of the imminent completion of the single market and the establishment of Europe-wide infrastructure networks.

Phase 2

3. Completion of restricted qualitative surveys and the analysis of existing data to validate the proposed methodology.
4. Drafting the general conditions for a small-scale observatory to monitor changes in the location of business activities and the property market in a sample of the areas tested during stage 3.
5. Qualitative analysis of changes in the structure and logistics of goods transport chains. Qualitative analysis of changes in the organization of business and tourist travel.
6. Attempt to apply the methodology perfected and tested on the Channel Tunnel in other infrastructure impact studies (e.g. Transalpine link, missing Scandinavian links, etc.).

During phase 1, the working party will carefully follow the work being done in neighbouring fields concerning the monitoring of the Channel Tunnel impact at regional, national and international level.

The seminar of November 1991 will provide the possibility of making a mid-term assessment before launching phase 2 of the work, which will have a more applied character.

IV. Timetable

Duration	Three years
April 1990	Setting-up of the Technical Subcommittee
June or October 1990	Study of the Technical Subcommittee's report by the COST Steering Committee
October 1990	Setting-up of the COST 317 Management Committee
December 1990	Joint Meeting of COST 312 and COST 317
October 1990 to May 1992	Implementation of the work programme
November 1991	Two-day seminar with COST 312 and DG XVI End of phase 1 of the work programme
May 1993	End of phase 2 of the work programme Completion of work of COST 317
End 1993	Draft final report
15 June 1993	Entry into service of the Channel Tunnel
Before end 1993	Publication of the final report of COST 317

V. Cost

The financial contributions in the form of funding for studies and staffing announced by the delegations to the COST Technical Subcommittee amount overall to ECU 800 000 spread over three years.

Memorandum of Understanding for the implementation of a European research project in the field of the effects of EDI (electronic data interchange) on the transport sector

(COST Project 320)[1]

Date of entry into force of the project: 16.1.1992
Duration: 15.1.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
GERMANY	10.9.1992	10.9.1992
SPAIN	26.2.1992	26.2.1992
FRANCE	10.9.1992	10.9.1992
IRELAND	16.1.1992	16.1.1992
NETHERLANDS	16.1.1992	16.1.1992
NORWAY	16.1.1992	16.1.1992
PORTUGAL	17.12.1992	17.12.1992
SWITZERLAND	13.3.1992	13.3.1992
SWEDEN	15.6.1992	15.6.1992
UNITED KINGDOM	16.1.1992	16.1.1992

The overall value is ECU 1 000 000 (in 1991 terms).

ANNEX II

General description

1. Scope of the project

The general objective of COST Project 320 is stated as: 'international cooperation in analysing real effects of EDI application within the transport sector, with special reference to the European market'.

The main objective is to investigate the influence of EDI on:

(a) the organization and location of logistic activities;

(b) the relationship between shippers and transport companies;

(c) the position and role of each party within the transport chain;

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

(d) the structure of the transport sector (mergers associations, SMEs, etc.)

(e) international and national transport.

Other stated objectives are:

(a) to formulate recommendations to governments for creating optimal conditions for the use of EDI in conformity with the requirements of the internal market;

(b) to help transport enterprises to assess the opportunities and pitfalls of EDI.

COST Project 320 will concentrate on corporate-to-corporate EDI.

2. Organization of study

A Management Committee shall be formed with representatives from participating countries. The Management Committee should ideally be a mixture representing different disciplines, namely:

governments,

(international) transport organizations,

EDI tranport communities,

transport organizations.

The tasks and responsibilities of the Management Committee are to:

(a) monitor COST Project 320;

(b) guide the International Project Group;

(c) assist in the organization of the survey;

(d) liaise with national organizations;

(e) coordinate national contributions.

The Management Committee should meet approximately every quarter.

The Project Group shall be kept small (about five persons), in order to be effective, and be composed of members with know-how expertise in EDI, surveying and the transport sector. The tasks of the Project Group are to:

(a) coordinate COST Project 320;

(b) carry out the literature study;

(c) prepare the survey (questionnaire and interviews);

(d) analyse survey results;

(e) prepare the interim and final report;

(f) report to the Management Committee.

Some of the Project Group meetings will be extended by the participation of members of the Management Committee or other experts from the fields on which discussion will take place.

The Project Group is chaired by a Project Manager, who shall have the following tasks:

(a) daily management of Cost Project 320;

(b) chairing and preparing the meetings of the Project Group.

3. Programme

Based on the general objectives of COST Project 320 – international cooperation in analysing real effects of EDI application within the transport sector, with special reference to the European market – the project has been divided into the following stages:

I. A pre-investigation, consisting of:

- a literature study,
- national reports,
- a reference model.

II. A survey, consisting of:

- questionnaires,
- interviews.

3.1. Literature study

The first part of COST Project 320 will consist of a literature study. Literature can include books, reports, articles, outcomes of courses, seminars, etc. In accordance with the aspects mentioned in the scope of the project, the literature on the infuence of EDI can be divided into the following categories (a broader description is included in Appendix I):

- the location of logistical activities,
- logistics (distribution strategies, IT, structure),
- relations in the transport chain (informational, commercial),
- different parties in transport,
- different transport modes,
- national and international transport,
- the influence of the European common market after 1992,
- the internal organization of companies,
- small and medium-sized companies.

Every country is asked to carry out a small study on the literature available within the country or otherwise known. The result will be:

(a) a list of the literature available, with references on the categories which are concerned (see Appendix I as an example);

(b) a summary report of a maximum of nine pages, being the most important conclusions per category (one page per category); the conclusions should be drawn from the available literature;

(c) a small list of the 'best' books or reports.

The countries are requested to send this result to the Project Manager, who will prepare an interim report from the country contributions.

The Project Group will then prepare a literature study report, based on the available literature's overviews and reports.

3.2. National reports

Participating countries are also requested to write national reports. These can be seen as summaries of the state of the art of EDI in transport in the different countries.

The list of contents of the national reports is: projects, statistics, governmental initiatives and summary. An example is included in the Appendices (Appendix III). It should be noted that individual projects need more explanation (a few paragraphs per project).

3.3. Reference model

For a better judgment of the changes and effects of EDI in transport, a reference model of the transport structure will be composed. This model should represent the actual state of transport structure and relations. The value of the model will lie in its ability to analyse changes and effects. As an example, Appendix IV contains a diagram that could be part of the model.

The reference model will be drafted by the Project Manager, for discussion by the Project Group and the Management Committee.

3.4. Survey

The survey will investigate one or more aspects of the effects that can be expected from EDI. The subjects will be chosen in the following way:

(a) the literature study will indicate available know-how;

(b) fields of research will be suggested for investigation;

(c) a pragmatic choice of subjects for investigation will have to be made, which fits within size of survey possibilities.

The survey will consist of a questionnaire and additional interviews. The questionnaire consists of predefined questions and is meant to gather a wide range of opinions of experts from all over Europe. Interviews are interactive, giving space for discussions.

Both the questionnaire and the interviews will be undertaken by the participating countries. The preparations will be done by the Project Group.

4. Planning

The work to be done in order to carry out the project in an efficient and effective way has been transposed into activities (page 97). For every activity, the party that should carry out the activity has been mentioned. Some activities are to be carried out per country. It is intended that the members of the Management Committee assume responsibility for these activities, whether they carry them out themselves or not. The list of activities gives the parties responsible for the activities.

The activities have been put in a time schedule (see planning schedule, p. 97). The diagram contains three levels: project management, project group and countries. For all levels, the activities to be carried out are included.

The meetings of both the Project Group and Management Committee have been planned in synchronization with the activities. Most meetings will not just discuss progress, but are also planned to concluded or to prepare stages in the project.

At some Project Group meetings, experts or interested persons will be invited to participate in the discussions. Those meetings will be called 'extended Project Group meetings'.

The questionnaire will be prepared by the Project Group. The questionnaires may be drawn up in the languages of the countries concerned. For introduction to the questionnaire, both a general instruction day and several regional meetings will be held.

It is planned to finish all activities within a period of 18 months. After delivering the final report, a seminar is planned to give publicity to the results.

5. Duration

Two years.

6. Cost

About ECU 1 million.

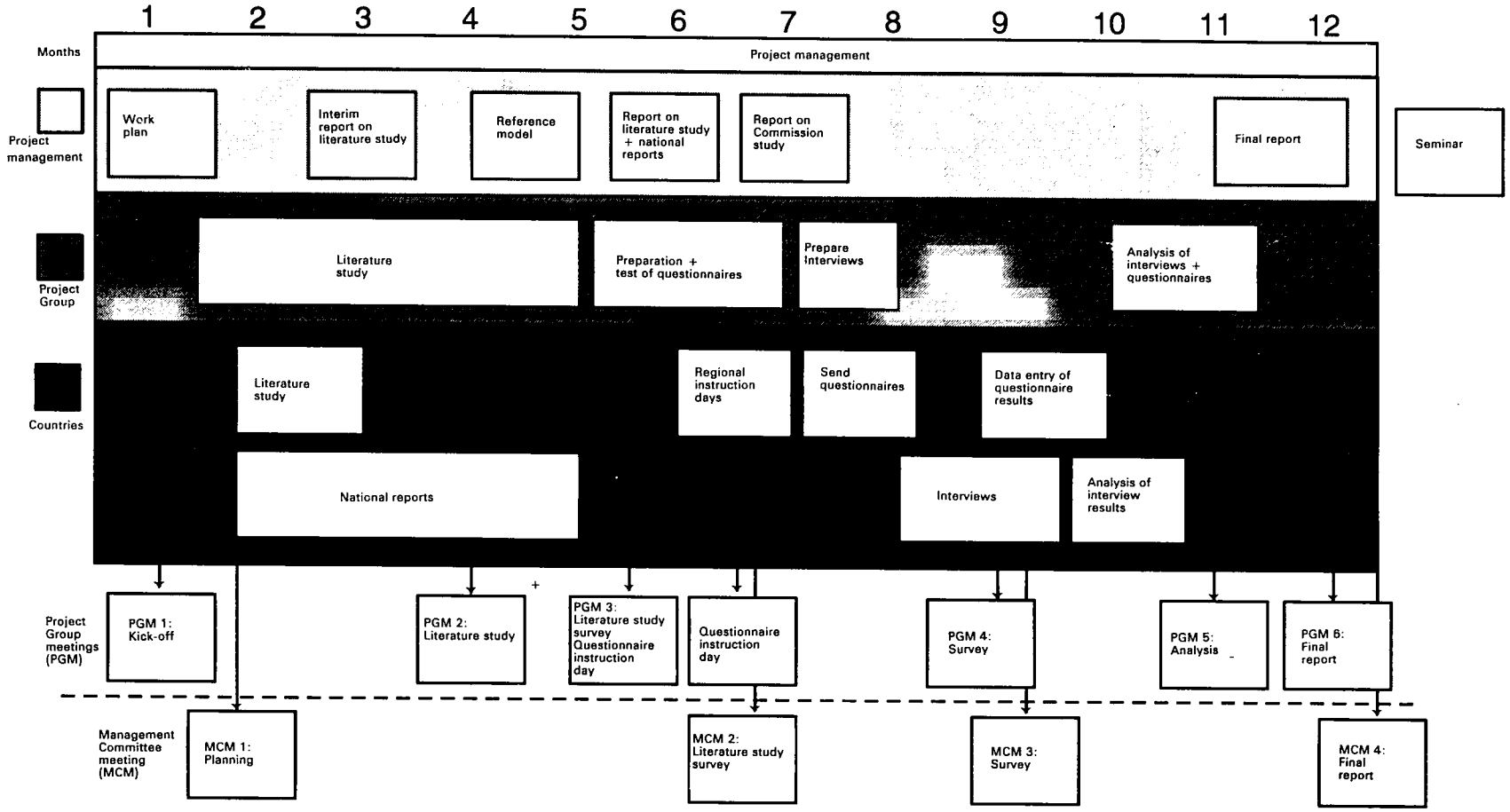
Activities	Party responsible
1. *Preparation*	
1.1. Work plan (approach, activities, planning)	PM
1.2. Reference model	PM
2. *Literature study*	
2.1. Investigation + report of literature available	MCm
2.2. Interim report on literature study	PM
2.3. Intensive study per category	PGm
2.4. Report on literature study	PM
3. *National status reports*	
3.1. Projects. statistics (use), governmental initiatives	MCm
3.2. International status report	PM
4. *Questionnaire*	
4.1. Preparation of contents of questionnaire	PG
4.2. Preparation of sample (size, selection, addresses)	PG
4.3. Preparation of method of analysing	PG

4.4. Instruction of questioner (Q)	PGm
4.5. Translation of questionnaire into other languages	Q
4.6. Sending out of questionnaire	Q
4.7. Data entry of questionnaires returned (per country)	Q
4.8. Analysis of results by computer	PG
5. *Interviews*	
5.1. Preparation of interviews	PG
5.2. Interviews	I
5.3. Analysis of interview results	I
6. *Analysis*	
6.1. Interpretation of analysis from questionnaires	PG
6.2. Interpretation of analysis from interviews	PG
6.3. Conclusions	PG
7. *Report*	
7.1. Overall report of COST Project 320	PM

Key

PM	Project Management
MCm	Management Committee member
I	Interviewer
PG	Project Group
PGm	Project Group member
Q	Questioner

Planning Schedule for COST Project 320



+ Extended Project Group meeting

APPENDIX I: CATEGORIES OF LITERATURE

1. Location of logistical activities

What influence does EDI have on the location of logistical activities (e.g. factories, warehouses, transport networks)?

2. Logistics (distribution, strategies, information systems)

Transport is to be seen increasingly as an important part of the total logistical chain. Information technology plays a key role. What is the specific influence of EDI on logistics and, more particularly, on the transportation part? What will the influence be on the original structure of the logistical chain?

3. Relations in the transport chain (informational, commercial)

Within the transport chain, several parties can be identified (shippers, forwarders, carriers, etc.). Has EDI any influence on their commercial relationship?

On the other hand, one can look at the information flows that run between the parties. Some flows will be influenced by EDI, others will not.

4. Different parties in transport

What is the influence of EDI on different parties of the transport chain, i.e. the shipper, the carrier, the forwarder, the customs broker, the stevedore, the cargadore, the liner agent and the consignee?

5. Different transport modes

Much literature deals with just one mode of transport, i.e. rail, road, air, sea and inland waterways. Sometimes intermodal transport is the topic of research, and in other cases it will be EDI and transport in general.

6. National and international transport

When a major distinction is made between the differences or the impact of EDI on national and international transport, it should be reported here.

7. European common market after 1992

'1992' has its influence on international trade. What does this mean exactly for the transport sector? Will this be positive or negative for EDI implementations?

8. Internal organization of companies

How does EDI affect the internal organization of parties involved in transport? Will there be, apart from the advantages from EDI, negative outcomes for the internal organization of companies?

9. Small and medium-sized companies

What is the effect of EDI on the position of SMEs? What are the possibilities for SMEs to take advantage of EDI, in comparison with larger companies?

APPENDIX II: REPORTING ON THE LITERATURE

When reporting on the literature, please indicate:

Title

Author

Type (book, article, report, course, seminar, etc.)

Publisher

Year

Country/Language

Description (in one or two sentences)

Keywords (topics dealt with)

Categories involved (see Appendix I)

Some examples are listed here:

1. Logistics and telematics

   Tanja, Smook, TNO

   Course

   PAO (Post Academic Education)

   1989

   The Netherlands/Dutch

   Overview of the possible contributions of EDI to the logistical organization of various branches and logistical chains

   - logistic information systems
   - parties involved
   - future trends

   Categories: 2, 3, 4 (shipper, forwarder, carrier)

2. Telematics and Road Transport

   Coopers & Lybrand Management Consultants

   Report

   Ministry of Transport, Dir. Goods transport

   1990

   The Netherlands/Dutch

Possibilities of telematics (e.g. EDI) in road transport information systems

- logistical functions in road transport
- systems for eletronic data interchange, including navigation systems, tracking and tracing, EDI, customs systems, etc.

Categories: 2, 3, 5 (road)

APPENDIX III: EXAMPLE OF NATIONAL REPORT (NETHERLANDS)

A. Projects

Sector	Name	Typology
Air transport (Schiphol Airport)	Cargonaut	Clearing house
Intermodal (Port of Rotterdam)	INTIS	Clearing house
Customs (Ministry of Finance)	Sagitta	Application
Road transport	Tradicom	Database
Rail transport	Hermes	Network
Regional (cooperative) initiatives		
Transportcentrale Gelderland	TANGO	
Region Twente	Tristar	
Research initiatives		
SUTC (standardization of messages in road transport)		
TNO-INRO (research institute in logistics, transport and IT)		
E-Dispute (cooperation of researches in EDI)		

B. Statistics

Name	Messages/year	Users (companies)
Cargonaut	600 000	50
INTIS	1 000 000	100
Sagitta	3 000 000	270

Some active EDI users are:

Philips (as a shipper)	Sealand (as a carrier (sea))
Nedlloyd (carrier (Sea + road))	Frans Maas (road carrier)
Malenstein (road carrier)	Incotrans (sea carrier)
NSG (Dutch railways)	ECT (container handling)

In transport, there are approximately 350 EDI users (including shippers), each of them responsible for an average of 15 000 messages yearly.

Important VAN providers (in order of market shares) are:

- General Electric Information Services (GEIS)
- PTT Telecom (Osides)
- IBM Information Network (IIN)

C. Governmental initiatives

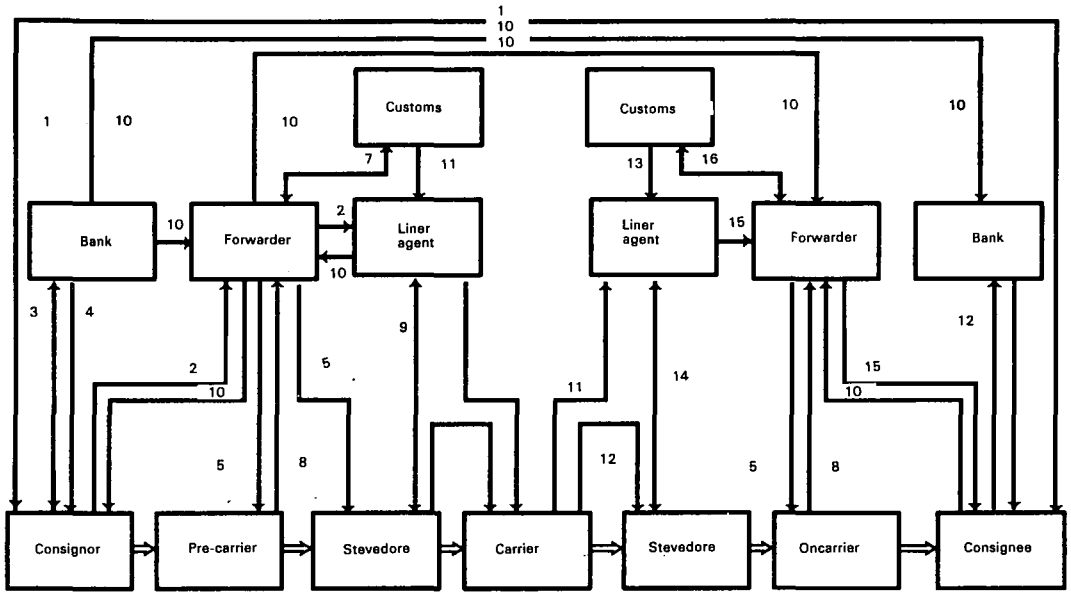
The Ministry of Economic Affairs initiated the VEDI project to stimulate companies to use EDI. Total funds are approximately ECU 7 000 000.

Ediforum (1989) is an intersectorial organization stimulating and coordinating EDI initiatives, in which approximately 100 companies participate.

D. Summary

Transport is a key activity of the Dutch economy. EDI is seen as a substantial factor in contributing towards improving its position. In relative terms, the use made of EDI is very good. Regarding the organization and initiatives, rapid growth is expected.

APPENDIX IV: REFERENCE MODEL (SUGGESTIONS)



Physical goods flow and → Information flow

related information flows ⇨ Goods flow

1. *Purchase order/Invoice*
2. Shipping instruction
3. Invoice (for information)
4. Letter of Credit
5. Transport instruction
6. Arrival notification
7. Export declaration/Approval
8. Notification of delivery
9. Loading instruction/Report
10. Bill of loading
11. Manifest
12. Stowage plan/Report
13. General declaration/Permission for discharge
14. Unloading instruction/Report
15. (Pre-)arrival notice
16. Import declaration/Customs release
17. Payment of goods (and transport)

Memorandum of Understanding for the implementation of a European research project on corrosion and protection of metals in contact with concrete

(COST Project 509)[1]

Date of entry into force of the project: 18.9.1991
Duration: 17.9.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
CZECHOSLOVAKIA	14.12.1992	14.12.1992
GERMANY	18.9.1991	18.1.1991
SPAIN	13.2.1992	13.2.1992
FRANCE	6.2.1992	6.2.1992
IRELAND	18.9.1991	18.9.1991
ITALY	20.3.1992	20.3.1992
NETHERLANDS	18.9.1991	18.1.1991
NORWAY	25.9.1991	25.9.1991
FINLAND	6.11.1991	6.11.1991
SWEDEN	20.11.1991	20.11.1991
UNITED KINGDOM	18.9.1991	18.9.1991

The overall value is ECU 800 000 (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

The corrosion of steel reinforcement and other metals in contact with concrete is a technical problem common to all European countries. Much work has been done in the past to determine the ways in which corrosion occurs and how it advances, on the effects of the concrete, methods of reducing the risk of progressive corrosion and techniques for repair. The damage caused by corrosion can be high, both in terms of reduced safety to individuals and in the cost of effective and durable repairs or replacements.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

In the United Kingdom alone and as long ago as the early 1970s the cost of metal corrosion to the building and construction industry was estimated at UKL 250 million per annum with the cost of protective measures amounting to some 1 to 15% of the contract price of the structure. Much of the cost is necessitated by the premature deterioration of reinforcing steel with the cost of repair being currently estimated in billions of ECUs for Europe as a whole but significant costs also arise because of the deterioration of other metals.

This high cost has resulted in considerable expenditure on research over many years and was addressed in the now completed COST Project 502 on 'Corrosion in the construction industry'. However, despite continued effort, the deterioration has continued and many questions remain unanswered. Whilst many laboratories in Europe are involved in research on the performance of metals in concrete, each laboratory has tended to develop a particular expertise in one or more aspects of the overall subject; for example: on chloride ion penetration, or repair of deteriorated concrete, or coatings to minimize carbonation of concrete. Coordinated effort with other laboratories, also engaged on studies within the same area, is likely to increase the chances of reaching conclusions of practical value in a relatively short time. Such collaboration will ensure that practitioners are made aware of the technical studies (and so find a succesful application of the results with the minimum of delay), and will provide a means of disseminating information as quickly as possible and a forum of expert opinion where ideas can be put forward and critically assessed. It will also ensure that there is a minimum duplication of effort reducing the overall cost of research and it will be possible to achive a consensus view on the way to develop acceptable methods of dealing with a particular problem, which is particularly important for agreements on codes of practice and setting standards.

In such a broad field as metal corrosion, it is essential that working partners are engaged on individual projects within a relatively narrow subject area. This ensures that effort is properly focused. Such subject areas include the performance of coatings, repair systems, assessment of concrete quality, electrochemically-based methods for maintenance and restoration, corrosion-rate monitoring, design and service life prediction and pre-stressing steels.

2. Scope of the project and general programme of work

The project seeks to establish solutions to reduce and, where possible, to eliminate the corrosion of metals within or in contact with concrete. For example, the alkalinity of fresh concrete, while providing protection to embedded steel, has an adverse effect on aluminium, aluminium alloys, zinc and zinc-based alloys in contact with it. Protection of reinforcing steel may be lost by reduction of the alkalinity by cabonation of the concrete from the carbon dioxide in the atmosphere while chlorides, from marine sources or from road de-icing salts, have a particularly damaging effect if they penetrate to the level of the reinforcement. It will be necessary to investigate the corrosion mechanism and influencing factors, methods of protection and ways of rectifying damage already caused. Technology transfer should be properly addressed during the COST initiative as well as the importance of design, specification and manufacture to actual performance.

It is proposed therefore that the general objectives of the programme should be to:

(a) reduce the costly repair and maintenance of concrete structures where metals within or in contact with the concrete have deteriorated;

(b) identify questions to which there are no generally accepted answers;

(c) achieve a consensus view on the most favourable experimental approaches and the parameters which have to be taken into account to find effective solutions to the corrosion of metals in concrete;

(d) increase awareness of the corrosion of metals in concrete and, by collaboration, to achieve a unified approach to developing economical and techically acceptable solutions to the problems which arise.

A specific objective is to establish a coordinated framework to develop a better understanding of the corrosion and corrosion protection mechanisms by:

(a) the derivation of models for the corrosion and protection processes (including the associated transport phenomena)

(b) the achievement of a consensus view on the validity of test methods and criteria for assessment.

This will entail consideration of the following topics:

(i) electrochemical phenomena, including *in situ* monitoring of corrosion in new and existing structures, non-destructive testing techniques, criteria for cathodic protection, chloride removal and realkaliation of carbonated concrete;

(ii) assessment of concrete, including assessment of concrete quality, migration of ions into and within the concrete, semi-dry concrete pore water composition, use of corrosion inhibitors in concrete and coatings on concrete;

(iii) corrosion protection of reinforcement, including metal coatings on rebars, organic coatings on rebars and stainless steel rebars;

(iv) repair of deteriorated concrete, including patch repairs and coatings on concrete;

(v) pre-stressing steels, including electrochemistry and protection of tendons in ducts and hydrogen embrittlement of high tensile steel.

Memorandum of Understanding for the implementation of a European research project on advanced materials for temperatures above 1 500°C – Development of testing methods

(COST Project 510)[1]

Date of entry into force of the project: 23.6.1992
Duration: 22.5.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	18.6.1992	18.6.1992
GERMANY	18.6.1992	18.6.1992
ITALY	23.6.1992	23.6.1992
UNITED KINGDOM	18.6.1992	18.6.1992

The overall value is ECU 9 to 12 million (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

1.1. Background

For the realization of new technical projects and for improving available techniques as well, high-temperature resistant materials and protecting systems are needed to an increasing extent. Examples for typical applications include:

- hot structures of spacecraft and hypersonic aircraft,
- advanced gas turbines,
- rocket engines,
- fusion reactors,
- magneto-hydrodynamic power units,
- solar power plants,
- advanced internal combustion engines,
- waste incinerators.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

To fulfil the needs for such applications, new materials and protecting systems are being developed or existing materials are being improved. For proving the applicability and for assessing the necessary design data, extensive tests have to be carried out. Since most of the mechanical or physical properties depend on the temperatures, testing at realistic service temperature is a basic necessity. For most applications, the influence of other environmental factors, such as type of medium and atmospheric pressure, also has to be considered, especially when investigating the chemical interactions and the behaviour of protecting systems.

Testing at temperatures up to about 1 000°C can be considered, more or less, as a routine task. At higher temperature, however, testing (including measuring) is difficult and becomes more and more difficult the higher the temperature. For temperatures above approximately 1 500°C, the testing and measuring techniques available at present are not sufficient for evaluating all necessary data to satisfy quality and reliability requirements. Testing and measuring equipment, testing techniques or procedures and measuring methods have to be improved, and even new developments will be necessary in some cases. This development work is considered an urgent prerequisite in order to accelerate progress in the development of advanced materials as well as in their more widespread use.

From today's point of view the following types of materials provide promising properties for high-temperature application and are therefore considered as high-temperature resistant, structural materials for the application mentioned above:

- refractory metals,
- monolithic ceramics,
- CMCs (ceramic matrix composites),
- (reinforced) intermetallics.

Some basic requirements for testing these materials at high temperatures are common for all types of materials, but, besides that, the different nature of the materials also requires different test methods to be developed with regard to the specific materials'characteristics.

1.2. Current status

There is not too much known and very litte published about characterization and testing of advanced materials at temperatures above 1 500°C, except for special experimental boundary conditions.

The state of the art in basic requirements for evaluating mechanical high-temperature properties can be described, as an example and in a simplified manner, as follows.

(a) Measuring temperatures with thermocouples and pyrometers up to approximately 1 500°C is state of the art. However, accurate, stable and reliable systems for measuring temperatures above 1 500°C and appropriate calibration systems still have to be developed.

(b) Heating techniques for application in vacuum or inert gas are available up to approximately 3 000°C, and in oxidizing atmospheres up to approximately 1 700°C. Systems for temperatures above 1 700°C for oxidizing atmospheres are missing. Special systems for high gradients and transients are also to be developed.

(c) Systems for load application (grips) are available only for limited duties and temperatures. However, amongst others, systems for the basic loading modes (tension, compression, shear, bending and tension compression) are still not generally available in the proposed field of research.

(d) There are contracting systems for measuring strain and elongation (extensometry) up to approximately 1 600°C and non-contracting systems for limited duties. For higher

temperatures there is a dearth of precise and reliable systems, for both contracting and non-contracting systems. As a first step, systems for use of up to 2 000°C are to be developed.

There are several isolated (in contrast to concerted) national and European activities in the field of development of advanced materials for extremely high temperatures. There are also some plans for manufacturing and testing components, e.g. for the reusable space vehicles (Hermes, HOTOL, Sänger). However, there is no concerted action on the development of test methods for advanced materials for temperatures above 1 500°C. This proposed research work is thus complementary to national and European activities in the research and development of high-temperature resistant materials.

1.3. Reasons for a European programme and for the incorporation into the COST framework

Successful research in this challenging field is dependent on new ideas, concentrated individual efforts and most importantly effective interdisciplinary collaboration between European partners in well-defined areas of activity, and requires a concerted effort of experts from research institutes, testing laboratories and industrial companies (materials producers and users).

Furthermore, experts from manufacturers of high-temperature testing equipment should be involved in this research from the beginning, not least to assist the later widespread use of the test methods to be developed. Concerted European action will facilitate an international consensus on the application of the jointly developed test methods.

Concerted European action is also required because of the high expenses associated with experimental work with such a degree of difficulty. All this excludes an approach by one organization or country.

The framework of COST has proven to be very attractive for more than a dozen COST member States to cooperate succesfully for many years in concerted actions in materials development and materials testing development for temperatures around 1 000°C (COST 50, 501 and 505). The proposed new project complements in an ideal manner these related activities.

2. Objectives

2.1. Main objectives

The main objective of the programme is to develop high-temperature (HT) testing and measuring techniques to promote the application of advanced materials at extremely high temperatures and to improve the reliability of structures operating at such temperatures.

The programme encourages the development of new technologies including construction techniques of facilities and structures for high temperatures as well as high-temperature processing facilities with special regard to energy use and environmental considerations. Further benefits result from improved European industrial competitiveness in the field of high-temperature materials production and use and testing equipment manufacturing. It is worthwile mentioning that, in particular, the area of application of materials at very high temperatures is dominated by the USA and that Japan is making extensive efforts to develop new HT resistant materials. The results achieved so far are often treated as confidential and are not accessible.

2.2. Specific objectives

Specific objectives are to develop or improve:

(i) testing and measuring methods (theoretical and experimental, destructive and non-destructive);

(ii) test procedures;

(iii) testing and measuring equipment, etc. for the evaluation of mechanical, thermo-mechanical, physical and chemical properties,

in order to meet the requirements for materials processing, for component design and manufacturing, for quality assurance, and for modelling and calculation.

3. Content

3.1. Requirements

Efforts will be concentrated on the specific requirements for characterizing the advanced high-temperature structural materials mentioned above, in uncoated and coated condition.

The following test requirements are the same for all types of test materials covering the range from short to extended test times:

(i) accurate determination and well-defined distribution of temperature and stress/strain;

(ii) defined, conditioned environment.

A variety of problems which have not yet been solved or only solved up to a certain limiting temperature derive from these requirements. Basic problems are associated with the following items:

- temperature measurement/calibration;
- heating techniques;
- load application, specimen fixtures or grips;
- extensometry;
- techniques for characterization of behaviour of materials and coatings, and failure criteria;
- upscaling to real service conditions concerning size of specimen/component, loading (multiaxial loading, load sequence), environmental conditions, etc.

The research and development work concerning the above items has to take into account the complex interactions between different problems; an integrated approach is therefore required.

In addition, the individual, characteristic behaviour of the different types of materials requires the development of specific different test methods, specimen shapes, grips, models for the material's behaviour and life prediction, etc.

3.2. General working plan: priorities

The field of problems described above is considered as too wide for it to be covered completely by one COST project. Therefore it may be necessary to define and establish priorities in a general working plan. The following subjects are proposed for priority treatment.

Load application

Development of grips and load-introducing parts for loading specimens and components of the relevant HT materials in tension, compression, bending, shear and tension compression. Specific problems:

(a) Design:

- gripping system,
- activation system,
- temperature distribution,

(b) Material for hot parts:

- HT strength,
- resistance to environment,
- compatibility with the test material.

Measuring techniques

Development and testing of methods for measuring:

- strain and displacement (extensometry),
- temperature.

Common problems for contacting measuring systems:

- adaptation,
- HT resistance,
- compatibility with test material,
- resistance to environment,
- long-term stability.

Common problems for non-contacting measuring systems:

- contrast,
- reflection,
- resolution,
- disturbance by mechanical vibration, optical, electrical and magnetic effects.

Heating techniques

Development and testing of heating systems. Specific problems:

- oxidation resistance,
- temperature gradients and transients, and stability,
- compatibility,
- shape and dimensions.

Development and evaluation of test procedures for mechanical HT tests: tensile, compression, bending, shear tests, reversed tensile compression loading, etc. Specific problems:

- shape of specimen (material specific),
- fixation,
- type of loading,
- test assembly,
- procedure for heating and loading, etc.

4. Organization

Three years appear to be appropriate for a first round when concentrating on high-priority, medium-risk R&D topics. A following round might be necessary due to the complexity of the R&D problems. There are R&D topics which, although they seem to be too risky today, may still be very important tomorrow.

The total effort is estimated at 30 to 40 man-years per year (up to 120 man-years over the three-year period).

The total cost of the project is estimated at ECU 9 to 12 million over three years.

The invitation to take part in the proposed project is directed both at industrial companies (materials producers and appliers, manufacturers of testing and measuring equipment) and of research and testing institutes. Present contacts show a genuine and widespread interest in the proposed project.

The project will be divided in several groups, each organized by a coordinator. The groups will be defined according to appropriate technical/scientific fields of activity, for example:

- load application,
- measuring techniques,
- heating techniques,
- test procedures.

The final definition depends on the actual number of participants and on the content of the individual proposals. Annual progress meetings will be mandatory, complemented, of course, by workshops and informal meetings.

Memorandum of Understanding for the implementation of a European research project on the interaction of microbial systems with industrial materials

(COST Project 511)[1]

Date of entry into force of the project: 22.5.1992
Duration: 21.5.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	30.4.1992	30.4.1992
GERMANY	24.6.1992	24.6.1992
SPAIN	7.10.1992	7.10.1992
FRANCE	9.12.1992	9.12.1992
ITALY	24.6.1992	24.6.1992
SWITZERLAND	22.5.1992	22.5.1992
FINLAND	30.4.1992	30.4.1992
SWEDEN	8.12.1992	8.12.1992
UNITED KINGDOM	30.4.1992	30.4.1992

The overall value is ECU 9 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

The growth of biofilms is observed in all solid materials in contact with water or moisture. A biofilm consists of one or several layers of cells together with extracellular polymer materials, inclusions of solid materials and water. A biofilm usually develops from a chemical or physical interaction with the substrate which may lead to a change of properties of the industrial material and which may influence technical processes. These interactions concern metals and ceramics as well as polymers and may be advantageous or disadvantageous. Negative influences are, for example, corrosion and fouling of industrial materials and components, leading, for example, to the reduction of heat transfer in heat exchanges. Positive influences are, for example, microbial supported processes in ore refining (leaching), in fermentation processes (pharmaceutical industry) as well as in

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

conditioning of ceramic powders for the porcelain industry. This short description already reveals the great importance of biofilm-affected surfaces in practice.

Research on biofilms started in the mid-1970s and has subsequently been particularly fostered by microbiologists. On the other hand, materials experts and physical chemists have shown increasing interest in microbially induced corrosion. Both disciplines are brought together in this COST project. COST has proved to be succesful with respect to concerted international materials projects. The necessary interdisciplinary attempt in this new project is a challenge for COST.

In Germany, only a few research groups are dealing with the problems of biofilms. An appreciable amount of work is being done in the Netherlands and Belgium, mainly on the basic principles of adhesion to surfaces. In France there is a group which is well equipped for biofilm studies. Work in Great Britain and Northern Europe is mainly focused on offshore metal corrosion and on detrimental processes in the pulp and paper industry. In contrast to these isolated European activities, intensive work is being done in the USA, Canada, Australia, Japan and even South America (mainly Brazil and Argentina).

An introduction to the R&D topics of this project is given in the *Proceedings of the Federation of European Microbiological Societies Symposium 'Microbiology and civil engineering'* edited by P. Howsam, 1990, E. & F.N., Spon, University Press, Cambridge, United Kingdom, and in the Dechema-Study, *Mikrobielle Materialzerstörung und Materialschutz, 1989,* Dechema Verlag, Frankfurt-on-Main, Germany.

At the moment there are no Community R&D activities in the field of this project. The 'umbrella' project Eurocare within the Eureka initiative focuses on the conservation of art treasures and cultural monuments (paintings, sculpture, etc.). In addition to many other harmful environmental influences, the microbial influence is also investigated in this context.

Synergisms between COST and Eurocare are nevertheless looked for by the personal involvement of experts in both activities.

B. Scope of the project and general programme of work

The scope of the project – the vast field of biofilm interaction with industrial materials surfaces – has to be concentrated on only a few focal points: the development or further development of appropriate methods in order to better characterize biofilms; their interaction with biocides and materials surfaces; the improvement of knowledge on the surface accumulation of micro-organisms, and on their adhesion and aggregation into biofilms; and on the structure and function of biofilms in order to better understand and be able to influence their interaction with their environment and in particular industrial materials including their protection. The affected materials include powders, particles, fibres, porous and dense materials, filters, membranes, etc.

The following topics are excluded from the project because a limitation of topics is necessary and because they are already the subject of national or international research: leaching processes of ore refining, biodegradation of waste, biofilm interaction with copper surfaces and the use of micro-organisms in the fermentation or pharmaceutical industry.

The following topics have to be considered:

(i) the generation of artificial biofilms as model systems with well-defined microbiological and physico-chemical properties, which permit investigation of the processes in a laboratory;

(ii) the development of new concepts, mathematical models, improved characterization and testing models as well as devices (experimental set-ups) for better understanding of the ensuing reactions with respect to artificial as well as natural biofilms;

(iii) the use of advance methods common in surface chemistry and physics also for failure analysis and for characterization of the affected materials surfaces;

(iv) the development of specific protection technologies for metals, ceramics and polymers;

(v) the avoidance of environmental damage through increased use of biocides;

(vi) the development of technical specifications and international standards.

