COST

EUROPEAN COOPERATION IN THE FIELD OF SCIENTIFIC AND TECHNICAL RESEARCH

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1995 - 1996

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

COST as an important research policy instrument has proven its value over 25 years, in particular by taking up emerging areas of science and technology. The present collection of texts provide the reader with different examples of new topics.

The growing number of COST Actions - at present approximately 150 - in both traditional and new areas of research confirms the opportunities this structure of cooperation offers to European scientists compared to other frameworks.

A remarkable development in recent years is the intensified interest from institutes or universities from non-COST states in participating on a project-by-project basis in individual COST Actions. These participations, on which the COST Senior Officials Committee decides case-by-case after careful consideration of the mutual scientific interest, have widened the COST cooperation, which is fundamentally a European network, to contacts with Australia, India, Japan, the Russian Federation and the United States.

On the eve of a Ministerial Conference to take place on 26 and 27 May 1997 in Prague, COST is ready to continue to play its important role in pioneering new ideas and themes in cooperation between 25 European countries and others.

M. METZGER
Chairman of the
Committee of Senior Officials

Detailed information on COST may be obtained by accessing the COST Home Page on CORDIS. Internet: http://www.cordis.lu/cost/home.html

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Volume 9

1995-1996

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 15
"Many-valued logics for computer science applications"

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Contracting parties	Date of signing	Date of entry into force
BELGIUM	05.04.95	05.04.95
CZECH REPUBLIK	19.01.96	19.01.96
GERMANY	29.06.95	29.06.95
GREECE	27.09.95	27.09.95
SPAIN	05.04.95	05.04.95
FRANCE	17.05.95	17.05.95
ITALY	11.05.95	11.05.95
AUSTRIA	21.02.96	21.02.96
POLAND	18.10.96	18.10.96
PORTUGAL	12.09.96	12.09.96
SLOVAKIA	17.07.96	17.07.96
FINLAND	05.04.95	05.04.95
TURKEY	02.05.96	02.05.96
UNITED KINGDOM	05.04.95	05.04.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to coordinate research in many-valued logics leading to computer science applications.

3. The overall cost of the activities carried out unter the Action has been estimated, on the basis of information available during the planing of the Action, at ECU 10,5 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION OF THE ACTION

A. General background

After the pioneering work by Jan Lukasiewicz in the early twenties, followed by a blossoming of theoretical studies in the forties and fifties, there has in the last two decades been a revival of interest in the most general aspects and applications of many-valued logics. The far-reaching scientific US policy towards this topic is reflected by the annual IEEE Symposia on Multiple-Valued Logic held for now more than 20 years. On a market-orientated scale Japanese companies were the first to develop very successful controlling devices based on fuzzy logics, i.e. logics with infinitely many truth values.

At present, European research in many-valued logics is mainly pursued along the following lines:

1. Automated deduction

   Previous research already showed that many-valued reasoning may in principle be mechanized. Recently, inference systems geared towards machine implementation emerged and have already been realized in experimental automated reasoning programmes. To name just two of the more recent approaches we mention labelled deductive systems and inference methods based on linear and integer programming. This research will continue, new types of deduction systems are under investigation, more comprehensive and comfortable inference laboratories are being developed.

2. Application areas

   The main thrust in applying many-valued logics lies in fuzzy logic applications for intelligent and adaptive control systems and has already been incorporated into some innovative industrial products. The current situation in Europe is characterized by:

   - developing an application culture using existing tools and methodologies,
   - establishing tool kits as a core technology platform for industry,
   - exploring further improvements and extensions of fuzzy logic technologies, e.g. in combination with neural computing to mention just one example.

   The scientific community has for a long time been aware of the possibility of using many-valued logics in formal specification and verification of soft- and hardware. But only now has the subject of formal specification and verification reached a sufficient degree of sophistication and only now are sufficiently powerful automated deduction tools available to warrant a successful realization of this long-standing perspective. Numerous other applications areas that have to deal with incomplete or uncertain information have been proposed and deserve careful study. For instance, three-valued logic has been instrumental in more than one way in the area of non-monotonic or defeasible logics, a type of logic that is in widespread use in artificial intelligence as a model of human-oriented, everyday reasoning. Connections between modal and many-valued logics also show fruitful results in modelling and reasoning about intelligent multi-agent systems. To give a further example, many-valued logics have been employed in possibility theory to investigate the relationship between preference orderings and associated logical statements. A very interesting approach, finally, is the application of three-valued logic to adaptive error-correcting communication, where the third truth value, besides true and false, designates the possibility of a transmission error.

3. Theoretical foundation

Despite its long tradition, work on foundational issues in many-valued logics still spawns new and thrilling problems and results. The computational properties of these logics are still not completely understood. In particular, the investigations into normal forms pose a remarkable challenge with respect of the required mathematical tools. Also the algebraic and relational representation of many-valued logics needs further clarification. But probably the most interesting issue is the exact relationship both in theory and in implementations between fuzzy logic, using infinitely many truth values, and its finitely valued approximation. Progress in this topic may also have a substantial impact on applications.

Research in the areas mentioned above is at the time carried out on a bilateral basis or within nationally funded projects all over Europe. The importance of this COST action may be summarized in the following three observations:

- The wide scope of the activities that we want to bring together ranging from theory over computational tools to applications makes it very hard, and for smaller countries impossible, to find all the necessary expertise within national boundaries.

- The increasing complexity of software systems, be it automated reasoning or formal software engineering systems, requires a prohibitive development and maintenance effort that makes it impossible for each research and development group to have its own systems. Sharing intellectual and physical resources is the route to take.

- The introdoction of new technologies and products in fuzzy logic is moving at an extraordinary pace. If we want to avoid the situation that only one or two centres in Europe do research up to the state of the art, a fast dissemination of new results is necessary.

Two other reasons incite us to think that the framework of COST cooperation is the most advisable for carrying out this action: the present state of the group of research teams which want to collaborate and the geographical scattering of these teams.

The Group is at present under establishment and structuration. A first meeting was held at Dagstuhl (Germany) on 20-24 September, 1993. It was dedicated to the presentation of the most advanced researches on many-valued logics. A second meeting, whose purpose was to define and set the possible cooperations between the various teams, was held in Lyon on 16 and 17 December. The COST structure, mainly conceived for enabling information and ideas exchanges from the beginning of research and development works is well adapted to that situation.

In other respects, the geographical scattering of the various teams that gave expression to their intention to participate in this action is very large, as these teams are spread over eleven European countries: Austria, Belgium, Finland, France, Germany, Greece, Italy, Norway, Poland, Spain and the United Kingdom. The kind of collaboration we want to put into place can be funded only within the framework of the Basic Research ESPRIT Programme, as a Working Group, or by the COST cooperation. As some abovementioned countries are not members of the EC, an ESPRIT funding cannot be envisaged; whereas, all countries being COST members, this structure is the most suitable for the collaboration we want to establish.

B. Objectives of the Action

The overall objective of this COST action is to coordinate research in many-valued logics leading to computer science applications. Amongst the numerous possible applications, a special emphasis will be put on the specification and representation of uncertain and/or incomplete knowledge. A clearly indispensable prerequisite is to provide the theoretical basis for developing tools to process and manipulate such knowledge.

In order to reach this objective, we need to create a European forum for research in many-valued logics. We must take advantage of the complementary efforts based on the long European tradition of research in mathematical logic. We need to concentrate the presently scattered efforts, so that European experts, who are acknowledged as world leaders in their particular fieds, can collaborate more closely. That is, we have to establish, in a structured form, cooperation and regular exchages of information and personnel, thereby making sure the continuation of research excellence in Europe within application of many-valued logics to computer science.

This COST action aims at some important secondary objectives. In order to expand the research potential of the involved groups, a great effort will be put in training excellent young scientists for theoretical and applied research in the area. Links will be emphasized with other non-European groups working in the field of many-valued logics in Computer Science. Cooperation with other European teams working in different branches of logic will be developed further.

The most important benefits that the participating teams expect to derive from this action consists of:

- a general raising of the theoretical level, resulting from the exchange of knowledge,
- a synergy resulting from the wide range of expertise of the participants and the complementarity of their various approaches,
- the provision of sound foundations for tackling not yet or not well solved problems in knowledge representation.

C. The scientific content of the Action

Introduction

The envisages scientific work will comprise all types of logics that use more than two truth values:

- three-valued logics for A.I. reasoning with incomplete knowledge as it is required, for example, in expert systems; three-valued logics for modelling non-terminating behaviour in software verification, and three-valued logics needed in the investigation of the formal semantics of logic programmes;
- many-valued logics with a large number of truth values as used, for example, in hardware verification and in informtion logics that model the behaviour of cooperation intelligent agents;

- real-valued logics; this refers mainly to fuzzy logic with applications, for example, in fuzzy control, but as well to Lukasiewicz logic as required, for example, in adaptive coding.

The overall goal of the proposed action is to combine the efforts of the leading experts in the field for systematic, continued cooperation on all layers of expertise. The main perspective is to study the computational properties of many-valued logics, and the extent to which these can be turned into algorithms. In the long term, new algorithmic ideas will lead to substantially improved performance and to extended functionality of implementations in the areas mentioned above.

The success of the programme just outlined essentially hinges on the systematic use and further development of precise mathematical concepts. Close connections among model theory (in particular, algebra), proof theory and fuzzy set theory have to be investigated further, and must be exploited for computational logic.