C. Organization of the project

Three years appear to be appropriate for a first round when concentrating on basic R&D problems. If one starts with an estimate of 30 man-years per year, the total cost of the project would amount to ECU 9 million over three years. A further round might be necessary due to the complexity of the R&D problems.

Effective coordination of the work preformed in different scientific and enginering disciplines in science and industry is to be foreseen. In spite of the fundamental research character of this project, an appreciable of industrial participation should be assured.

There is an effective management structure in other materials projects, for example to the subdivision of a project into subgroups or work packages covering related tropics of joint international projects and guided by a technical coordinator, which has proved its worth and should be taken into account. The publication of final reports as well as the presentation and discussion of results in a status seminar at the end of the first round be maintained.

Memorandum of Understanding for the implementation of a European research project on the topic of pesticides, soil and environment

(COST Project 66)[1]

Date of entry into force of the project: 7.10.1992
Duration: 6.10.1997

Contracting parties	Date of signing	Date of entry into force
CZECHOSLOVAKIA	7.10.1992	7.10.1992
NORWAY	7.10.1992	7.10.1992
SWITZERLAND	7.10.1992	7.10.1992
UNITED KINGDOM	7.10.1992	7.10.1992

The overall value ECU is 60 000 (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

1.1. Why a COST Project on this topic?

The soil ecosystem finally receives most of the plant protection products, whatever their pattern of use. Both the fate of these products in the soil and their dispersion in the environment mainly depend on the characteristics and the overall functioning of this ecosystem, and determine the risks of dispersion in the environment. These risks increase in proportion to the toxicity of the pesticide involved, its application frequency and dosage, and its persistence and mobility in soil.

Since soil plays such a part as the main entrance of pesticides into the environment, it appears indispensable to elaborate and coordinate a European research programme into the fate of pesticides in the soil and the environment. Moreover, as the systems investigated become more and more complex, it is obvious that close collaboration and the use of large and expensive equipment in European research centres become a necessity.

This research requires a real multidisciplinary basis since many scientific fields are involved. The creation of a network through a COST proposal will attempt to realize this scientific goal on a European scale. This proposal will mostly include applied research

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

objectives since the latter (European cooperation) is the ultimate basis for help in decision-making and setting rules. However close links with fundamental research through long-term projects will be maintained.

The research topic of the proposed project includes three major scientific fields for which state-of-the-art knowledge and possible research approaches are described in the following sections. They are:

- degradation, essentially by soil micro-organisms;
- adsorption/desorption by soil components;
- transport (run-off and leaching).

The related research, both in the laboratory and in the natural environment, requires expertise especially in analytical chemistry for determining amounts of residues in soils. Therefore, the scientific programme divides into five subunits, all of which are directly or indirectly interrelated. Furthermore, the programme is open for additional initiatives:

- degradation of pesticides in the soil (including soil micro-organisms);
- adsorption/desorption of pesticides in the soil;
- transport of pesticides in the soil;
- mathematic modelling;
- experimental approach under natural conditions.

1.2. Relationships with other European programmes

Because the present project is an open project, it is planned to work in close collaboration with any national and international organizations which are concerned with the environmental fate of pesticides. Basically, the objective is not to set up a completely new structure but, on the contrary, to bring together the existing means and skills which the concerned organizations will be able to use.

Some activities of this COST project should be coordinated with the work of the Joint panel of the Council of Europe and the European Plant Protection Organization (CoE/EPPO Panel of Experts on Environmental Risk Assessment) to support harmonization of the registration requirements, the technical guidelines and the registration schemes to be used by the European governments.

Links should also be established to COST Project 810 concerning the investigations of side-effects of plant protection products on mycorhizal fungi and their impact on improved degradation.

2. Objectives

Four workshops have already been held before this new project was proposed. Several research organizations, namely INRA (France) in 1988, the Departmento de Quimica Agricola of Alicante University (Spain) in 1989, GSF (Germany) in 1990 and the Instituto per lo Studio del Suolo di Firenze and the University of Rome (Italy), have thus already provided considerable support for the organization of scientific workshops and the publication of their proceedings. The debates which took place during these workshops have led to clarification of our major objectives for research and cooperation. The COST proposal reflects a real will to set up thorough and regular scientific cooperation especially through the organization of workshops in the near future.

2.1. Main objectives

The main objectives of the project will be to:

(a) bring together European laboratories which intend to cooperate in investigating the topic of pesticides, soil and environment by research on both the consequences of using pesticides in crops and the ecotoxicological problems resulting from the dispersion of pesticides in the environment;

(b) set up a programme for scientific research and exchange aiming to study the physicochemical and biological processes which control the fate of pesticides in soil and their dispersion in the environment;

(c) develop and improve those laboratory and field methods which are essential for predicting and assessing the hazards involved in the qualitative and quantitative transfer of the active ingredients and their metabolites to aquatic environments.

2.2. Secondary objectives

The secondary objectives are as follows:

(a) to set up an operational network or expertise (representative soils, standard methods, databases, etc.) and means committed to this research topic, thus making it possible to investigate the diversity of agricultural, soil and climate conditions in Europe. Numerous partners, such as public services, universities and industries, could make requests to members of such a network;

(b) to contribute to defining and bringing into line European regulations that would include the requirements for optimum equilibrium between the use of toxic products in agriculture and the necessary protection of man and the environment;

(c) to draw up a yearbook of member laboratories, listing their addresses, research potential for this particular topic, and those features they would preferentially investigate in cooperation with other European partners. Such a yearbook should be of use to all the public services, professional organizations and industries that are faced with the problems in relation to the fate of agricultural pesticides.

3. Content of the project

DEGRADATION OF PESTICIDES IN SOIL AND WATER BODIES

The soil is an ecosystem which is endowed with high degradation potential because it contains numerous micro-organisms. Biodegradation is due to the activity and diversity of the soil microflora. All the parameters such as temperature, water content and soil composition that act on the growth and functioning of the soil microflora affect biodegradation. Abiotic degradation may result from decomposition by the sunlight or the catalytic breakdown at the surface of clays and organic matter. These processes, mainly microbiological, contribute to decreasing the amount of soil residues, thus limiting the pollution of soils, plants and both surface and ground waters.

In each country, laboratory experiments are carried out to estimate the degradation rates (half-life) of the active ingredients (and relevant metabolites), and the degradation pathways, in soil and surface waters, both in abiotic (e.g. photochemistry is studied in Germany) and biological conditions. Photolysis at the soil surface, but especially in water, can widely differ according to the characteristics of the medium. The significance of this process which can contribute to pesticide degradation must also be assessed. In addition, the following must be considered:

- studies concerning residues of pesticides trapped by SOM; these studies aim at updating the concept of non-extractable ('bound') residues, and explaining their nature in terms of chemicals and physical interactions, and of resistance to (bio)degradation;

- study of the interactions between pesticides and soil microflora;
- degradation in aquatic systems (water and sediments);
- bound residues.

ADSORPTION/DESORPTION OF PESTICIDES IN THE SOIL

The adsorption/desorption phenomena have an effect upon the behaviour of pesticides in soils: an adsorbed molecule is neither in the aquaeous phase nor in the gaseous phase. Thus, it is not:

- bio-available, so its biological effects are diminished;
- degraded by the soil micro-organisms, so its persistence is increased;
- carried away by water movement in soil, so the risks of water pollution are reduced... (the compound may however be transported by run-off).

When it desorbs, the molecule becomes bio-available again, and it may be degraded and carried away by leaching or run-off.

Laboratory experiments will be carried out to:

(a) assess the amount of active ingredient adsorbed by the soil (adsorption isotherms);

(b) estimate adsorption and desorption velocities;

(c) study the adsorption mechanisms of pesticides on clay minerals (Spain), on humic materials, as well as on clay-humic complexes. Irreversible adsorption that can occur on such absorbents is also related to studies on bound residues in soils.

TRANSPORT OF PESTICIDES IN THE SOIL

Run-off generally occurs in particular situations, depending on the slope of the soil, the rainfall characteristics (intensity, time elapsed between treatment and the rainfall that induces run-off), the structural stability of the soil, the agricultural practices and the crop cover. Run-off, whether in solution or in suspension (crystallized compounds or molecules adsorbed on suspended soil sediments), also depends upon the water solubility of the compounds and their adsorption by the soil components.

Run-off is very irregular, and markedly reduced in crop-covered soils. It contributes to the pollution of surface waters and sediments.

Field run-off studies will be carried out, and computer simulation models will often be used (see below).

Leaching can vary widely according to the compound, to soil and climate conditions and to the agricultural practices. it may control the efficiency of the application according to the distribution of the active ingredient in the soil. Transfer from the soil surface or profile contributes to the pollution of surface and ground waters. Laboratory and field experiments are carried out to determine the vertical distribution of agrochemicals in the soil profile and to assess the risk of leaching towards ground water.

The transport of adsorbed pesticides associated with removal of colloidal particules and particules fluxes will also be assessed.

BASIC EXPERIMENTAL METHODS

In the laboratory the two basic methods, soil column and soil thin-layer chromatography, have a fundamental analogy with conventional chromatography in that they allow a direct measurement of leaching. Soil columns are used in most of the participating countries.

Outdoor experiments, with devices of different levels of complexity, will be carried out, such as:

- microlysimeters and lysimeters;
- field experiments, involving agricultural practices with monitoring of run-off and drainage waters, over several years;
- fate in aquatic systems.

MODELLING

Only a small number of the different situations can be covered by laboratory and field experiments. Thus, computer modelling is generally used to estimate the likely variability in behaviour. During the past years different models have been developed to evaluate just one dissipation phenomenon, whereas others take into account the roles and the interactions between several phenomena.

Other studies are proposed by Austria and the former Czechoslovakia (general studies on the environmental fate of pesticides) and Croatia and Slovenia on the genotoxicity of pesticides.

Evaluation of progress

Brief annual reports will be written by the participating scientists, describing their results obtained through this concerted action. The proceedings of the next workshops will contain papers on the results obtained to inform the non-participating scientists; the next (fifth) workshop will be organized in Belgium in 1993.

4. Schedule

A five-year programme is proposed for each of the subprojects described above. The schedule will be the following:

(i) setting up a management panel composed of delegates from various participating research teams;

(ii) carrying out a detailed inventory of ongoing research and existing research programmes in all the participating countries before starting joint projects; this will result in a document;

(iii) implementing research programmes based on the use of common and standardized laboratory methods and field trials;

(iv) gathering and disseminating the results obtained through an internal newsletter;

(v) exchanging students and scientists;

(vi) organizing further workshops regularly. In April 1993, the fifth workshop will be organized in Belgium, and the international organizations will be invited as observers. During the workshop this document will be discussed, and joint collaborative projects decided. An intermediate progress report should be prepared in 1994 for review by the COST Technical Committee.

5. Economics and financial matters

5.1. Research efforts

Setting out a COST research project on the topic of pesticides, soil, and environment should allow the abovementioned objectives to be met, thus leading to precise determination of how widely the behaviour of pesticides in soil may vary with the agricultural, soil and climate conditions occurring in various European countries and to assess environmental hazards.

Firstly, an agreement must be reached on the subprojects which will take into account the research proposed in COST Scheme No 2. Then, as a first step, the interest of the existing methodology will be tested throughout Europe and representative soils will be chosen. Such a list of representative soils will be very useful for the Community and for industry to assess the fate of pesticides in soil. As a second step we will be able to study the variation of the behaviour of the pesticides in all member countries, while research programmes could start. In the near future we will examine how the methodology may be useful for foreign countries, in Africa for example.

An estimation, on the basis of ECU 60 000 per man-year, could be made when we know how many people will be involved in the research programmes.

5.2. Coordination costs

Research costs will be taken over by the participating countries according to their respective involvement.

Memorandum of understanding for the implementation of a European research project on impact of elevated CO_2 levels, climate change and air pollutants on tree physiology (ICAT)

(COST Project 614)[1]

Date of entry into force of the project: 18.9.1991
Duration: 17.9.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1991	16.1.1991
CZECHOSLOVAKIA	23.12.1992	23.12.1992
GERMANY	18.9.1991	18.1.1991
SPAIN	26.2.1992	26.2.1992
FRANCE	6.2.1992	6.2.1992
IRELAND	18.9.1991	18.1.1991
ITALY	11.12.1991	11.12.1991
NETHERLANDS	18.9.1991	18.1.1991
NORWAY	2.10.1991	2.10.1991
PORTUGAL	12.3.1992	12.3.1992
SWITZERLAND	13.3.1992	13.3.1992
FINLAND	18.9.1991	18.1.1991
SWEDEN	20.11.1991	20.11.1991
UNITED KINGDOM	18.9.1991	18.1.1991

The overall value is ECU 10 million (in 1991 terms).

ANNEX II

General description of the project

I. Introduction

Human activities have resulted and will continue to result in a dramatic increased CO_2 level within the next decades and have resulted in enhanced levels of various atmospheric trace gases (e.g. SO_2, NO_x, N_2O, O_3, NH_3 and CH_4).

Elevated CO_2 levels and gaseous pollutants may directly or indirectly affect growth of both terrestrial and aquatic plant species. In addition, enhanced atmospheric levels of

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

CO_2, N_2O and CH_4 also will result in a global climate change (an increase in temperature, altered precipitation patterns) which will affect plant ecosystems, forestry and agriculture. Natural populations of plant species will partially have the ability to adapt to a relatively fast-changing atmosphere and altered climatic conditions by ecotypic differentiation through selection. However the significance of this adaptation depends on the genetic variation within the population and the length of the plant life cycle. In plants with a long life cycle, such as trees, ecotypic differentiation will be slow and will hardly have an adaptive value. Here the availability of phenotypic plasticity will be the important factor in the adaptation and survival of the species in a relatively fast-changing atmosphere.

Forest is the major vegetation type on earth: it covers a major part of the earth's surface area and it accounts for more than 90% of the terrestrial biomass. However, the greater part of the current research on the physiological effects of elevated CO_2 levels and air pollutants is traditionally focused on quick-growing herbaceous plants. The impact of these environmental factors may be quite significant for the fitness of forests and tree vegetations and for commercial wood production. For these reasons, the research on the effects of elevated CO_2 levels, climate change and air pollutants on tree physiology needs to be intensified. In addition, the interactive effects of a changing atmosphere and an altered climate on tree physiology need to have a very high priority in research as well as environmental impact.

II. Objectives

The primary aim of the project is to coordinate cooperative European research on the impact of the so-called greenhouse effect (elevated CO_2 levels, climate change) and air pollutants and its combination on trees functioning in the different European climate regions.

The project proposed has the following research objectives:

1. Tree functioning and adaptation

To promote, integrate and intensify cooperative interdisciplinary research on the impact of a combination of elevated CO_2 levels, the consequences of an altered climate (drought, temperature stress) and a polluted atmosphere (also in the various combinations) on the physiological functioning and phenotypic plasticity of trees. To expand the present knowledge of the impact of multiple environmental stress factors on the biophysics, biochemistry and physiology of trees.

2. Forests

To assess the role of forests as a sink for CO_2. To develop a system analysis for the forests of the various European regions in which the effects of combinations of elevated CO_2 levels and air pollutants on forest functioning can be simulated.

3. Forest fitness and wood production

To obtain parameters which will be essential in the modelling and prediction of the consequences of the greenhouse effect on forest fitness and commercial wood production in general.

III. Project procedures

The proposed objectives are to be achieved over a five-year period as follows:

(a) formation of a committee composed of one delegate from each participating research group;

(b) appointment of a researcher and secretary to coordinate the project, to collect and to communicate the data of the participating research groups and to publish a project newsletter;

(c) organization of regular meetings and workshops, to rotate between the participating countries;

(d) exchange of the research results, materials and methods;

(e) integration of research of the participating research groups;

(f) setting-up of joint standardized climate-controlled exposure facilities for trees;

(g) exchange of Ph.D. students, postgraduates and senior scientists between the participating research groups.

IV. Financing

Funding for the research activities should be provided by both European fund agencies and national programmes of the participating countries.

Memorandum of Understanding for the implementation of a European research project on optimizing the design and operation of biological wastewater treatment plants through the use of computer programmes based on a dynamic modelling of the process

(COST Project 682)[1]

Date of entry into force of the project: 6.2.1992
Duration: 5.2.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	6.2.1992	6.2.1992
DENMARK	7.10.1992	7.10.1992
SPAIN	6.2.1992	6.2.1992
FRANCE	6.2.1992	6.2.1992
ITALY	4.11.1992	4.11.1992
NORWAY	25.9.1992	25.9.1992
SWITZERLAND	13.3.1992	13.3.1992
FINLAND	6.2.1992	6.2.1992
SWEDEN	6.2.1992	6.2.1992

The overall value is ECU 4 million (in 1991 terms).

ANNEX II

General description of the project

Introduction

Computer simulation programmes are being used to optimize the design and operation of plants for the biological treatment of wastes. This kind of software provides a solution to the dynamic mathematical models describing the biochemical processes. The usefulness of the software depends on the predictive ability of the models, i.e. on the model structure, on the calibration accuracy and on the validation reliability.

As activated sludge (AS) and bioflims are the aerobic biochemical processes most commonly employed in large-scale wastewater treatment facilities, the abovementioned computer programmes are being applied to them.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

Most of the researchers in the abovementioned fields recognize the need to improve the models, their calibration and validation methods and the mathematical methods dealing with the process control.

The improvement of AS model structure is being carried out by introducing new concepts and more complex configurations into the existing AS models. Nevertheless, some phenomena and their corresponding theoretical descriptions still need to be incorporated into the latest models.

A sound, comprehensive mathematical methodology is required for the purposes of establishing process control strategies as well as calibration and validation. The calculation of AS model stoichiometric and kinetic coefficients (calibration) is normally carried out through specific experiments on a bench or pilot scale. Sometimes these experiments produce unrealistic values as test conditions differ from the conditions at full-scale plants. Validation, on the other hand, is achieved by comparing tests with computer simulations by using constant values for the model coefficients. It is known that some coefficients vary with the state of the AS system due to microbial population phenomena, configuration and plant operation. Accordingly, optimizing design and operation methods based on computer simulations that use constant coefficients can lead to unreliable predictions.

Objectives

The overall objective of the new COST project is to improve the structure of the existing AS models and the mathematical methodology for their calibration, validation and use in the process control.

First objective

Improving the structure of the mechanistic dynamic models of the AS process.

It is understood that the following phenomena are to be incorporated into the existing AS models:

- phosphorus removal;
- a better characterization of substrate;
- accumulation of readily biodegradable substrate because of its importance in oxic and anoxic selectors;
- population dynamics; foaming or bulking; better AS characterization;
- changes in kinetics by metals and toxic compounds (inhibition of micro-organisms) or by changes in wastewater composition;
- relationships between state variables of AS and sludge-settling characteristics/floc properties;
- dynamic behaviour of thickening and clarification in the secondary settler; bioflocculation and filtration-like phenomena.

Second objective

Improving the calibration and validation procedures, together with the mathematical methodology for the online identification of the AS state variables and the stoichiometric and kinetic coefficients, each of which is a function of time.

The second objective can be divided into three parts:

(i) designing methods simpler than the existing ones for the calculation of model coefficients following the actual trends;

(ii) developing advanced mathematical methods for online identification of measurable and non-measurable state variables and for the estimation of time-varying coefficients from experimental online measurements. This is directly aimed at improving AS models;

(iii) developing online identification methods by simplifying the model and moving towards adaptive control of the AS process.

Specific conditions in this research

This research project is expected to last three years.

Each of the eight research groups involved in this project has developed its own methodologies after working on the topic for years. As the scope and topics of the proposed project are so broad it would seem appropriate to set the specific conditions of the overall work when the project goes ahead. They would be defined so that the participants could interchange results and conclusions.

Some of the conditions are:

- scale of the tests (laboratory, pilot or full scale) and plant configuration;
- type of operational conditions in the tests;
- chemical analysis methods/online measurement sensors;
- mathematics on state estimation; system identification.

In the first stages of the project, the AS process will be considered. The research might expand to biofilms later on.

Initially, sewage wastewater will be used and the subsequent introduction of industrial wastewaters into the project will be considered.

This project could also serve to promote the use of biodegradation models (for teaching purposes) at university level in addition to their practical applicatons.

Final remarks

The project has a double research line. On the one hand, it is a systematic search to improve biodegradation models by enabling us to check new characterization methods and to prove the new concepts and hypotheses introduced into the models. On the other hand, it aims towards the adaptive control of these kinds of processes.

The work programme must be as flexible as possible because each group is already working on the topic and the model requirements for design are different from those for operation and control.

A team of researchers specialized in chemistry, microbiology, engineering and mathematics is needed for this project. Researchers from these fields, covering all the topics included in the new project, are at present involved in it, thus promoting research networking in this area.

Memorandum of Understanding for the implementation of a European research project on advanced radar systems

(COST Project 75)[1]

Date of entry into force of the project: 29.10.1992
Duration: 28.10.1997

Contracting parties	Date of signing	Date of entry into force
CZECHOSLOVAKIA	11.12.1992	11.12.1992
GERMANY	7.10.1992	7.10.1992
SPAIN	29.10.1992	29.10.1992
HUNGARY	11.12.1992	11.12.1992
SWITZERLAND	7.10.1992	7.10.1992
FINLAND	30.10.1992	30.10.1992
UNITED KINGDOM	7.10.1992	7.10.1992

The overall value is ECU 20 million (in 1991 terms).

ANNEX II

General description of the project

1. General background

Over the last 10 years there has been a rapid increase in the deployment, by national meteorological services, of digital weather radar systems throughout Western Europe. Many of these radars form integrated networks producing precipitation-based products which are distributed in near real time to a variety of users.

The work undertaken within COST Project 73 has provided a foundation upon which the operational exchange of radar data between European countries can be established. Outline software systems to accomplish radar networking and data display have been prepared and extensions to the BUFR-94 communications code to accommodate radar information have been proposed and accepted by the World Meteorological Organization. In addition, a training curriculum in radar meteorology has been specified and proposals made for an operating framework of a radar network.

During the period of COST Project 73, composite images using radar reflectivity data over much of north-west Europe were generated in the United Kingdom every hour and

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

distributed on an experimental basis to several other countries. Similar products were produced in France, and more recently in Germany. The potential benefits of these data were assessed, and the directors of West European meteorological services established a working party to consider how best to transfer the results of this research to operational implementation.

Although much of the work undertaken in COST Project 73 has been concerned with investigating the feasibility and potential of the international exchange of radar reflectivity and derived products, there has been a rapid increase in the number of Doppler radars deployed for operational weather forecasting. These systems provide wind information, as well as reflectivity data. The potential of Doppler radars has been assessed but there remain uncertainties in how best to use their data and which algorithms are most appropriate. Indeed, it is not yet clear how to use Doppler radar data within a network of conventional (single frequency and polarization) weather radars.

There has been considerable work on high-powered Doppler weather radars in the USA as part of the Nexrad programme, although this work has concentrated on product development rather than the use of such data within networks. Only recently, with the specification of the lower-power terminal Doppler weather radar programme, has there been extensive work on systems similar to those deployed in Western Europe.

Doppler radar represents one example of the more advanced systems which have been developed over the last few years. Multiparameter radars and techniques such as pulse compression and frequency agility may also offer operational advantages. Likewise, electronically scanned antennes, used extensively for defence systems, may offer new opportunities. In defining the requirement for the next generation of weather radars it is necessary to investigate these sometimes competing technologies to assess their potential and what hardware and software developments will be necessary. Work on aspects of this problem concerning polarization diversity radars has been proposed in two projects seeking funding under the CEC environment programme. In addition, there is a proposal under Esprit seeking support to investigate aspects of electronically scanned radars. However, the present COST proposal is the only project seeking to examine all aspects of advanced radar technology and balance the various approaches to clarify strengths and weaknesses. To do this requires experience and information across a wide range of countries to ensure that all points of view are represented. The COST forum offers the only approach which is likely to achieve this.

2. Objectives of the project

The objectives may be summarized as follows:

2.1 to review the performance characteristics and operational viability and utility of Doppler, multiparameter and electronically scanned (phased array) radars, both separately and as combined systems;

2.2 to review, assess and test advanced algorithms for use with conventional (single frequency and polarization), Doppler, multiparameter and electronically scanned radar systems, and to identify areas where algorithm development is required;

2.3 to investigate the operational viability of pulse compression, frequency agility and differential attenuation systems;

2.4 to encourage the development of the competitiveness of European industry in this and associated fields by the preparation of guideline specifications for an advanced (next-generation) radar system embodying hardware and software;

2.5 to identify how advanced radar technology might be introduced into existing conventional radar networks;

2.6 to specify training requirements needed to maintain advance radars and to make use of advanced radar products within an operational environment.

3. Scientific content of the project

The Signatories intend, on the basis of the present state of development of radar systems in their countries, to have investigation and research work carried out by public institutions or, if such work has already been done, to make the results available.

The topics covered by the programme are to include the following.

3.1. Electronically scanning (phased array) weather radars:

3.1.1. Assessment of the flexibility of such systems to satisfy several users (aviation, forecasting/hydrology) simultaneously.

3.1.2. Consideration of how scanning strategies may include the ability to concentrate on particular areas where interesting weather is occurring.

3.1.3. Development of procedures by which scanning may be optimized for ground-clutter elimination.

3.1.4. Assessment of the ease with which a multiparameter (including Doppler) capability can be included.

3.1.5. Definition of wavelength and antenna dimensions which will provide the basis of a practical operational system.

3.1.6. Assessment of the costs of a practical operational system.

3.1.7. Assessment of the degree of interest in such radar systems throughout Europe.

3.1.8. Drafting the outline specification for such a system.

3.2. Multiparameter (including Doppler) radar:

3.2.1. Reassessment of the potential of such radars taking as a starting-point the work carried out in COST 73 and identification of the most useful parameters.

3.2.2. Development of an outline specification for an operational radar system incorporating multiparameter specifications.

3.2.3. Review of the uses to which measurements by multiparameter radars can be put.

3.2.4. Identification of the specific applications for which such systems are likely to provide useful information.

3.2.5. Assessment of the potential market for these radars over the next 10 years both within Europe and worldwide.

3.3. Pulse compression techniques and frequency agility

3.3.1. Reduction of acquisition time of volumetric scans.

3.3.2. Optimization of the waveform and bandwidth to be used in operational systems.

3.3.3. Definition of the operational specification for the system to be used simultaneously in several applications.

3.4. Research into algorithms

3.4.1. Review and development of algorithms and procedures (combination of algorithms) for multiparameter (including Doppler) radars, including elimination of ground clutter and consequences of anomalous propagation on measurements of precipitation by radar.

3.4.2. Assessment of the need to develop algorithms used for combining multiparameter (including Doppler) radar data with conventional radar data.

3.4.3. Review and development of algorithms for use in processing three-dimensional reflectivity data.

3.4.4. Investigation of the use of artificial intelligence systems to recognize precipitation type and, possibly, provide automatic moderation of radar-scanning procedures and algorithms.

3.4.5. Consideration of how to introduce observations from electronically scanning and multiparameter radar (including Doppler) into radar databases comprising conventional data.

3.4.6. A review of differential attenuation techniques for the early detection of hail.

3.5. Experiment assessments:

3.5.1. Carrying out limited experiments to assess new products.

3.6. Training requirements:

3.6.1. Specification of training requirements needed to maintain advance radars and to make use of advanced radar products within an operational environment.

4. Timetable

The project would last for five years. It is likely that a number of the project areas specified in section 3 above would be investigated in parallel, building upon existing work in several countries. Annual reports would be produced for the COST senior officials by the Technical Committee for Meteorology.

5. Organization, management and responsibilities

A Management Committee would be set up following signing by the appropriate number of Signatories to the Memorandum of Understanding. A Chairman would be elected and entrusted with drafting an outline project plan based upon the items specified in section 3 above. This plan would be approved by the Management Committee and submitted to the Technical Committee for Meteorology.

In order to carry out the work a small number of subcommittees would be formed with the responsibility of carrying out specific tasks as follows:

COST senior officials		
Technical Committee for Meteorology		
COST Management Committee		
Subcommittee 1 Technology review	Subcommittee 2 Algorithms	Subcommittee 3 Experimental testing
Advantages and disadvantages Capabilities Ongoing work Groups within national meteorological services, universities or companies	Requirements Existing work Identify needs Instigate work	Review current plans Access to R&D results Instigate work testing to answer specific questions

The Management Committee would report formally to the Technical Committee annually, but would provide short reports to each meeting of the Technical Committee either verbally or in written form. The Management Committee would meet three times per year, at least once per year in Brussels. It is anticipated that at least two workshops will be arranged during the project, and a detailed final report will be written. The final report would be based upon a series of technical reports written throughout the period of the project.

6. Economic dimension of the project

It is estimated that each country would allocate up to four man-years to the project. Assuming the involvement of 10 to 12 countries, the total project cost would be in the region of ECU 20 million including overheads (comparable to COST 73).

Memorandum of Understanding for the implementation of a European research project on the improvement of the means of control of warble-fly in cattle and goats

(COST Project 811)[1]

Date of entry into force of the project: 14.3.1991
Duration: 13.3.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
CZECHOSLOVAKIA	24.9.1992	24.9.1992
SPAIN	30.5.1990	30.5.1990
FRANCE	30.5.1990	30.5.1990
ITALY	14.3.1991	14.3.1991
SWITZERLAND	13.3.1992	13.3.1992

The overall value is ECU 800 000 (in 1988 terms).

ANNEX II

General description of the project

A. Introduction

Warble-fly is a parasitic disease which causes major financial losses to stock breeding. An informal European working party was set up in 1979 to harmonize research into warble-fly control. Over a series of meetings, this *ad hoc* working party compiled an economic statement on the incidence of the disease and drew up a map showing its prevalence in Europe. The various national warble-fly control programmes were then compared, which made it possible to identify the reasons for their successes and failures. Lastly, a number of research targets were defined with a view to improving the programmes currently being applied in a number of European countries. The varying degrees of progress achieved under these programmes were reviewed and taken into account in looking into possible new control methods. These should make preventive measures readily adaptable to the differing social and economic circumstances of our respective countries. The research topics which have been given priority are:

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

(i) the definition of a method for precise evaluation of the disease in order that the effectiveness of programmes to combat it can be assessed and any further outbreaks can be monitored:

(ii) enhancement of knowledge of the mechanisms whereby the parasite evades the host's defence system and how the host builds up resistance, the longer-term objective being to heighten this resistance and to develop a vaccine.

European teams working on warble-fly are small and thus, unable to investigate on a broad front all the parameters which overlap in the areas proposed. This COST project should therefore enable our laboratories to coordinate and cooperate on the basis of protocols which have been prepared jointly. The *ad hoc* working party could then move on from exchanging results and sharing thoughts to the stage of joint research.

B. Areas of cooperation to be discussed within the COST working party

I. Improving methods for evaluating the disease

(a) Warble-fly can be diagnosed by locating the parasite but this is a method which does not ally exactitude with low-cost collection of information. Indirect methods for detecting warble-fly have been developed by immunodiagnosis either through passive haemagglutination or through ELISA. Finally these immunodiagnostic methods have performed well when applied to pooled serum or pooled milk. One of the priority objectives of our working party is to improve the sensitivity of these methods when applied to pooled media. This would make herd diagnoses even cheaper. These methods are to be extended to diagnosis of warble-fly in goats.

(b) Sampling plan. In order to reduce the number of samples taken for the purposes of epidemiological surveys, a sampling plan is necessary. Sampling plans should be worked out with the help of biometricians, biologists and those in charge of prevention plans.

II. A model for the life cycle of the warble-fly

It would be very useful to construct a mathematical model of the lifecycle of the warble-fly. Information on the various factors which influence warble-fly numbers are available in the laboratories and in Soviet and Czech scientific literature. However, the *ad hoc* working party does not include a biometrician. If it were possible to take on a specialist in this field, or to secure specialist collaboration, it would be possible to put together an important prophylactic tool. The possibility of recruitment is one which should be considered by every member of the *ad hoc* working party. A model of this sort would make economic appraisal of programmes, and their practical follow-up, possible.

III. Studies on host-parasite relationships

It has been found that certain proteins produced by the cattle warble-fly act upon various factors which contribute to inflammation in the host animal. What is needed now is to define more clearly the possible interaction of these proteins with other defences and in particular the more specific immune defence systems. In this way we would like to address some of the mechanisms involved in the immune deficiency effects noted in connection with this disease. The ways in which the host reacts must also be more clearly defined.

The study of host-parasite relationships is also worth conducting on goat warble-fly. If the interrelationship between host and parasite proves similar, goats could become a laboratory model of value for experiments and in particular for testing vaccines.

Such cooperation between the laboratories should swiftly lead to the definition of new ways of evaluating and monitoring the disease. In the longer term it should lead to the

identification of a further alternative means of combating cattle and goat warble-fly. If so, these results would exceed the initial objective of warble-fly control and would have a far wider impact on veterinary parasitology.

C. Indicative financial assessment of the project carried out in France

I. Improving methods for evaluating the disease

1. IMPROVING THE SENSITIVITY OF IMMUNOLOGICAL TECHNIQUES

(a) Producing a major antigen by genetic engineering:

one researcher year + FF 50 000 operating appropriations;

(b) validation of immunological tests with this antigen on the basis of soil samples, using either individual or pooled samples:

eight technician months + FF 50 000 operating appropriations;

(c) definition of a method of immunodiagnosis of warble-fly in goats:

one researcher year + FF 60 000 operating appropriations + FF 30 000 travelling expenses for trainees.

2. DEFINITION OF SAMPLING PLAN

(a) use of existing information:

six researcher months;

(b) verification during a parasite life cycle:

four technician months + FF 30 000 operating costs including data-processing costs;

(c) use of both techniques for drawing up an epidemiological map to be used in the framework of national, serology-based, surveys on health:

two technician years per country for cattle or goat warble-fly.

II. A model of the life cycle of the warble-fly

This work could be the subject of a dissertation or Ph.D. thesis (three years full time).

III. Studies of host-parasite relationships

Parasite-inflammation interaction (two researchers for three years).

Interactions between the parasite and the lymphocytic response (two researchers for three years).

Use of biotechnology, flux cytometers, cell cultures.

Annual cost FF 150 000 = FF 450 000 over three years.

IV. Annual coordination meeting

FF 50 000 per year = FF 150 000 over three years.

V. Travel expenses for setting up and operating joint protocols

About FF 5 000 per trip, or FF 100 000 over three years for the working party.

Memorandum of Understanding for the implementation of a European research project on crop development for the cool and wet regions of Europe

(COST Project 814)[1]

Date of entry into force of the project: 21.2.1991
Duration: 20.2.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
DENMARK	13.5.1992	13.5.1992
GERMANY	18.6.1992	18.6.1992
SPAIN	21.2.1991	21.2.1991
FRANCE	16.10.1991	16.10.1991
IRELAND	4.7.1991	4.7.1991
NETHERLANDS	7.3.1991	7.3.1991
NORWAY	21.2.1991	21.2.1991
SWITZERLAND	17.5.1991	17.5.1991
FINLAND	21.2.1991	21.2.1991
UNITED KINGDOM	21.2.1991	21.2.1991

The overall value is ECU 41 400 per researcher per year.

ANNEX II

General description of the project

I. Objectives

The primary aim of the project is to coordinate crop development research in those northern and western regions of Europe which are strongly influenced by a maritime climate. It is also recognized that other regions have related problems in upland areas and as such should be included.

The action proposed would be as follows.

[1] The texts of the Memoranding of Understanding and Annex I are given an page 13 of the model.

1. Plant adaptation and breeding

To coordinate and encourage research in existing parallel programmes, particularly to ensure adequate research into the adaptation and development of crops relevant to the region. For example, genetic and phenotype adaptability to existing climatic, edaphic and biotic conditions and to stresses arising from foreseeable climate change, and application of conventional and new techniques to improvement of these crops. Action will be taken to avoid duplication and to facilitate more extensive multisite trialling. Product quality will be particularly important.

2 Ecology and agronomy

To coordinate and encourage research into the distinctive ecological problems in the region in peatlands, wet grasslands, forestry, etc. For example, the influence of managed grasslands on field margins, water courses and natural habitats; population structure and dynamics and species diversity on grasslands; low-input grazing systems and use of legumes; nutrient turnover in grazing and cropping systems.

To coordinate and encourage research in agronomy relevant to the cool and wet regions, including agricultural engineering. Development of environmentally-friendly technologies for production from genetically adapted, high-quality, crops. Relevant crop modelling.

3. Crop-related alternative enterprises

To coordinate and encourage research on new cropping and related opportunities for the region, specifically to develop demonstration projects on a transnational basis.

Examples would include alternative crops such as fodder maize for cool regions, triticale, oats genetically enhanced to give high added value, forage root crops, fibre from flax, modified cereals and grasses for paper pulp, forestry enterprises, berry production; adding value to existing livestock production systems, alternative livestock such as camelids, fish and goats; grasses suitable for amenity areas such as golf courses.

4. Market structure

To coordinate and encourage research in agricultural economics with emphasis on development of a unified market for regional products and incorporating studies on physical and social factors, product development, pricing policy, market research, promotion and advertising, and distribution problems. Economic modelling for crop processing and for providing guidance on development of new and added-value products in the region will be an important development.

Recognition of, and facilitating, interactive studies among these four major areas will be necessary.

II. Project procedures

The proposed objectives are to be achieved over a five-year period as follows:

1. formation of a committee composed of two delegates from each participating country. The delegates to be actively involved in the designated areas of research;
2. appointment of a researcher and part-time secretary to coordinate the project, to collate data and to organize a database of expertise and projects in the regions;
3. organization of regular meetings with reports and presentations to rotate between the regions;

4. exchange of research results, materials and methods;
5. formation of subgroups to address topics agreed by the *ad hoc* committee.

As the project progresses the operating procedure should be adapted at the discretion of the *ad hoc* committee.

III. Financing

Financing for the research activities should be provided by the national programmes of the participating countries.

IV. Interaction with other EC programmes

The programme has possible links with the following EEC programmes: Eclair, Bridge, FLAIR, JOULE, Forest and MARS.

Memorandum of Understanding for the implementation of a European research project in the field of antiparasitical chemotherapy

(COST Project 815)[1]

Date of entry into force of the project: 10.4.1991
Duration: 9.4.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.10.1991	16.10.1991
GERMANY	10.4.1991	10.4.1991
SPAIN	10.4.1991	10.4.1991
FRANCE	10.4.1991	10.4.1991
HUNGARY	11.12.1992	11.12.1992
SWITZERLAND	17.5.1991	17.5.1991
UNITED KINGDOM	10.4.1991	10.4.1991

The overal value is ECU 1 million (in 1990 terms).

ANNEX II

General description of the project

The objective of the Acrival project is to prepare, to study biologically and also physico-chemically and finally to exploit various original molecules with a view to therapeutic application with regard to trypanosomes and related parasites.