Working Groups

One of the most prominent features of the proposed action is that it brings together researchers covering the full spectrum of work done in many-valued logics, ranging from mathematical foundations to computational issues and studies of real applications, so, in order to make the best use of this wide range of expertise, the action will be organized into three working groups put together on a common scientific basis rather than following methodological criteria. This structure best supports our overall intention to bridge the gap between theoretical results and application-oriented research and in a final step real applications. Accordingly, each working group will ideally comprise activities at each of the following levels:

1. foundational research,

2. development of tools, software, prototyping of typical implementations,

3. applications.

As the list of teams participating in this action is not yet set and is likely to increase, the reasearch topics listed in each group reflect the subject of interests of the already known participants. These lists are not closed and will certainly evolve. In particular, new applications will be added.

Group 1: Enhancement of the theoretical basis

The theoretical activities in this working group are intended to develop fundamental aspects of many-valued logics and structures in order to tackle problems raised by computer science. The interests will be focused on:

- Kripke-style and relational semantics for logics based on Lukasiewicz algebras,

- congruential and protoalgebraic Gentzen systems,

- poset-based approximation logics,

- varieties of MV-algebras and their equational bases,

- fibring systems for Lukasiewicz logics,

- relational proof systems for many-valued logics.

This working group will also intend to develop tools concerning implementable relational semantics, parallelization of many-valued logics, model building systems for n-valued Lukasiewicz and Post logics, theorem deduction from Gentzen systems.

Results of these theoretical studies will be applied in various domains such as multi-agent reasoning, parallel logic programming with many-valued logics, and knowledge representation.

Group 2: Automated deduction: theory and tools

On the theoretical side, the activities in this working group will aim at a better understanding of the computational properties of many-valued logics including in particular investigations into normal forms, extensions of the logic programming paradigm and approximations of infinetily valued logics by discretely valued logics.

Results from these activities will be incorporated into existing inference systems or taken into account in the development of new deductive systems.

The main applications will be formal verification of software and hardware.

Group 3: Modelling of, and reasoning on, incomplete and uncertain knowledge

The objective of this working group is to point out the general features of many-valued logics as a tool for the representation and processing of uncertain information. Reasoning under incomplete knowledge is an important issue in Aritificial Intelligence nowadays.

Many-valued calculi are often encountered in the proposed approaches. For instance, possibility theory and possibilistic logic provide a natural framework for manipulation orderings between preferred interpretations, or more or less entrenched propositions in non-monotonic reasoning. Still another example is given by conditional objects which are symbolic counterparts of conditional probabilities and are 3-valued logical entities. Direct connections can be established between 3-valued logics of conditional objects and non-monotonic consequence relationships as studied by Lehmann and Magidor. Besides, truth-functional fuzzy logic has proved to be useful for modelling interpolative reasoning, as used in fuzzy control applications for instance.

These works will constitute the prerequisite theoretical foundations of the development of tools for processing and manipulating incomplete and uncertain knowledge.

Potential applications of this working group are numerous. Amongst those developed by the teams participating in the action one can cite: software synthesis, non-terminating behaviour in software verification, user-oriented inference tools, robotic planning, intelligent user interfaces, reasoning about information processing machines, etc. In the medical domain, diagnosis help will be investigated and a system devoted to the rehabilitation of aphasics will be developed.

The means

Formally, these aims will be pursued by:

- organization of workshops, conferences; at least one international event per year is envisaged;

- exchange of researchers and PhD students;

- training of young scientists, for example, in summer schools devoted to many-valued logic;

- publications. In addition to publications in conferences and journals, it is planned to edit special issues on topics in many-valued logic of leading journals and to publish a book that will contain a collection of research and survey papers reflecting the broad spectrum of research done in many-valued logics. Although several monographs on specific topics in many-valued logics exist, there is no up-to-date collection of essays with a broad spectrum like the influential and successful volume "Modern Uses of Multiple-Valued Logic" edited in 1977 by Dunn and Epstein which is by now outdated.

- compiling an annotated bibliography;

- quick, electronic dissemination of scientific results among the participants. Storage and dissemination of the information will be ensured through an information server to be installed at Grenoble. It will serve also software assets that partners will agree to share.

- keeping in contact with important research groups and institutions outside Europe.

D. Timetable

An initial period of six months is required for consultation between the different partners, the completion of defining the working groups, and integration, if any, of new participants.

At the beginning of this period, a kick-off seminar will be organized. Its objectives will be:

- presentation by each participant of the researches and applications he intends to carry out within the framework of the action;

- decision upon a calendar of meetings: seminars, workshops, conferences, and setting-up of the organizing and scientific committee for these meetings;

- in each working group: designation of an administrative and a scientific coordinator.

The second period of three years will be allotted to the carrying out of the researches and applications.