Such parasites give rise to human and animal health problems – and hence economic problems – of which a few figures will give a better idea (TDR News, March 1990): 18 million sufferers from Chagas' disease (American trypanosomiasis) and 90 million persons at risk, 17 million sufferers from leishmaniasis and 350 million persons living in areas where it is endemic (including the South of France, Greece, Italy, Spain and Portugal). 25 000 new cases each year of African trypanosomiasis, in terms of human health alone. In veterinary terms, it need only be pointed out that stockbreeding has been banned in large tracts of Africa since 1979 because of trypanosomiasis (WHO Report, Ser. 635) and the disease affects more than 25 million head of livestock.

The Acrival project is an interdisciplinary one, designed to bring a better understanding of both the method of action of the active substances prepared (in order to pinpoint all

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

the biological targets and thus, possible, to make use of other approach routes to improve therapy) and the side-effects (in order to reduce them and thus optimize the molecules available).

The distribution of tasks is therefore as follows:

CHEMISTRY	Initial synthesis; optimization of active molecules; CAD modelling.
PARASITOLOGY	*In vitro* screening covering the infestant forms (trypomastigote and amastigote) of parasites as well as those present in the vector (epimastigote).
	In vivo study on an infested animal.
TOXICOLOGY	Acute toxicity; mutagenicity.
HEMATOLOGY	Adverse morphological changes; toxicity as regards hematopoietic progenitors.
MOLECULAR BIOLOGY	Evaluation of metabolization processes (*in vitro* model of human hepatocytes); action on DNA gyrase; interaction with DNA; modification of basic cell mechanisms (nucleic acid synthesis, protein synthesis); enzyme inhibition (reductase trypanothione).
BACTERIOLOGY	Inhibition of growth and lethal effect.

The need for the various disciplines involved lies in the fact that the project is based on an established body of knowledge concerning active molecules as regards Trypanosoma cruzi and Leishmania donovani (set out in COST proposal 239/89) and it is therefore proposed, in particular, on that basis to:

(a) prepare new derivatives (in order to define the best molecular medium, the best substitute and the best grafting position);

(b) pin down their trypanocidal and anti-leishmanian activity (in order to target research);

(c) assess their acute toxicity (in order to eliminate substances whose activity-toxicity ratio would not be satisfactory), hepatotoxicity and mutagenicity (in order to avoid developing series which would ultimately prove unusable in practice);

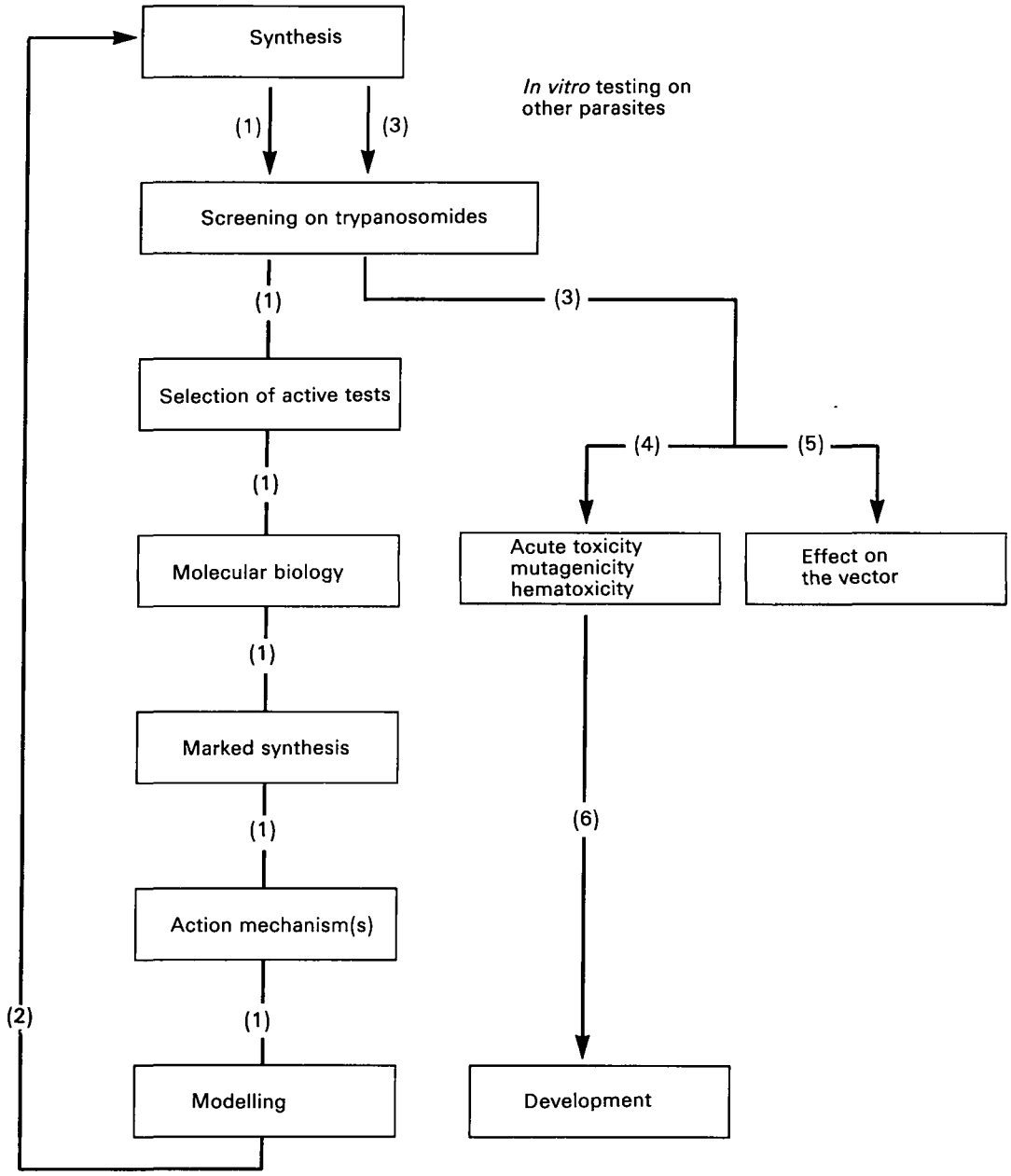
(d) measure the effects on blood components (in order to ascertain their specific toxicity there and also to assess their possible application as a prophylactic agent in blood banks, which are, for instance, to a considerable extent responsible for contamination by Trypanosoma cruzi);

(e) study the mechanism of their intracellular action, possibly after synthesis of the marked derivatives called for by biologists (in order to define the role of transmembrane permeation and, if possible, highlight the real targets);

(f) find out their antibacterial spectrum (in order to adapt therapy in the frequent cases of bacterial superinfections related to parasitic conditions);

(g) promote their development in the context of 'orphan drugs' in close liaison with international organizations such as the World Health Organization (WHO) (in order to meet a fundamental human and animal health requirement of a large number of Third-World countries where medicine distribution is manifestly inadequate).

The programme is shown in the following diagram:



Participation of 30 researchers a year is envisaged for the implementation of this five-year programme. The estimated budget is ECU 1 million.

In conclusion, the Acrival project should:

(a) enable medicines to be obtained for human and animal conditions for which research is a priority on health and economic grounds;

(b) promote the emergence of a European role in this field, seeking considerable contact with partners upstream (basic scientists) and downstream (clinicians);

(c) associate, in the nexus of problems, non-European specialists and research centres (in South America and Africa);

(d) act as a melting-pot for specialist European educational and research training.

Memorandum of Understanding for the implementation of a European research project on migration – European integration and the labour force

(COST Project A2)[1]

Date of entry into force of the project: 18.9.1991
Duration: 17.9.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
DENMARK	23.1.1992	23.1.1992
GERMANY	18.9.1991	18.9.1991
SPAIN	15.11.1991	15.11.1991
FRANCE	6.2.1992	6.2.1992
ITALY	10.6.1992	10.6.1992
LUXEMBOURG	26.3.1992	26.3.1992
HUNGARY	11.12.1992	11.12.1992
NETHERLANDS	18.9.1991	18.9.1991
NORWAY	18.9.1991	18.9.1991
AUSTRIA	24.7.1992	24.7.1992
PORTUGAL	26.3.1992	26.3.1992
SWITZERLAND	29.4.1992	29.4.1992
FINLAND	18.9.1991	18.9.1991
SWEDEN	4.2.1992	4.2.1992
UNITED KINGDOM	18.9.1991	18.9.1991

The overall value is ECU 2.45 million (in 1990 terms).

ANNEX II

General description of the project

Background

Movement of human population has always been an essential ingredient of economic development and social change. Voluntary migration ought not to be regarded in a negative manner; in many cases it will bring positive benefits to both the host community and the community of origin. It would be wrong to start off with the supposition that the natural state of mankind is sedentary and that movement is a deviant activity that threatens the harmony of all society. The development of the Community from an assembly of

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

sovereign States is a key phase in the economic and social evolution of Europe. The Community is itself an important stimulus for the mobility of its citizens. In the past, economic and social development led to the redistribution of populations between and within nations. Is it plausible to believe that further economic development of Europe will not involve more labour flows? If it is, then the reasons for believing it need to be set down.

If it is not, then the information must be gathered to formulate policies to facilitate such flows, while minimizing the problems of assimilation and safeguarding the standards of peripheral regions. There is also the very important factor of the new situation in Eastern Europe, where the fact that frontiers have been closed for decades could imply a huge backlog of migration. However, even before the recent developments in Eastern Europe, the amount of migration that has been taking place in recent years is substantial; in one Member State, 3.5% of the total labour force migrated in 1988. Taking into account the different types of migration, it is also important to focus more on understanding the dynamics and mechanisms of migration.

The core of the research will concentrate on the three main parties affected: the host community, the community of origin and the migrants themselves. The host community gains an additional labour force, perhaps a skilled one, but may incur social costs and associated problems of the families and the cultural integration of coexistence. In the initial period, the community of origin may lessen its unemployment problems and ease demands on social services but it may suffer a 'brain drain' and be left with a poor demographic structure.

The migrants themselves may improve their standard of living, or, in the case of the highly skilled, may attain levels of achievements they could not have reached at home. On the other hand, migrants can face problems and difficulties in adjusting to new environments, may face institutional barriers and be confronted with unknown problems in connection with their cultural identity.

Objectives

The central aim of this COST project is to identify current problems of migration, assessing how the European market will affect the problems (pre- and post-1992 comparative analyses needed); how the developments in Eastern Europe will influence flows; the current interaction problems of host and migrant populations; the effect of migration on such host country concerns as the labour market, urban renewal and cultural facilities, automatization/new technologies and a changing labour demand; assessment of the brain drain effects; evaluation of whether migration will help build the European entity.

This project will be complementary to work at the Vienna Centre and to the European Science Foundation's programmes, 'Demography and social change in Europe' and 'Rural and urban restructuring of Europe'. Appropriate liaison will be maintained. The focus on the interactive aspects of the community of origin, the host community and the migrants requires en extended European comparison and cooperation which will contribute to the added value of research.

Contents of the project

The research programme will be mainly based on ongoing research in several countries. The Signatories intend, on the basis of the state of development of the different subjects related to the present project in their countries, to have research work carried out or, if such work has already been done, to make the results available. The topics to be dealt with in the programme follow on, to a large extent, from the objectives listed above. Central general topics will be:

- the Community and new patterns of migration;
- the need to formulate adequate theories explaining migration, integrating both economic and sociological perspectives;
- different aspects of new Eastern European migration;
- the role of migration in reducing/increasing narrow nationalism and building a European entity;
- the political consequences of migration;
- the role of big cities as a factor underlying migration; old and new patterns.

With regard to the host communities the following areas seem important:

- the migrants' contribution to the host economy;
- the structure of the migration flow;
- the potential creation of separate labour markets for migrant and host country workforces;
- problems regarding self-employment and the black economy;
- multiethnic problems, assimilation, integration or coexistence;

For the communities of origin the following areas seem to be of relevance:

- the demographic impact on the native community;
- the true effect of the 'brain drain';
- unemployment and migration; the match of migration and employment policies;
- the social and cultural strains on the native community through the reabsorption of returning migrants;
- capital flows and reimbursements.

Finally, as regards the migrants themselves, the following areas would be interesting to pursue further:

- the current educational, demographic and cultural profile of migrants;
- the interactive problems of migrant and host populations as regards the economy, social life and culture;
- the interaction between different migration groups with regard to race, social stratification and religion;
- problems concerning immigration and naturalization legislation.

Time schedule

The duration of the project will be four years. The work programme comprises three phases.

Phase 1

Several national research teams linked to the project already have a number of projects under way. The main task in this phase is to initiate cooperation, and in particular com-

parative studies, between these teams. For this purpose seminars will be arranged, and in the first one each country will present a survey of the state of the art, focusing on ongoing and planned research.

Phase 2

National original research wil be continued and new research will be initiated. Cooperation will take place in the form of research seminars and exchanges of researchers and joint projects, preferably of a comparative nature.

Phase 3

This phase will involve synthesis of the research results and recommendations.

A first explanatory seminar with specialists is planned to take place during spring 1991.

Organization

The project will be organized by the Management Committee (MC). It is desirable that at least one member of the MC is also a member of the Technical Committee. The MC will report to the Technical Committee twice a year.

The MC is responsible for the acceptance of projects, for arranging seminars and coordinating research between the national teams. On the basis of the seminars on the state of the art in the participating countries, the MC may decide to what extent cooperation could be established between national projects, for example in the form of joint projects, and whether comparative research projects could be initiated in selected areas.

The MC should stimulate the exchange of researchers between the national teams. It will also set the terms of reference for the exchange of existing and new knowledge, and will ensure dissemination of the main results (e.g. through the translation of articles and summaries of research monographs). The MC will also take initiatives for publishing books on selected topics, containing contributions from several participating countries.

The MC is responsible for establishing links with related Community and other international networks in the field, in particular those carried out by the Vienna Centre and European Science Foundations. At least one seminar should be arranged together with those organizations.

In the final phase of the project, the MC is responsible for producing a final report.

Memorandum of Understanding for the implementation of a European research project on management and new technology

(COST Project A3)[1]

Date of entry into force of the project: 18.9.1991
Duration: 17.9.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
CZECHOSLOVAKIA	23.12.1992	23.12.1992
DENMARK	23.1.1992	23.1.1992
GERMANY	18.9.1991	18.9.1991
FRANCE	6.2.1992	6.2.1992
IRELAND	17.9.1992	17.9.1992
ITALY	5.2.1992	5.2.1992
NETHERLANDS	18.9.1991	18.9.1991
NORWAY	18.9.1991	18.9.1991
SWITZERLAND	29.4.1992	29.4.1992
FINLAND	18.9.1991	18.9.1991
SWEDEN	4.2.1992	4.2.1992
UNITED KINGDOM	18.9.1992	18.9.1992

The overall value is ECU 3 500 000 (in 1990 terms).

ANNEX II

General description of the project

1. Background and rationale

It is now widely accepted that contemporary technological changes can only be implemented successfully if they are accompanied by appropriate organizational and motivational/attitudinal changes, as well as novel approaches to dealing with social problems. New management structures, new systems of employee participation and involvement have been widely proposed and, in some cases, implemented. New approaches to work organization, such as quality circles, development groups, and human-centred work systems have been the subject of considerable experimentation and discussion across Europe. The totality of changes is conditional upon the emergence of new skills, new

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

professional qualifications and specializations as well as upon fundamental transformations of cultural orientation, attitudes and perceptions of traditional professional groups.

Empirical evidence shows that within Europe certain categories of professions find it particularly difficult to adjust to these changes. This applies specifically to those sections of the workforce placed between the shop-floor worker and top management. The strategic importance of these positions and the urgency of implementing the changes under consideration emphasize the relevance or research into these problem areas.

The increasingly intense competition that will be faced within the single European market of 1992, and within the wider common European economic area involving EFTA and some parts of Eastern Europe, is likely to accentuate further the introduction of new technologies and new forms of organization as enterprises seek to achieve economic success in new markets.

This increases the need for research on management, participation and motivation systems which will strengthen the capacity for reorganization and change at all levels of the company. Since new forms of organization and new technologies are closely linked, it is needed to stimulate organizational analyses as a strategic instrument in company development. New technology cannot fully develop its possibilities for economic growth, efficient use of natural resources and social improvement unless organisation, technology and the market are all considered in a holistic perspective. It is further necessary to emphasize the management and employee participation and motivation perspective, i.e. the incentive systems.

2. Objectives of cooperative research

The central aim of this COST project is to link the analysis of organizations with the implementation of new technologies, as strategic elements in enterprise adaptation. The programme should bring together on a European scale a wide range of theoretically based empirical research which can identify, illuminate and describe problems and new themes of research, and offer solutions for identified problems.

The proposed research programme aims at two kinds of objectives.

(i) Explanatory objectives, concerning:

(a) Mechanisms forming the professional identity of managers, and in particular their attitudes towards developing and introducing new technologies. Identification and explanation of managerial resistance to technological changes. Reasons for evolution of different management systems in different countries, and their impact upon the introduction of new technologies;

(b) identification of factors relevant to changing the present attitudes and modes of behaviour *vis-à-vis* technological and organizational change. Study of management systems being conducive towards adaptation of new technologies. Comparative empirical investigations in different European countries should make visible the influence of societal factors upon the ability to adapt and to develop a variety of efficient ways to use new technologies for qualified and satisfying workplaces and successful production, especially for small and medium-sized enterprises.

(ii) Operational objectives:

(a) to provide action-oriented practical information for the users of research: decision-makers who have direct influence over the design and execution of management systems in both public and private sectors, advisers to decision-makers, and those responsible for education and training;

(b) to provide research evidence that will support the maintenance of European competitiveness in the world economy, while creating organizational structures at the enter-

prise level which stimulate the creation and pluralistic adaptation of new technologies, and at the same time reflect European social values.

3. Contents of the project

The research programme will be based on ongoing research in several countries, stimulating cooperation among the different research groups. The Signatories intend, on the basis of the state of development of the different subjects related to the present project in their countries, to have research work carried out or, if such work has already been done, to make the results available.

The topics to be dealt with in the programme follow on, to a large extent, from the objectives listed above. Among the explanatory objectives, central research topics will be:

(a) identification of the main qualitative changes in the environment of the organizations (firm, company, institution) which affect the management perceptions, styles and procedures (i.e. increased complexity of the environment, cooperation as part of competition and vice versa, increased dynamics of change) and the response of the managerial behaviour;

(b) identification and explanation of managerial resistance to technological changes and the factors which can influence the propensity to take managerial posts and responsibility in connection with workers' attitudes towards new technology. In particular, it is of interest to study the behaviour of lower and intermediate management in relation to the introduction of new technologies;

(c) variations between different sectors of economic activity – private services, the government sector, and manufacturing industry – with respect to how management handles the introduction of new technology;

(d) studies of how managers with different educational backgrounds (e.g. engineers, economists, lawyers) are able to adjust to technological changes;

(e) identification of factors relevant to the modification of attitudes and modes of behaviour in relation to technical change, and the influence of societal factors on the capacity to adapt. This calls for comparative research, comparing adaptation to technological change in different cultural environments.

Among the types of new technologies to be dealt with in the programme are information and communications technologies, but some research teams may concentrate on other technologies as well, e.g. new technologies designed to protect the environment.

The operational parts of the programme would be to extract research insights that can be put to practical use. Guidelines can be worked out for:

- management structures being conducive towards adaptation to new technology;
- incentive schemes which will increase the willingness of management to adapt to new technologies;
- programmes for training managers in the fields of the introduction of new technologies;
- networks linking R&D institutions with the users of technology.

4. Time schedule

The duration of the project is three years. The work programme comprises three phases (from which the main emphasis will be on phase 2).

Phase 1

Several national research teams linked to the project already have a number of projects under way. The main task in this phase is to initiate cooperation, and in particular comparative studies, between these teams. For this purpose, seminars and conferences will be arranged. In the first one, each country presents a survey of the state of the art, focusing on ongoing and planned research.

Phase 2

Research on explanatory objectives (see section 2). National research will continue, and new fields will be launched. Cooperation will take place in the form of research seminars, and preferably also exchanges of researchers and the initiation of joint projects, preferably of a comparative nature.

Phase 3

This phase comprises a summing-up of the results obtained in the research on explanatory objectives, as well as applied research related to operational objectives, i.e. providing action-oriented practical information to the users (management schools and universities as well as companies).

In practice, phases 2 and 3 may to some extent overlap.

A tentative timetable is set out as follows (depending upon when the project starts):

April 1991	Seminar on the state of the art, and preliminary planning of research cooperation.
May/June 1991	Start of the project. Setting-up of a Management Committee.
December 1992/January 1993	Seminar for mid-term assessment.
April 1994	Drafting of final report.

5. Organization

The project will be organized by the Management Committee (MC). It is desirable that at least one member of the MC is also a member of the Technical Committee. The MC will report to the Technical Committee twice a year.

The MC is responsible for the acceptance of projects, for arranging seminars and coordinating research between the national teams. On the basis of the seminar on the state of the art in the participating countries, the MC may decide to what extent cooperation could be established between national projects, for example, in the form of joint projects, and whether comparative research projects could be initiated in selected areas.

The MC will stimulate the exchange of researchers between the national teams. It will also set the reference terms for the exchange of existing and new knowledge, ensuring that the main results of the national projects are made available internationally (e.g.

through the translation of articles and summaries of research monographs). The MC will also take initiatives for publishing books on selected topics, containing contributions from several participating countries.

The MC is responsible for establishing links with related international networks in the field, for example BRITE, EURAM and other Community networks, and in particular the COST project, 'Impact of the social environment upon the creation and diffusion of technolgies', and at least one joint seminar should be arranged together with that project.

In the final phase of the project, the MC is responsible for producing a final report.

Memorandum of Understanding for the implementation of a European research project on the impact of the social environment upon the creation and diffusion of technologies, with special reference to environment, health and transport

(COST Project A4)[1]

Date of entry into force of the project: 18.9.1991
Duration: 17.9.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
DENMARK	23.1.1992	23.1.1992
GERMANY	18.9.1991	18.9.1991
FRANCE	6.2.1992	6.2.1992
NETHERLANDS	18.9.1991	18.9.1991
NORWAY	18.9.1991	18.9.1991
SWITZERLAND	29.4.1992	29.4.1992
FINLAND	18.9.1991	18.9.1991
UNITED KINGDOM	18.9.1991	18.9.1991

The overall value is ECU 2.25 million (in 1990 terms).

ANNEX II

General description of the project

1. Background

The technological pattern in Europe is changing. Traditional areas such as the Ruhrgebiet in West Germany or the northern part of England find themselves in a situation of structural change and have largely lost their central importance. In contrast to this, not only the areas of Grenoble/Lyon (France), Piedmont/Lombardy (Italy), but also Baden-Württemberg (Germany) show significant advances. They have developed their own centres for high technology: their potential for the creation and use of new technologies is very great and continues to grow.

However, the innovation potentials vary not only from country to country and area to area, but also often from branch to branch. There are even considerable differences

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

within one branch. The following questions have therefore to be put: How can the different regional, branch- and enterprise-specific abilities to create and use new technologies be explained? What is the impact of the social and cultural environment upon the creation and diffusion of new technologies and what potential and practical possibilities exist to improve the innovation potential in the various sectors?

2. Objective of cooperative research

The objective of the research is to study how the impact of the social and cultural environment upon technologies and innovation patterns differs from country to country in order to exploit the knowledge of mastering the development technology for the greatest possible benefit to society.

The research shall be based on the following thesis: the creation, diffusion, use and effects of techniques are the result of social processes in the broadest sense. Creation of techniques and patterns of diffusion are not simply predetermined, but also follow a social logic. This also means that the process of technological advancement and use can vary according to the specific social, cultural, legal and economic conditions to which they are related.

This thesis could be tested in the areas of environment, health and transport, but also in relation to certain specific technologies such as information technology or biotechnology.

3. Contents of the project

The objectives of the project are the following:

1. To study networks, regarding the relationship between supplier and consumer and/or between bearers of various functions (science and users), or generally speaking, the 'milieu innovateur' which is becoming increasingly important for successful innovation processes.

1.1. To study the importance of supplier networks of large companies or the company/subsidiary for the development and diffusion of new technologies (national and international level).

1.2. To investigate the patterns of collaboration and the way they change between enterprises, scientific institutions, consulting offices and possibly the government and which differences exist between enterprises – with and without their own research – and especially to analyse the processes by which standards for uniform data formats are negotiated.

1.3. To study how such networks are organized, maintained and further developed.

1.4. To study the significance of organized perception, evaluation, knowledge and activities for the development of the technical devices.

1.5. To analyse the different network cultures in the various countries. Identification of factors relevant to the modification of attitudes and modes of behaviour in relation to technical change, and the influence of societal factors on the capacity to adapt. This calls for comparative research, comparing adaptation to technological change in different cultural environments.

1.6. To study the impact of social and cultural factors on the diffusion of technologies to different user groups.

2. To investigate the existing and changing patterns of knowledge transfer between science-producing institutes (educational institutions, research institutions, etc.) and knowledge-utilizing institutions (industry, for example).

2.1. To analyse which cultural and economic conditions (type of production, size of enterprise, qualification structure of workers within the enterprise) produce which

kind of knowledge and technology transfer (consulting, further education, research and development projects).

2.2. To analyse the practical problems related to the access to scientific knowledge for social groups, with special attention to trade unions and environmental associations.

2.3. To study the relationship between the structures of national research systems and the type of knowledge transfer from research to industry.

2.4. To investigate the driving force behind the formation and expansion of various forms of technology transfer and the role that personal relationships (for instance, common education), the scientific reputation of the universities visited or simply well-functioning traditional teamwork play in this context.

2.5. To study the way enterprises experiment with the various forms of technology and knowledge transfer. To analyse the conditions and restrictions of national and international collaboration. To study the role of scientific federations for the establishment of such collaboration.

3. To analyse the functioning of science parks as knot-points in the new network economy. They are considered as innovative, dynamic milieux. Science parks are also nodal points in information technology networks, gathering information from many sources.

4. Time schedule

The Signatories intend, on the basis of the state of research of the different subjects related to the present project in their countries, to have investigation and research work carried out or, if such work has already been done, to make the results available.

It should be emphasized that internationally comparative studies are particularly appropriate for the proposed topics. In order to increase the comparability of the studies, they should be restricted to the technology field of new technologies, with special reference to the environment, health and transport.

The duration of the project is three years. The work programme comprises three phases. Phase 2 will be the main phase.

Phase 1. Synthesis of the state of the art

Reports from each country involved. Some national research teams linked to the project already have projects under way. The main task in this phase is to initiate cooperation, and in particular comparative studies, between these teams. For this purpose, a seminar will be arranged to assure the international comparison. Each country presents a survey of the state of the art, focusing on ongoing and planned research.

Phase 2. Drawing-up and realization of the national research projects

Cooperation will take place in the form of research seminars. Possibilities for the exchange of researchers and joint projects, preferably of a comparative nature.

Phase 3. Synthesis of the research results and recommendations

In practice, phases 2 and 3 may to some extent overlap.

5. Organization

The project will be organized by the Management Committee (MC). It is desirable that at least one member of the MC is also a member of the Technical Committee. The MC will report to the Technical Committee twice a year.

The MC is responsible for the acceptance of projects, for arranging seminars and co-ordinating research between the national teams. On the basis of the seminar on the state of the art in the participating countries, the MC may decide to what extent cooperation could be established between national projects, for example, in the form of joint projects, and whether comparative research projects could be initiated in selected areas.

The MC should stimulate the exchange of researchers between the national teams. It will set the terms of reference for the exchange of existing and new knowledge, ensuring that the main results of the national projects are made available internationally (e.g. through the translation of articles and summaries of research monographs). The MC will take initiatives for publishing books on selected topics, containing contributions from several participating countries.

The MC is responsible for establishing links with related international neworks in the field, in particular the COST project, 'Management and new technology' and at least one seminar should be arranged together with that project.

In the final phase of the project, the MC will be responsible for producing a final report.

Memorandum of Understanding for the implementation of a European research project on ageing and technology

(COST Project A5)[1]

Date of entry into force of the project: 18.9.1991
Duration: 17.9.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
GERMANY	18.9.1991	18.9.1991
FRANCE	6.2.1992	6.2.1992
IRELAND	17.9.1992	17.9.1992
HUNGARY	11.12.1992	11.12.1992
NETHERLANDS	18.9.1991	18.9.1991
SWITZERLAND	29.4.1992	29.4.1992
FINLAND	18.9.1991	18.9.1991
SWEDEN	4.2.1992	4.2.1992
UNITED KINGDOM	18.9.1991	18.9.1991

The overall value is ECU 4.5 million (in 1990 terms).

ANNEX II

General description of the project

1. Introduction

In all industrialized countries the population is ageing. This involves a transformation which States have willingly brought about as a sign of development. On the other hand, the development will give rise to an extensive need for services, especially in the field of housing, social welfare and health care.

Elderly people constitute an important resource in society. This view has gained prominence recently, with the emergence of elderly people's activity on their own behalf. The activity and functioning ability of elderly people are of utmost importance, e.g. for the new structure of family life, for culture, etc. Technologies have contributed to the extension of the life-span after retirement and towards improving the quality of life. Some technologies can ease the process of ageing; others can provide substitution for lack of

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

physical skills. Not enough is known about which technologies contribute to the improvement of the quality of life for elderly people and which possibly hinder it.

The concept of old age is narrowed down in this context to the more limited issue of the 'third age'. The 'third age' means the stage of life in which a person reaches retirement age, but nevertheless can still manage quite well. It is ever more likely that in industrialized countries the mean population can look forward to 10 to 15 years of retirement. On average, this increasingly better educated and financially better off group will have wishes and demands relating to the management of its own life.

Taking all this into consideration, multidisciplinary research is needed to support the independence of elderly people. Within this context, technologies serve to substitute functional disabilities or to mitigate loss of abilities. Technologies are also needed to make the production of services and their use of manpower more effective.

At a European level, cooperation is needed in working out issues relating to old age. Especially challenging cooperation could result with the theme 'ageing and technology'. This would permit a merging of scientific programmes which bear on old age and the problems of functional ability within the framework of COST cooperation. Hitherto there has been little European coordination concerning ageing and technology in the field of social sciences. Research on this general theme would have much to gain from a European cooperation effort, which would enhance its value because of its multidisciplinary character and its vast array of questions.

2. Objectives of cooperative research

The objective of the research is to explore conditions of extended autonomy, independence and activity for elderly people in a European comparative perspective. Special attention would be addressed to questions concerning cultural differences and the acceptance of new technologies. There is also a need for more knowledge with regard to pensioners' attitudes to working life and autonomy, and their active role in social and public activities.

Within this general framework, some more general, as well as more specific, objectives can be identified:

General objectives:

(a) to create European coordination for research on ageing and technology;

(b) to coordinate and promote national research activities at European level;

(c) to stimulate the multidisciplinary collaboration between experts in social science and technology, medicine, architecture, psychology, etc.;

(d) to incorporate the aspect of social sciences into COST activities relating to the process of ageing in order to promote comparative research.

Specific objections:

(a) to show how different countries cope with the ageing process and which role can be played by technology;

(b) to explore the repercussions of the relationship between 'third age' people and the labour market, taking into consideration the challenges and possibilities of technology;

(c) to afford the elderly, with the aid of technology, better possibilities for prolonged autonomy.

3. Content of the project

The research programme will be based mainly on ongoing research in several countries. The Signatories intend, on the basis of the state of development of the different subjects related to the present project in their countries, to have research work carried out, or if such work has already been done, to make the results available. The topics to be dealt with in the programme follow on, to a large extent, from the objectives listed above. Central general topics will be:

(a) 'third age' and autonomy, with special attention to questions concerning:

- new technologies designed for increased 'third age' autonomy,
- the elderly as consumers,
- social technology and technology for the home,
- the elderly and their services,
- technology related to equipment and devices;

(b) repercussions of the relationship between the 'third age' and the labour market, with special attention focused on:

- elderly workers and adaptation to rapid technical change,
- the applicability of new technology with regard to elderly people,
- the abilities and specific needs of elderly people concerning learning,
- pension systems and forms of social security.

3.1. European cooperation network

The project is based on research activities taking place in the participating countries in the field of social science and technology. A dialogue between involved partners is needed at European level.

This will take place by:

(a) organizing workshops and seminars to address the specific research objectives;

(b) organizing the exchange of researchers between participating institutions, organizations and industry;

(c) organizing regular cooperation between COST and EC projects which are connected with problems of ageing and technology (e.g. COST 219, 220, TIDE, RACE);

(d) reporting regularly on the activities, and exchanging relevant information immediately.

4. Time schedule

The duration of the project will be three years, with a possible addition of two years because of the applied nature of the research. The work programme comprises three phases:

Phase 1

Several national research teams linked to the project already have a number of projects under way. The main task in this phase is to initiate cooperation, and, in particular comparative studies, between these teams. For this purpose, seminars will be arranged, in the first one of which each country will present a survey of the state of the art, focusing on ongoing and planned research.

Phase 2

National original research will be continued, but new research will also be initiated. Cooperation will take place in the form of research seminars, and the exchange of researchers and joint projects, preferably of a comparative nature.

Phase 3

Concentration on applied aspects and diffusion of information.

A first exploratory seminar with specialists is planned to take place during autumn 1991.

5. Organization, management and responsibilities

Organization is based on a Management Committee (MC) with a secretariat and coordinated subprojects with their project leaders and national coordinators.

The MC will comprise one or two delegates from each Signatory and will be nominated after approval of the project.

The delegates of the MC are expected to:

(a) attend, and contribute to, meetings of the MC (usually two to four meetings annually);

(b) be responsible for the general programme, development of subprojects and time scale of the project;

(c) be responsible for the research cooperation with other COST projects;

(d) be responsible for setting up multinational task groups and a network of cooperating institutes, etc.;

(e) be responsible for liaison between the MC and national research groups in the participating countries.

The MC is expected to:

(a) contact annually the COST secretariat for suitable liaison between the project and other related COST projects;

(b) create contract with appropriate international groups as well as national ones. Representatives of other organizations can be given an observer status in the MC;

(c) organize annual financial and scientific reporting.

The MC should arrange meetings, workshops, the exchange of researchers, visits, etc. in order to achieve a rapid exchange of information.

The MC is responsible for the acceptance of projects, for arranging seminars and coordinating research between the national teams. On the basis of the seminars on the state of the art in the participating countries, the MC may decide to what extent cooperation could be established between national projects, for example, in the form of joint projects, and whether comparative research projects could be initiated in selected areas.

The MC should stimulate the exchange of scholars between the national teams. It will also set the reference terms for the exchange of existing and new knowledge, ensuring that the main results are circulated (e.g. through the translation of articles and summaries of research monographs). The MC will also take initiatives for publishing books on selected topics, containing contributions from several participating countries.

The MC is responsible for establishing links with related Community and other international networks in the field, in particular the COST project 'Impact of the social environment upon the creation and diffusion of technologies', and at least one seminar should be arranged together with that project.

In the final phase of the project, the MC will be responsible for producing a final report.

Subproject management

The MC will designate the national contributions to the different subprojects.

All subprojects will have a coordinator with defined responsibilities and duties.

The coordinator is appointed by the MC.

Assuming that the project will be approved early in 1991, the following time schedule is suggested by the *ad hoc* Technical Committee:

August 1991: preparatory activities with an international workshop;

Autumn 1991: first meeting of the MC.

6. Economic dimensions of the project

The present estimate indicates an investment of 120 man-years, and to the costs has to be added money for seminars, networking, travel, publications, etc. The costs of the project would total ECU 4.5 million.

Memorandum of Understanding for the implementation of a European research project on the evaluation of action against drug abuse in Europe

(COST Project A6)[1]

Date of entry into force of the project: 17.12.1992
Duration: 16.12.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.1992	17.12.1992
NETHERLANDS	17.12.1992	17.12.1992
NORWAY	17.12.1992	17.12.1992
SWITZERLAND	17.12.1992	17.12.1992

The overall value is ECU 1.7 million (in 1991 terms).

ANNEX II

General description of the project

1. Background

During the last decades, a number of substances of abuse have been introduced into European countries, raising serious concern especially because mainly adolescents and young adults became involved. Authorities and experts reacted in various ways in order to minimize or eliminate these more recent forms of drug abuse. International conventions such as the Single Convention of 1961 and the Convention on Psychotropic Substances of 1971 were widely, but not unanimously, adopted. Treatment and rehabilitation programmes for those affected were set up, but with different perspectives, ranging from programmes focusing mainly on complete abstinence to programmes of harm minimization including the legal prescription of otherwise illegal substances. A similarly wide variety of approaches was used in prevention, ranging from information campaigns to structural changes aimed at eliminating living conditions that encouraged drug abuse. Often enough, additional confusion arose from contradictions and incompabilities among those working in the field.

A growing number of countries, therefore, developed national plans for a consistent drug policy, defining operational goals and indicating action to be taken. However, concepts

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

and perspectives among European countries still show considerable differences. These differences are more based on elements such as value systems and traditional beliefs rather than on empirical knowledge of the effect of policy action.

2. Objectives of cooperative research

The objective of the research is to gain valid information concerning the impact of various drug policy concepts and measures on the extent, the nature and the consequences of drug abuse. This study should contribute to providing an improved rational basis for drug policy measures, and to enabling those concerned to identify topics for a shared European drug policy, in contrast to topics where national or regional solutions are more appropriate.

The research is not designed merely to describe patterns of drug abuse or their causes or consequences; the main focus is on the impact of policy measures on those phenomena.

A secondary objective of research is to improve knowledge on the feasibility and the modalities of evaluation studies in the field of drug policy and to invite more widespread and appropriate use of those modalities.

3. Contents of the project

The project includes research on the following topics.

1. Review of relevant positions and changes of drug policy in participating countries.

1.1. Analysis of official legislation, concepts, defined strategies (in the public health field, in the field of social and educational provisions and in the administration of justice).

1.2. Analysis of relevant action which has been taken within the last two decades at national or provincial or community level, identifying main acting parties.

1.3. Analysis of parliamentary interventions and other types of proposals regarding drug policy, including an analysis of media and official response.

1.4. Analysis of acceptance of drug policy action or changes, as documented by polls, expert statements, content analysis in the media, etc.

1.5. The analysis will consider external factors which bar on drug availability (e.g. decreased border control or changes in the production countries).

2. Identitification of past and ongoing research on the impact and effects of drug policy action and changes.

2.1. Identification of relevant evaluation research in the field of drug abuse prevention.

2.2. Identification of relevant evaluation research in the field of the prevention of negative consequences of drug abuse.

2.3. Identification of relevant evaluation research into relapse prevention.

2.4. Identification of relevant evaluation research into public consequences of drug abuse (visible drug scene, drug-related delinquency, drug-related prostitution, etc.).

3. Implementation of evaluation research in conjunction and coordination with new policy action (especially when policy action has defined operational goals).

4. Comparative analysis of national research results.

4. Time schedule

The Signatories intend, on the basis of the state of research related to the present project in their countries, to make the results of past and present research available and to have investigation and research work carried out to the extent possible. The duration of the project is three years. The work programme comprises three phases.

Phase 1: Preparation of research review

The main task in this phase is to review evaluation methods used in earlier research. A seminar will be arranged to exchange internationally methodological experience as summarized in national reports, including main reasons for evaluation failure.

Phase 2: Design of evaluation projects

In this phase, research groups are preparing evaluation projects for planned policy action, to be carried out within the duration of the COST project.

Phase 3: Synthesis of research results and recommendations

Earlier research and new research projects are analysed for results, with respect to the type of evaluated action and to the type of evaluation method used. A summary report is prepared.

5. Organization

The project will be organized by the Management Committee (MC). It is desirable that at least one member of the MC is also a member of the Technical Committee. The MC will report to the Technical Committee twice a year.

The MC is responsible for the acceptance of projects, for arranging seminars and co-ordinating research between the national teams. On the basis of the seminar mentioned under phase 1, the MC may decide to what extent cooperation could be established between national projects and whether comparative research projects should be initiated in selected areas.

The MC should stimulate the exchange of scholars between the national teams. It will set the reference terms for the exchange of existing and new knowledge, ensuring that the main results of the national projects are made available internationally.

The MC is responsible for establishing links with related international networks in the field. In the final phase of the project, the MC will be responsible for producing a final report.

6. Economic and financial dimensions of the project

The present estimate indicates an investment of 50 man-years and costs to be added for seminars, networking, travel, publications, exchange of researches, etc. The costs of the project would total ECU 1.7 million.

Memorandum of Understanding for the implementation of a European research project on the evaluation of rules for a single European market

(COST Project A7)[1]

Date of entry into force of the project: 14.10.1992
Duration: 13.10.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.1992	17.12.1992
CZECHOSLOVAKIA	21.10.1992	21.10.1992
FRANCE	14.10.1992	14.10.1992
IRELAND	9.12.1992	9.12.1992
NETHERLANDS	11.11.1992	11.11.1992
NORWAY	14.10.1992	14.10.1992
SWITZERLAND	17.12.1992	17.12.1992
FINLAND	14.10.1992	14.10.1992
SWEDEN	16.11.1992	16.11.1992
UNITED KINGDOM	14.10.1992	14.10.1992

The overall value is ECU 2 million (in 1991 terms).

ANNEX II

General description of the project

1. Background

The free movement of people, goods and capital – which is implied in the single European market – will have a considerable impact on the economies involved and their institutional and legal frameworks. The single market is not just a voluntary exercise, as it entails, among other things, a social dimension and requirements for political-economic decision-making. Moreover, all countries in Europe are involved, not just those of the current European Community.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

2. Objective of cooperative research

The objective is to advance understanding of the process of European integration and the problems and opportunities going with it. Light will be shed on the key questions of the 1990s.

What are the consequences of broadening, smoothing and harmonizing markets for the industrial structures?

What consequences will the free movement of people have for the labour market and social security legislation?

Is the single market complementary to or at the expense of relations with the rest of the world, particularly with the rest of Europe?

There is an additional factor of timeliness in that at present there are:

(i) major intergovernmental negotiations which could lead to significant new factors in the rules of the single market;

(ii) new policies in East and Central European countries;

(iii) discussions on the extension of the Community involving other European countries.

3. Structure of the programme

The potential research agenda for consideration of the single European market and its development through economic, political and monetary union is vast. To give shape and feasibility to a research programme, it is necessary to identify a common theme which will guide research towards the key questions set out above in a coherent approach. The theme we put forward is that of: 'the evolution of rules for a single European market'.

Different types of rules can be distinguished. Firstly a distinction can be made between formal and informal rules and secondly between procedural and substantive rules.

The different research projects may vary in terms of scope, aspects or issues. The structure of the present programme helps link the various projects in such a way as to ensure a sufficient measure of coherence and synergy. As to scope, some research projects belonging to the programme may deal with specific markets, while others may comprise whole industrial sectors.

3.1. Research aspects

The following aspects are distinguished:

Setting the rules

This aspect covers how rules are made and decisions taken. How are the priorities established by the different institutions and social partners within the Community? How are priorities influenced by pressure from outside the Community? How are conflicts within and between institutions resolved? There are many different and well-established regulatory styles in different European countries. How will these interact with the setting of

rules for a single European market? How far can democratic accountability be introduced to ensure popular legitimacy for the rules of the single market?

Enforcing the rules

Unlike most national systems, the European Community has considerable heterogeneity of how its rules are implemented at national, regional and local level. Only 'regulations' are directly applicable in the Member States; for other rules, national authorities choose form and method in subordinate legislation. What mechanisms exist to enforce the observance of rules? How will control systems (e.g. the police) develop? Will there be a 'compliance gap' between rules and actual behaviour? Can we predict how this will vary according to local systems? How far can the Court of Justice develop a model of supranational enforcement? What are the constraints and facilitating mechanisms for its effectiveness? Will 'mutual recognition' work in practice? Will more legaslistic forms of regulation (e.g. environmental prohibitions) dominate market-oriented systems (e.g. environmental taxes)? How will non-member States be affected?

Evolution of rules

The single market is intended to help European industry become more competitive in the world economy. The question remains which of the different political, economic and social forces will be dominant in establishing the rules and how will the concomitant processes of power sharing interact and lead to a common social and economic policy?

Regional effects

The economies of the Member States have to adjust to the single market. Some geographical areas will 'gain' and others will 'lose'. What are the social and income-generating effects of the adjustment process in the various regions of Europe? Will the single market allow compensation for the losers?

3.2. Research issues

In particular, four research issues stand out.

Technology

Will the rules of the single European market aid technological investment and innovation by permitting and perhaps encouraging appropriate collaboration between firms?

Competition

The single European market rules on mergers and acquisitions have to be judged in the light of the latest social and scientific theories of dominant positions and entry barriers. Will the rules ensure adequate competition within the single market? The scope of rules is being extended to State aid and public procurement. The Community may be confronted with new forms of protection and support requiring additional powers at Community level. How does this relate to controls on non-Community multinational companies?

Standards

The 'new approach' to standards within the Community needs to be assessed in its own terms and those of other theories of optimal regulation. Will mutual recognition supple-

menting basic harmonization promote efficiency or will gains be outweighed by restructuring costs? Will bad standards drive out good ones in the competition between rules (e.g. to the detriment of consumer choice)?

SOCIAL DIMENSION

The reshuffling of power may have substantial social effects demanding a minimum of income and other protection. To prevent unbalanced processes of migration, a common social policy is needed. Market forces may play a role, however. With a common currency, would the social dimension and other rules allow for labour market flexibility to replace the loss of exchange-rate flexibility?

A number of relevant combinations of aspects and issues can be visualized with the aid of the following matrix. Each cell shows a particular research question. Researchers may approach a problem area either from the aspect point of view (studying one aspect of a number of issues) or from the issue point of view (studying various aspects of a single issue).

Aspects	*Issues*			
	Technology	Competition	Standards	Social dimension
Setting the rules				
Enforcing the rules				
Evolution of rules				
Regional effects				

4. Time schedule

The Signatories intend, on the basis of the state of research in the different subjects related to the present research area in their countries, to have investigation and research work carried out or, if such work has already been done, to make the results available.

Research already under way includes the following:

UNITED KINGDOM

The United Kingdom has an Economic and Social Research Council initiative coordinated by Professor David Mayes. The above content for the COST topic has been largely based on this initiative. Sixteen projects are about to begin.

NETHERLANDS

In the Netherlands this year, the possibilities for cooperation in research on European integration will be explored in a number of clusters of research questions, in particular:

- the design and implementation of regulating mechanisms;
- European economic law – implementation and compliance;
- the social dimension of the single market;

- environmental policy.

DENMARK

In Denmark, research is under way at the Social Forsknings Instituttet, Copenhagen. It includes:

- social security systems: a comparison of the way they are financed and administered;
- public expenditure: will the single market bring convergence?

GERMANY

In Germany, there is a research programme in this field at the Institut für Wirtschaftsforschung in Berlin (DIW).

(France and Finland have research programmes in this field but details were not available at the time this paper was written.)

The duration of the programme would be three years. There would be three phases:

(i) synthesis of the state of the art in each country;

(ii) drawing-up of national research projects through seminars, exchanges and perhaps joint projects of a comparative nature;

(iii) synthesis of the research results and recommendations.

5. Organization

The topic would have the usual COST social science structure of a Management Committee.

6. Benefits of collaboration

The research area both relates to the whole of the Community and has implications for behaviour and policy throughout Europe at local, regional, national and Community level and also beyond its borders.

However, the organization of research is inherently national and the setting-up of links between research institutions to undertake the work is difficult. As a result there is unnecessary duplication, inefficiency and failure to take account of advances made elsewhere. The duplication occurs because each national programme can see similar issues, but is unaware of what has been or is being undertaken elsewhere, particularly when it is published in another language. The inefficiency occurs not just because work undertaken at a distance lacks local knowledge and contacts. It is, therefore, more expensive because of the need to learn more and probably of lower quality because of failure to see the best people or tap all local sources of knowledge.

A COST programme will help overcome these difficulties.

7. Economic and financial dimensions of the project

The present estimate indicates an investment of 50 man-years and costs to be added for seminars, networking, travel, publications and the exchange of researchers. The total would amount to ECU 2 million.

Memorandum of Understanding for the implementation of a European research project on the development of new radiotracers and methods of quality assurance for nuclear medicine application

(COST Project B3)[1]

Date of entry into force of the project: 11.12.1992
Duration: 10.12.1997

Contracting parties	Date of signing	Date of entry into force
FRANCE	8.10.1992	8.10.1992
HUNGARY	11.12.1992	11.12.1992
SWITZERLAND	8.10.1992	8.10.1992
SWEDEN	8.10.1992	8.10.1992

The overall value is ECU 1.5 million (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

Nuclear medicine is based on the use of radionuclides and labelled substances (i.e. radiotracers) for the study of human physiology and pathophysiology. After administration, radiotracers accumulate in specific regions of the body depending on their properties. External measurement and quantification largely depend on the selective uptake of the radiotracer; for quantification of physiological parameters highly specific radiotracers are required. The development of specific ligands, labelled with gamma- or positron-emitting radionuclides, has considerably enhanced nuclear medicine methodology, since these radiotracers can simulate biologically active substances. Thus, organ function can be localized and quantified.

Biological mechanisms, such as transport and metabolism, place strict requirements on molecular structure, whereas receptor-binding ligands are characterized by a high affinity for the binding site. The development of metabolic, pharmacological and receptor-affine radiotracers labelled with either photon- or postiron-emitting radionuclides is, in consequence, a multi-disciplinary task and can be seen as the result of several research elements.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

Development of enzyme- and receptor-binding ligands

The elements in a strategy for the development of receptor ligands for nuclear medicine are:

(a) identification of suitable areas of interest in nuclear medicine (organs, systems, tumours, etc.);

(b) definition of areas of research (defining the required precursor molecules);

(c) structure- and activity-related biochemical evaluation of potentially useful precursors;

(d) development of labelling methods with photon- or positron-emitting radionuclides;

(e) development of quality control procedures;

(f) studies of pharmaco-kinetic parameters in experimental models;

(g) pharmaco-kinetic studies with SPET- and PET-radiotracers in healthy volunteers and in patients in compliance with the legal requirements and with permission from the Ethical Committee;

(h) the compounds and methods developed in the COST framework should be evaluated jointly at European level.

Nuclear medicine diagnostic procedures are highly dependent on the availability, quality and safety of labelled compounds. Functional imaging of human physiology, in particular, will benefit most from the development of new ligands and methods ensuring pharmaceutical quality. This is of general concern and will be beneficial to about 3 000 users in nuclear medicine throughout Europe.

Since radiotracer development requires complex methods, (chemistry, radiochemistry, biochemistry, radiopharmacology, medicine (i.e. endocrinology, neurlogy) and physics), it is dependent on research institutions and technical know-how.

2. Objectives of cooperative research

Owing to the multidisciplinary nature of radiotracer development, European multicentre cooperation is needed. Depending on know-how and technical facilities, each signatory State will contribute a special element to the project.

Centres of excellence will perform special tasks in the field of chemical and radiochemical development as well as establishing quality standards for the safe application of radiotracers.

Clinical evaluation will be performed at SPET and PET centres on patients and on healthy volunteers. The results obtained at different centres will be pooled to establish optimal diagnostic protocols.

2.1. The main objectives of the project are to:

(a) create a European project for the development of new radiotracers for nuclear medicine application;

(b) set up standard methods of preparation as well as methods of quality assurance;

(c) coordinate and promote national activities at European level;

(d) stimulate and promote collaboration with European industry in the field.

2.2. The cooperation consists of the following research elements:

(a) to coordinate and evaluate the development of specific ligands;

(b) to synthesize precursor molecules suitable for labelling with SPET and PET tracers;

(c) to develop labelling methods with these radionuclides;

(d) to demonstrate the biological effectiveness of the new radiotracers in experimental models;

(e) to perform clinical trials and evaluate the benefit of the new radiotracers;

(f) to provide pharmaceutical standards of preparation for safe application of the radiotracers (quality assurance programme).

3. The content of the project

The main goal of the project will be reached by means of general activity and coordinated special projects described as follows.

3.1 European know-how coordination

The project is based on locally funded know-how and research activities taking place in the participating countries.

This comprises the following:

(a) an exchange of reseachers between participating institutions and industry for the carrying-out of specific tasks;

(b) running of workshops to address the specific research objectives.

3.2. Radiotracer development

The verious phases of radiotracer development will be considered as subprojects assigned to different institutions and countries according to the available know-how.

By pooling efforts together at European level a great saving of costs and time can be achieved. The coordination of radiotracer development is a central part of the project.

The preparatory phase indicated a great interest in the development of enzyme- and receptor-binding ligands. Therefore, emphasis will be given to special topics related to the development of precursors and labelling methods with gamma or positron emitters. Each topic will have a special coordinator.

3.2.1. Development of radiotracers for enzyme and receptor studies

(a) The development of metyrapone analogues as radiotracers for functional studies of the adrenal cortex

At present ^{131}I-6β-iodomethyl-cholesterol is used for the detection and localization of adreno-cortical disorders. From diagnostic and radiation protection viewpoints there is a need for a better agent with a faster metabolic clearance worldwide. Metyrapone derivatives can be labelled with short-lived radionuclides, thus reducing the radiation dose to the patient as well as facilitating diagnostic procedures.

Work in this field has already begun (Austria and Belgium).

Metyrapone has been derivatized to produce suitable precursors for labelling with either photon- or positron-emitting radionuclides.

Biochemical *in vitro* analysis has been applied to identify ligands with optimal biological effectiveness.

Labelling with ^{123}I-iodine and methylation with ^{11}C has been developed (Mertens, 1991; Halldin, 1991).

Scaling-up of the laboratory labelling method for commercial production by install-

ing a device for permanent production and design of a delivery scheme for Europe on a weekly basis is in preparation (Paul Scherrer Institute, Switzerland).

(b) Other special projects, i.e. the development of short-lived radiotracers for neurotransmission exploration, will be created later.

3.2.2. Clinical evaluation of radiotracers

Application of gamma- and positron-emitting radiotracers in patients is based on different instrumentation, therefore a network of cooperating nuclear medicine centres is needed. The results of the multicentre clinical investigation will provide sufficient data to demonstrate the clinical benefit of new radiotracers.

3.3. Definition of quality assurance programme

The establishment of quality standards has considerable importance for safe application of short-lived radiotracers. To offer guidelines for the implementation of quality standards, it is a common goal to document methods of preparation and quality control. To perform this task, a network of cooperating institutes with good previous experience in radiochemical and radiopharmaceutical development will be assigned.

This comprises the following:

3.3.1. Radiochemical purity:

(a) stability of labelling,

(b) labelled impurities,

(c) stereochemical purity,

(d) specific activity,

(e) sterility, apyrogenicity.

3.3.2. Pharmaceutical formulation and its effect on:

(a) biodistribution,

(b) degradation,

(c) side-effects.

4. Appropriate forms of cooperation within the COST project

4.1. Type of project

The proposal is that the project be a Category III project which means 'a COST project where there is parallel participation by Community Member States and the Community itself, as well as by COST States which are not members of the Community'.

4.2. Management

The organization is based on a Management Committee with a secretariat, coordinated special projects and centres of excellence in the following way:

Management Group (with secretariat),

Coordinator for special projects with subproject leaders,

Coordinator for clinical evaluation of radiotracers with subproject leaders,

Coordinator for the quality assurance programme with subproject leaders.

4.2.1. Management Committee

The Management Committee (MC) will comprise one or two delegates from each Signatory and will be nominated after approval of the project.

The delegates in the MC are expected to:

(a) attend and contribute to meetings of the MC (usually two to four meetings annually);

(b) be responsible for the general programme, development of subprojects and time scale of the project;

(c) be responsible for setting up multinational task groups and a network of cooperating institutes, jointly with industry if desirable;

(d) be responsible for liaison between the MC and national research groups in the participating countries.

The MC is expected to:

(a) contact annually the COST secretariat for suitable liaison between the project and other related COST projects;

(b) create contacts with appropriate international groups within COST, IAEA, WHO, etc. as well as with national ones, in order to increase interest, and if appropriate to exchange information. Representatives of other organizations (WHO-EURO, IAEA, etc.) can be given an observer status in the MC.

(c) organize annual financial and scientific reporting which will be kept confidential.

The final report on the results will have a wide circulation covering nuclear medicine society at large.

The MC should arrange meetings, workshops, laboratory visits for interlaboratory comparison of results, in order to achieve a rapid exchange of information.

4.2.2. Secretariat

Here it is assumed that one of the signatory States (Austria) will provide the secretariat service for the project.

4.2.3. Subproject management

The MC will designate the national contributions to the different projects.

All projects will have a coordinator with defined responsibilities and duties.

The coordinator is appointed by the MC.

4.2.4. PROJECTS

Each project consists of one or more subprojects with project leaders.

4.2.5. DOCUMENTATION

Documentation of and reports on the project will be made in accordance with the COST recommendation.

4.3. Economic dimension of the project

The information obtained from the COST Form 2 up to 10 September 1991 indicates that 20 institutes in nine countries have shown a serious interest in the project.

The present estimation indicates an investment of more than 20 man-years. On the basis of one man-year equivalent to ECU 40 000, the budget of the project is at present about ECU 4 million for five years.

5. Time schedule

5.1. Duration

The duration of this project will be about five years.

5.2. Planning

Assuming that the project will be approved in late 1991, the following time schedule is suggested by the *ad hoc* working party:

Autumn 1991: preparatory activities at all levels will continue including international working meetings;

March 1992: first meeting of the MC. The result of this meeting may be the setting-up of special projects and subprojects and the preparation of a workshop scheduled to be held in late 1992.

Memorandum of Understanding for the implementation of a European research project on control of the semi-rigid behaviour of civil-engineering structural connections

(COST Project C1)[1]

Date of entry into force of the project: 7.3.1991
Duration: 6.3.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CZECHOSLOVAKIA	31.7.1992	31.7.1992
GERMANY	10.4.1991	10.4.1991
SPAIN	8.5.1991	8.5.1991
FRANCE	7.3.1991	7.3.1991
IRELAND	17.5.1991	17.5.1991
ITALY	25.5.1991	25.5.1991
NETHERLANDS	7.3.1991	7.3.1991
AUSTRIA	10.3.1992	10.3.1992
SLOVENIA	17.11.1992	17.11.1992
SWITZERLAND	4.7.1991	4.7.1991
FINLAND	7.3.1991	7.3.1991
SWEDEN	7.3.1991	7.3.1991
TURKEY	7.3.1991	7.3.1991
UNITED KINGDOM	22.6.1991	22.6.1991

The overall value is estimated at approximately 160 man-years.

ANNEX II

General description of the project

1. Introduction

From the industrial and economic point of view, the aim of this COST project is to improve the knowledge of the behaviour of the connections in order to:

(a) be able to control the level of semi-rigidity, by developing practical analytical tools using realistic connection behaviour;

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

(b) determine which amount of savings can be achieved by using semi-rigid connections and simplifying accordingly the detailing of the connections;

(c) gain a better estimation of the level of safety and provide information for the determination of partial safety factors;

(d) estimate the energy dissipation in the case of cyclic loading.

From the scientific point of view the aim is to fill up the gap between the levels of accuracy that are now reached for member behaviour, on the one hand, and for connection behaviour, on the other hand. As far as the whole response of the structure is concerned the influence of connection behaviour is as important as member behaviour. Furthermore, in case of seismic loading any damage in the connection is much more important that any damage in the adjacent members. New structural analysis concepts have to be developed in order to recognize the importance of the connection behaviour.

At this pre-competitive stage it is expected that work will focus on a multimaterials modelling suitable for both static and dynamic loading. The materials concerned are: steel, reinforced and pre-stressed concrete, timber, composite steel concrete and all other new combinations that could appear in the near future. The purpose is to use the same concepts as far as possible and to transfer the knowledge from one material to the others. Of course at the final stage the conclusions and the requirements could be material dependent and the competition between the materials will subsist.

Finally it would be very useful for this work to be done bearing in mind that the results must be transferred into the code requirements. A permanent contact between research teams and Eurocode writers and CEN committees has to be maintained.

2. Description of the project

2.1. Materials and fasteners concerned

All the materials used in civil-engineering structures are concerned, i.e. steel, concrete (reinforced and pre-stressed), timber, composite and all types of fasteners:

- welds, bolts, pins, rivets and screws for steel structures;
- metal or timber connectors for timber structures (nails, bolts, plate);
- mechanical connectors and cast on-site concrete for concrete structures;
- steel fasteners and rebars for composite construction;
- viscoelastic adhesives for metal structures and timber structures.

2.2. Connection types concerned

The types of connections that have to be studied will be:

- the regular semi-rigid connections that are already used but not necessarily known from the point of view of mechanical behaviour;
- the hollow sections in steel structures;
- the other regular connections which are probably semi-rigid and which are used as rigid or pinned connections;
- the new connection types that have to be defined by practising engineers as more

simple to build and more economical (including high-strength steel and high-strength concrete if these materials allow for global optimization).

2.3. Type of loading

Static and dynamic loading will be studied. The purpose of static loading is to learn about:

(a) global force-displacement behaviour and to evaluate the level of loading (/displacement) at the typical values of serviceability limit state and ultimate limit state of the whole structure;

(b) the internal forces in the connections, more especially at the ultimate limit state, in order to be able to propose new design methods for the fasteners.

The purpose of dynamic loading is principally devoted to the knowledge of the energy dissipation in case of seismic loading, with and without hysteretic degradation of the nodes. A subsequent problem is the low-cycle fatigue behaviour for which it will be necessary to propose constitutive equations or at least some boundary values. For higher frequencies, machinery buildings for example, it could be interesting to know the damping capacities due to the connections.

The effect of fire on semi-rigid joints must also be studied, more especially with regard to time duration requirements.

2.4. Type of studies

All relevant methods of analysis must be used and three typical fields of investigation will be covered.

EXPERIMENTAL WORKS

- Tests on isolated joints (category 1): cruciform tests, cantilever tests, etc.
- Tests on substructures (category 2): subassemblages, one bay one storey frame, etc.
- Tests on whole structures (category 3).

THEORETICAL WORKS

- Local modelling for nodes.
- Computerized frame analysis methods for dynamic loading.
- Simplified methods for static and dynamic loading (in order to avoid complete step-by-step analysis for practical design).

NUMERICAL WORKS

- Setting-up of constitutive equations for nodes from constitutive equations for material in case of quasi-continuous node (reinforced concrete for example) by using finite element analysis or other relevant methods (meso-mechanics for example).
- Numerical simulations for model calibration from experimental results.

2.5. Collection of results on database

The experimental results will be collected and published in interim reports and in a final report, but in order to be more efficient a database collection should be organized for several purposes:

(a) to allow for calibration of theoretical models from test results;

(b) for direct use in practical design in cases where analytical methods are not relevant;

(c) for researchers who need various experimental information to set up analytical or numerical models.

2.6. Expected outcome

It is expected to identify clearly what the parameters are that govern semi-rigid behaviour in terms of ultimate strength, stiffness, ductility, energy dissipation and low-cycle fatigue in order to be able to control the whole behaviour and to provide practical methods of design for each material. The relations between the actual behaviour and the design values must be clearly defined. Therefore, design criteria could be developed, allowing a better utilization both of the joints themselves and the members that are connected.

3. Organization of the project

3.1. Exchange of information

Besides the interim reports and seminars or workshops that could be organized, the mutual exchange of information from individual to individual will be organized in two different ways:

(i) in a vertical way for each material, in order to improve quickly the knowledge for a given material;

(ii) in a horizontal way for several materials in order to be sure that all the areas are covered.

3.2. Organization of workshops

Several workshops could be organized but a first one of prime interest must be organized some months after the signature of the Memorandum of Understanding in order to identify clearly what has already been done, what the new concepts are that have to be developed and to discuss these new concepts in depth.

3.3. Coordination of works

Such a COST project, by its nature, does not have to be rigidly coordinated and each Signatory must retain enough flexibility regarding its own developments. Nevertheless, to avoid overlaps, more especially in the experimental field, and to set up a satisfactory database organization, it will be necessary to know as exactly as possible the activity of each participant and to proceed to a coordination of activities decided by agreement. The Committee will be in charge of this coordination.

3.4. Coordination with code-drafting panels

For all the concerned Eurocode drafting panels (EC2, EC3, EC4, EC5, EC8, etc.) and subsequent CEN committees, a close contact will be established with the different research teams (of course, sometimes the individuals are the same), in order to allow for a mutual exchange of information.

4. Aims of international cooperation

4.1. Exchange of knowledge

Depending on the customs and on available materials, technology is different from one country to another. It is of mutual benefit to know the concepts that have been developed in each country. Therefore, the code requirements will reflect these various technologies.

4.2. Standardization of experimental techniques

A properly organized database requires standardized procedures for experiments, i.e. size of the specimen, type of measurements, type of transducers, loading control or displacement control, etc. It is necessary to have an international settlement for all of these.

4.3. Volume of experimental works

The number of tests that have to be done is so large that international cooperation is necessary to share this task.

4.4. Understanding of design methods

Owing to the cooperation of various countries, generally accepted methods of design can be developed with the result that time-consuming discussions about the interpretation of rules and assumed design parameters can be avoided.

Memorandum of Understanding for the implementation of a European research project on coordination chemistry in the context of biological and environmental systems

(COST Project D1)[1]

Date of entry into force of the project: 14.9.1992
Duration: 13.9.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.1992	17.12.1992
DENMARK	8.10.1992	8.10.1992
GERMANY	10.9.1992	10.9.1992
FRANCE	9.12.1992	9.12.1992
ITALY	20.11.1992	20.11.1992
NETHERLANDS	8.10.1992	8.10.1992
NORWAY	16.12.1992	16.12.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 150 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

A1. Reason for a COST project on this topic

The role of metal ions in living systems is a vital one and its study is generally described as 'bioinorganic chemistry'. During the last decade, the area of bioinorganic chemistry has grown rapidly, bringing together scientists from several subdisciplines within chemistry, but also from other sciences like medicine, pharmacy, biology and (very recently) the environmental sciences. All these areas have a common interest: the role and effect of a metal ion in living systems, with particular attention to the understanding of coordination, around the metal and its changes as a function of some reaction or external effect and the fine-tuning that can be achieved towards (sub)disciplines, for example drug

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

design and toxic effects, involved in bioinorganic chemistry. A carefully prepared and performed COST Project will be a means to reach this aim.

The field of bioinorganic chemistry is quite wide and is attracting increasing attention in several of the COST member countries. However, in quite a few countries the activities are minimal, whereas communication and collaboration between researchers (leading to joint projects) of these countries have not, or have hardly, developed. There is a clear opportunity for COST to contribute to the stimulation of this area. A recent ESF programme entitled 'Chemistry of metals in biological systems' provides further evidence of the great importance of this area. It is proposed that the COST Project focuses on the chemistry of metal ions and will be named 'Coordination chemistry in the context of biological and environmental systems'.

A2. Status of research in the field

Because the field has developed and expanded so much, an all-inclusive definition is difficult, but the research area is recognized as centring around the various terms or synonyms used worldwide: inorganic biochemistry, metals in biological systems, bioinorganic reactions, coordination biochemistry, biocoordination chemistry, and overlaps into the areas of medicinal and environmental chemistry. Exploration and understanding were, and still are, the major aims in this field. However, application is increasingly considered as an important future objective.

The interdisciplinary nature of the field is further illustrated by the following medical and pharmaceutical fields to which scientists are contributing:

- therapeutic and diagnostic radiolabels (^{67}Cu, ^{99}Tc);
- anti-cancer and anti-arthritic drugs (Rh, Pt, Ru, Au);
- treatment of psychiatric disorders (Li);
- control of diseases caused by metal ion deficiency (e.g. Zn in hypogonadism) or overload (e.g. Fe via siderophores);
- detoxicification processes (e.g. Cd, Hg and Pb via specifically designed ligands);
- stereo-specific synthesis of antibiotics (using oxidation catalysis); more generally, enantiomeric drug design via bio-organic chemistry and theoretical molecular modelling;
- involvement of aluminium and silicon in Alzheimer's disease.

Further targets for research related to health, environment, catalysis, materials and energy (i.e. the five important topics for European strategic research, as mentioned in the 1990 ECCC report), are:

- the design of new anti-tumour drugs with a low toxicity (e.g. with Sn and Pt);
- understanding and control of the biosynthesis of metal-active sites in enzymes for biotechnology (biomimeting);
- synzyme catalysts based on biological catalyst principles;
- biological denitrification of ground water; this involves chains of metalloenzymes containing copper, iron and molybdenum;
- control of soil nitrate levels; to involve proper strategies for this, an understanding of the mechanisms of the metalloenzymes mentioned in the preceding point is a precondition;
- metal winning, e.g. by microbial action on pyrites in order to extract copper and gold

more easily, metal accumulation by certain organisms is well known, e.g. sea squirts filter sea water for vanadium; certain plants select zinc from the soil;

- growth of inorganic crystals of high perfection and uniform size, but unusual habits, via controlled precipitation initiated by biomolecules (a special branch of biomineralization);
- fuel production involving microbial action to convert CO into CH_4 and CH_4 into methanol;
- water splitting and CO_2 activation.

The above list of topics also illustrates that many important developments for the economy, industrial activities, health development and our European environment are likely to be stimulated by research in this field. The present proposal will give special attention to the coordination chemistry which originates from the abovementioned problems and approaches. This implies that especially the role of the metal (ion) will be considered as central.

A3. Relationship with other European programmes

The importance of this research area, both from the scientific and applied technology approach, has been realized at an early stage in a few countries and has since developed. Other countries are likely to start or increase activities in this research field, for example by participation in the present COST Project. In fact, the recent ESF programme (see point 4 below) is a further illustration of the importance of the field of metals in biological systems. Some of the current important international activities are outlined below.

1. International Conferences on Bioinorganic Chemistry

These biannual series started in 1983 in Italy and attracted about 400 participants (250 from Europe). The next meetings were held in Portugal (1985, 450 participants, 300 from Europe) and the Netherlands (1987, 500 participants, 350 from Europe). In 1989 this meeting was held in the USA (MIT), whereas in 1991 the conference will return to Europe (Oxford).

2. Bilateral exchange and biannual workshop meetings

Such meetings on (bio-)inorganic chemistry have been set up between scientists in Italy and Switzerland since 1981 (50 to 100 participants).

3. Trilateral exchange, collaboration programmes and biannual meetings

These have been taking place between the United Kingdom, France and Germany since 1986.

The RCS discussion group, Inorganic Biochemistry (London), also includes several members from the continent. Total membership amounts to 400.

Starting in 1992, the meetings under points 2 and 3 will merge and be transferred into European Bioinorganic Conferences (Eurobic), illustrating the importance of the field and the need for concertation.

4. At the end of 1990, an ESF programme was started entitled: 'Chemistry of metals biological systems'

This programme is devoted to:

- Euroconferences (100 to 120 participants in the ratio 1:1:1 for lecturers, senior participants and junior participants);
- workshops (duration: three days; up to 50 participants) on selected fields (two per annum);
- exchange of postdoctoral fellowships (advanced training, to prevent brain drain) and short-term fellowships (two to four months).

In addition, some infrastructural facilities (communication, secretariat) are made available by the ESF.

On a (bi)national level in Europe, in several countries initiatives have been undertaken with the aim of extra stimulation in this area. This has been particularly effective in the United Kingdom (the Tramps programme; joint cooperation between SERC and AFRC), in Germany (Schwerpunktprogramm of DFG) and France (CNRS national programme).

The UK initiative has recently (1991) resulted in extra funding on the 'application of coordination chemistry of transition metal ions to biological agricultural and environmental research'. The programme was strongly recommended by several companies (e.g. ICI, Amsterdam, Rhône Poulenc, Glaxo, Celltech, Smith Kline Beecham, Johnson & Matthey, Exxon) and leading academics outside this research field.

B. Objectives of the project

B1. Main objective

The main objective for the present proposed COST Project can be described as: 'to explore the coordination chemistry of metal ions in the context of biological and environmental systems', and to apply the knowledge and experience obtained for the development of new catalysts, new synthetic products, new metal recovery systems and new drugs, to be detailed in five secondary objectives.

B2. Secondary objectives (specification of five subprojects)

1. To study and explore biomimetic chemistry within a European network; this is a large area dealing with understanding and exploration of the synthetic analogues of active metal centres present in metalloproteins and on DNA, including biomimetic production of H_2, N_2, O_2, using (photo)catalysis and also activation of O_2, N_2, hydrocarbons by synthetic metal centres. This objective has close connections with supramolecular chemistry (COST Projects B and D) and molecular modelling (COST Projects C and G).

2. To start a programme for the development of new metal-containing diagnostics and drugs, including the detailed understanding of the mechanism, eventually leading to improved new diagnostic and therapeutical metal-containing drugs. This objective has close connections with molecular modelling (COST Projects C and G).

3. To set up a programme devoted to metal recovery from waste (water) using chemicals based on biological chelation principles (use of plants and bacteria in environmental cleaning).

4. To set up a programme for the specific synthesis of organic compounds, using bioinorganic catalysts, with special attention to chirality. This objective is related to supramolecular chemistry (COST Projects B and D) and molecular modelling (COST Projects C and G).

5. To support research on molecular recognition (metal ion and ligand interactions). This objective has close connections with supramolecular chemistry (COST Projects B, G and D), chemistry-biological interactions (COST Project G), molecular recognition (COST Project G) and molecular modelling (COST Projects C and G).

C. The content of the project

C1. Classification of the subprojects

The objectives described under section 2.2. are a selection of very important subprojects studied and stimulated already in several European countries and which are very promising for concertation of the European level. The (scientific) relationship between the five subprojects described above and with the Management Committee are as follows.

Management Committee			Secretariat	
Subproject 1	Subproject 2	Subproject 3	Subproject 4	Subproject 5

C2. Evaluation of progress

The intention is to monitor the progress in the programme by means of brief annual reports of the participating scientists, describing the results obtained through the concertation. After three years of joint activities, a milestone report should be prepared by the Management Committee. This report can then be reviewed by the – then appointed – COST Technical Committee for Chemistry.

A final report, perhaps in parallel with a few review research papers (for international research journals) should be published, to inform the non-participating scientists and possible future users of the results and the obtained scientific conclusions. A symposium after a period of five years, which will be accessible to other scientists, will conclude the COST project in this field.

D. Timetable

A five-year programme for each of the five subprojects described above and consisting of four stages (each of one to three years) is proposed to be set up as a COST project.

Stage 1

After the first meeting of the Management Committee, a detailed inventarization of ongoing research and existing plans of the participating groups to start joint projects, based on the results of the present *ad hoc* Technical Committee, will take place. This will result in a document for further use and for mutual adjustment of plans. A short workshop-type meeting of the university and industry group leaders in this field may be used to evaluate these plans.

Stage 2

In this stage, which will start at the end of the first year, the activities between closely related projects should be visible, so that the researchers (and their co-workers) can meet to set up (and continue) joint collaborative projects and exchange their recent research results. Perhaps during this stage some collaboration with other (East) European countries can be explored.

Stage 3

An intermediate progress report should be prepared after three years for review by the COST Technical Committee for Chemistry.

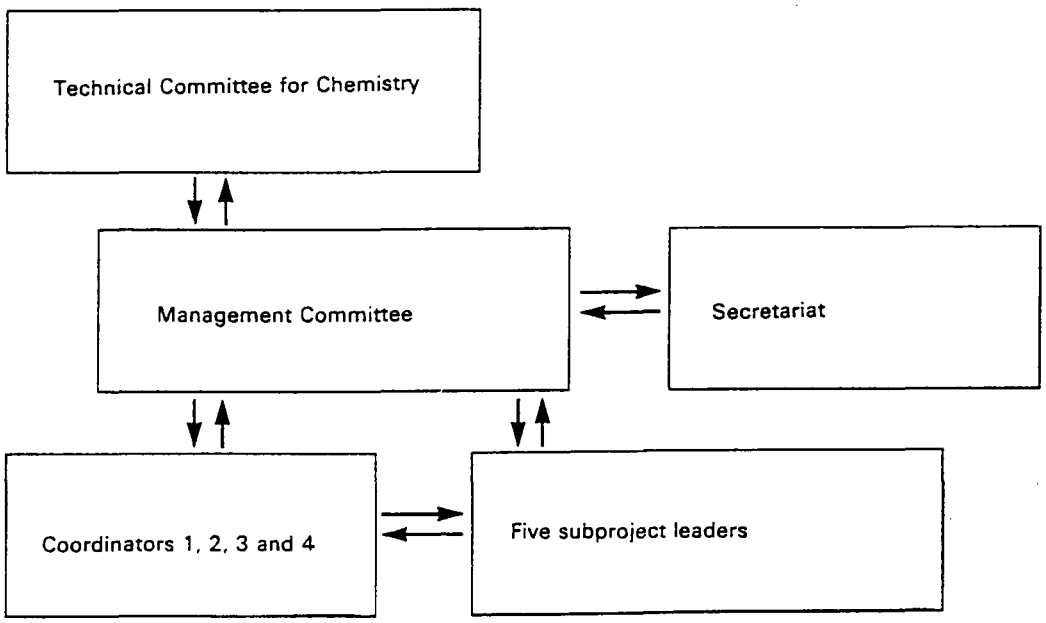
Stage 4

In this final phase, which will start after four years, an evaluation of the results obtained shall take place, perhaps by organizing a concluding symposium for all participants and their co-workers.

1991	1992	1993	1994	1995	1996
Starting-point (appointment of Management Committee)					
	Formation of five sub-projects; workshop of group leaders; overview available; start meetings; continue meetings on subprojects				
		Start exploration and participation; East European countries			
			Intermediate progress report becomes available for Technical Committee		
				Start of evaluation of results	
					Concluding symposium

E. Organization, responsibilities and management

The organization of the total project could operate under the following structure:



The four coordinators have responsibilities for, respectively:

(i) the inventarization in the first year, the organization of the workshops and the start of the activity; existing contacts (see section 1.3 above) will be used and should make this task rather easy;

(ii) coordination of the joint activities with other COST chemistry projects (B to G); joint meetings are likely to result from this activity;

(iii) the possibilities of expanding to other countries, in particular to Eastern Europe; this coordinator is also responsible for the exchange of information with the EC science programme and the ESF;

(iv) the planning of the intermediate report, the final report and the concluding symposium.