An intermediate progress report, assessing the advances made and presenting the developed applications will be published at mid-run of the action, two years after the start of the action.

The third and last period, covering the last six months, will be mainly devoted to the writing up and publication of the results. A seminar will be organized six months before the end of the action to prepare the final reports.

E. Organization, management and responsibilities

The method of organization and management of the action will be defined, and the resultant management structures will be set, during the first seminar which will bring together all the participants.

Nevertheless, it is possible as of now to present the organizational chart.

PARTICIPANTS

The management committee will comprise the administrative and scientific coordinators and one member for each participating research team.

Each working group will have an administrative and scientific coordinator; the two functions may be exercised by the same person.

One of the members of the managment committee will be responsible for the relations with the projects of the third and fourth work programmes of the EC.

The management committee will meet at least every six months; once during the interval between two scientific events bringing together all participants (seminars, workshops, conferences) and once before or after each one of these events, the envisaged frequency of which is yearly.

F. Economic dimension of the Action

As the number of participants is not yet settled, the action's economic dimension can only be estimated, and presented figures should be considered as a lower limit.

Delegates of eleven countries (Austria, Belgium, Finland, France, Germany, Greece, Italy, Norway, Poland, Spain and the United Kingdom) have already expressed their interest and taken part in the actions' preparatory works.

F.a Personnel costs

In order to give an indication of the importance of this action we indicate, in man-years, the average manpower that will be involved, each year, in the researches and applications.

The personnel is divided into three categories:

- A: senior researcher, cost: ECU 60 000 for one person/year
- B: junior researcher, cost: ECU 40 000 for one person/year
- C: PhD student, cost: ECU 25 000 for one person/year.

Estimated manpower for the whole set of participants

- A: 13
- B: 15
- C: 27

	Taking into account the duration of the action, the estimated personnel cost is:	ECU 8 200 000
F.b	Operational costs	
	Organization of seminars, workshops:	ECU 40 000
	Travel expenses. The manpower does not indicate the number of researchers involved in the action, as Type A and B researchers dedicate about 50% (estimated average) of their time to the action. Considering an average of two journeys/year for each researcher, the estimated travel expenses are:	ECU 300 000
	Additional costs (secretary, management, documentation, etc.) are estimated on the same basis as for the ESPRIT projects, i.e. 20 % of the sum of salaries + travel expenses:	ECU 1 700 000
F.c	Coordination costs (to be covered by the COST budget of the Commission)	
	ECU 60 000 per year:	ECU 240 000
F.d	Total	
	The estimated global cost of the action is ECU 10,5 million.	ECU 10 480 000

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 219 bis
"Telecommunications : Access for Disabled and Elderly People"

Date of entry into force of the project : 18.12.1996
Duration : 18.12.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
DENMARK	04.12.96	04.12.96
FRANCE	04.12.96	04.12.96
ITALY	18.12.96	18.12.96
AUSTRIA	10.12.96	10.12.96
FINLAND	04.12.96	04.12.96
UNITED KINGDOM	04.12.96	04.12.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to increase the availability of telecommunications services and equipment designed so as to be accessible also to elderly and disabled people or, alternatively, adaptable for that purpose when required. In cases where this cannot be achieved, the Action will aim at establishing appropriate supplementary services and equipment.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 9 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least 5 Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION OF THE ACTION

ACTION 219 bis

"Telecommunications: Access for Disabled and Elderly People"

A. BACKGROUND

Today telematics and telecommunication are no longer a luxury but a necessity in everybody's life. The rapidly growing importance of information highway concepts (1) indicates that the individual in the future will be more dependent on telecommunications and teleinformatics (2) and that present methods of communications will change. Teleinformatics will in the near future be a necessity for everybody and must also benefit disabled people and take into consideration the needs of elderly people.

The rapid development of telecommunications and teleinformatics is also making it possible to develop new services for elderly people or people with disabilities and to modify the access and use of services in such a way that elderly people and people with disabilities can more easily obtain benefits from these teleinformatic services.

However, these rapid developments can work to the disadvantage of disabled and elderly people unless urgent consideration is given to this matter now. The more complex systems like the information highway, since they require a lot of a person's motor, sensory and cognitive capacities, will cause more people to become unable to operate them efficiently.

Issues in telecommunications and teleinformatics and people with disabilities were taken up by the COST 219 Action between 1986 and 1996, and issues related to elderly people were included from 1991 onwards, as shown in a series of studies, publications and seminars. It became clear, that the results could achieve a broad uptake only if the equipment manufacturers and service providers could be convinced that there is a market and that many of the special requirements of elderly and disabled users would also benefit normal untrained users and subscribers, in the form of "Design for All. The goal of the Action is therefore to include the results of COST 219 in a "Design for All" strategy.