The five subproject leaders are scientifically responsible for the five subfields mentioned under point 2.2 above. They interact with the Management Committee (MC) and also with the four coordinators.

The MC will meet every six months. This Committee shall consult the Technical Committee for Chemistry once every year (in a joint meeting) and report on the progress. After completion of the project, the final report should be made available to the general public and the governments of the participating countries; this is a major duty of the MC.

Of course, progress in the five subprojects will also be reported by the respective participants in their own countries (in the framework of existing programmes, such as mentioned under point 1.3).

F. Economics and financial matters

The total efforts spent in Europe (all countries expected to participate; five subprojects) are (at early 1991) as follows:

1. Research costs in the several subprojects

Subproject 1: in about 12 countries, a total of 120 man-years, totalling ECU 7.5 million;

Subproject 2: in about 6 countries, a total of 40 man-years, totalling ECU 2.4 million;

Subproject 3: in about 11 countries, a total of 100 man-years, totalling ECU 6.0 million;

Subproject 4: in about 15 countries, a total of 140 man-years, totalling ECU 8.4 million;

Subproject 5: in about 10 countries, a total of 100 man-years, totalling ECU 6.0 million.

In total, activities – in at least one of five topics – are progressing in all COST member countries. The total human effort in the area of biocoordination chemistry, as described in this paper, amounts to 500 man-years, being the equivalent of ECU 30 million per year. For the five-year period of project duration, this would correspond to a total of ECU 150 million.

2. Coordination costs

The costs for coordination and travelling expenses, as well as for workshops and seminar organization, publications and some translations, are estimated to be not more than ECU

4.5 million for the whole period of five years, provided that all countries analysed participate in this COST project. Should one or other of these countries not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.

3. Specification of activity per country

This is available as a list (and name of a contact person) and shows that activities are progressing in 15 countries that are members of COST. Actual participation in one or more of the five subprojects is therefore quite likely.

The list of activities and contact persons in 15 COST member countries is given in the final report of the COST *ad hoc* Technical Committee for Chemistry (Cost 240/91), Topic A.

Memorandum of Understanding for the implementation of a European research project on selective synthesis

(COST Project D2)[1]

Date of entry into force of the project: 10.9.1992
Duration: 9.9.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.1992	17.12.1992
DENMARK	8.10.1992	8.10.1992
GERMANY	10.9.1992	10.9.1992
FRANCE	9.12.1992	9.12.1992
NETHERLANDS	8.10.1992	8.10.1992
NORWAY	16.12.1992	16.12.1992
POLAND	10.9.1992	10.9.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 500 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

A1. Reason for a COST project on this topic

Synthesis has always been recognized as a typical and fundamental activity of chemists. It aims at the preparation of known molecules, natural or not, or at the creation of new molecular structures. Synthesis did not only have an immense impact on the quality of life but also kindled the development of modern theories of chemistry. Since the chemical industry creates and sells more and more sophisticated molecular materials which must be prepared in economically and environmentally acceptable conditions, the discovery and development of efficient synthetic methods is a prerequisite for the survival of the chemical industry in a competitive world and for the satisfaction of the continuing demand for new organic materials made by clean technologies.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

In spite of spectacular successes, organic synthesis has still a long way to go before achieving its ultimate goals: being as, or even more, efficient than nature in terms of the chemo-, regio- and stereo-specific control of reactions, and of producing high yields of structurally complex molecules using processes which are simple, cheap, catalytic and which do not adversely affect or destroy our environment.

In this respect, the absence – thus far – of support programmes in the European Community is striking especially given the fact that other economic communities (USA, Japan) stimulate various forms of organic synthesis. It is rather ironic that the Community has perhaps the strongest chemical industry but that, in terms of innovative research in the field of synthesis, it has left the leadership to the USA and Japan. Therefore COST projects in this area would be totally appropriate.

A2. Status of research in the field

The field has, in the last 50 years, expanded into a large research area with many interdisciplinary links. In this context especially the medical, pharmaceutical and environmental fields should be mentioned.

The last decade showed a development towards safer and better chemicals, pharmaca and phytopharmaca. Therefore, a better understanding of the principles of selectivity in synthesis are of the uttermost importance.

Efficiency and selectivity are essential characteristics of a good synthetic method. An efficient method of synthesis will: (i) give high yields of the desired product, (ii) enable the construction of a complex molecular structure from simple molecules, and (iii) will give environmentally acceptable secondary products or, preferably, no secondary products. In this respect, isomerization reactions or addition reactions are particularly efficient.

Chemoselectivity is often a problem in the synthesis of complex polyfunctional molecules. The traditional way of dealing with this problem is to use protection groups which have to be introduced and later removed. The development of chemoselective methods which would tolerate the presence of unprotected functional groups is thus an important target.

Diastereoselectivity refers to the control of the relative configuration of the atoms of a molecular material. It has already been the subject of a large number of studies but still remains an essential target for synthesis. The development of diastereoselective catalytic methods of construction of a carbon skeleton should become a major target for future research in the field.

Enantioselectivity refers to the control of the absolute stereochemistry of a molecule. It is now obvious that the preparation of enantiometrically pure molecules will become a major challenge for organic synthesis. This is of great economic importance as a result of the large number of potential applications for chiral materials. It is well known that the biological activity of a molecule is most often the property of a single enantiomer. It is clear that, in the near future, drugs, veterinarian products, or agrochemicals based on racemic materials will no longer be accepted in most countries. It is also well known that the physical properties of many new materials in the fields of non-linear optics, ferroelectric crystals, etc. rely upon the chiral properties of their molecular constituents. The valorization of these products will only be possible if they are accessible by efficient and selective methods. The realization of these objectives should be facilitated by interdisciplinary collaboration between synthetic chemists and those studying the properties of the new materials.

The preparation of enantiometrically pure molecules has been traditionally effected by resolution of racemic mixtures. Although this approach can still be of some practical value in certain cases, it should not be included as a main objective in this collaborative programme.

Natural products (in particular, agrochemicals) and chemicals directly derived therefrom are potential sources of useful enantiometrically pure materials. A great deal of attention should therefore be turned toward the development of practical methods converting stereoselectively these 'chirons' into useful molecules. This would allow the recycling of natural waste and the valorization of up-to-now useless residues which create environmental problems.

Nevertheless, the main efforts in this field should be focused on methods which allow for: (a) intermolecular chirality transfer, (b) chiral multiplication, and (c) chiral amplification using chiral auxiliaries or chiral catalysts. In this area, only a little progress has been made. The development of this field relies upon our understanding of reaction mechanisms and, in particular, of the weak molecular interactions determining selectivity. The field would therefore certainly benefit from collaboration between synthetic and physical chemists.

The major problems to be solved in synthetic methodology are best defined within the framework of multistage synthesis of complex molecular structures. The importance of the field is well illustrated by the recent award of the Nobel Prize to E. J. Corey. It is therefore of primary importance to favour collaboration between scientists interested in methods and those involved in total synthesis of specific molecular targets.

A3. Relationship with other European programmes

The importance of the field has been realized at an early stage as is reflected by a number of ongoing activities and concertations at European level.

ESOC meetings: organic chemistry, every two years, approximately 500 participants;

BOSS meetings: organic synthesis, every two years, approximately 300 participants;

Cambridge and Oxford meetings on organic synthesis, approximately 110 participants;

ERC Burgenstock meeting on stereochemistry, annual, approximately 100 participants;

ECHC meetings on heterocyclic chemistry: heterocyclic synthesis, every two years, approximately 300 participants;

Topical ERC meetings on various aspects of organic synthesis.

B. Objectives of the project

B1. Main objective

The main objective of this proposed COST project is the search for new selective synthetic methods and their application for the development of new synthetic products, fine chemicals and drugs.

B2. Secondary objectives (specification of six subprojects)

The projects in the areas described in section A2 should focus on the following objectives:

1. Asymmetric syntheses based on the use of efficient chiral auxiliaries, or chiral catalysts or on the transfer of chirality from natural or modified natural products.

2. Synthetic methods based on the use of heteroelements or organometallic compounds with a particular emphasis on homogeneous catalysis (COST Projects A and F).

3. Biosystems as catalysts for reactions with a particular emphasis on the use of enzymes in organic solvents and the application of catalytic antibodies to organic synthesis (COST Project G).

4. Design and execution of efficient strategies for the preparation of complex molecules of value as potential drugs, agrochemicals, molecular materials, etc. Particular attention should be given to the improvement of properties of biologically active natural products and the finding of new 'lead compounds' (COST Projects E and G).

5. Organic synthesis at interfaces: heterogenous and phase transfer catalysis (COST Project E).

6. Application of biosynthetic pathways in total synthesis (biomimetric synthesis).

The various goals mentioned above will normally overlap. High priority should be given to projects which combine different objectives.

C. The content of the project

C1. Classification of subprojects

The objectives described in section B2 are important subprojects which are currently already under study in several European countries and which should be stimulated by active concertation. The relationships between the six subprojects and the management are as follows.

Management Committee	Secretariat
Project 1 Project 2 Project 3	Project 4 Project 5 Project 6

C2. Evaluation of progress

The progress will be followed by brief annual reports describing the results obtained within the framework of the concertation. After three years of joint activities, extensive reports should be prepared by the Management Committee and reviewed by the *ad hoc* COST Technical Committee for Chemistry.

The final report and research papers should be made available to non-participating chemists. In addition a symposium could be devoted to one or more subprojects of this topic.

D. Timetable

A five-year programme is proposed for each of the six subprojects described above, consisting of four stages (each of one to three years) proposed to be set up as a COST project.

Stage 1

After the first meeting of the Management Committee a detailed inventarization of ongoing research and existing plans of the participating groups to start joint projects, based on the results of the present *ad hoc* Committee, will take place. This will result in a document for further use and for mutual adjustment of plans. A short workshop-type meeting of the university and industry group leaders in this field may be used to evaluate these plans.

Stage 2

In this stage, which will start at the end of the first year, the researchers can meet to set up and continue joint collaborative projects and exchange their recent research results. Perhaps during this stage some collaboration with other (East) European countries can be explored.

Stage 3

A progress report should be presented after three years for review by the COST Technical Committee for Chemistry.

Stage 4

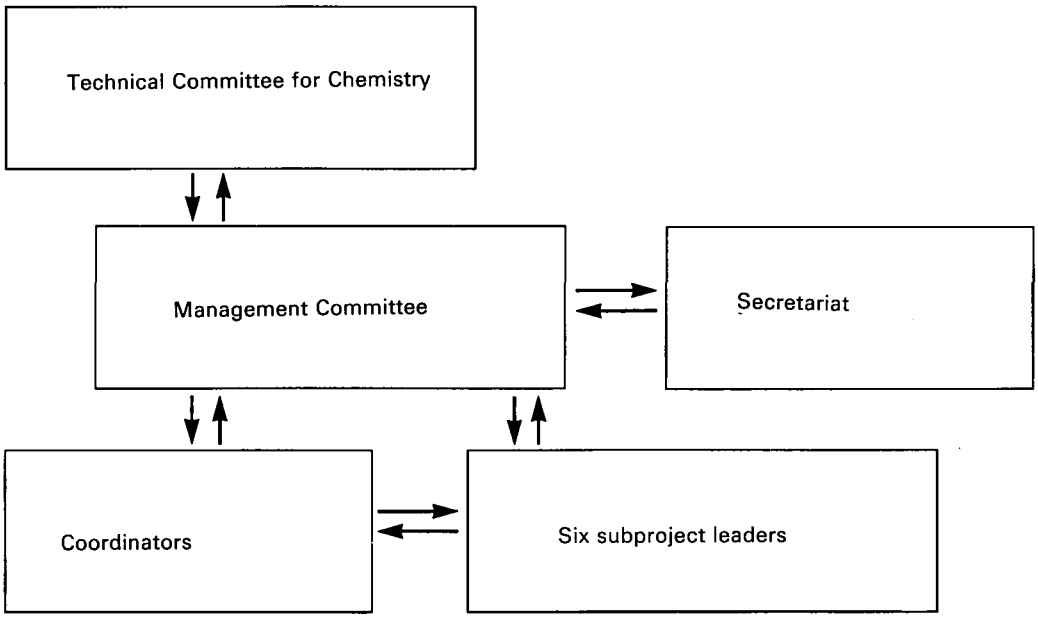
In this final phase, which will start after four years, the evaluation of the obtained results shall take place, perhaps by organizing a concluding symposium for all participants and their co-workers.

In summary, the total timetable can be presented as follows.

1991	1992	1993	1994	1995	1996
Starting-point (Management Committee)					
	Formation of six subprojects; workshop of group leaders; overview available; start meetings; continue meetings on subprojects				
		Start exploration and participation; East European countries			
			Intermediate progress report becomes available for Technical Committee		
				Start of evaluation of results	
					Concluding symposium

E. Organization, responsibilities and management

The organization of the project could operate under the following structures:



The coordinators have responsibilities for, respectively:

1. the inventorization in the first year, the organization of the workshop and the search for existing contacts (section 1.3);

2. coordination of the joint activities with other COST chemistry projects and joint meetings;

3. the possibilities of expanding to other countries, in particular to Eastern Europe; this coordinator is also responsible for the exchange of information with the EC science programme and the ESF;

4. the planning of the intermediate report, the final report and the concluding symposium.

The six subproject leaders are scientifically responsible for the six subfields mentioned in section 2.2. They interact with the Management Committee and also with the coordinators.

The Management Committee (MC) will meet every six months. This Committee shall consult the Technical Committee for Chemistry once every year (in a joint meeting) and report on progress. After the completion of the project, the final report should be made available to the general public and the governments of the participating countries; this is a major duty of the MC.

Of course, the progress in the six subprojects will also be reported by the respective participants in their own countries (in the framework of existing programmes, such as mentioned under section 1.3).

F. Economic and financial matters

Coordination costs

1. The costs for coordination, travel expenses, meetings and publications can be estimated to be not more than ECU 15 million for the five years, provided that all countries analysed participate in this COST project. Should one or the other of these countries not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.
2. The total effort spent in Europe for the countries expected to participate can be estimated to amount to ECU 100 million (approximately 700 man-years) in 1991. For the five-year period of project duration this would correspond to a total of ECU 500 million.

The list of activities and contact persons in 15 COST member countries is given in the final report of the COST *ad hoc* Technical Committee for Chemistry (COST 240/91), Topic B.

Memorandum of Understanding for the implementation of a European research project on the theory and modelling of chemical systems and processes

(COST Project D3)[1]

Date of entry into force of the project: 10.9.1992
Duration: 9.9.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.1992	17.12.1992
CZECHOSLOVAKIA	10.9.1992	10.9.1992
DENMARK	8.10.1992	8.10.1992
GERMANY	10.9.1992	10.9.1992
FRANCE	9.12.1992	9.12.1992
ITALY	20.11.1992	20.11.1992
NETHERLANDS	8.10.1992	8.10.1992
NORWAY	16.12.1992	16.12.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 225 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

The strong interaction between theory and experiments, fuelled on one side by the impressive evolution of computer technologies and on the other side by advances in instrumentation and techniques, permits both the evaluation of physical observables starting from first principles and the determination of quantities of theoretical interest in experimental measurements. As a result, the modelling of complex chemical systems underlying several modern technologies and environmental problems as well as the current understanding of molecular dynamics and chemical and biological reactivity is becoming more detailed and accurate.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

The price paid to achieve such an advancement is the high specialization of single laboratories. As a result, the necessary expertise is spread over all Europe and only a project coordinated at European level can have a truly cooperative effect. In fact, while multilateral collaborations do already exist, they have not yet reached the critical mass necessary to acieve finalized targets of strategic interest.

The goal of this project is to establish an operational link between the investigation of structural properties of molecular systems, the evaluation of their dynamic properties and the modelling of chemical environments.

B. Objectives of the project

On a European scale, the primary target of a COST project is to promote collaboration. A particular effort has to be devoted to favour circulation of ideas, stimulate the exchange of young researchers and the transfer of theoretical and experimental technologies.

This will form a more solid basis for the growth of common basic research and the development of a homogeneous scientific background. An increase in the extent of circulation of theoretical and technical achievements will promote valid innovations, stimulate laboratory activity and introduce an appreciable amount of competition.

Another target of cooperative effort is the possibility of putting together a suffucient and coordinated ensemble of experts that can more easily address complex objectives than those involved in certain modern technologies or environmental problems.

Specific scientific objectives, already discussed in the *ad hoc* Technical Committee, are as follows:

- Development of methods and software with emphasis on vector and parallel processing and cost efficiency: use of modern, fast, low-price hardware (e.g. workstations). Development of graphics and visualizing techniques.
- Development of methods for the study of large molecules (e.g. polymers, biopolymers, clusters) and molecular materials.
- Design of pharmaceutical products and of synthetic enzymes for technical catalysis.
- Information on the activation of N_2, CO_2, hydrocarbons, and other inert substances by metal centres and surfaces.
- Information on the reversible transfer of electrons for the purpose of energy accumulation and other areas (molecular energy storage).
- Improvement in the methods of study of highly reactive or short-lived species in gas and liquid phases.
- Model and experimental studies of energetic and entropic control of covalent and non-covalent single and multisite molecular interactions.
- Improvement of methods for treating complex reaction systems (e.g. combustion atmospheric chemistry and catalytic processes in aqueous media).
- Improvement in the theoretical approaches and beam experiments for the investigation of state-specific processes.
- Improvement in *ad initio* methods to handle electron correlation in arbitrary electronic states and in efficient calculatons of potential energy surfaces.
- Development of new techniques for the modelling of molecular aggregates (e.g. C_{60} cluster, etc.), coordination compounds and organometallic systems.

C. The content of the project

The project can be structured into three different subprojects.

(a) STRUCTURE AND SPECTROSCOPY

This subproject is devoted to the investigation of the structure and properties of isolated molecules and solids as well as to the determination of intra- and intermolecular potentials. To this end, accurate traditional and innovative techniques have to be used.

(b) REACTIVITY AND MOLECULAR DYNAMICS

This subproject is devoted to the investigation of the reactivity and dynamics of molecular systems on ground and exited states also under the effect of perturbing fields. Gas-gas, gas-surface and gas-solution processes will be investigated using accurate 3D and approximate theoretical approaches as well as advanced experimental techniques.

(c) SIMULATION AND MODELLING

This subproject is devoted to the investigation of complex chemical systems using statistical, graphical, mechanical, dynamic and kinetic means. It will be particularly concerned with the modelling of liquids, solutions, drugs, chemical and biological catalysts and other highly complex systems.

A detailed description of the structure of the project and its breakdown is given in Table 1. Evaluation is finalized to assess the progress in individual achievements and advancements in reaching the common targets. Evaluation criteria are determined as follows:

(i) an annual report per participating researcher;

(ii) an annual meeting of the research task team to discuss achievements and assess the progress on the methodological and finalized sides (two separate reports).

Each report is one A4 page with predetermined structure and questions (e.g. including statistics on conferences, papers, patents, etc.).

D. Timetable

The project is broken down into five years, as detailed in Table 2. In the first year, after a preliminary meeting, the work will progress in parallel at the various laboratories to 'tune' the different methodologies to the project goals. In the second and third year, the task teams will be organized to work on specific scientific objectives. In the fourth and fifth year the work of different task teams will be coordinated to achieve the final goals of the project.

E. Organization, management and responsibilities

The organization of the management of the project (as shown in Table 3) has been designed to adjust itself to the evolution of the projects. For this reason, in the first year the laboratories will report directly to the project coordinator; in the second and third year, the task teams, which group some laboratories, will refer to the project coordinator. In the final two years, the coordinated task teams (grouping several task teams) will refer to the project coordinator.

F. Economic and financial matters

The total effort developed in 15 COST member countries expected to participate is estimated to amount to 750 man-years, corresponding to about ECU 45 million in research expenditure per year.

For the five-year period of project duration this would correspond to a total of ECU 225 million.

The costs for coordination and travel expenses, workshops and seminar organization could be set at not more than ECU 6.75 million for the five years, provided that all countries analysed participate in this COST project. Should one or the other of these countries not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.

The list of activities and contact persons in 15 COST member countries is given in the final report of the COST *ad hoc* Technical Committee for Chemistry (COST 240/91), Topic C.

TABLE I

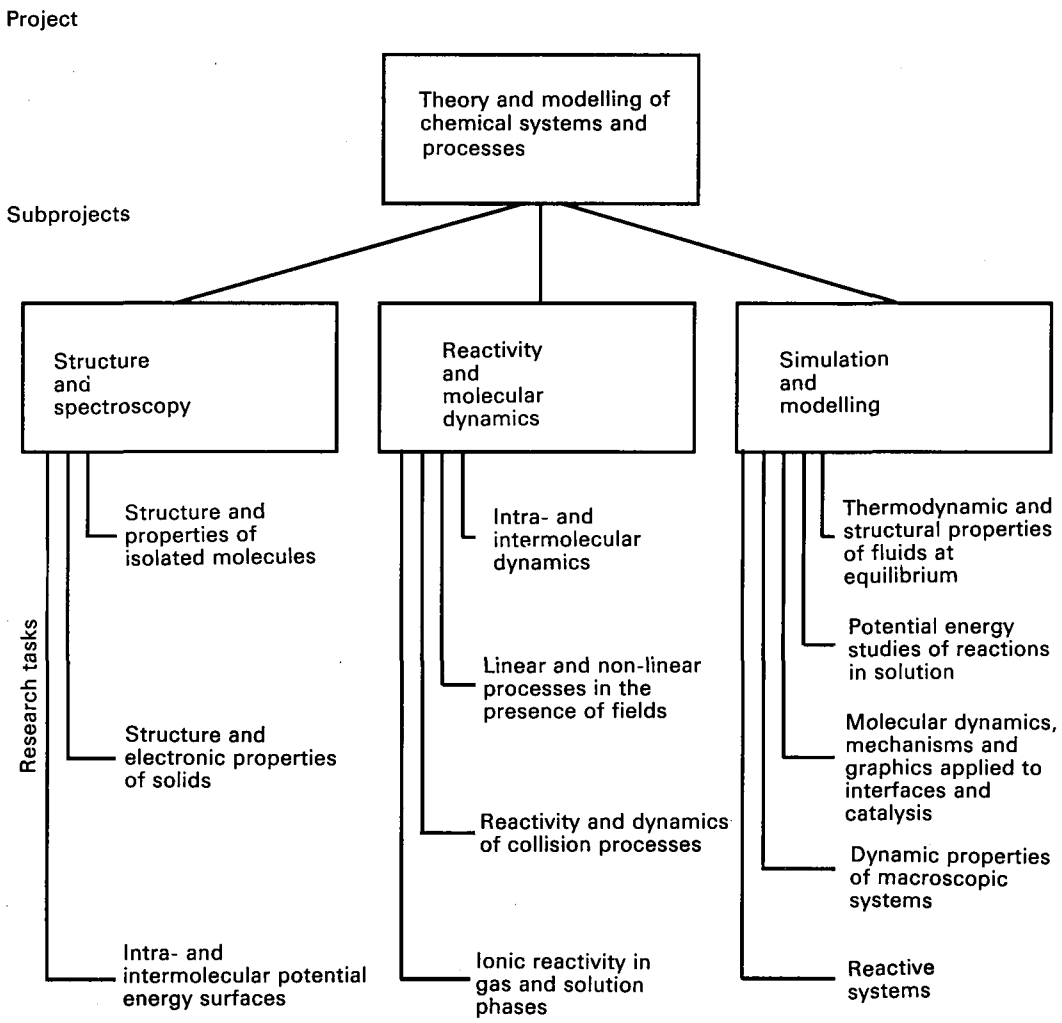


TABLE II

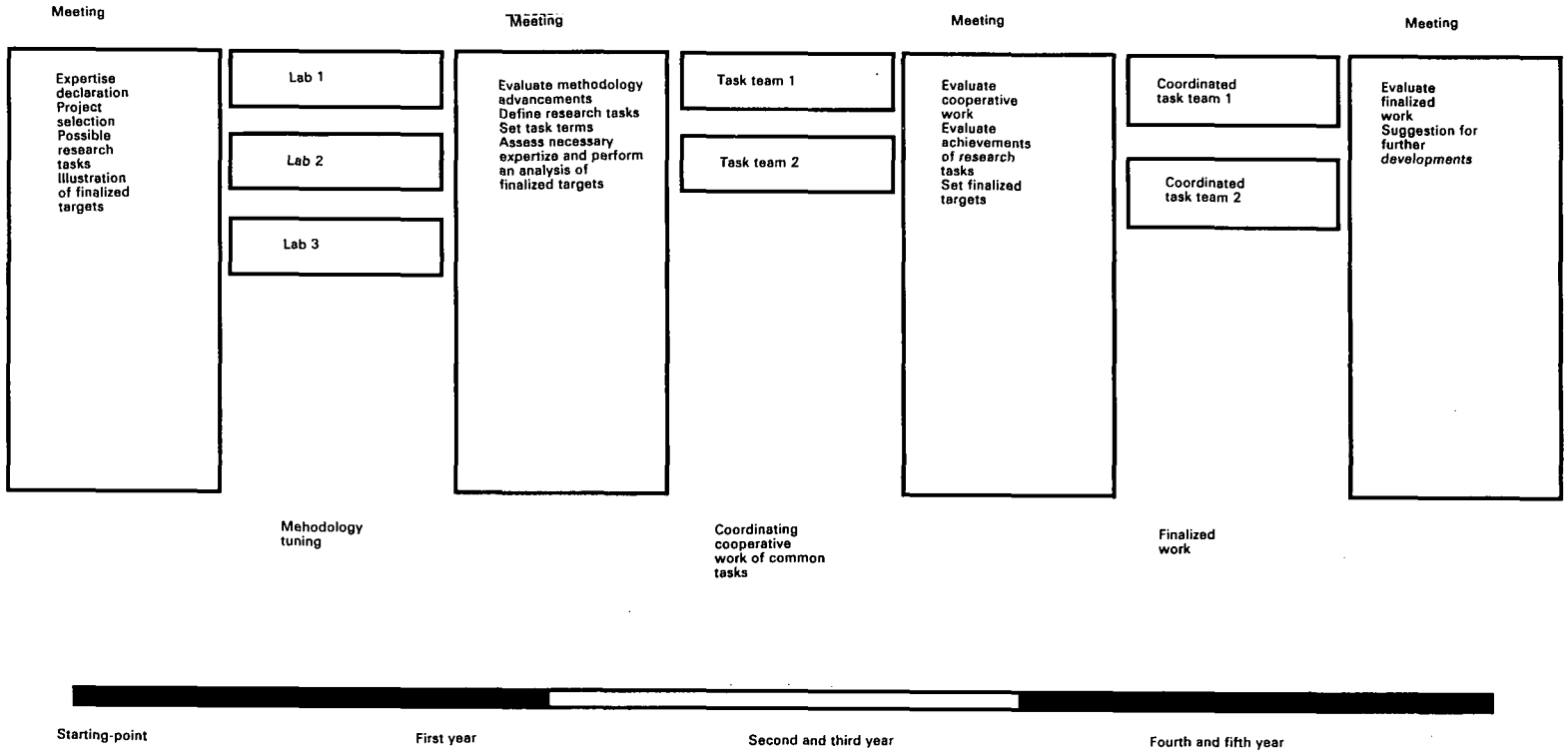
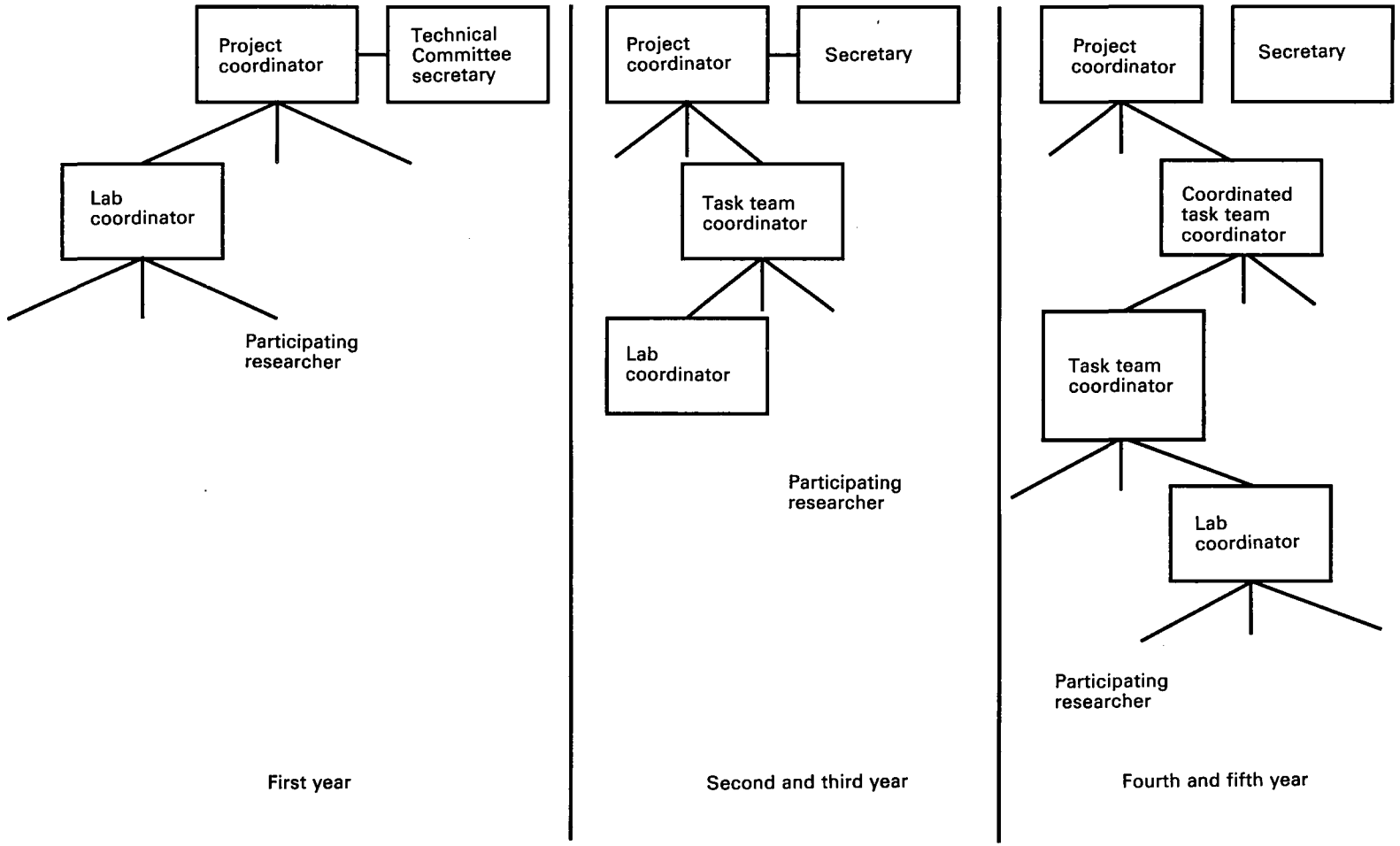

Meeting
Expertise declaration
Project selection
Possible research tasks
Illustration of finalized targets
Lab 1
Lab 2
Lab 3
Meeting
Evaluate methodology advancements
Define research tasks
Set task terms
Assess necessary expertize and perform an analysis of finalized targets
Task team 1
Task team 2
Meeting
Evaluate cooperative work
Evaluate achievements of research tasks
Set finalized targets
Coordinated task team 1
Coordinated task team 2
Meeting
Evaluate finalized work
Suggestion for further developments
Mehodology tuning
Coordinating cooperative work of common tasks
Finalized work
Starting-point
First year
Second and third year
Fourth and fifth year

TABLE III


Project coordinator
Technical Committee secretary
Lab coordinator
Participating researcher
First year
Project coordinator
Secretary
Task team coordinator
Lab coordinator
Participating researcher
Second and third year
Project coordinator
Secretary
Coordinated task team coordinator
Task team coordinator
Lab coordinator
Participating researcher
Fourth and fifth year

Memorandum of Understanding for the implementation of a European research project on the design and preparation of new molecular systems with unconventional electrical, optical and magnetic properties

(COST Project D4)[1]

Date of entry into force of the project: 14.9.1992
Duration: 13.9.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.1992	17.12.1992
DENMARK	8.10.1992	8.10.1992
GERMANY	10.9.1992	10.9.1992
FRANCE	9.12.1992	9.12.1992
ITALY	20.11.1992	20.11.1992
NETHERLANDS	8.10.1992	8.10.1992
NORWAY	16.12.1992	16.12.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 232.2 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

A1. General comment

Within the last decade, interest in materials science and technology has grown exponentially. There is a widely held view that the next major techno-industrial advances for mankind will be made on the basis of extraordinary developments in the generation and engineering of materials whose existence, structure and properties could barely have been imagined 15 years ago. As part of the explosion of activity in the materials field, chemistry plays a key role – in the design of new compounds, in developing the assembly of these substances into the desired solid or fluid, in understanding the properties of

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

the constituent molecules and their bulk properties, and in developing interfaces with physics, biology, medicine and engineering as part of a cooperative, interdisciplinary effort in extending the frontiers of materials technology.

However, one of the key issues in materials science is the discovery of new molecules with required properties, and/or the understanding of those molecules which occur in nature which have specific purposes as yet unexploited and are therefore little understood, or which can be modified to enhance existing or introduce new properties. Targets incorporating required properties include sensory systems, molecules capable of transmitting charge and/or electrons, molecules with unusual magnetic and electric properties (ferromagnets, ferroelectrics), compounds which can be assembled into systems exhibiting semi- or superconductivity, molecules which, in the bulk phase, have non-linear optical properties, liquid crystalline phases, etc. The chemist is in a unique position to design such molecules with desirable properties, to deploy existing synthetic methodology, or to invent new methodologies, to translate the designs into reality. The chemist is also able to work with known molecular systems which do not occur in nature, or systems provided by biology, in order to modify them to enhance or introduce specific properties.

A2. Scope of the area and status of the research

The field outlined above is very wide, and in order to focus on areas where European/EC cooperation may be maximized, selectivity is necessary. Accordingly, the proposal concentrates on the study of molecular systems, thereby deliberately excluding the study of what is traditionally regarded as solid state chemistry (binary and ternary metal oxides, sulphides, intercalated systems, alloys, etc.). The fields of study do include what is traditionally recognized as inorganic and organic chemistry, coupled with the physical interpretation of phenomena of interest in the context of new materials properties. Thus, molecular design should focus on the generation of compounds of relevance to molecular-scale electronics. This could include molecules that switch between two or more states via a physical response (optical, electrical, mechanical) in a way that is similarly detected, self-ordering molecular systems, which could include discotic liquid crystal polymers, and biomimetic materials and proteins, which, if not immediately able to fulfil a molecular electronic function, could be modified by the addition of suitably designed groups to confer desirable properties. Further systems for study could include the immobilization of molecules in orientated surfaces, through epitaxial film formation, Langmuir-Blodgett films, etc. The synthesis of chemically and biologically prepared and sensitized surfaces which will allow well-defined molecular emplacement should also be included. Molecules could be designed which, when grouped in ensembles, are capable of exhibiting switching when probed by a local excitation such as one from an STM probe.

The fields of electrical conductivity, molecular magnetism and opto-electronics are complementary to that of molecular-scale electronics, and encompass the study of inorganic and organic crystalline, quasi-crystalline and amorphous solids and liquid crystalline substances and clusters. Design can be directed towards the production of magnetic or optical properties for superconductivity, for information storage, and for optical information processing.

A3. European activities

The fields described above are focused but nevertheless quite wide. It is apparent from the information collected that research in some of the abovementioned activities in some countries is already quite well developed, with some interaction at a European level established, although at a limited level. However, in other countries, while there is interest in molecular-scale electronics, electrical and magnetic systems, the core activity is minimal, and coordination and cooperation on a Europe-wide basis presents a meaningful opportunity for these countries to develop their research interests and expertise. Such

collaboration is also beneficial for those countries which have existing programmes, since it broadens the operational basis for training and enhances research opportunities. Some of the activities are indicated below.

CONFERENCES

European Collaboration in Molecular Electronics; Bangor, United Kingdom, April 1989.

Molecular Electronics, European Research Office of US Army, Special Meeting; Durham, United Kingdom, March 1990.

Polymer Science and Technology for Electronics; Kerkrade, the Netherlands, April 1990.

Science and Applications of Conducting Polymers; Lofthus, Norway, May 1990.

NATO Advanced Study Institute on Granular Nano-electronics; Il Ciocco, Italy, July 1990.

International Conference on Science and Technology of Synthetic Metals; Tübingen, Germany, September 1990.

International Symposium on New Organic Materials; Durham, United Kingdom, September 1990.

European Conference on Organized Organic Thin Films; Mainz, Germany, October 1990.

NATO Advanced Research Workshop on Magnetic Molecular Materials; Il Ciocco, Italy, October 1990.

Forthcoming meeting: European Conference on Molecular Electronics; Padua, Italy, August 1992 (a joint programme sponsored by the European Chemical Societies).

There are specific national programmes in various countries devoted to the development of molecular electronics, chemistry for new materials and related topics. Some of these are listed below.

United Kingdom: SERC Materials Commission initiative in the synthesis and evaluation of new materials for the 21st century, and in molecular electronics.

Italy: Progetto finalizzato materiali speciali per tecnologie avanzate; national programme for chemistry of materials.

Portugal: Portuguese Group of Molecular Electronics.

B. Objectives

In terms of enabling chemistry in the design of new molecular systems which may exhibit unconventional electrical, optical and/or magnetic properties, there are several broad research activities which are relevant to the targets outlined in the introduction. These include the synthesis and characterization of polymers, and supramolecular chemistry as it relates to the preparation of substances with designed physical properties which may refer to aspects of molecular recognition, aggregation, formation of liquid crystals and other complex fluids, in the generation of stacking systems, molecular pillars, molecular wires, etc.

There is clear evidence across Europe of significant chemical activity in the areas outlined above, although it has not yet been coordinated. The facilitation of cooperation and

development of new or more closely defined targets, while permitting the fullest possible range of imaginative development of new synthetic pathways and the design of new types of molecules, would substantially enhance European effectiveness in this area of chemistry, giving a competitive incentive vis-à-vis North America and the Pacific nations in the search for new, cheap devices and artifices.

The objectives of the proposal are as follows:

1. the design, synthesis, structural and physical characterization of molecules which are capable of functioning as, or of being converted into, molecular electronic devices. This will be achieved either by the development of new systems which are capable of having appropriate properties built into them (e.g. incorporation of photocentres, paramagnetic metal ions, charge-responsive centres, etc), or by modifying existing molecules (synthetic or biological) by appropriate functionalization. This objective has close links to those of proposed COST Projects A, B, C, F and G;
2. the design, synthesis, structural and physical characterization of molecules which exhibit, when aggregated, a substantial degree of long-range order, and the synthesis of molecules which are the basis of complex fluids, e.g. thermotropic liquid crystals and amphililic systems. This objective has close links to those of proposed COST Projects A, B, C, F and G;
3. the design, synthesis, structural and physical characterization of molecules which, in bulk, exhibit useful and/or extraordinary physical properties, e.g. optical, magnetic or electrical. This objective has close links to those of proposed COST Projects B, C and G;
4. physical limitation on information processing in molecular systems, e.g. by quantum fluctuations. This objective has close links to those of proposed COST Projects C and E;
5. to relate the science developed by fulfilment of objectives 1, 2, 3 and 4 to the bulk properties of materials. This objective has close links to those of proposed COST Projects C and E.

C. The content of the project

There are already a number of programmes in European countries which have begun to establish programmes in molecular electronics and the opportunities for coordination and concerted effort are now very considerable. The project will comprise four major subprojects; (i) molecular electronics, (ii) molecular conductivity, (iii) molecular magnetism, and (iv) molecular opto-electronics. The outlines of the subproject activities are given below.

Subproject 1: Molecular electronics

Design of molecules and molecular aggregates or clusters with 'switch' potential; self-ordering molecular systems, immobilization of molecules on surfaces and surface sensitization; design and synthesis of molecular wires; molecular sensors for small ions (metallic and molecular), and with chiral selectivity.

Subproject 2: Molecular conductivity

Design of systems capable of unidirectional electrical conductivity; mixed-valence systems; molecular semi- and superconductors; molecular piezo-electrics; synthetic metals.

Subproject 3: Molecular magnetism

Molecular paramagnetics for sensor purpose and imaging; molecular ferromagnetics; magnetic ferro- and ferri-electrics.

Subproject 4: Molecular opto-electronics

Molecular species having non-linear optical properties, particularly second- and third-order effects; photochromics; photoelectrics.

D. Timetable

The project is intended to operate within a five-year time scale. The development of each subproject would proceed from decisions made at the first meeting of the Management Committee. It is expected that there would be four general steps in project development.

Step 1: Management Committee review (year 1–start).

Identification of active groups, preliminary selection of coordinators, project leaders, and possible programme goals.

Step 2: Inventorization and assessment (year 1)

Review of existing activities at national levels, with a view to establishing complementary programmes, existing expertise, and gaps in expertise. Identification of groups which have natural affinities and/or complementary expertise and equipment. Identification and formation of subprojects.

Step 3: Planning (years 1 and 2)

Agreement on common programmes and development of schemes of research, with a view to attracting increased national support, the end-point being ultimately EC/pan-European support. Exchange of programme information and limited exchange of personnel to assist in development of pan-European activities. Conferences on selected topics to attract attention to the programmes and their goals. Reference to national priorities, to NATO actions and other international activities. Identification of interests and directions of research. Identification of short- and long-term goals.

Step 4: Implementation (years 2 and 3 to 5)

Operation of joint proposals, cooperative research programmes, conferences, exchange of research workers; regular conferences in the style of the European Science Foundation. Introduction/integration of East European participants into suitable programmes. Progress towards achieving identified short-term goals.

Evaluation

Annual reports by participating scientists to project leaders, annual reports by project leaders to the Management Committee. An intermediate report by the Management Committee to the COST Technical Committee for Chemistry in year 3, and a final report by the former to the latter in year 5, the latter preparing a full report on all activities.

E. Organization and management

The project could be operated under the aegis of the COST Technical Committee for Chemistry (COST TCC). The project coordinator, who should be a member of COST TCC, will chair the Management Committee (MC), ideally representing a broad section of scientific activity within the project and also representing appropriate national interests and participation. The MC will meet approximately every six months, and will report annually to the COST TCC. Each subproject will have a coordinator and a scientific project leader. The role of the coordinator is to report to and liaise with the MC regard-

ing steps 1 and 2 in the programme outlined above, to coordinate activities with other COST chemistry projects (A, B, C, E, F and G), to liaise with the ESF, CERC 3, FECS and ECCC and to explore relationships with East European countries. The coordinator will also be responsible for the planning of the intermediate and final report. The scientific project leader will be responsible for the coordination of the subproject in terms of the precise details of the programmes to be adopted, and for keeping national representatives (contact persons) and national organizations informed about developments within the subprojects (e.g. workshops, seminars, mini symposia, technical reports, publications of relevance). The scientific project leader will also liaise with the MC. Directors of collaborating research groups and individual research scientists, as and where appropriate, will report to the scientific project leader on the technical progress of their work. The COST TCC and the MC could be serviced by a secretariat operated through the Directorate-General for Science, Research and Development.

F. Economic and financial matters

The total European effort, as specified by the individual countries expected to participate, and based on an estimate of activity within the individual subproject areas at early 1991, is as follows.

(a) Research costs (estimates)

Subprojects:

1: in 14 countries, a total of 344 man-years, totalling ECU 20.64 million;

2: in 13 countries, a total of 255 man-years, totalling ECU 13.50 million;

3: in 7 countries, a total of 98 man-years, totalling ECU 5.88 million;

4: in 9 countries, a total of 107 man-years, totalling ECU 6.42 million.

All countries but one are involved in subproject 1, 13, in subproject 2, about seven in subproject 3 and about nine in subproject 4. The total human effort almost wholly uncoordinated, in the field of molecular electronics, conductivity, magnetics and optoelectronics, is c. 774 man-years, totalling c. ECU 46.44 million per year. For the five-year period of project duration this would correspond to a total of ECU 232.20 million.

(b) Coordination costs (estimated)

The costs for coordination and travelling expenses, as well as for workshop and seminar organization, publications and some translations are estimated to be not more than ECU 7 million over five years, provided that all countries analysed participate in this COST project. Should one or the other of these countries not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.

The list with the activities and contact persons in 15 COST member countries is given in the final report of the COST ad hoc Technical Committee for Chemistry (COST 240/91), Topic D.

Memorandum of Understanding for the implementation of a European reasearch project in the field of the effects of EDI (Electronic Data Interchange) on the transport sector (COST Project 320)

Memorandum of Understanding for the implementation of a European research project on the chemistry at surfaces and interfaces

(COST Project D5)[1]

Date of entry into force of the project: 24.9.1992
Duration: 23.9.1997

Contracting parties	Date of signing	Date of entry into force
DENMARK	8.10.1992	8.10.1992
NETHERLANDS	8.10.1992	8.10.1992
SWITZERLAND	24.9.1992	24.9.1992
FINLAND	24.9.1992	24.9.1992
SWEDEN	24.9.1992	24.9.1992

The overall value is ECU 300 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

A1. Reason for a COST project on this topic

Chemical processes at surfaces and interfaces are of great scientific interest and also of enormous practical importance. This is due to the fact that surface phenomena play a crucial role in processes such as heterogeneous catalysis, corrosion, adhesion, lubrication, integrated circuitry, crystal growth, bio-compatibility, etc. Basic understanding in this field is therefore of great relevance to such different fields of application as, for example, chemical technology, information technology, medicine and the protection of the environment.

In the case of solid/gas surfaces there is considerable knowledge about the processes: adsorption. Adsorbate-induced reconstruction of the surface, diffusion, reactions of adsorbed species, desorption. We owe this knowledge to the development of new analytical methods during the last three decades, i.e. the different electron spectroscopies (Auger, EELS, etc.), structure sensitive diffraction methods (LEED, LEIS, etc.) and laser techniques in connection with molecular beams. The recent development of scanning tunnel-

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

ling microscopy now allows the investigation of the topology of surfaces with high lateral resolution and in addition the detection of adsorbed species in a very direct way.

Those remarks hold true for small, especially diatomic, molecules on metal and/or semiconductor surfaces. As the molecules become larger and more complex, however, and as we look at other surfaces, i.e. polymers, our arsenal of analytical tools and therefore our knowledge about these systems rapidly decrease. Only during the last five years new techniques which can be summarized as surface-mass spectroscopy (i.e. with laser desorption or laser postionization) opened new possibilities. This is even more when other interfaces such as solid/liquid, liquid/liquid or solid/solid interfaces are considered.

A2. Status of research in the field

A fundamental point about the chemistry of surfaces and interfaces is of special interest as it connects very divergent disciplines such as theoretical chemistry, synthetic chemistry, colloid chemistry, electrochemistry, chemical engineering, materials science, metallurgy, crystallography, thermodynamics or electronics. The solution of the problems which arise in surface chemistry requires the application of sophisticated and expensive equipment and careful design of experiments. In spite of significant progress already made in this field knowledge is still growing rapidly at the present time.

Our present knowledge of surfaces and interfaces, only briefly described in the introduction, confirms the evolutionary nature of the subject and is the result of major efforts by many groups over the world using numerous, often very expensive, techniques. It is obvious that, as the systems to be investigated become more complex, the close collaboration of different groups and the use of large equipment in research centres (i.e. synchrotron rings) become more and more important. This makes the field very suited to the COST project.

Among different aspects of surface and interface science, this part of the COST programme focuses on the topics where chemical processes are involved and which are of great importance for different applications.

It is recognized that chemical processes on surfaces and interfaces play an important role also in the field of electrochemistry, certain aspects of materials science and development, tribology and lubrication, biology, etc. In spite of the importance of surface-related phenomena for the above topics, their incorporation in the proposed programme would make the project unwieldy and overloaded. Furthermore, they are also partly covered by other COST areas and close cooperation is needed and highly recommended.

Four subfields have been selected by members of the *ad hoc* Technical Committee on Chemistry for the initial project but the programme is open for additional initiatives.

A2.1. Analysis and theory of surfaces

It has already been outlined that the development of existing analytical tools as well as the development of new ones was essential for progress in this field. This trend will prevail in the future, especially when the systems to be investigated become more complex. There is a general need for methods which work under real *in situ* conditions, which have high lateral resolution and which allow investigation of interfaces other than metals and semiconductors (insulating materials like polymers). One possible way to reach this target is the simultaneous of different spectroscopic techniques.

A2.2. Heterogeneous catalysis

Catalysis is of great scientific interest and plays an important role in the chemical industry. It is estimated that in the developed countries about 90% of chemical production

involves the use of catalysts at some stage and about 20% of the gross national product is generated industrially by the use of catalytic methods. In various fields of human activity, such as food production, energy conversion, defence technologies, environmental protection and health care, the use of catalytic processes is indispensable. This justifies the steadily growing interest of scientific groups all over Europe for research in homogeneous, heterogeneous, electro-, photo-, and enzyme catalysis. Although surface science has greatly contributed to the progress of various surface phenomena, its impact on catalysis research still remains in its early stages. The great complexity of most industrial catalysts and catalytic reactions has until now limited the extent to which the fundamental techniques developed in surface science have been able to generate relevant information.

A2.3. Molecular surfaces

As already mentioned, the chemistry of atoms and small molecules and the modification of surfaces by atoms has been the subject of research for a long time. During recent years, first steps into the even more complex systems of molecular surfaces have been taken. This topic deals with the adsorption of larger molecules at surfaces, their ordering behaviour and their chemistry and photochemistry, as well as with the chemical surface characteristics of molecular and macromolecular bodies.

In the case of investigation of solid/gas and solid/liquid interfaces, the results are of great importance for understanding and planning sensor systems, MO-CVD processes, electrode processes, the influence of additives on crystallization processes, and the modification of the biocompatibility of materials. The chemistry at liquid/liquid interfaces (i.e. vesicles, micelles) should also be included as it plays an important role in separation and polymerization processes especially as a new reaction medium.

A2.4. Chemistry of highly dispersed systems

As the size decreases, the properties of small particles are increasingly governed by the influence of the surface. In the extreme case of nanocrystals and clusters respectively, the commonly known bulk properties undergo drastic changes. Under such conditions the optical properties of semiconductor particles depend very much upon their specific size which makes these materials interesting, e.g. for applications in solar light conversion. It should also be kept in mind that the small clusters in solution are the very first step in the nucleation and growth of crystals.

In order to achieve the desired size distribution in, and the desired morphology of, stable dispersions, the formation of the particles has to be carefully monitored and controlled. In industrial processes quite a number of ingredients are used for this purpose. These have mostly been found and evaluated on a purely empirical basis. Today we begin to understand that these additives determine the surface properties (hydrophilicity, surface charge, etc.) of the solid particles to quite a large extent; thus stabilizing or destabilizing the corresponding colloidal systems. Examples are polyelectrolytes which can act as stabilizers or as flocculants.

The wide field of colloid science started decades ago but has been neglected recently in basic research in many European countries despite its economic importance (e.g. for the food, polymer and paint industries). With the development of new analytical tools and the existence of new theoretical methods (molecular modelling), one can expect and should promote the renaissance of this field.

Highly dispersed systems also exist in all-liquid systems as, for example, micelles and vesicles. They are important for separation and polymerization processes and as new

media for synthesis and catalysis (see the COST project on 'Chemical processes and reactions under extreme or non-classic conditions with industrial materials').

A3. Relationship with other European programmes

In all European countries the importance of this field is evident, leading to initiatives designed to achieve more than to amplify simply the ongoing research efforts. The initiative 'Interfaces and catalysis' established by the UK Science and Engineering Council and the national programme 'Surfaces and interfaces' established by the Swiss National Foundation for Scientific Research are just two examples of nationally concerted actions. Similar activities can be found in almost every developed country.

In 1990 an ESF proposal entitled 'Dynamics of gas-surfaces interactions' was launched. It is planned that more than 20 groups from 12 European countries should cooperate and represent a significant stimulus in this important research area.

The large and increasing number of different journals and conferences covering various aspects of this topic is overwhelming. Out of new journals since 1980, published by Elsevier and Springer in the fields of chemistry, physics and material science, more than 25 journals include topics related to this programme. Five Nobel Prizes awarded from 1985 to European scientists, working on topics closely related to surface phenomena or surface characterization, demonstrate the high level of European scientific effort related to surfaces and interfaces.

From the inventarization of local efforts and activities in European countries (data represent only a fair estimate), it can be concluded that effective research and development requires an effective communications system including databases, rapid personal communication with emphasis on the exchange of experts between different research groups, joint seminars and conferences at different levels for different subtopics of the project. Professor Goepel pointed out in his review 'State and perspectives of research on surfaces and interfaces', prepared for the Commission of the European Communities Directorate-General for Science, Research and Development, that the creativity of researchers is often surprisingly good in smaller groups and does not necessarily require expensive instruments for all investigations. To share the increasing R&D costs for instrumentation in smaller groups, their basic research effort calls for close collaboration with larger research centres. Concerted COST action on this topic would include all the above and is therefore highly recommended.

The topic 'Chemistry at surfaces and interfaces' is not an isolated field within the COST chemistry programme. On the contrary, they are close connections to several other topics, as follows.

Topic C - The theory and modelling of chemical systems and processes. The need for a better theoretical understanding and modelling of chemical surface processes has been emphasized.

Topic D - The design and preparation of new molecular systems with unconventional electrical, optical and magnetic properties. Molecules which work as switches or wires have to be adhered by using light or electric fields. Probably the most important way will be their fixation on structured solid surfaces via direct covalent bonding or via fixation within self-organizing systems. In both cases the understanding of the chemistry taking place is extremely important.

Topic F - Chemical processes and reactions under extreme or non-classic conditions. 'Chemistry in microstructural environment' takes place at the inner surface of porous materials. There exists an overlap between instrumentation and theory (modelling).

B. Objectives

B1. Main objective

The basic objective of the proposed programme should be a contribution to the understanding of fundamental aspects governing surface chemistry. Specifically, the aims are to develop novel methods for the fundamental analysis and corresponding theoretical description, design, preparation and subsequent analysis of surfaces and interfaces at the microscopic level. To achieve these goals, quite expensive means are essential, such as large computer facilities, advanced experimental equipment and, particularly, the necessary costly combinations of instrumentation required. Thus international cooperation seems to be indicated in order to overcome the financial and technical obstacles inherent to surface chemistry.

It is therefore important to bring together experts from various scientific disciplines engaged in surface and colloid science research and closely related topics working in different laboratories to cooperate in a concerted manner on the problems relevant to surfaces and interfaces.

Furthermore, the project should encourage cooperation among scientists working in various fields related to surface science. Preference is given to selected problems of potential practical importance and to efforts of finding general principles having practical implications for various technologies.

B2. Secondary objectives (specification of four subprojects)

As indicated in section 1.2, four subprojects should constitute the hard core of the programme. Basic objectives to be reached within each of the proposed subprojects are described below.

B2.1. Analysis and theory of surfaces

Important research topics among others in this field are:

(a) to encourage the *in situ* examination of surfaces by various methods sensitive to surface structure, surface relaxation, surface reconstruction and reaction processes on the surfaces;

(b) the development of analytical methods is of great relevance to the whole field and therefore also to the topics described further on. The development of theoretical methods for the description of chemical processes at interfaces can become of similar importance in the future and therefore should be integrated;

(c) the molecular modelling of species at surfaces and inner surfaces (i.e. zeolites) taking into account the dynamic coupling between surface and adsorbate;

(d) the quantum mechanical treatment of the chemical bond at interfaces to obtain more reliable data for molecular modelling;

(e) the simulation of structural analysis (i.e. LEED, STM, EXAFS);

(f) the description of non-linear dynamics of open systems under non-equilibrium conditions and their temporal behaviour on external parameters.

B2.2. Heterogeneous catalysis

Important research topics among others in this field are as follows.

(a) A fundamental understanding of a catalytic reaction requires the knowledge of the dynamics of chemisorption of individual molecules, their interaction and final product desorption, as well as relaxation of the catalyst surfaces to its initial state.

(b) Fundamental studies relating to surfaces, sorption and surface reactivity based on surface science are highly desirable to explore the possibility of a 'first principle' design of a surface capable of achieving a desired catalytic reaction at high turnover, high selectivity and insensitivity to catalyst poisons over long periods. There is thus a strond need for a concerted multidisciplinary approach.

(c) The concept of surface characterization in catalysis is specific in nature from that which prevails in the surface science. It involves typical measurements for materials characterization (i.e. microstructure, pore and grain size distribution, etc.). There exists a relatively good insight into the behaviour of 'clean' surfaces; however, the 'contaminated' surfaces of practical importance defy proper understanding. Therefore, *in situ* investigations are highly desirable.

(d) Essential are the physico-chemical as well as geometric characteristics of the surface at an atomic level and the local electronic structure that is associated with it.

(e) Complex chemical processes occur already during the preparation and manufacture of multicomponent catalysts and many of these are still poorly understood. The final product often depends critically on the nature of the intermediate phases, which in turn are highly susceptible to variations in the conditions for their preparation. New synthetic skills being involved in the context of materials science (e.g. metal-organic chemical vapour deposition, molecular beam epitaxy and ion implementation) are likely to find increasing use in catalyst preparation. In this context, efforts towards a concerted collection of basic knowledge on a European level could be very helpful in promoting systematic progress in the field.

B2.3. Molecular surfaces

Important research topics among others in this field are as follows.

Preparation, characterization and technological application of molecular surfaces (i.e. Langmuir-Blodgett films, molecular beam methods).

Interaction between solid surfaces and solutions (adsorption of ions and neutral molecules and the structure of adsorbed species in equilibrium with the solution.

Modification and restructuring of surfaces by chemical reactions induced by the scanning tunnel microscope.

Determination of the role of chemical interactions in the adhesion between polymers and metals; polymerization processes at solid surfaces.

Determination of the elementary photochemical and thermal steps in metal-organic chemical vapour deposition (MO-CVD) processes, including the detection of important fragments (heterostructure generation, HT superconductor films).

The role of surfacants on epitaxial growth (netting processes and island information).

B2.4. Chemistry of highly dispersed systems

Important research topics among others in this field are as follows.

To carry out surface and colloid science work relevant to various disciplines at a fundamental level and relevant to practical industrial application.

The COST programme should focus on the characterization and modelling of chemical reactions at the interfaces of highly dispersed systems, their information (i.e. nucleation processes, stabilization of colloids) and the development of new, high-selective, preparation techniques.

Beside these, fundamental questions about the relevance of nanoparticles for applications in highly dispersed solid systems (i.e. in the production of paints and in ceramic processing) should be answered.

C. The content of the project

C1. Classification of the subprojects

This COST project is organized as follows:

Management Committee	Secretariat
Project 1 Project 2	Project 3 Project 4

There are four subprojects for each of the fields described sections 1.2 and 2.2. Within each subproject as well as within the complete programme, activities are coordinated. The Management Committee has to ensure that this structure does not prevent the exchange of knowledge and cooperation among the different subprojects. European workshops have to be organized and cooperation in the solution of problems described in section 2 is to be promoted.

C2. Evaluation of progress

It is aimed to follow progress in the programme by means of brief annual reports of the participating scientists, describing the results obtained through the concerted action. After three years of joint activities, a milestone report should be prepared by the Management Committee. This report can then be reviewed by the – then appointed – COST Technical Commitee for Chemistry.

A final report, perhaps in parallel with a few review research papers (for international research journals) should be published, to inform the non-participating scientists and possible future users of the results obtained and the scientific conclusions arrived at. A symposium after a period of five years, which will be accessible by other scientists, will conclude the COST project in this field.

D. Timetable

A five-year programme is proposed for each of the four subprojects described above, consisting of four stages (each of one to three years).

Stage 1. After the first meeting of the Management Committee a detailed inventarization of ongoing research and existing plans of the participating groups to start joint projects, based on the results of the present *ad hoc* Committee, will take place. This will result in a document for further use and for the mutual adjustment of plans. A short workshop-type meeting of the university and industry group leaders in this field may be used to evaluate these plans.

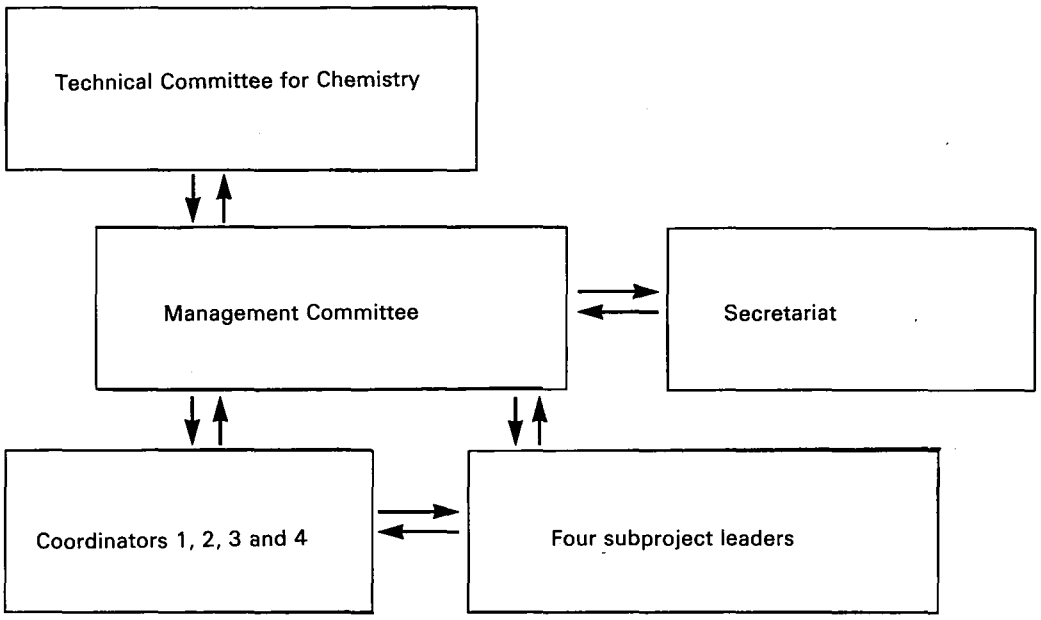
Stage 2. In this stage, which will start at the end of the first year, the activities between closely related projects should be visible, so that the researchers (and their co-workers) can meet to set up (and continue) joint collaborative projects and exchange their recent research results. Perhaps during this stage some collaboration with other (East) European countries could be explored.

Stage 3. An intermediate progress report should be prepared after three years for review by the COST Technical Committee for Chemistry.

Stage 4. In this final phase, which will start after four years, the evaluation of the obtained results shall take place, perhaps by organizing a concluding symposium for all participants and their co-workers.

E. Organization, responsibilities and management

The organization of the total project could operate under the following structure:



The coordinators have responsibilities for:

(i) the inventarization in the first year, the organization of the workshop, and the start of the activity;

(ii) coordination of the joint activities with other COST chemistry projects; joint meetings are likely to result from this activity;

(iii) the possibilities of expanding to other countries, in particular to Eastern Europe; the exchange of information with the EC science programme and the ESF;

(iv) the planning of the intermediate report, the final report and the concluding symposium.

The four subproject leaders are scientifically responsible for the four subfields mentioned under section 2.2. They should interact with the Management Committee and also with the coordinators.

The Management Committee will meet every six months. This Committee shall consult the Technical Committee for Chemistry once every year (in a joint meeting) and report on the progress. After the completion of the project, the final report should be made available to the general public and the governments of the participating countries; this is a major duty of the Management Committee. Progress in the four subprojects also be reported by the participants in their own countries.

F. Economic and financial matters

F1. Research efforts

The estimated total efforts spent in Europe in all subprojects (all countries expected to participate) are about 1 000 man-years in 15 COST member countries, totalling roughly some ECU 60 million per year. For the five-year period of project duration this would correspond to a total of ECU 300 million.

F2. Coordination costs

The amount of coordination costs will depend on the number and size of the projects but should be in the order of not more than ECU 9 million for five years, provided that all countries analysed participate in this COST project. Should one or the other of these countries will not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.

The list with activities and contact persons in 15 COST member countries is given in the final report of the COST *ad hoc* Technical Committee for Chemistry (COST 240/91), Topic E.

Memorandum of Understanding for the implementation of a European research project on chemical processes and reactions under extreme or non-classic conditions with industrial materials

(COST Project D6)[1]

Date of entry into force of the project: 10.9.1992
Duration: 9.9.1997

Contracting parties	Date of signing	Date of entry into force
GERMANY	10.9.1992	10.9.1992
POLAND	10.9.1992	10.9.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 213 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

A1. Reason for a COST project on this topic

In our natural environment there exist conditions (pressure, temperature, composition of the atmosphere, etc.) which are only facets of possible reaction conditions for chemical transformations. Industrial chemical processes for practical reasons very often operate close to these environment conditions. A view towards the centre of the earth or to the stars shows that different conditions can give rise to completely different chemical reaction paths. It is, therefore, comprehensible that one can expect new and interesting results from the application of unusual conditions or unusual media. New or better compounds may result in special electrical, magnetic, optical, mechanical or chemical properties as well as high value-added materials such as drugs. More selective energy saving and process integrated environment protecting processes may be found for many applications from communications technology, electronics, etc. to waste regeneration. There exist many different ways to achieve 'unusual conditions'. In order to exploit this potential

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

and to find out the best methods to solve different synthetic problems, different research groups have to join together and to pool their experiences which makes this field or part of it perfectly appropriate for European programmes.

A2. Status of research in the field

Among the unusual conditions there is the application of high pressures and very low pressures, high temperatures, ultrasonics, electric discharges and microwaves or plasma, strong electromagnetic fields as in laser and particle radiation. Special attention should be paid to chemistry in the microstructural environment. In the following sections these fields are briefly described with regard to their expected contribution to the main goals of chemistry.

PROCESSES AT EXTREME VARIABLES OF STATE

(i) Chemistry at high pressure

High pressure is an important and very sensitive parameter for both the effective control of chemical syntheses and the understanding of chemical reactivity. New processes and chemical products are to be expected. Modern high-pressure chemistry spans several disciplines from organic and inorganic chemistry to biochemistry, macromolecular chemistry and geochemistry, and there is partial overlap with high-pressure physics in the field of electronic transitions. Important research fields are:

- increase of reactivity and selectivity in chemical information;
- production of new materials: polymers, 'synthetic' metals, semi-conductors, compounds in unusual oxidation states;
- transformations of thermo-labile compounds;
- simulation of geochemical reactions in laboratory experiments;
- chemical reactions in supercritical solvents;
- development of adapted instrumentation for high-pressure studies of chemical reactivity (i.e. NMR, very fast mixing devices).

(ii) Chemistry at high temperatures

Solid state chemistry at high temperatures is closely connected to the search for new materials with unusual electrical, magnetical, optical or mechanical properties:

- synthesis of metastable compounds (for example, with disordered cation-lattice);
- synthesis of compounds in unusual valence states;
- modification of the surface of ceramic materials;
- modification of electron, and conductivity and luminescence properties of ceramic materials by high-temperature treatment;
- healing of defects and avoiding of twin formation;
- interfacial phenomena in fluid systems at high temperatures.

Very high temperatures can be achieved by the use of plasma burners by laser or particle heating and by shock waves. A special challenge for chemistry is the development of new materials which can be applied at high temperatures without losing their special properties.

There is also great interest in the reactions of atoms, radicals and ions at high temperature or more generally at high energy as they take place, for example in combustion pro-

cesses, in plasmas, in the atmospheres of certain stars or in high-intensity radiation fields as in laser beams (see *(vi)* below). For the solution of important problems, such as the protection of the lower and upper atmosphere, the improvement of material applications, laser deposition processes, etc. a better understanding of the different reaction steps and the theoretical modelling of the systems is necessary.

The experimental techniques for the investigation of these reactions are very sophisticated and sometimes quite expensive. It will scarcely be possible to find one laboratory which has all the necessary methods available. Cooperation between different laboratories will therefore be essential for the investigation, even of rather simple high-temperature reactions.

Besides the use of the two state variables, pressure and temperature, to extend the range of reaction conditions, several other possibillities to influence chemical reactions exist: the use of microstructural environment, the application of sound field, of plasmas, particle beams, etc. which can generate very specific chemical conditions.

PROCESSES IN FIELDS

(iii) Sonochemistry

The applications of ultrasonics can initiate several classes of chemical reactions:

- reactions in cavitation bubbles where adiabatic compression generates high temperatures and pressures for a very short time;
- reactions in the hot boundary layer where dissolved molecules can undergo new reactions;
- acceleration of reactions: in the case of liquid-solid reactions, the effects can be partly referred to cleaning and heating of the solid surfaces, and in the case of liquid-liquid reactions to the extreme dispersion; but as there is often a superposition of different effects one also needs new theoretical approaches for a better understanding of the systems;
- reactions of radicals in solution, formed by ultrasonics;
- mechanical degradation: in the neighbourhood of the imploding cavitation bubbles, macromolecules and biological structures are degraded.

Several of the processes described above resemble processes in photochemistry and chemistry under high temperatures and pressures. There should be close contact between scientists working in these different fields.

(iv) Microwave chemistry in condensed matter

The application of microwave dielectric loss heating effects is a new way of accelerating the rates of chemical reactions in either the solution or solid state. A wide range of polar organic solvents couple strongly to microwaves and this provides the basic for a range of synthetic possibillities in organic as well as in inorganic chemistry;

- synthesis of new organometallic compounds;
- synthesis of substitutionally inert transition metal completes;
- intercalation of quest molecules into inorganic oxide host materials.

The coupling of microwaves to 'lossy' materials in the solid state can lead to very dramatic dielectric loss heating effects and provides the basis for sintering processes and for new routes to the:

- synthesis of mixed metal oxide sulphides, etc.;
- synthesis of high-temperature, super-conducting ceramic oxides.

The overall reaction times for these syntheses can be reduced by as much as 10^2 to 10^3.

(v) Plasma chemistry

In plasma chemistry one has to distinguish between cold, low-pressure, plasmas, including microwave discharges, and hot, high-pressure, plasmas. In the latter case the high energy density provides temperatures of up to 3 000 to 5 000 K; the opportunities especially for the synthesis of new materials (ceramics) and for the treatment of toxic wastes are treated in point (ii) above.

Reactions in a cold plasma are processes which proceed under non-equilibrium conditions. There are several fields of possible application:

- synthesis of new compounds;
- purification of materials by transport processes;
- elimination of pollutants from gases;
- treatment of surfaces (CVD, etching, polymerizations, etc);
- improved chemical analysis.

Although several technical applications are based already on this chemistry there is a need for better understanding of the fundamental processes in order to achieve progress in this field; this holds true for plasma diagnostics, plasma-wall interactions, transport phenomena, mechanisms in plasmas and for theoretical modelling. It should also be mentioned that the interaction of well-defined particle beams (ions, neutrons, etc.) with solids (polymers, for example) strongly influence the material properties. This might be of great technical relevance and is also of importance for the basic understanding of particle-wall interactions.

(vi) Chemistry in strong electromagnetic fields

Magnetic and electric fields can strongly influence chemical reactions. The availability of laser electromagnetic fields with extremely high-field strength and high coherence of extremely short duration opened new doors for chemical analysis, for the registration of chemical dynamics and for the generation of well-defined excited states of molecules with specific reaction behaviour.

The application of lasers in chemistry is a young field and a large number of new achievements appeared during recent years. Many more are expected to come.

There are several areas of possible application of a strong electromagnetic field in synthetic, analytical and technical chemistry. Some examples which use either the high-field strength or the short-pulse duration of laser light are:

(a) the promotion of special state selective reactions in the gas and liquid phase and on solid surfaces including the formation of special structures on surfaces;

(b) the direction of electrochemical processes at special electrodes by laser pulse;

(c) the application of photochemical processes in technical syntheses and in opaque media;

(d) the preparation and processing of aerosols and surfaces;

(e) photochemistry on a microscopic scale.

Special attention deserves the influence of magnetic fields on chemical and biochemical processes.

PROCESSES IN RESTRICTED SYSTEMS

(vii) Chemistry in a micro-structural environment

Microstructured environments represent another unusual medium in which highly selective and reactive processes can be realized.

The best-known example are the zeolites; their potential for new synthetic routes or for the heterogenization of homogenous catalysts is nevertheless not exhausted. There exists great interest in the development of new types, especially with high pore width, in the development of new methods for the characterization of active sites and in the modelling of structure-activity relationships. New inorganic microporous materials such as the pillared clays should be included in the programme.

The development of similar organic materials is only beginning. Their lattice consists of compounds with low molecular weight which aggregate via non-covalent bonds, producing an open structure. These systems have the inherent disadvantage of lower thermal and chemical resistitvity, but the size, structure and even chirality of the pores can be programmed by variation of the components. It should also be possible to functionalize the inner walls. These materials are very attractive for catalysis as well as for chromotographic application.

In addition to these solid systems there also exist defined microstructures in fluids. They appear in one-phase or multiphase solutions of surfactants or block coopolymers. The dispersed component can build up networks of one-dimensional or two-dimensional structures. In these systems it is possible to fix the structure chemically (i.e. by photopolymerization) and extract the solvent, leaving behind materials with high porosity which can be interesting for different applications (i.e. membranes, absorbers). It is also possible to make use of the high inner surface area which separates hydrophilic and hydrophobic parts of the microstructural systems. This can be applied for the control of chemical reactions; in some cases catalytic activity can also be observed.

A3. Relationship with other European programmes

At present no special European programmes exist; the different topics are treated at many conferences. A selection of some specified ones is given below.

Meetings of the European Society of Sonochemistry; first meetings, 100 to 400 participants; 150 participants, Grenoble.

European High Pressure Group; annual meetings; 100 to 400 participants, 1990, Bordeaux.

International Symposium on Plasma Chemistry; biannual meetings, circa 500 participants, 1991, Bochum.

Many conferences of the European and national scientific societies.

B. Objectives of the project

B1. Main objective

The main objective for the proposed COST project can be summarized as the 'investigation of the chances offered by the application of process technologies under extreme or unusual conditions for highly reactive and selective methods in chemical transformations'. It should aim at possible applications in process-integrated environmental protection and the synthesis of materials with unconventional properties.

B2. Secondary objectives

1. Diagnostics and modelling of the processes taking place under extreme and unusual conditions. This objective has close connections with COST Project C ('Theory and modelling of chemical systems and processes').

2. New highly selective and reactive routes in the synthesis of organic and inorganic compounds. This objective has close connections with COST Project B ('Selective synthesis').

3. Synthesis of new materials with unusual electrical, magnetic, optical and mechanical properties. This objective has close connections with COST Project D ('Design and preparation of new molecular systems with unconventional electrical, optical and magnetic properties').

4. Activation of inert substances (i.e. C-C1 bonds CO2 coal polymers).

5. Hazardous waste treatment.

6. Scale-up of laboratory reactors for pratical applications.

As already indicated in the description of the field there are important correlations among the different summarized here. Therefore, projects which combine or compare different extreme or unusual conditions should have priority.

C. The content of the project

C1. Classification of the subprojects

This COST project is organized as follows (see diagram below).

There are seven subprojects for each of the fields described in section 1.2. Within such a subproject, activities are coordinated which aim at least at one of the objectives itemized in section 2.2. The Management Committee has to take care that this structure does not prevent the exchange of knowledge and cooperation among the different subprojects. European workshops have to be organized and cooperation in the solution of problems described in section 2 must be promoted.

Management Committee	Secretariat
Project 1 Project 2 Project 3	Project 4 Project 5 Project 6 Project 7

C2. Evaluation of progress

It is aimed to follow progress in the programme by means of brief annual reports of the participating scientists, describing the results obtained through the concertation. After three years of joint activities, a milestone report should be prepared by the Management Committee. This report can then be reviewed by the – then appointed – COST Technical Committee for Chemistry.

A final report, perhaps in parallel with a few review research papers (for international research journals) should be published, to inform the non-participating scientists and possible users of the results and the obtained scientific conclusions.

A symposium after a period of five years, which will be accessible by the other scientists, will conclude the COST project in this field.

D. Timetable

A five-year programme is proposed for each of the seven subprojects described above, consisting of four stages (each of one to three years).

Stage 1

After the first meeting of the Management Committee a detailed inventorization of ongoing research and existing plans of the participating groups to start joint projects, based on the results of the present *ad hoc* Committee, will take place. This will result in a document for further use and for the mutual adjustment of plans. A short workshop-type meeting of the university and industry group leaders in this field may be used to evaluate these plans.

Stage 2

In this stage, which will start at the end of the first year, the activities between closely related projects should be visible, so that the researchers (and their co-workers) can meet to set up (and continue) joint collaborative projects and exchange their recent research results. Perhaps during this stage some collaboration with other (East) European countries could be explored.

Stage 3

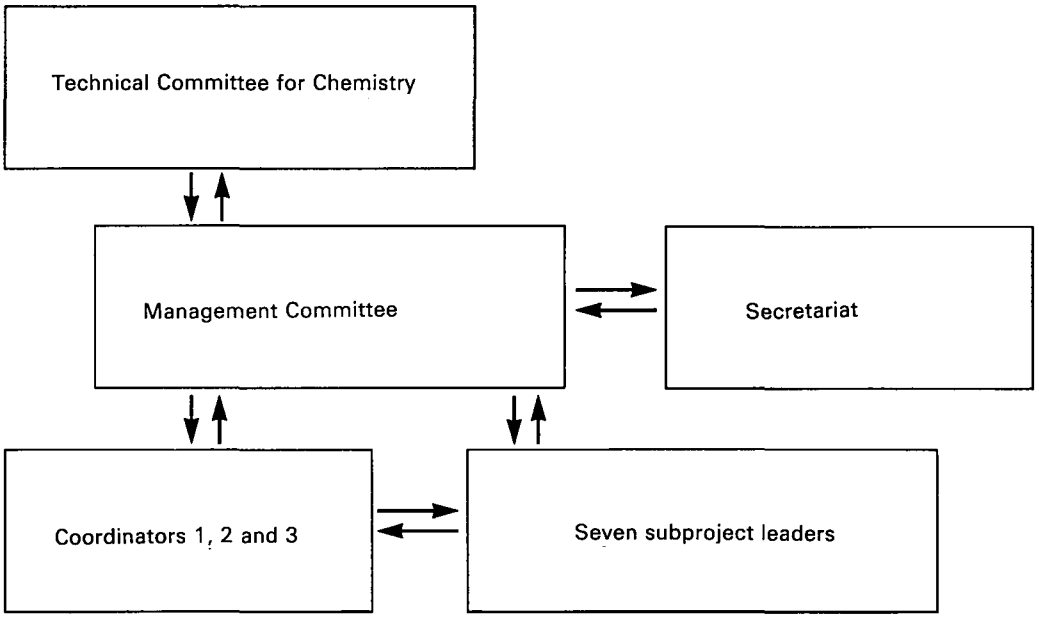
An intermediate progress report should be prepared after three years for review by the COST Technical Committee for Chemistry.