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(1) Information Highway is a concept by which telecommunication networks and telematic services offer to the user a unified interface to information retrieval, remote shopping, remote education etc. The emerging Internet already includes the embryo for such a concept.

(2) Teleinformatics is a term used to describe a range of facilities provided by information technology such as videotex, multimedia information retrieval etc.

Various organizations are active in other aspects of this field, such as the EU Commission, Directorate-General for Employment, Social Affairs and Education with its Helios program and the Handynet database work. A number of telecommunication administrations in the various countries are also active in providing telecommunication facilities such as amplifying handsets, acoustic couplers, text telephone relay services for people with disabilities or alarm telephone and support services to elderly people. The European Telecommunication Standardization Institute has a group (ETSI Technical Committee Human Factors, Subcommittee HF2, People with Special Needs) for considering how disability issues should be considered in telecommunications standardization.

While coordination between experts from telecommunication and teleinformatics organizations is well established, the needs of elderly people and people with disabilities are represented by different bodies, which often have no direct contact with these experts.

The Action will therefore bring together experts on telecommunications and teleinformatics and those experts with a knowledge of the needs of disabled and elderly people in order to make modern telecommunication and teleinformatics services accessible to elderly people and people with disabilities.

Thus a joint effort is needed to coordinate the activities which are being carried out in the European countries and to study and influence the development and provision of new telecommunication and teleinformatics facilities and services (e.g. information highway services) for disabled and elderly people.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to increase the availability of telecommunications services and equipment designed so as to be accessible also to elderly and disabled people or, alternatively, adaptable for that purpose when required. In cases where this cannot be achieved, the Action will aim at establishing appropriate supplementary services and equipment.

Always taking into account the "Design for All" concept in telecommunications and teleinformatics, the objectives of the Action can be specified in operational terms, as follows:

Collect, assess and process knowledge, i.e:

1. to identify the impact of technical, social and economic developments on elderly people and people with disabilities;

2. to define the needs of the target groups and alleviate problems of the target groups; to produce guidelines to meet the needs of the target groups and influence the development of services and equipment;

3. to provide a forum for the exchange and dissemination of results from research and specialist's experiences;

4. to create a network of users and experts in this field;

5. to initiate and perform feasibility studies, research preparation and technology evaluation.

Disseminate knowledge, i.e:

6. to disseminate information and create awareness among relevant actors;

7. to influence standardization, regulation and legislation to take into account present and future needs of elderly people and people with disabilities;

8. to promote end user involvement;

9. to promote involvement of industry, service providers, policy and decision makers in the process.

C. SCIENTIFIC PROGRAMME

Building on the results achieved by COST Action 219 action (field knowledge, network of contacts) the work will be to:

1. continuously update information on relevant, existing services and technical solutions as well as ongoing and planned R&D work (including COST, ACTS, TIDE etc) and to retrieve and disseminate information through use of databases and informatics services (e.g WWW);

2. identify and collate information on the practical needs of elderly people and people with disabilities;

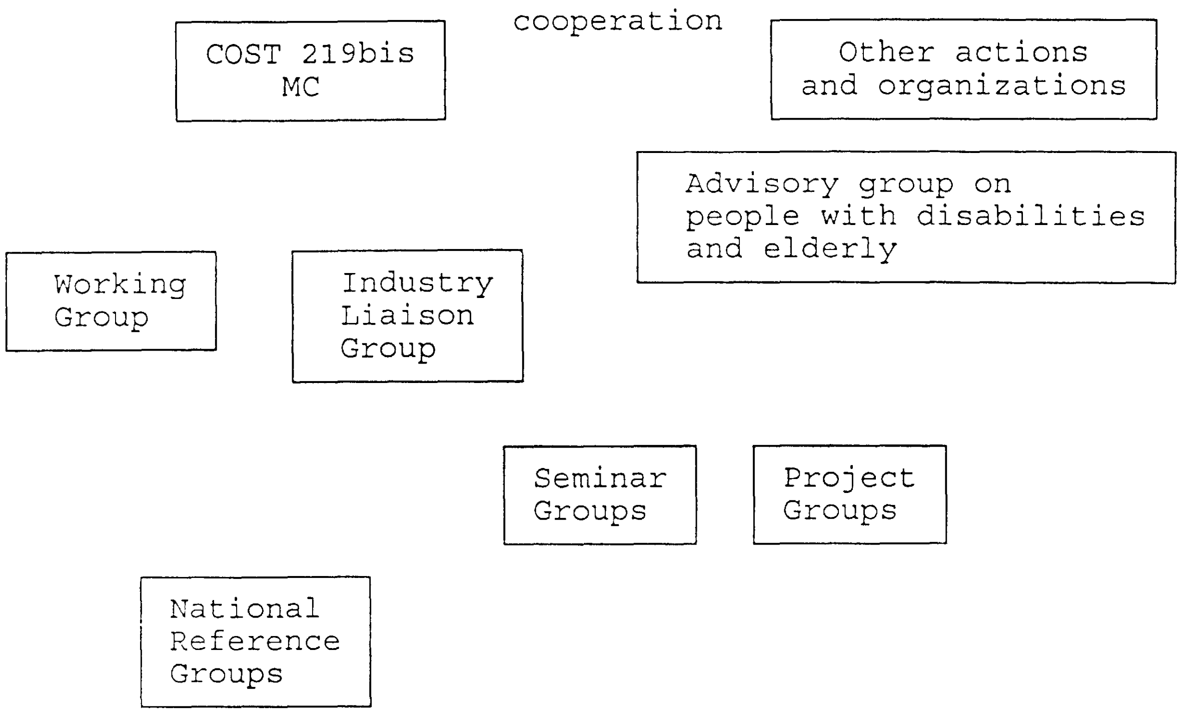
3. promote feasibility studies and concepts for improving accessability or improving adaptability of services or concepts for new special services and their implementation;