Stage 4

In this final phase, which will start after four years, the evaluation of the obtained results shall take place, perhaps by organizing a concluding symposium for all participants and their co-workers.

E. Organization, responsibilities and management

The organization of the total project could operate under the following structure:



The three coordinators have responsibilities for:

1. the inventarization in the first year, the organization of the workshop, and the start of the activity;
2. coordination of the joint activities with other COST chemistry projects (A to E and G); joint meetings are likely to result from this activity.
3. the possibilities of expanding to other countries, in particular to Eastern Europe; the exchange of information with the EC science programme and the ESF;
4. the planning of the intermediate report, the final report and the concluding symposium.

The seven subproject leaders are scientifically responsible for the seven fields mentioned under section 2. They interact with the Management Committee and also with the three coordinators.

The Management Committee will meet every six months. This Committee shall consult the Technical Committee for Chemistry once every year (in a joint meeting) and report on the progress. After the completion of the project, the final report should be made available to the general public and the governments of the participating countries; this is a major duty of the Management Committee.

Of course, progress in the seven subprojects will also be reported by the respective participants in their own countries.

F. Economic and financial matters

1. Research efforts

The total efforts spent in Europe in all subprojects (all countries expected to participate) are about 710 man-years in 13 COST member countries, totalling roughly some ECU 42.6 million per year. For the five-year period of project duration this would correspond to a total of ECU 213 million.

2. Coordination costs

The amount of coordination costs will depend on the number and size of the projects but should be in the order of not more than ECU 6.4 million for five years, provided that all countries analysed will participate in this COST project. Should one or the other of these countries not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.

3. Specification of activity per country

The list with activities and contact persons in 15 COST member countries is given in the final report of the COST *ad hoc* Technical Committee for Chemistry (COST 240/91), Topic F.

Memorandum of Understanding for the implementation of a European research project on molecular recognition chemistry

(COST Project D7)[1]

Date of entry into force of the project: 14.9.1992
Duration: 13.9.1997

Contracting Parties	Date of signing	Date of entry into force
GERMANY	10.9.1992	10.9.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 219 million (in 1991 terms).

ANNEX II

General description of the project

A. Introduction

A1. Reason for a COST project on this topic

Specific molecular recognition occurs in many crucial life processes such as the interaction between antibodies and antigens, enzymes and their substrates and inhibitors, and hormones and their receptors. The understanding of the recognition phenomena and of the nature of the forces which determine specific biological interactions in physical and chemical terms is of the greatest interest since it may permit a better insight into many vital life processes. Furthermore, molecular recognition is a key issue in factorizing and understanding the contributions to such important areas as enzyme catalysis, enantioselective catalysis, and stereoselectivity in synthetic reactions and molecular aggregations.

Inspired by biological processes, chemists can devise systems which may perform molecular recognition, transport and molecular catalysis with the highest efficiency and selectivity. Thus, new processes and systems can be continuously invented giving rise to artificial molecular recognition phenenomena of lower complexity and broader scope since they are not limited by the constraints of life, death and evolution.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

Molecular recognition, molecular catalysis and transport may be considered the first level of functional properties displayed by the supramolecular species resulting from the interaction of substrates with their receptor molecules. The rapidly growing interest in the nature of the forces involved in specific molecular interactions is taking chemical research beyond the molecule into the realm of supramolecular science giving rise to a multidisciplinary area located at the crossroads between the life sciences and the material sciences. Its further development is crucial to the cross-fertilization process which is taking place between physics and biology.

The field of molecular recognition is very broad and involves research in many different areas. The need for the development of a highly integrated basic science as the foundation for the understanding of the crucial life processes, as well as for molecular materials, information storage, processing and transfer, enzyme-like catalysis, etc. is fully recognized in most of the COST member countries. Some of these countries have already well-established research groups working on basic aspects of molecular recognition in biologically relevant systems. In many others, various aspects of supramolecular chemistry are being investigated. Some national programmes and funding procedures have been initiated and launched. However, communication, collaboration, and coordination between research groups in the different countries have not developed. There is, therefore, an interesting opportunity for COST to contribute to stimulate research in this important area. Some recent activities at European level are summarized below.

EUCHEM Conference on Supramolecular Reactivity and Catalysis, Padua (Italy), 8 to 13 September 1991.

Glycolipids and Molecular Recognition in Membrane Organization, Sheffield (United Kingdom), 11 to 14 September 1988.

Organized Molecular Systems in Chemical and Physical Processes, Parma (Italy), 29 September 1989.

First International Summer School on Supramolecular Chemistry, Strasbourg (France), 16 to 28 September 1990.

Thirteenth International Symposium on Macrocyclic Chemistry, Hamburg (Germany), 4 to 8 September 1988.

Sixth International Symposium on Molecular Recognition and Inclusion, Berlin (Germany), 10 to 14 September 1990.

Supramolecular Chemistry: Towards Self-Organization Processes, Le Bischenberg, Obernai (France), 5 to 8 July 1991.

Because of the precompetitive nature of the fundamental science which may be termed 'molecular recognition chemistry', no direct industrial application of the research in this area is to be expected. However, the pharmaceutical industry will benefit from the basic understanding of molecular recognition in biological systems and, at the same time, supramolecular chemistry will become pre-eminent in the generation of a vast range of new technologies based on microscopic processes operating at the molecular level by organizing synthetic molecules in a designed way for the translation of molecular properties into specific macroscopic properties. Therefore, many important developments for the economy, industrial activities and health are likely to be stimulated by research in this area.

B. Objectives of the project

B1. Main objective

The main objective for the proposed COST project can be described as understanding the non-covalent interactions which underlie molecular recognition phenomena in both biological and non-biological systems, studying the structure of these supramolecular systems and developing practical applications from this fundamental knowledge.

B2. Secondary objectives

(1) To analyse, at the molecular level, the structural features applied by nature in molecular recognition phonomena with particular emphasis on DNA-protein, protein-protein and carbohydrate-protein interactions, as well as on the nature of drug – (either natural or unnatural) – receptor interaction. These studies include the characterization of interacting molecular systems and their role in the biological processes as well as the development of chemical approaches to the understanding of the structure-function relationships which underlie recognition events. This objective has close connections with biocoordination chemistry (COST Project A), selective synthesis (COST Project B) and molecular modelling (COST Project C).

(2) To develop efficient strategies for the control of enzyme activity with special emphasis on selective chemical modification either of the active site or the secondary structure. Special attention should also be paid to the preparation of *de novo* designed proteins and the design and synthesis of peptide mimetics. This objective has close links with that of selective synthesis (COST Project B).

(3) To develop efficient strategies for the preparation of specific catalytic antibodies and their application in the achievement of selective reactions. Special attention should be given to the use of specific catalytic antibodies for the hydrolysis of proteins and peptides at specific sequences. This objective has close links with that of selective synthesis (COST Project B).

(4) To study the self-organization of molecules and to develop coaggregates such as bilayers, catalytic micelles, liposomes and vesicles – to be used as stereoselective catalysts and for chiral recognition – or biomimetic ion-channel structures, and surfactants – to be used for biomimetic ion transport, drug-delivery systems, and as models for prebiotic self-organizing and self-replicating molecular systems. This objective has close links with those of biocoordination chemistry (COST Project A) and selective synthesis (COST Project B).

(5) To design and synthesize new polymeric materials as models for reactive biological systems, membranes and biomembranes, as solid phase catalysts for asymmetric synthesis, as chiral stationary phases, and as reactive microgels. This objective has close links with those of selective synthesis (COST Project B) and molecular systems with unconventional properties (COST Project D).

(6) To promote research in host-guest chemistry with particular emphasis in inclusion compounds including molecular engineering of crystals. The results obtained in this field should shed light on the nature of intermolecular interactions and on their influence on the geometry of molecules and crystals. This objective has close links with that of biocoordination chemistry (COST Project A).

(7) To develop the efficient preparation and characterization of uniform heterogeneous catalysts such as zeolites, lays and pillared clays, as well as their application in the achievement of selective chemical transformations. This objective has close links with molecular systems with unconventional properties (COST Project D) and selective synthesis (COST Project B).

(8) To design and to synthesize artificial receptors based on molecular recognition of selective transport and catalysis, for model studies of specific interactions in biological systems and for the development of new molecular devices with unconventional properties. This objective has close links with those of selective synthesis (COST

Project B), molecular systems with unconventional properties (COST Project D) and molecular modelling (COST Project C).

C. The content of the project

C1. Classification of the subprojects

The objectives described above are a selection of important topics studied and stimulated already in several member countries and which are promising for further concentration at European level. The relationships between the eight subprojects and with the Management Committee are as follows:

Management Committee	Secretariat

Project 1 Project 2 Project 3 Project 4 Project 5 Project 6 Project 7 Project 8

C2. Evaluation of progress

It is aimed to monitor progress in the programme by means of brief annual reports of the participating scientists describing the results obtained through the concertation. After three years of joint activities, a report should be prepared by the Management Committee. This report can then be reviewed by the – then appointed – COST Technical Committee for Chemistry.

A final report should be published to inform non-participating scientists and possible future users of the results and scientific conclusions. A symposium after a period of five years will include the COST project in this field.

D. Timetable

A five-year programme for each of the eight subprojects described above is proposed to be set up as a COST project. The programme would consist of four stages.

Stage 1. After the first meeting of the Management Committee a detailed inventarization of ongoing research and existing plans of the participating groups to start joint projects will take place. This will result in a document for further use and for the mutual adjustment of plans. A short workshop-type meeting of the academic and industrial group leaders may be used to evaluate these plans.

Stage 2. In this stage, which will start at the end of the first year, the activities between closely related projects should be visible, so that the researchers can meet to set up and continue joint collaborative projects and exchange their research results.

Stage 3. An intermediate progress report should be prepared after three years for review by the COST Technical Committee for Chemistry.

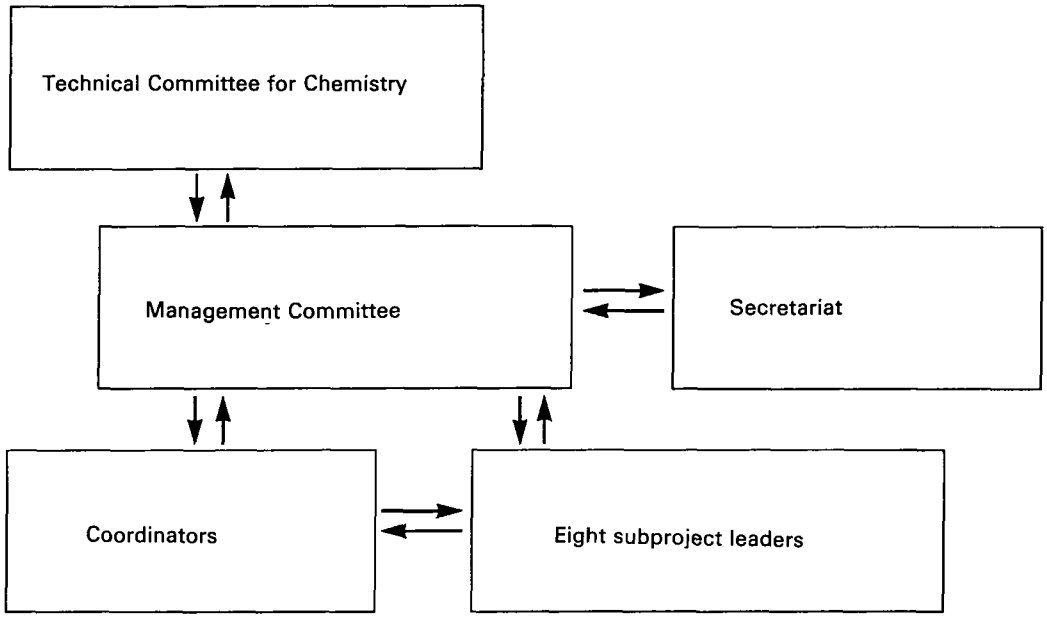
Stage 4. In this final phase, which will start after four years, evaluation of the obtained results should take place, perhaps by organizing a concluding symposium for all participants.

In summary, the total timetable can be represented as follows:

1991	1992	1993	1994	1995	1996
Starting-point (management Committee)					
	Formation of eight projects; workshop of group leaders; overview; start meetings; continue meetings				
		Start exploration and participation; East European countries			
			Intermediate progress report becomes available for Technical Committee		
				Start of evaluation	
					Concluding symposium

E. Organization, responsibilities and management

The organization of the total project could operate under the following structure:



The coordinators are responsible for:

1. the inventarization in the first year; the organization of the workshop and the start of the activity; existing contacts will be used;

2. coordination of joint activities with other COST chemistry projects (A to F); joint meetings are likely to result from this activity;

3. the possibilities of expanding to other countries, in particular to Eastern Europe; the coordinators are also responsible for the exchange of information with the EC science programme and the ESF;

4. the planning of the intermediate report, the final report and the concluding symposium.

The eight subproject leaders are scientifically responsible for the eight objectives. They interact with the Management Committee and also with the coordinators.

The Management Committee will meet every six months. This Committee shall consult the Technical Committee for Chemistry once every year and report on the progress. After completion of the project, the final report should be made available to the general public and the governments of the participating countries.

F. Economic and financial matters

The total efforts spent in Europe are (status early 1991; all countries expected to participate) as follows.

F1. Research costs in the several subprojects

Subproject 1: in about 16 countries, a total of 160 man-years, totalling ECU 9.6 million;

Subproject 2: in about five countries, a total of 50 man-years, totalling ECU 3.0 million;

Subproject 3: in about five countries, a total of 40 man-years, totalling ECU 2.4 million;

Subproject 4: in about 12 countries, a total of 130 man-years, totalling ECU 7.8 million;

Subproject 5: in about six countries, a total of 40 man-years, totalling ECU 2.4 million;

Subproject 6: in about five countries, a total of 40 man-years, totalling ECU 2.4 million;

Subproject 7: in about 10 countries a total of 100 man-years, totalling ECU 6.0 million;

Subproject 8: in about 16 countries a total of 170 man-years, totalling ECU 10.2 million.

In total, activities – in at least one of the eight subprojects – are ongoing in all COST member countries. The total human effort in the area of molecular recognition chemistry, as described in this paper amounts to approximately 730 man-years, being the equivalent of ECU 43.8 million per year. For the five-year period of project duration this would correspond to a total of ECU 219 million.

F2. Coordination costs

The costs for coordination and travelling expenses as well as for workshop and seminar organization, publication and some translations is estimated to be not more than ECU 7 million for the whole period of five years, provided that all countries analysed participate in this COST project. Should one or the other of these countries will not participate in this project, the global cost for coordination will be reduced proportionately. All these costs (research costs and coordination costs) will be taken over by the participating countries according to their respective involvement.

F3. Specification of activity per country

This is available as a list (and the name of a contact person) and shows that there are activities in 16 COST member countries. Actual participation in one or more of the five subprojects is therefore quite likely.

The list with activities and contact persons in 15 COST member countries is given in the final report of The COST *ad hoc* Technical Committee for Chemistry (COST 140/91), Topic G.

Memorandum of Understanding for the implementation of a European research project on complex three-dimensional viscous flows: prediction, modelling, manipulation and control

(COST Project F1)[1]

Date of entry into force of the project: 10.9.1992
Duration: 9.9.1995

Contracting parties	Date of signing	Date of entry into force
GERMANY	10.9.1992	10.9.1992
SWITZERLAND	10.9.1992	10.9.1992
FINLAND	10.9.1992	10.9.1992
SWEDEN	14.9.1992	14.9.1992

The overall value is ECU 8.4 million (in 1991 terms).

ANNEX II

General description of the project

1. Introduction

The general study of fluid dynamics, taken in its widest physical context, covers a vast area of applications in science and technology. Indeed, the applications are so many and so varied and often far reaching in economic terms that vast amounts of experimental and computational resources are expended, for instance to find solutions or to optimize designs of technological importance. Fluid dynamics and, in particular, complex three-dimensional viscous flows constitute an area of science which plays a dominant role in many other scientific or technical areas known under other designations, such as aerodynamics, meteorology, turbulence and pollution control, and in neighbouring sciences of medical, chemical or other origin. Conseqently it is an area where international cooperation is already active and indeed indispensable. An integrated form of action at European level in order to motivate, to coordinate but also to control the research activities in complex three-dimensional viscous flows that often demand large amounts of resources is beneficial to the progress in any one particular branch of fluid dynamic research.

[1] The texts of the Memorandum of Understanding and Annex I are given on page 13 of the model.

The proposed project could be a good example of a systematic basic search for the development of new methods and techniques, for improvement of existing methods to analyse and to predict complex three-dimensional viscous flows. It links in with the effort of improving the understanding of fluid phenomena currently occuring in industrial applications. In technical economic terms, the availability of a reliable predictive model, which is also cost effective and easy to use, enables the handling of different configurations for designing various applications and providing high investment saving.

Great interest amongst fluid dynamicists in collaborating on the European scale has already brought about the formation of the Ercoftac Association (European Community research on flow turbulence and combustion), and has manifested itself through different applied BRITE/EURAM programmes, specific ESA programmes, etc. The Ercoftac Association, an association on a volunteer basis, has so far obtained very limited financial support to handle its various scientific activities.

2. Objectives of cooperative research

The main objectives of the project are as follows:

General objectives:

(a) to create a European project for work on the basic development of complex three-dimensional viscous flows;

(b) to coordinate and promote national activities at a European level;

(c) to stimulate and promote collaboration with European academic and industrial groups in the field.

Specific objectives:

(a) to improve the understanding of three-dimensional complex flows in real conditions and complex configurations;

(b) to set up new methods of quantitative prediction and experimental techniques for three-dimensional complex flows;

(c) to improve existing methods of quantitive prediction and experimental techniques for three-dimensional complex flows;

(d) to develop reliable, cost-effective and easy-to-use methods to predict and to analyse three-dimensional complex viscous flows;

(e) to establish new extensive databases of relevant information to the testing of numerical models or to the improvement of such models.

3. Realization of research objectives

The project is based on locally funded know-how and research activities taking place in the participating countries. The objectives will be realized by research in the following strongly interconnected fields:

(1) Laminar-turbulent transition; i.e.:

the prediction of complex, transitional, turbulent, and relaminarizing turbulent flows (including those subjected to manipulation, and combinations or sequences of extra strain rates such as curvature, pressure gradients and rotation).

(2) New advanced turbulence models; i.e.:

(a) the prediction of flows subjected to manipulation;

(b) the prediction of complex flows subjected to combinations of extra strain rates such as curvature, pressure gradients and rotation;

(c) the development of numerical methods for computing complex viscous flows; the numerical method solving the Reynolds-average Navier-Stokes equation for compressible flows is based on a finite-volume technique and uses a multigrid method for better convergence. The aim is to modify existing turbulence models and to test new ones for different test cases. Models based on differential equations or large eddy models will be utilized;

(d) the refinement of current 3D flow models (including both high-level, to five equation models for boundary layer codes, and lower level, algebraic to two equation closures for implementation in Navier-Stokes codes).

(3) Large eddy and direct numerical simulation; i.e.:

direct numerical simulation of flow through a straight square duct.

(4) Numerics; i.e.:

(a) the development of finite element algorithms for analysis of imcompressible and compressible 3D viscous flows using non-structured adaptive grid refinement techniques;

(b) the solution of 3D Navier-Stokes equations through an ALE method and other solvers; test-case checking also towards autonomous experimental results;

(c) the solution of 3D Navier-Stokes equations through vectorized solvers in phase of being improved in convergence and turbulence modelling in view of combustion applications;

(d) the solution of transonic Euler and Navier-Stokes equations with advanced techniques, applicable also to the 'inverse design' of aerodynamic geometries.

(5) Visualization; i.e.:

the application of pattern recognition techniques to the analysis of direct simulations of both transitional and turbulent flows.

(6) Experimental validation; i.e.:

(a) the investigation of 3D turbulent boundary layer (near or with separation) generated by pressure gradient: to build up an extensive database, to improve existing and to set up new measurement techniques, to explore and to improve existing turbulence models;

(b) the investigation of 3D flow influenced by curvature and rotation, Goertler, Dean vortices development;

(c) the solution of 3D Navier-Stokes equations within internal geometries through and Arbitrary Lagrangian Eulerian (ALE) technique, in phase of test-case checking toward experimental results;

(d) particle movement and especially the dispersion of small particles are important in the applications utilizing highly swirling flows.

There is a lack of general theories for turbulence-particle interaction. A better understanding of these phenomena is needed in all combustion applications and basic research is being carried out in order to elucidate their nature; the time-dependent flow at or near stall; and three-dimensional high subsonic flow through a rotating model turbine.

4. Appropriate forms of cooperation within the COST project

4.1. Management

The organization is based on a Management Committee with a secretariat, coordinating subprojects in the following way.

4.1.1. Management Committee

The Management Committee (MC) will comprise one or two delegates from each Signatory and will be nominated after approval of the project.

The delegates in the MC are expected to:

(a) attend and contribute to meetings of the MC;

(b) be responsible for the general programme, development of subprojects and time scale of the project;

(c) be responsible for setting up a network of cooperating institutes, jointly with industry if desirable;

(d) be responsible for liaison between the MC and national research groups in the participating countries.

The MC is expected to:

(a) contact annually the COST secretariat for suitable liaison between the project and other related COST projects;

(b) create contacts with appropriate international groups within COST, European Community programmes, e.g. BRITE/EURAM, Science, etc., as well as with national ones in order to increase interest, and if appropriate to exchange information. Representation of other organizations can be given an observer status in the MC;

(c) organize annual financial and scientific reporting which will be kept confidential.

The final report on the results will have a wide circulation covering complex three-dimensional viscous flows' society at large.

The MC should arrange meetings, workshops, laboratory visits for interlaboratory comparison of results, in order to achieve a rapid exchange of information.

4.1.2. Secretariat

Here it is assumed that one of the signatory States will provide the secretariat service for the project.

4.1.3. Subproject management

The MC will designate the national contributions to the different subprojects.

All subprojects will have a coordinator with defined responsibilities and duties.

4.1.4. Projects

Each subproject consists of one or more projects with project leaders.

4.1.5. Documentation

Documentation of and reports on the project will be made in accordance with the COST recommendation.

4.1.6. Economic dimension of the project

The information obtained up to 10 November 1991 and from the COST-Form 2 up to 10 September 1991 indicates that more than 23 institutes in seven countries show a serious interest in the project.

The present estimation indicates an investment of more than 140 man-years. On the basis of 1 person/year equivalent to ECU 60 000, the budget of the project is at present about ECU 8.4 million (140 x 60 000) over three years.

5. Time schedule

5.1. Duration

The duration of this project will be about three years.

5.2. Planning

Assuming that the project will be approved in late 1991, the following time schedule is suggested.

Early 1992

- preparatory activities at all levels will continue;
- first meeting of the MC;
- the result of this meeting may be the setting-up of subgroups and the preparation of a workshop scheduled to be held in 1993.

Synoptic tables for other COST projects in force at 1 January 1991

The texts of the projects signed prior to 1 January 1991 are contained in Volumes 1 to 6 of the Collected Agreements covering the period from 1971 to 1991.

Memorandum of Understanding for the implementation of a European research project on cooperation technology (co-tech)

COST Project 14)[1]

Date of entry into force of the project: 19.7.1990
Duration: 18.7.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
DENMARK	10.9.1992	10.9.1992
GERMANY	26.4.1990	26.4.1990
SPAIN	7.2.1991	7.2.1991
IRELAND	20.9.1990	20.9.1990
ITALY	25.4.1991	25.4.1991
NETHERLANDS	19.7.1990	19.7.1990
SWITZERLAND	28.1.1991	28.1.1991
FINLAND	19.7.1990	19.7.1990
SWEDEN	25.1.1991	25.1.1991
UNITED KINGDOM	19.7.1990	19.7.1991

[1] COST Projects, Vol. 6, p. 10.

Memorandum of Understanding for the implementation of a European research project on wide-band digital local telecommunication networks

(COST Project 202 bis)[1]

Date of entry into force of the project: 5.4.1984
Duration: 4.4.1991

Contracting parties	Date of signing	Date of entry into force
BELGIUM	14.3.1984	14.3.1984
DENMARK	29.3.1984	29.3.1984
GERMANY	23.5.1984	23.5.1984
FRANCE	17.10.1984	17.10.1984
IRELAND	12.9.1984	12.9.1984
ITALY	25.7.1984	25.7.1984
NETHERLANDS	14.3.1984	14.3.1984
SWITZERLAND	31.10.1984	31.10.1984
FINLAND	13.4.1984	13.4.1984
SWEDEN	5.4.1984	5.4.1984
UNITED KINGDOM	14.3.1984	14.3.1984

[1] COST Projects, Vol. 3, p. 185.

Memorandum of Understanding for the implementation of a European research project on redundancy reduction techniques for coding of video signals in multimedia services

(COST Project 211 ter)[1]

Date of entry into force of the project: 11.10.1990
Duration: 10.10.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
GERMANY	11.10.1990	11.10.1990
SPAIN	6.2.1992	6.2.1992
FRANCE	7.2.1991	7.2.1991
IRELAND	11.10.1990	11.10.1990
ITALY	19.5.1992	19.5.1992
NETHERLANDS	11.10.1990	11.10.1990
NORWAY	23.1.1991	23.1.1991
PORTUGAL	4.7.1991	4.7.1991
SWITZERLAND	17.5.1991	17.5.1991
FINLAND	10.4.1991	10.4.1991
SWEDEN	9.11.1990	9.11.1990
TURKEY	7.3.1991	7.3.1991
UNITED KINGDOM	11.10.1990	11.10.1990

[1] COST Projects, Vol. 6, p. 25.

Memorandum of Understanding for the implementation of a European research project on human factors in information services

(COST Project 212)[1]

Date of entry into force of the project: 25.8.1986
Duration: 24.8.1991

Contracting parties	Date of signing	Date of entry into force
DENMARK	26.6.1986	26.6.1986
SPAIN	3.3.1988	3.3.1988
ITALY	25.8.1986	25.8.1986
FINLAND	26.3.1986	26.3.1986
SWEDEN	26.3.1986	26.3.1986

[1] COST Projects, Vol. 4, p. 127.

Memorandum of Understanding for the implementation of a European research project on optical switching and routing devices

(COST Project 216)[1]

Date of entry into force of the project: 27.2.1986
Duration: 26.2.1991

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.9.1988	19.9.1988
DENMARK	27.2.1986	27.2.1986
GERMANY	17.9.1987	17.9.1987
SPAIN	3.3.1988	3.3.1988
FRANCE	27.2.1986	27.2.1986
IRELAND	18.1.1988	18.1.1988
ITALY	22.8.1986	22.8.1986
NETHERLANDS	3.7.1986	3.7.1986
SWITZERLAND	28.4.1986	28.4.1986
FINLAND	27.2.1986	27.2.1986
SWEDEN	24.2.1986	24.2.1986
UNITED KINGDOM	27.2.1986	27.2.1986

[1] COST Projects, Vol. 4, p. 117.

Memorandum of Understanding for the implementation of a European research project in the field of optical measurement techniques for advanced optical fibre devices systems

(COST Project 217)[1]

Date of entry into force of the project: 25.9.1986
Duration: 24.9.1991

Contracting parties	Date of signing	Date of entry into force
DENMARK	25.9.1986	25.9.1986
GERMANY	25.9.1986	25.9.1986
SPAIN	3.3.1988	3.3.1988
ITALY	24.3.1987	24.3.1987
NETHERLANDS	18.12.1986	18.12.1986
SWITZERLAND	19.12.1986	19.12.1986
FINLAND	25.9.1986	25.9.1986
TURKEY	22.12.1986	22.12.1986
UNITED KINGDOM	25.9.1986	25.9.1986

[1] COST Projects, Vol. 4, p. 163.

Memorandum of Understanding for the implementation of a European research project on material science and reliability of optical fibres and cables

(COST Project 218)[1]

Date of entry into force of the project: 19.2.1987
Duration: 18.2.1993

Contracting parties	Date of signing	Date of entry into force
EC	23.7.1987	23.7.1987
DENMARK	19.2.1987	19.2.1987
GERMANY	19.2.1987	19.2.1987
FRANCE	10.1.1991	10.1.1991
ITALY	19.2.1987	19.2.1987
NETHERLANDS	19.2.1987	19.2.1987
SWITZERLAND	29.4.1987	29.4.1987
FINLAND	19.2.1987	19.2.1987
SWEDEN	19.2.1987	19.2.1987
UNITED KINGDOM	19.2.1987	19.2.1987

[1] COST Projects, Vol. 5, p. 9.

Memorandum of Understanding for the implementation of a European research project on future telecommunication and teleinformatic facilities for disabled people

(COST Project 219)[1]

Date of entry into force of the project: 23.9.1986
Duration: 22.9.1996

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
DENMARK	25.9.1986	25.9.1986
GERMANY	7.7.1988	7.7.1988
GREECE	4.7.1991	4.7.1991
SPAIN	3.3.1988	3.3.1988
FRANCE	25.9.1986	25.9.1986
IRELAND	16.6.1988	16.6.1988
ITALY	26.4.1989	26.4.1989
NETHERLANDS	6.11.1986	6.11.1986
NORWAY	25.9.1986	25.9.1986
AUSTRIA	1.12.1992	1.12.1992
PORTUGAL	26.7.1990	26.7.1990
SWITZERLAND	30.3.1990	30.3.1990
FINLAND	25.9.1986	25.9.1986
SWEDEN	18.12.1986	18.12.1986
UNITED KINGDOM	25.9.1986	25.9.1986

[1] COST Projects, Vol. 4, p. 151.

Memorandum of Understanding for the implementation of a European research project on communication protocols and user interfaces for keyboards and display equipment intended for telecommunication use by disabled people

(COST Project 220)[1]

Date of entry into force of the project: 28.6.1988
Duration: 27.6.1993

Contracting parties	Date of signing	Date of entry into force
SPAIN	3.3.1988	3.3.1988
IRELAND	16.6.1988	16.6.1988
NETHERLANDS	6.11.1986	6.11.1986
AUSTRIA	1.8.1991	1.8.1991
PORTUGAL	26.7.1990	26.7.1990
SWITZERLAND	30.3.1990	30.3.1990
FINLAND	19.2.1987	19.2.1987
SWEDEN	19.2.1987	19.2.1987
UNITED KINGDOM	19.2.1987	19.2.1987

[1] COST Projects, Vol. 5, p. 67.

Memorandum of Understanding for the implementation of a European research project on antennas in the 1990s – active array antennas for future satellite and terrestrial communications

(COST Project 223)[1]

Date of entry into force of the project: 12.1.1989
Duration: 11.1.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.1.1989	12.1.1989
DENMARK	12.1.1989	12.1.1989
GERMANY	6.4.1989	6.4.1989
GREECE	12.1.1989	12.1.1989
SPAIN	12.1.1989	12.1.1989
FRANCE	6.4.1989	6.4.1989
ITALY	12.6.1989	12.6.1989
NETHERLANDS	6.4.1989	6.4.1989
NORWAY	5.3.1992	5.3.1992
PORTUGAL	2.3.1989	2.3.1989
SWITZERLAND	23.6.1989	23.6.1989
FINLAND	3.3.1990	3.3.1990
SWEDEN	21.2.1989	21.2.1989
TURKEY	5.6.1990	5.6.1990
UNITED KINGDOM	12.1.1989	12.1.1989
ESA	7.7.1989	7.7.1989

[1] COST Projects, Vol. 6, p. 37.

Draft Memorandum of Understanding for the implementation of a European research project on methods for the performance evaluation and design of asynchronous and synchronous multiservice networks

(COST Project 224)[1]

Date of entry into force of the project: 16.9.1988
Duration: 15.9.1991

Contracting parties	Date of signing	Date of entry into force
DENMARK	15.9.1988	15.9.1988
FRANCE	15.9.1988	15.9.1988
FINLAND	16.9.1988	16.9.1988
SWEDEN	20.9.1988	20.9.1988
UNITED KINGDOM	15.9.1988	15.9.1988

COST Projects, Vol. 5, p. 79.

Memorandum of Understanding for the implementation of a European research project on secure communication

(COST Project 225)[1]

Date of entry into force of the project: 26.1.1989
Duration: 25.1.1994

Contracting parties	Date of signing	Date of entry into force
DENMARK	26.1.1989	26.1.1989
IRELAND	17.5.1989	17.5.1989
ITALY	12.6.1989	12.6.1989
SPAIN	26.1.1989	26.1.1989
NETHERLANDS	15.4.1992	15.4.1992
SWITZERLAND	23.6.1989	23.6.1989
FINLAND	26.1.1989	26.1.1989
SWEDEN	26.1.1989	26.1.1989

[1] COST Projects, Vol. 6, p. 51.

Memorandum of Understanding for the implementation of a European research project on integrated space/terrestrial networks

(COST Project 226)[1]

Date of entry into force of the project: 22.2.1990
Duration: 21.2.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.9.1989	15.9.1989
DENMARK	22.2.1990	22.2.1990
GERMANY	2.10.1991	2.10.1991
SPAIN	24.7.1991	24.7.1991
ITALY	26.4.1991	26.4.1991
HUNGARY	11.12.1992	11.12.1992
AUSTRIA	23.3.1990	23.3.1990
PORTUGAL	11.11.1992	11.11.1992
SWITZERLAND	4.7.1991	4.7.1991
SWEDEN	15.9.1989	15.9.1989
ESA	26.7.1990	26.7.1990

[1] COST Projects, Vol. 6, p. 63.

Memorandum of Understanding for the implementation of a European research project on applications of digital signal processing in communications

(COST Project 229)[1]

Date of entry into force of the project: 5.4.1990
Duration: 4.4.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
FRANCE	5.4.1990	5.4.1990
SPAIN	5.4.1990	5.4.1990
ITALY	26.4.1991	26.4.1991
PORTUGAL	3.10.1990	3.10.1990
SWITZERLAND	5.4.1990	5.4.1990
SWEDEN	5.4.1990	5.4.1990

[1] COST Projects, Vol. 6, p. 87.

Memorandum of Understanding for the implementation of a European research project on the evolution of land mobile radio (including personal) communication

(COST Project 231)[1]

Date of entry into force of the project: 6.4.1989
Duration: 5.4.1993

Contracting parties	Date of signing	Date of entry into force
CZECHOSLOVAKIA	18.6.1992	18.6.1992
DENMARK	6.4.1989	6.4.1989
GERMANY	6.4.1989	6.4.1989
SPAIN	30.11.1989	30.11.1989
FRANCE	6.4.1989	6.4.1989
IRELAND	17.5.1989	17.5.1989
ITALY	12.6.1989	12.6.1989
NETHERLANDS	6.4.1989	6.4.1989
NORWAY	18.4.1991	18.4.1991
AUSTRIA	18.4.1990	18.4.1990
PORTUGAL	7.9.1989	7.9.1989
SWITZERLAND	23.6.1989	23.6.1989
FINLAND	30.3.1990	30.3.1990
SWEDEN	27.11.1989	27.11.1989
TURKEY	5.6.1990	5.6.1990
UNITED KINGDOM	6.4.1989	6.4.1989

[1] COST Projects, Vol. 6, p. 99.

Memorandum of Understanding for the implementation of a European research project on speech recognition over the telephone line

(COST Project 232)[1]

Date of entry into force of the project: 26.4.1990
Duration: 25.4.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.10.1991	16.10.1991
CZECHOSLOVAKIA	2.4.1992	2.4.1992
DENMARK	26.4.1990	26.4.1990
GERMANY	26.4.1990	26.4.1990
SPAIN	7.2.1991	7.2.1991
ITALY	26.4.1991	26.4.1991
NORWAY	25.9.1992	25.9.1992
PORTUGAL	26.7.1990	26.7.1990
SWITZERLAND	28.1.1991	28.1.1991
SWEDEN	26.4.1990	26.4.1990
UNITED KINGDOM	26.4.1990	26.4.1990

[1] COST Projects, Vol. 6, p. 113.

Memorandum of Understanding for the implementation of a European research project on the prosodics of synthetic speech

(COST Project 233)[1]

Date of entry into force of the project: 14.11.1990
Duration: 13.11.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CZECHOSLOVAKIA	2.4.1992	2.4.1992
SPAIN	8.5.1991	8.5.1991
NORWAY	16.12.1992	16.12.1992
SWITZERLAND	14.11.1990	14.11.1990
SWEDEN	14.11.1990	14.11.1990
UNITED KINGDOM	14.11.1990	14.11.1990

[1] COST Projects, Vol. 6, p. 127.

Memorandum of Understanding for the implementation of a European research project on expanded single mode optical fibre communication (ESM)

(COST Project 234)[1]

Date of entry into force of the project: 5.12.1990
Duration: 4.12.1994

Contracting parties	Date of signing	Date of entry into force
DENMARK	5.12.1990	5.12.1990
GERMANY	5.12.1990	5.12.1990
FRANCE	10.1.1991	10.1.1991
NETHERLANDS	5.12.1990	5.12.1990
SWITZERLAND	28.1.1991	28.1.1991
UNITED KINGDOM	5.12.1990	5.12.1990

[1] COST Projects, Vol. 6, p. 139.

Memorandum of Understanding for the implementation of a European research project on the field of freight-transport logistics

(COST Project 310)[1]

Date of entry into force of the project: 13.4.1989
Duration: 12.4.1992

Contracting parties	Date of signing	Date of entry into force
GERMANY	7.6.1990	7.6.1990
GREECE	13.9.1989	13.9.1989
SPAIN	13.4.1989	13.4.1989
FRANCE	31.1.1990	31.1.1990
IRELAND	8.11.1989	8.11.1989
ITALY	9.6.1989	9.6.1989
NETHERLANDS	13.4.1989	13.4.1989
NORWAY	13.4.1989	13.4.1989
PORTUGAL	26.9.1990	26.9.1990
SWITZERLAND	23.6.1989	23.6.1989
FINLAND	9.6.1989	9.6.1989
SWEDEN	13.4.1989	13.4.1989
EC	7.6.1989	7.6.1989

[1] COST Projects, Vol. 6, p. 151.