4. study the future possibilities and problems of the evolving technologies and services;

5. initiate dialogue with service providers;

6. create liaisons to appropriate groups within COST, ETSI, ITU, EC, EURESCOM, AAATE, etc., and to organize joint seminars or conferences on topics of mutual interest.

D. ORGANIZATION AND TIMETABLE



Users, Industry, Telecom service providers, Research centres, Universities, Legislation and standardization experts, User Associations, Social Welfare organizations, Social service providers, etc.

Working groups are set up to carry out specific tasks like information collation and dissemination, development and updating of the information in the WEB and database servers of the Action, development of Good Practice Guidelines, input to standardization work, input to legislation work and monitoring of technological trends.

Project groups are set up for performing specific technological work in order to find for instance practical solutions for text-telephony or sign-language communications in the broadband networks or to assess feasibility of promising new technology.

Important organizational solutions are the National Reference Groups which may be established in order to have a broad enough basis in order to ensure the quality of the work as well as the exploitation of the results of the activities. The National Reference Groups should also support activities in order to promote telematics for elderly and disabled people.

The advisory group of people with disabilities and the elderly consists of representatives from user organizations.

The Management Committee will usually have three meetings.

Working liaison with other COST Actions in the field of telecommunications and teleinformatics are ensured by consultations with the Technical Committee Telecommunications (TCT).

The delegates of the Management Committee are liaison officers to national groups in the participating countries.

Members of the Management Committee form Project Groups working with specific issues.

The Project Groups follow ongoing developments in the field of telecommunications and teleinformatics, monitor relevant projects in COST, ACTS, TIDE, etc., and establish liaison with relevant bodies.

The Project Groups collect information and knowledge about telecommunications and teleinformatics requirements of elderly people and people with disabilities.

The working methods of the project groups can be meetings where contributions from the delegates are considered and processed, arrangements of seminars, production of reports, books, pamphlets, videos, establishment of WWW-pages, databases, etc.

Timetable

The total duration of the Action will be five years.

T0 – Project Management
15 half day meetings for preparation and follow-up on work plan

T1 – Collection of information concerning requirements for elderly people and people with special needs. Establishment of liaisons and experts network.
Duration: 3 meetings

T2 – Development of Guidelines
Duration: 6 meetings

T3 – Distribution of information. Arrangements of seminars, development of printed and multimedia information.
Duration: 6 meetings

T4 – Reviews of the Action – final report
Duration: 2 meetings

E. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

On the basis of national estimates provided by the representatives of these countries and taking into account the coordination costs to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, in 1996 prices, at roughly ECU 9 million.

This estimate is valid under the assumption that all the countries mentioned above but no other country will participate in the Action. Any departure from this will change the total cost accordingly.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 244 bis
"Biomedical effects of Electromagnetic fields (II)"

Date of entry into force of the project : 20.11.1996
Duration : 20.11.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
CROATIA	19.11.96	19.11.96
CZECH REPUBLIC	10.12.96	10.12.96
DENMARK	04.12.96	04.12.96
GERMANY	09.01.97	09.01.97
SPAIN	14.11.96	14.11.96
FRANCE	04.12.96	04.12.96
ITALY	18.11.96	18.11.96
HUNGARY	04.12.96	04.12.96
POLAND	13.01.97	13.01.97
UNITED KINGDOM	14.11.96	14.11.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to create, to coordinate and to promote research in the area of EMF biomedical effects at the European level.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 33 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least 5 Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 244 bis

Biomedical Effects of Electromagnetic Fields (II)

A. Background

COST 244 provides an open channel for cooperation among all research groups in Europe and, as such, provides a unique form of cross-border research cooperation compared to the USA, Japan and others. This means that we are now able

- to coordinate the research activities in different COST 244 areas;
- to build on the cooperative/coordinate networks already established;
- to accelerate exchanges of scientists;
- to prepare common research protocols, etc.