Memorandum of Understanding for the implementation of a European research project on maritime traffic simulation

(COST Project 311)[1]

Date of entry into force of the project: 3.3.1988
Duration: 2.3.1992

Contracting parties	Date of signing	Date of entry into force
GREECE	8.12.1988	8.12.1988
SPAIN	3.3.1988	3.3.1988
FRANCE	3.3.1988	3.3.1988
IRELAND	7.7.1988	7.7.1988
ITALY	14.4.1988	14.4.1988
NETHERLANDS	3.3.1988	3.3.1988
FINLAND	3.3.1988	3.3.1988

[1] COST Projects, Vol. 5, p. 55.

Memorandum of Understanding for the implementation of a European research project in the field of the evaluation of the effects of the Channel Tunnel on the structure of traffic flows

(COST Project 312)[1]

Date of entry into force of the project: 6.4.1989
Duration: 5.10.1991

Contracting parties	Date of signing	Date of entry into force
DENMARK	8.3.1990	8.3.1990
GREECE	6.4.1989	6.4.1989
FRANCE	6.4.1989	6.4.1989
IRELAND	17.5.1989	17.5.1989
NETHERLANDS	6.4.1989	6.4.1989
SWITZERLAND	23.6.1989	23.6.1989
UNITED KINGDOM	6.4.1989	6.4.1989

[1] COST Projects, Vol. 6, p. 169.

Memorandum of Understanding for the implementation of a European research project in the field of the socioeconomic cost of road accidents

(COST Project 313)[1]

Date of entry into force of the project: 5.10.1989
Duration: 4.4.1993

Contracting parties	Date of signing	Date of entry into force
DENMARK	21.3.1990	21.3.1990
GERMANY	12.10.1989	12.10.1989
SPAIN	29.5.1991	29.5.1991
FRANCE	5.10.1989	5.10.1989
NETHERLANDS	5.10.1989	5.10.1989
NORWAY	23.11.1989	23.11.1989
AUSTRIA	5.10.1989	5.10.1989
PORTUGAL	8.3.1990	8.3.1990
SWITZERLAND	27.2.1990	27.2.1990
FINLAND	26.2.1990	26.2.1990
SWEDEN	5.10.1989	5.10.1989
UNITED KINGDOM	5.10.1989	5.10.1989

[1] COST Projects, Vol. 6, p. 181.

Memorandum of Understanding for the implementation of a European research project on high-temperature materials for conventional systems of energy generation and conversion using fossil fuels

(COST Project 501)[1]

Date of entry into force of the project: 23.11.1981
Duration: 31.12.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	7.10.1982	7.10.1982
CZECHOSLOVAKIA	18.6.1992	18.6.1992
DENMARK	23.11.1981	23.11.1981
GERMANY	23.11.1981	23.11.1981
FRANCE	23.11.1981	23.11.1981
IRELAND	23.11.1981	23.11.1981
ICELAND	4.12.1992	4.12.1992
ITALY	23.11.1981	23.11.1981
HUNGARY	11.12.1992	11.12.1992
NETHERLANDS	23.11.1981	23.11.1981
NORWAY	23.11.1981	23.11.1981
AUSTRIA	23.11.1981	23.11.1981
SWITZERLAND	23.11.1981	23.11.1981
FINLAND	23.11.1981	23.11.1981
SWEDEN	23.11.1981	23.11.1981
UNITED KINGDOM	23.11.1981	23.11.1981
EC	23.11.1981	23.11.1981

[1] COST Projects, Vol. 2, p. 61.

Memorandum of Understanding for the implementation of a European research project on powder metallurgy

(COST Project 503)[1]

Date of entry into force of the project: 21.4.1983
Duration: 20.4.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	5.10.1983	5.10.1983
DENMARK	21.4.1983	21.4.1983
GERMANY	21.4.1983	21.4.1983
SPAIN	29.1.1992	29.1.1992
FRANCE	21.4.1983	21.4.1983
ITALY	31.3.1992	31.3.1992
LUXEMBOURG	25.9.1992	25.9.1992
NORWAY	23.11.1981	23.11.1981
AUSTRIA	26.3.1984	26.3.1984
SLOVENIA	1.10.1992	1.10.1992
SWITZERLAND	2.8.1983	2.8.1983
FINLAND	11.1.1984	11.1.1984
SWEDEN	21.4.1983	21.4.1983
UNITED KINGDOM	21.4.1983	21.4.1993
EC	7.6.1983	7.6.1983

[1] COST Projects, Vol. 3, p. 53.

Memorandum of Understanding for the implementation of a European research project on castings technology

(COST Project 504)[1]

Date of entry into force of the project: 10.2.1983
Duration: 9.2.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	30.11.1983	30.11.1983
CZECHOSLOVAKIA	18.6.1992	18.6.1992
DENMARK	27.1.1988	27.1.1988
GERMANY	10.2.1983	10.2.1983
SPAIN	2.7.1992	2.7.1992
FRANCE	10.2.1983	10.2.1983
NETHERLANDS	23.12.1985	23.12.1985
NORWAY	29.1.1988	29.1.1988
AUSTRIA	16.1.1984	16.1.1984
SWITZERLAND	2.8.1983	2.8.1983
FINLAND	10.2.1983	10.2.1983
SWEDEN	10.2.1983	10.2.1983
UNITED KINGDOM	10.2.1983	10.2.1983
EC	14.3.1983	14.3.1983

[1] COST Projects, Vol. 3, p. 29.

Memorandum of Understanding for the implementation of a European research project to support industrial applications of light alloys

(COST Project 506)[1]

Date of entry into force of the project: 10.12.1986
Duration: 9.12.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.9.1988	29.9.1988
SPAIN	10.12.1986	10.12.1986
FRANCE	3.3.1988	3.3.1988
NETHERLANDS	10.12.1986	10.12.1986
NORWAY	4.12.1987	4.12.1987
AUSTRIA	10.12.1986	10.12.1986
SWITZERLAND	10.12.1986	10.12.1986
FINLAND	10.12.1986	10.12.1986
SWEDEN	10.12.1986	10.12.1986
UNITED KINGDOM	10.2.1983	10.2.1983

[1] COST Projects, Vol. 4, p. 223.

Memorandum of Understanding for the implementation of a European research project to create a databank for light alloy design

(COST Project 507)[1]

Date of entry into force of the project: 8.12.1988
Duration: 7.12.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.1.1989	12.1.1989
GERMANY	8.12.1988	8.12.1988
GREECE	8.12.1988	8.12.1988
SPAIN	25.10.1990	25.10.1990
FRANCE	8.12.1988	8.12.1988
ITALY	18.9.1990	18.9.1990
NETHERLANDS	5.7.1990	5.7.1990
NORWAY	8.12.1988	8.12.1988
AUSTRIA	5.10.1989	5.10.1989
PORTUGAL	7.9.1989	7.9.1989
SWITZERLAND	23.6.1989	23.6.1989
FINLAND	30.3.1990	30.3.1990
SWEDEN	21.2.1989	21.2.1989
UNITED KINGDOM	8.12.1988	8.12.1988

[1] COST Projects, Vol. 5, p. 107.

Memorandum of Understanding for the implementation of a European research project on wood mechanics

(COST Project 508)[1]

Date of entry into force of the project: 28.5.1990
Duration: 27.5.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CZECHOSLOVAKIA	9.12.1992	9.12.1992
DENMARK	24.9.1992	24.9.1992
GERMANY	5.7.1990	5.7.1990
SPAIN	11.10.1990	11.10.1990
FRANCE	26.4.1990	26.4.1990
IRELAND	20.9.1990	20.9.1990
ITALY	26.4.1990	26.4.1990
NETHERLANDS	26.4.1990	26.4.1990
PORTUGAL	4.7.1991	4.7.1991
SLOVENIA	17.11.1992	17.11.1992
SWITZERLAND	4.7.1991	4.7.1991
FINLAND	28.5.1990	28.5.1990
SWEDEN	30.7.1990	30.7.1990
UNITED KINGDOM	26.4.1990	26.4.1990

[1] COST Projects, Vol. 6, p. 193.

Memorandum of Understanding for the implementation of a European research project on the hydrogeological aspects of groundwater protection in karstic areas

(COST Project 65)[1]

Date of entry into force of the project: 14.11.1990
Duration: 13.11.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CZECHOSLOVAKIA	24.9.1992	24.9.1992
GERMANY	14.11.1990	14.11.1990
SPAIN	14.11.1990	14.11.1990
FRANCE	18.4.1991	18.4.1991
IRELAND	4.7.1991	4.7.1991
ITALY	4.2.1991	4.2.1991
AUSTRIA	14.11.1990	14.11.1990
PORTUGAL	4.7.1991	4.7.1991
SWITZERLAND	17.5.1991	17.5.1991
UNITED KINGDOM	14.11.1990	14.11.1990

[1] COST Projects, Vol. 6, p. 205.

Convention establishing the European centre for medium-range weather forecasts

(COST Project 70)[1]

Date of entry into force of the project: 1.10.1975
Duration: unlimited

Contracting parties	Date of signing	Date of entry into force
BELGIUM	7.5.1973	1.10.1975
DENMARK	7.5.1973	1.10.1975
GERMANY	7.5.1973	1.10.1975
GREECE	7.5.1973	1.9.1976
SPAIN	7.5.1973	1.10.1975
FRANCE	7.5.1973	1.10.1975
IRELAND	7.5.1973	1.10.1975
ITALY	7.5.1973	1.9.1977
NETHERLANDS	7.5.1973	1.10.1975
AUSTRIA	7.5.1973	1.10.1975
PORTUGAL	7.5.1973	1.1.1976
SWITZERLAND	7.5.1973	1.10.1975
FINLAND	7.5.1973	1.10.1975
SWEDEN	7.5.1973	1.10.1975
TURKEY	2.11.1975	1.5.1976
UNITED KINGDOM	7.5.1973	1.10.1975

[1] COST Projects, Vol. 1, p. 87.

Memorandum of Understanding on the implementation of a European research project on weather radar networking

(COST Project 73)[1]

Date of entry into force of the project: 25.9.1986
Duration: 24.9.1991

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.10.1986	16.10.1986
DENMARK	23.7.1987	23.7.1987
GERMANY	25.9.1986	25.9.1986
SPAIN	3.3.1988	3.3.1988
FRANCE	25.9.1986	25.9.1986
IRELAND	23.3.1987	23.3.1987
ITALY	25.9.1986	25.9.1986
NETHERLANDS	25.9.1986	25.9.1986
AUSTRIA	24.3.1987	24.3.1987
PORTUGAL	25.2.1987	25.2.1987
SWITZERLAND	16.10.1986	16.10.1986
FINLAND	25.9.1986	25.9.1986
SWEDEN	25.9.1986	25.9.1986
UNITED KINGDOM	25.9.1986	25.9.1986

[1] COST Projects, Vol. 4. p. 139.

Memorandum of Understanding for the implementation of a European research project on the utilization of UHF/VHF radar wind profiler networks for improving weather forecasting in Europe

(COST Project 74)[1]

Date of entry into force of the project: 17.9.1987
Duration: 16.9.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.1.1984	12.1.1984
GERMANY	17.9.1987	17.9.1987
SPAIN	8.6.1988	8.6.1988
FRANCE	17.9.1987	17.9.1987
ITALY	8.12.1987	8.12.1987
NETHERLANDS	17.9.1987	17.9.1987
AUSTRIA	2.3.1989	2.3.1989
PORTUGAL	10.11.1988	10.11.1988
SWITZERLAND	23.11.1987	23.11.1987
FINLAND	23.12.1987	23.12.1987
SWEDEN	28.4.1989	28.4.1989
UNITED KINGDOM	17.9.1987	17.9.1987
EC	28.9.1990	28.9.1990

[1] COST Projects, Vol. 5, p. 43.

Memorandum of Understanding for the implementation of a European research project on methods of early detection and identification of plant diseases

(COST Project 88)[1]

Date of entry into force of the project: 27.11.1986
Duration: 26.11.1991

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.9.1988	29.9.1988
DENMARK	27.11.1986	27.11.1986
GERMANY	27.11.1986	27.11.1986
SPAIN	9.7.1987	9.7.1987
FRANCE	27.11.1986	27.11.1986
NETHERLANDS	27.11.1986	27.11.1986
AUSTRIA	12.5.1987	12.5.1987
SWITZERLAND	27.11.1986	27.11.1986
FINLAND	27.11.1986	27.11.1986
SWEDEN	27.11.1986	27.11.1986
TURKEY	27.11.1986	27.11.1986
UNITED KINGDOM	27.11.1986	27.11.1986

[1] COST Projects, Vol. 4, p. 213.

Memorandum of Understanding for the implementation of a European research project on basic research on coccidioses of poultry and farm animals and development of vaccines using biotechnical procedures

(COST Project 89)[1]

Date of entry into force of the project: 22.3.1989
Duration: 21.3.1994

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.1.1989	12.1.1989
DENMARK	12.1.1989	12.1.1989
GERMANY	12.1.1989	12.1.1989
SPAIN	22.3.1989	22.3.1989
ITALY	4.4.1989	4.4.1989
SWITZERLAND	23.6.1989	23.6.1989

[1] COST Projects, Vol. 6, p. 233.

Memorandum of Understanding for the implementation of a European research project on vesicular-arbuscular mycorrhizae (va-mycorrhizae)

(COST Project 810)[1]

Date of entry into force of the project: 26.1.1989
Duration: 25.1.1984

Contracting parties	Date of signing	Date of entry into force
BELGIUM	26.1.1989	26.1.1989
GERMANY	26.1.1989	26.1.1989
SPAIN	26.1.1989	26.1.1989
FRANCE	26.1.1989	26.1.1989
ITALY	25.4.1989	25.4.1989
NORWAY	9.3.1989	9.3.1989
AUSTRIA	11.5.1989	11.5.1989
SWITZERLAND	23.6.1989	23.6.1989
FINLAND	26.1.1989	26.1.1989
UNITED KINGDOM	12.10.1989	12.10.1989

[1] COST Projects, Vol. 6, p. 245.

Memorandum of Understanding for the implementation of a European research project on the improvement of means of control of warble-fly in cattle and goats

(COST Project 811)[1]

Date of entry into force of the project: 30.5.1990
Duration: 29.5.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.1.1992	16.1.1992
CZECHOSLOVAKIA	24.9.1992	24.9.1992
SPAIN	30.5.1990	30.5.1990
FRANCE	30.5.1990	30.5.1990
ITALY	14.3.1991	14.3.1991
SWITZERLAND	13.3.1992	13.3.1992

[1] COST Projects, Vol. 6, p. 257.

Memorandum of Understanding for the implementation of a European research project on cold-active lines of insect parasitic nematodes

(COST Project 812)[1]

Date of entry into force of the project: 30.5.1990
Duration: 29.5.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	7.3.1991	7.3.1991
CROATIA	17.12.1992	17.12.1992
GERMANY	30.5.1990	30.5.1990
SPAIN	30.5.1990	30.5.1990
FRANCE	30.5.1990	30.5.1990
IRELAND	20.9.1990	20.9.1990
NETHERLANDS	30.5.1990	30.5.1990
AUSTRIA	2.12.1991	2.12.1991
SWITZERLAND	28.1.1991	28.1.1991
FINLAND	11.7.1990	11.7.1990
SWEDEN	30.5.1990	30.5.1990
UNITED KINGDOM	30.5.1990	30.5.1990

[1] COST Projects, Vol. 6, p. 269.

Memorandum of Understanding for the implementation of a European research project on diseases and disorders in forestry nurseries

(COST Project 813)[1]

Date of entry into force of the project: 5.4.1990
Duration: 4.5.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	7.3.1991	7.3.1991
SPAIN	11.10.1990	11.10.1990
FRANCE	26.4.1990	26.4.1990
IRELAND	20.9.1990	20.9.1990
ITALY	11.4.1991	11.4.1991
NETHERLANDS	5.4.1990	5.4.1990
NORWAY	5.4.1990	5.4.1990
SWITZERLAND	17.5.1991	17.5.1991
SWEDEN	17.5.1991	17.5.1991
UNITED KINGDOM	5.4.1990	5.4.1990

[1] COST Projects, Vol. 6, p. 281.

Memorandum of Understanding for the implementation of a European research project on metabolic and physiological aspects of dietary fibre

(COST Project 92)[1]

Date of entry into force of the project: 28.2.1990
Duration: 27.2.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
CROATIA	19.10.1992	19.10.1992
DENMARK	18.5.1990	18.5.1990
SPAIN	2.5.1990	2.5.1990
FRANCE	26.4.1990	26.4.1990
ITALY	31.8.1990	31.8.1990
NETHERLANDS	28.2.1990	28.2.1990
NORWAY	28.2.1990	28.2.1990
AUSTRIA	2.12.1991	2.12.1991
SWITZERLAND	28.1.1991	28.1.1991
FINLAND	28.2.1990	28.2.1990
SWEDEN	9.3.1990	9.3.1990
UNITED KINGDOM	28.2.1990	28.2.1990

[1] COST Projects, Vol. 6, p. 293.

Memorandum of Understanding for the implementation of a European research project on the continuous-heat treatment of food

(COST Project 93)[1]

Date of entry into force of the project: 28.6.1990
Duration: 27.6.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
DENMARK	13.5.1992	13.5.1992
GERMANY	28.6.1990	28.6.1990
SPAIN	7.2.1991	7.2.1991
IRELAND	18.9.1991	18.9.1991
ITALY	20.12.1991	20.12.1991
NETHERLANDS	28.6.1990	28.6.1990
NORWAY	28.6.1990	28.6.1990
SWITZERLAND	28.1.1991	28.1.1991
FINLAND	28.6.1990	28.6.1990
SWEDEN	30.7.1990	30.7.1990
TURKEY	22.4.1991	22.4.1991

[1] COST Projects, Vol. 6, p. 307.

Memorandum of Understanding for the implementation of a European research project on the post-harvest treatment of fruit and vegetables

(COST Project 94)[1]

Date of entry into force of the project: 30.5.1990
Duration: 29.5.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	2.10.1991	2.10.1991
GERMANY	30.5.1990	30.5.1990
SPAIN	29.5.1991	29.5.1991
IRELAND	20.9.1990	20.9.1990
ITALY	20.12.1991	20.12.1991
NETHERLANDS	30.5.1990	30.5.1990
NORWAY	30.5.1990	30.5.1990
SLOVENIA	17.11.1992	17.11.1992
SWITZERLAND	28.1.1991	28.1.1991
FINLAND	11.7.1990	11.7.1990
TURKEY	22.4.1991	22.4.1991
UNITED KINGDOM	30.5.1990	30.5.1990

[1] COST Projects, Vol. 6, p. 321.

Memorandum of Understanding for the implementation of a European research project on criteria for the choice and definition of healthy volunteers and/or patients for Phases I and II studies in drug development

(COST Project B1)[1]

Date of entry into force of the action: 24.2.1986
Duration: 23.2.1995

Contracting parties	Date of signing	Date of entry into force
BELGIUM	7.3.1991	7.3.1991
DENMARK	24.2.1986	24.2.1986
GERMANY	10.4.1986	10.4.1986
SPAIN	16.11.1989	16.11.1989
FRANCE	24.2.1986	24.2.1986
IRELAND	18.1.1989	18.1.1989
ITALY	25.9.1990	25.9.1990
THE NETHERLANDS	9.7.1987	9.7.1987
NORWAY	24.2.1986	24.2.1986
SWITZERLAND	28.4.1986	28.4.1986
FINLAND	24.2.1986	24.2.1986
SWEDEN	24.3.1986	24.3.1986
TURKEY	17.2.1992	17.2.1992
UNITED KINGDOM	11.2.1987	11.2.1987

[1] COST Projects, Vol. 4, p. 107.

Memorandum of Understanding for the implementation of a European research project on quality assurance in nuclear-medicine software

(COST Project B2)[1]

Date of entry into force of the action: 16.9.1988
Duration: 15.9.1993

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.1.1989	12.1.1989
GERMANY	30.6.1988	30.6.1988
GREECE	15.5.1990	15.5.1990
SPAIN	22.3.1989	22.3.1989
FRANCE	6.4.1989	6.4.1989
ITALY	21.4.1989	21.4.1989
HUNGARY	11.12.1992	11.12.1992
THE NETHERLANDS	15.3.1989	15.3.1989
NORWAY	19.9.1990	19.9.1990
AUSTRIA	25.11.1988	25.11.1988
SWITZERLAND	25.1.1989	25.1.1989
FINLAND	16.9.1988	16.9.1988
SWEDEN	30.6.1988	30.6.1988
UNITED KINGDOM	15.9.1988	15.9.1988
EC	28.9.1990	28.9.1990

[1] COST Projects, Vol. 5, p. 91.

Recapitulatory tables

These tables contain the projects signed in 1991 and 1992 (indicated in shaded areas) as well as the projects signed previously which were still in force on 1 January 1991.

COST projects (Category B)

Projects	Transport								Metallurgy and materials science									Environment			
	310	311	312	313	314	315	317	320	501	503	504	506	507	508	509	510	511	65	66	614	682
Signatories	13	7	7	12	5	10	7	11	16	15	14	10	14	15	12	4	9	13	9	15	9
BELGIUM						2.10.91	16.1.92	16.1.92	7.10.82	5.10.83	30.11.83	29.9.88	12.1.89	2.10.91	16.1.92	18.6.92	30.4.92	2.10.91	17.12.92	16.1.92	6.2.92
CROATIA																					
CZECHOSLOVAKIA									18.6.92		18.6.92			9.12.92	14.12.92			24.9.92	7.10.92	23.12.92	
DENMARK			8.3.90	21.3.90			4.7.91		23.11.81	21.4.83	27.1.88			24.9.92						23.12.92	7.10.92
GERMANY	7.6.90			12.10.89				10.9.92	23.11.81	21.4.83	10.2.83		8.12.88	5.7.90	18.1.92	18.6.92	24.6.92	14.11.90	17.12.92	18.9.91	
GREECE	13.9.89	8.12.88	6.4.89										8.12.88								
SPAIN	13.4.89	3.3.88		29.5.91		8.5.91	4.7.91	26.2.92		21.1.92	2.7.92	10.12.86	25.10.90	11.10.90	6.2.92		7.10.92	14.11.90		26.2.92	6.2.92
FRANCE	31.1.90	3.3.88	6.4.89	5.10.89	8.4.91	18.4.91	4.7.91	10.9.92	23.11.81	21.4.83	10.2.83	3.3.88	8.12.88	26.4.90	18.9.91		9.12.92	18.4.91	14.10.92	6.2.92	6.2.92
IRELAND	8.11.89	7.7.88	17.5.89		18.4.91	18.4.91	4.7.91	16.1.92	7.11.83					20.9.90	20.3.92			4.7.91		18.9.92	
ICELAND									4.12.92												
ITALY	9.6.89	14.4.88							23.11.81	31.3.92			18.9.90	26.4.90	18.9.91	23.6.92	24.6.92	4.2.91		11.12.91	4.11.92
LUXEMBOURG										20.10.83											
HUNGARY									11.12.92									11.12.92			
NETHERLANDS	13.4.89	3.3.88	6.4.89	5.10.89	18.4.91	18.4.91		16.1.92	23.11.81		23.12.85	10.12.86	5.7.90	26.4.90	18.9.91					18.9.91	
NORWAY	13.4.89			23.11.89				16.1.92	23.11.81	25.9.92	29.1.88	4.12.87	8.12.88		13.2.92				7.10.92	2.10.91	25.9.92
AUSTRIA				5.10.89					23.11.81	26.3.84	16.1.84	10.12.86	5.10.89					14.11.90			
POLAND																					
PORTUGAL	26.9.90			8.3.90		12.3.92		17.12.92					7.9.89	4.7.91				4.7.91		12.3.92	
SLOVENIA					17.11.92	17.11.92				1.10.92				17.11.92				17.12.92			
SWITZERLAND	23.6.89		23.6.89	27.2.90		4.7.91	4.7.91	13.3.92	23.11.81	2.8.83	2.8.83	10.12.86	23.6.89	4.7.91			22.5.92	17.5.91	7.10.92	13.3.92	13.3.92
FINLAND	9.6.89	3.3.88		26.2.90					23.11.81	11.1.84	10.2.83	10.12.86	30.3.90	28.5.90	6.11.92		30.4.92		8.12.92	18.9.91	6.2.92
SWEDEN	13.4.89			5.10.89	18.4.91	15.6.92		15.6.92	23.11.81	21.4.83	10.2.83		21.2.89	30.7.90	25.9.91		8.12.92		16.11.92	20.11.91	6.2.92
TURKEY												10.12.86									
UNITED KINGDOM			6.4.89	5.10.89		18.4.91	18.12.91	16.1.92	23.11.81	21.4.83	10.2.83	10.2.83	8.12.88	26.4.90	25.9.91	18.6.92	30.4.92	14.11.90	7.10.92	18.9.91	
ESA																					
EC	7.6.89								23.11.81	7.6.83	14.3.83										
ENTRY INTO FORCE	13.12.90	3.3.88	6.4.89	5.10.89	18.4.91	18.4.91	4.7.91	16.1.92	23.11.81	21.4.83	10.2.83	10.12.86	8.12.88	28.5.90	18.9.91	23.6.92	22.5.92	14.11.90	7.10.92	18.9.91	6.2.92
END OF PROJECT	4.12.94	2.3.92	5.10.91	4.4.93	17.4.94	17.3.93	3.7.94	15.1.94	31.12.95	20.4.94	9.2.94	9.12.94	7.12.95	27.5.94	17.9.94	22.6.95	21.5.95	13.11.94	6.10.97	17.9.96	5.2.95

Projects	Meteorology				Agriculture								Food technology			Social sciences						Medical research			Civil eng-ineering	Chemistry							Physics
	70	73	74	75	88	89	810	811	812	813	814	815	92	93	94	A2	A3	A4	A5	A6	A7	B1	B2	B3	C1	D1	D2	D3	D4	D5	D6	D7	F1
Signatories	16	14	13	7	12	6	10	7	12	10	11	7	12	12	12	16	13	9	10	4	10	14	15	4	16	10	10	11	10	10	11	11	10
BELGIUM	7.5.73	16.10.86	12.1.84		29.9.88	12.1.89	26.1.89	16.1.92	7.3.91	7.3.91	2.10.91	16.10.91	2.10.91	2.10.91	2.10.91	16.1.92	16.1.92	16.1.92	16.1.92	17.12.92	17.12.92	7.3.91	12.1.89		2.10.91	17.12.92	17.12.92	17.12.92	17.12.92	17.12.92	17.12.92	17.12.92	
CROATIA									17.12.92				19.10.92																				
CZECHOSLOVAKIA				9.12.92				24.9.92						22.4.91	22.4.91		23.12.92				21.10.92				31.7.92			10.9.92		24.9.92	7.10.92	21.10.92	7.10.92
DENMARK	7.5.73	23.7.87			27.11.86	12.1.89					13.5.92		18.5.90	13.5.92		23.1.92	23.1.92	23.1.92				24.2.86				8.10.92	8.10.92	8.10.92	8.10.92	8.10.92	8.10.92	8.10.92	
GERMANY	7.5.73	25.9.86	17.9.87	7.10.92	27.11.86	12.1.89	26.1.89		30.5.90		18.6.92	10.4.91		28.6.90	30.5.90	18.9.91	18.1.91	18.9.91	18.9.91			10.4.86	30.6.88		10.4.91	10.9.92	10.9.92	10.9.92	10.9.92	17.12.92	10.9.92	10.9.92	11.11.92
GREECE	7.5.73																						15.5.90										
SPAIN	7.5.73	3.3.88	8.6.88	29.10.92	9.7.87	22.3.89	26.1.89	30.5.90	30.5.90	11.10.90	21.2.91	10.4.91	2.5.90	7.2.91	29.5.91	15.11.91						16.11.89	22.3.89		8.5.91								11.11.92
FRANCE	7.5.73	25.9.86	17.9.87		27.11.86		26.1.89	30.5.90	30.5.90	26.4.90	16.10.91	10.4.91	26.4.90			6.2.92	6.2.92	6.2.92	6.2.92		14.10.92	24.2.86	6.4.89	8.10.92	7.3.91	9.12.92	9.12.92	9.12.92	9.12.92	9.12.92	9.12.92	9.12.92	9.12.92
IRELAND	7.5.73	23.3.87							20.9.90	20.9.90	4.7.91			18.9.91	20.9.90		17.9.92		17.9.92			18.1.89			17.5.91								
ICELAND																					9.12.92												
ITALY	7.5.73	25.9.86	8.12.87			4.4.89	25.4.89	14.3.91		11.4.91			31.8.90	20.12.91	20.12.91	10.6.92	5.2.92					25.9.90	21.4.89		23.5.91	20.11.92		20.11.92	20.11.92		20.11.92	20.11.92	3.11.92
LUXEMBOURG																26.3.92																	
HUNGARY				11.12.92								11.12.92				11.12.92			11.12.92				11.12.92	11.12.92									
NETHERLANDS	7.5.73	25.9.86	17.9.87		27.11.86				30.5.90	5.4.90	7.3.91		28.2.90	28.6.90	30.5.90	18.9.91	18.9.91	18.9.91	18.9.91	17.12.92	11.11.92	9.7.87	15.3.89		7.3.91	8.10.92	8.10.92	8.10.92	8.10.92	8.10.92	8.10.92	8.10.92	23.7.92
NORWAY							9.3.89			5.4.90	21.2.91		28.2.90	28.6.90	30.5.90	18.9.91	18.9.91	18.9.91		17.12.92	14.10.92	24.2.86	19.9.90			16.12.92	16.12.92	16.12.92	16.12.92	16.12.92		16.12.92	
AUSTRIA	7.5.73	24.3.87	2.3.89		12.5.87		11.5.89		2.12.91				2.12.91			24.7.92							25.11.88		10.3.92								
POLAND																											10.9.92				10.9.92		
PORTUGAL	7.5.73	25.2.87	10.11.88													26.3.92																	
SLOVENIA															17.11.92										17.11.92								
SWITZERLAND	7.5.73	16.10.86	23.11.87	7.10.92	27.11.86	23.6.89	23.6.89	13.3.92	28.1.91	17.5.91	17.5.91	17.5.91	28.1.91	28.1.91	28.1.91	29.4.92	29.4.92	29.4.92	29.4.92	17.12.92	17.12.92	28.4.86	25.1.89	8.10.92	4.7.91	10.9.92	10.9.92	10.9.92	10.9.92	24.9.92	10.9.92	10.9.92	23.7.92
FINLAND	7.5.73	25.9.86	23.12.87	30.10.92	27.11.86		26.1.89		11.7.90		21.2.91		28.2.90	28.6.90	11.7.91	18.9.91	18.9.91	18.9.91	18.9.91		14.10.92	24.2.86	16.9.88		7.3.91	10.9.92	10.9.92	10.9.92	10.9.92	24.9.92	10.9.92	10.9.92	23.7.92
SWEDEN	7.5.73	25.9.86	28.4.89		27.11.86				30.5.90	17.5.91			9.3.90	30.7.90		4.2.92	4.2.92		4.2.92		16.11.92	24.3.86	30.6.88	8.10.92	7.3.91	14.9.92	14.9.92	14.9.92	14.9.92	24.9.92	14.9.92	14.9.92	14.9.92
TURKEY	2.11.75				27.11.86																	17.2.92			7.3.91								
UNITED KINGDOM		25.9.86	17.9.87	7.10.92	27.11.86		12.10.89	30.5.90	30.5.90	5.4.90	21.2.91	10.4.91	28.2.90		30.5.90	18.9.91	18.9.91	18.12.91	18.9.91		14.10.92	11.2.87	15.9.88		7.3.91								10.9.92
ESA	7.5.73																																
EC			28.9.90																				28.9.90		22.6.92								
ENTRY INTO FORCE	1.10.75	25.9.86	17.9.87	29.10.92	27.11.86	22.3.89	26.1.89	14.3.91	30.5.90	5.4.90	21.2.91	10.4.91	28.2.90	28.6.90	30.5.90	18.9.91	18.9.91	18.9.91	18.9.91	17.12.92	14.10.92	24.2.86	16.9.88	11.12.92	7.3.91	14.9.92	10.9.92	10.9.92	14.9.92	24.9.92	10.9.92	14.9.92	10.9.92
END OF PROJECT	unlimited	24.9.91	16.9.93	28.10.97	26.11.91	21.3.94	25.1.94	13.3.94	21.5.93	4.5.95	20.2.96	29.4.96	27.2.95	27.6.95	29.5.93	17.9.95	17.9.94	17.9.94	17.9.94	16.12.95	13.10.95	23.2.95	15.9.93	10.12.97	6.3.95	13.9.97	9.9.97	9.9.97	13.9.97	23.9.97	9.9.97	13.9.97	9.9.95

COST projects (Category B)

Projects	Informatics	Telecommunications																												
	14	202 bis	211 ter	212	216	217	218	214	220	223	224	225	226	227	228	229	230	231	232	233	234	235	237	238	239	240	241	242	243	244
Signatories	11	11	14	5	12	9	10	16	9	16	5	8	11	6	6	7	7	16	11	6	6	11	4	13	15	14	12	15	6	10
BELGIUM	2.10.91	14.3.84	2.10.91		29.9.88		19.2.87	16.1.92		12.1.89			15.9.89		16.1.92	2.10.91	2.10.91		16.10.91	2.10.91		26.3.92	13.2.92	2.10.91	9.12.92	2.10.91	16.1.92			11.11.92
CROATIA																														19.10.92
CZECHOSLOVAKIA														31.7.92				18.6.92	2.4.92	2.4.92		2.4.92		31.7.92	2.4.92	2.4.91	2.4.92	7.10.92		7.10.92
DENMARK	10.9.92	29.3.84		26.6.86	27.2.86	25.9.86		25.9.86		12.1.89	15.9.88	26.1.89	22.2.90		12.6.92			6.4.89	26.4.90		5.12.90		13.2.92	24.7.91	24.7.91	23.1.92	6.2.92	13.5.92		
GERMANY	19.7.90	23.5.84	11.10.90		17.9.87	25.9.86	19.2.87	7.7.88		6.4.89			2.10.91				27.2.91	6.4.89	26.4.90		5.12.90	2.10.91	13.2.92	7.3.91	7.3.91	25.4.91	16.1.92	18.6.92	21.10.92	7.10.92
GREECE								4.7.91		12.1.89					9.12.92		9.12.92							24.7.91	9.12.92	25.4.91		21.10.92	21.10.92	21.10.92
SPAIN	14.11.90		6.2.92	3.3.88	3.3.88	3.3.88		3.3.88	16.3.88	12.1.89		26.1.89	24.7.91		12.6.92	5.4.90		30.11.89	7.2.91	8.5.91			13.2.92	7.3.91	12.6.91		13.2.92	7.10.92	21.10.92	7.10.92
FRANCE		17.10.84	7.2.91		27.2.86		10.1.91	25.4.86		6.4.89	15.9.88					5.4.90	27.2.91	6.4.89			10.1.91	6.2.92		6.2.92	6.2.91	5.3.92	13.2.92	13.4.92	9.12.92	9.12.92
IRELAND	20.9.90	12.9.84	11.10.90		18.1.88			16.6.88	8.11.89			17.5.89						17.5.89							18.9.91	4.7.91		17.9.92		
ICELAND																														
ITALY	25.4.91	25.7.84	19.5.92	25.8.86	22.8.86	24.3.87	19.2.87	26.4.89		12.6.89		12.6.89	26.4.91	26.4.91		26.4.91	26.4.91	12.6.89	26.4.91			23.1.92		6.11.91	3.3.92	7.4.92	14.4.92	22.7.92	8.12.92	8.12.92
LUXEMBOURG																														
HUNGARY													11.12.92															11.12.92		11.12.92
NETHERLANDS	19.7.90	14.3.84	11.10.90		3.7.86	18.12.86	19.2.87	6.11.86	26.9.90	6.4.89		15.4.92						6.4.89			5.12.90	2.10.91		7.3.91	12.6.91	5.6.91	16.1.92	13.4.92		
NORWAY			23.1.91					25.9.86		5.3.92								18.4.91	25.9.92			2.10.91			18.9.91	18.9.91				
AUSTRIA								1.12.92	1.8.91				23.3.90					18.4.90				24.7.92								
POLAND																								23.10.92				11.9.92		
PORTUGAL			4.7.91					26.7.90	23.7.92	2.3.89			11.11.92	21.6.90	11.11.92	3.10.90	27.2.91	7.9.89	26.7.90						15.7.92	23.7.92	2.7.92			
SLOVENIA																														
SWITZERLAND	28.1.91	31.10.84	17.5.91		28.4.86	19.12.86	29.4.87	30.3.90	25.1.89	23.6.89		23.6.89	4.7.91	3.7.90		5.4.90		23.6.89	28.1.91	14.11.90	28.1.91	22.5.92			29.4.92	17.5.92	11.12.92	8.10.92		7.10.92
FINLAND	19.7.90	13.4.84	10.4.91	26.3.86	27.2.86	25.9.86	19.2.87	25.9.86	16.3.88	3.3.90	16.9.88							30.3.90										13.4.92		
SWEDEN	25.1.91	5.4.84	9.11.90	26.3.86	24.2.86		19.2.87	18.12.86	28.6.88	21.2.89	20.9.88	26.1.89	15.9.89			5.4.90		27.11.89	26.4.90	14.11.90		4.2.92		17.12.91	12.6.91	25.4.91	9.4.92	15.5.92		
TURKEY			7.3.91			22.12.86				5.6.90		26.1.89			12.6.92			5.6.90						17.2.92						
UNITED KINGDOM	19.7.90	14.3.84	11.10.90		27.2.86	25.9.86	19.2.87	25.9.86	16.3.88	12.1.89	15.9.88			2.7.92			27.2.91	6.4.89	26.4.90	14.11.90		2.10.91		7.3.91			16.1.92	10.9.92	9.12.92	
ESA										7.7.89				26.7.90	26.7.90						5.12.90				12.6.91	25.4.91				
EC							23.7.87																							
ENTRY INTO FORCE	19.7.90	5.4.84	11.10.90	25.8.86	27.2.86	25.9.86	19.2.87	23.9.86	28.6.88	12.1.89	16.9.88	26.1.89	22.2.90	25.3.91	16.1.92	5.4.90	26.4.91	6.4.89	26.4.90	14.11.90	5.12.90	2.10.91	13.2.92	7.3.91	12.6.91	25.4.91	16.1.92	15.5.92	8.12.92	7.10.92
END OF PROJECT	18.7.94	4.4.91	10.10.95	24.8.91	26.2.91	24.9.91	18.2.93	22.9.96	27.6.93	11.1.93	15.9.91	25.1.94	21.2.94	24.3.95	15.1.96	4.4.94	25.4.96	5.4.93	25.4.93	13.11.93	4.12.94	1.10.95	12.2.97	6.3.95	11.6.96	24.4.96	15.1.97	14.5.96	7.12.96	6.10.96

Index[1]

[1] This alphabetical index classifies and cross-refers the project according to the Contracting Parties and the subject-matter of the project.

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