As a consequence the potential exists for considerable acceleration of scientific advance in this area, with complementary use of equipment, instrumentation and other laboratory resources and human potential.

Understanding the interaction of living beings with electromagnetic fields (EMF) requires a knowledge of both EMF propagation and the biophysical and biochemical mechanisms of interactions.

The coordination of research under the COST 244 has put European activity in this area on a footing comparable to that in the USA, Japan, etc. Active cooperation of non-EU COST countries and others (on the Institutional principle) have completed research programme and scientific dialogue.

The accomplishments of the COST 244 include:

- establishment of communication channels among European researchers;
- construction of a data base of European research in the COST 244 area;
- initiation of coordinated research activity;
- initiation of discussion on almost all tasks identified in the MOU;
- substantial progress on coordinated research activities related to benchmark models for numerical and physical dosimetry.

The multidisciplinary nature of COST 244 research activities and the unusually large number of participants in the Action (from 19 COST countries, plus others) has meant that it has been a challenging task to establish effective ways of coordinating the diversity of research undertaken by the scientists involved in COST 244. COST 244 has made considerable progress in establishing "a way of working" for such a diverse programme, and COST 244 bis should be supported to build on the accomplishments already realized.

The Action COST 244 bis should continue to be supported under the Technical Committee for Telecommunications (TCT) umbrella because:

- the use of wireless telecommunications is expanding rapidly;
- telecommunications encompasses both the sources of and those exposed to EM fields;
- there are many occupationally exposed people working in the area of telecommunications;
- the technical and scientific aspects of the problem of EM exposure to RF fields has not been sufficiently investigated;
- exposure and technical standards relating specifically to telecommunications are currently being formulated.

B. Objectives

The GENERAL OBJECTIVES of the Action are:

- to create European coordination for research in the area of EMF biomedical effects;
- to coordinate and promote national research activities at the European level;
- to stimulate multidisciplinary collaboration between experts in the fields of medicine, biology, electrical engineering, physics, etc.

On the basis of these general aims, some *SPECIFIC OBJECTIVES* can be identified:

- to establish a mechanism and a European network for continuously coordinated research in the area of biomedical effects of EM fields and interactive repercussions on the corresponding standards;
- to ensure that new European standards relating to the protection of the general public and occupationally exposed personnel against EM exposure have sound scientific bases;
- to ensure that new common European standards relating to the technical characteristics of EM sources have sound scientific bases.

SECONDARY OBJECTIVES are:

- to support and encourage links with the EU Community Programmes in the form of "Concertation Actions" or any other form;
- to support and encourage any action for additional network activity, including exchanges of scientists and training at recognized "centres of excellence";
- to encourage further research at the national level during the transition phase to a common European standard through the better understanding of the effects and mechanisms of action of EMFs on human beings that will arise as a result of coordinated research in this area;

- to establish an ongoing research programme for epidemiological studies in the field of long-term, low-level (outside the levels addressed by exposure standards) EMF exposure at selected frequencies.

The result of the coordination/cooperation of the research activities will accelerate promotion of the multidisciplinarity approach, better and controlled use of Electromagnetic spectrum as a natural resource (environmental improvements), accelerate basic research and development (R&D) as a backbone for all other disciplines, for the sake of mutual benefits of all COST countries.

C. Scientific Programme

General Topics

a. Continually updating of the common database of research teams and ongoing research projects in Europe and outside Europe established in the COST 244.

b. Critically analysing new scientific literature.

c. Preparing, on a regular basis, comprehensive reports assessing the progress on bioelectromagnetic research in Europe.

d. Identifying areas for intensified research activity in the Fifth Framework Programmes of the EU.

e. Elaborating specific position statements addressed to the scientific community, the decision-makers, regulators and industry managers.

f. Considering the implications of research results for standardization activities, e.g. of CENELEC, ETSI etc., particularly in the field of wireless communications.

Specific Topics

1. Human Epidemiology

To promote and/or coordinate international studies of particular importance for assessment of health risks from environmental or occupational exposures. For example: mobile phone users, residents living close to RF transmission stations, high voltage power lines or powerful radar stations, telecommunications personnel, resistance welders, plastic welding workers, transmitter factory workers. Studies on mobile phone users should be particularly encouraged as such studies presently are lacking.

2. Occupational Medicine

2.1. To promote and/or coordinate international studies of particular importance for assessments of health risks and morbidity of workers exposed occupationally to high level EMFs. For example: telecommunications personnel, resistance welders, radar service personnel, high power line workers, workers using sewing machines, transmitter factory workers.

2.2. To organize a network which would collect details of all cases of accidents and diseases assumed to be related to exposure to EMF.

3. Hypersensitivity to Electricity

Analysis and assessment of possible hypersensitive reactions to EMF exposure with emphasis on the borderline area between psychosomatic and somatic symptomatology.

4. Design, Performance and Evaluation of Experiments

4.1. *Design and quality control of laboratory exposure systems*
At the end of COST 244, general guidelines were sought for the two frequency ranges, ELF and RF, both in vivo and in vitro. For COST 244 bis the progress in exposure system designs should be assessed and incorporated into standardized designs.

4.2. *In vitro experiments*
Rationale for the choice of biological models and exposure conditions. Evaluation of published results and extrapolation to animal investigations.

4.3. *Animal experiments*
Rationale for the choice of biological models and exposure conditions. Evaluation of published results and extrapolation to human studies.

4.4. *Human studies*
Rationale for the choice of biological models and exposure conditions. Analysis of possible consequences of the experimental results on human health and on existing safety standards.

4.5. *Medical applications*
EMF exposure bioeffects related to medical applications. For example: cell differentiation and EMF exposure in bone and soft tissue repair.

5. Interaction Mechanisms leading to Biological Effects

5.1. Design of benchmark experiments, which should be reproduced by independent groups, with the goal of addressing specific interaction mechanisms under defined exposure conditions and of characterizing them in a quantitative fashion.

5.2. Development of theoretical models of interaction mechanisms with some predictive ability to better explain and design experiments.

6. Experimental and Numerical Dosimetry

6.1. Analysis of the reported biological effects with respect to the improvement of quantitative strategies for human exposure assessment.

6.2. Publish the database of dielectric properties of human tissues and extend it in terms of frequency and tissue types.

6.3. To characterize the sources as radiating elements and develop simulations of the EM sources.

6.4. Ongoing comparison of different modelling techniques for numerical dosimetric assessment (FDTD, FEM, MoM, MMP, impedance methods, etc).

6.5. To evaluate canonical problems more complex than those considered for use in software validation and in the experimental assessment of exposure in order to obtain a more complete evaluation of fields inside the human body, especially the head and torso.

6.6. To define reference numerical and physical models of the human body based on detailed anatomical data against which new instrumentation and modelling techniques can be tested.

6.7. To define worst case scenarios for assessment of EM exposure with respect to human exposure standards.

D. <u>Organization and Timetable</u>

The organizational framework of the COST 244 will be implemented for the MC activities in the COST 244 bis. This includes the three horizontal WGs:

WG 1: Epidemiology and Human Health Effects

WG 2: Basic Research

WG 3: Systems and Applications Engineering

and one vertical coordination committee will be:

MCCC: Mobile Communication Coordination Committee

In the interests of management effectiveness this structure may be modified or adapted by the MC depending on the then current demands for research coordination (see figure 1).

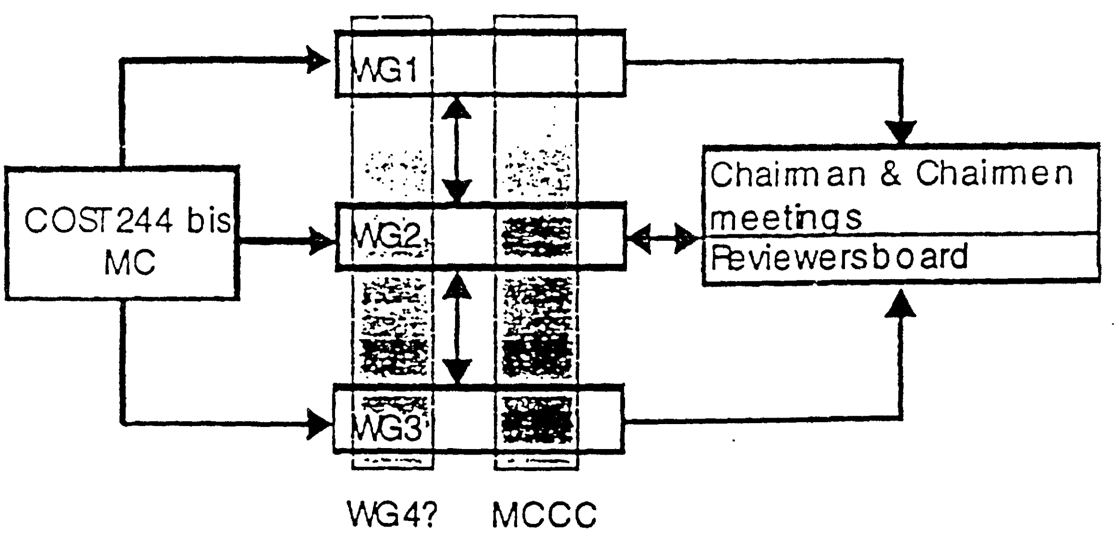


Figure 1: Structure of COST 244 bis

The Management Committee will have three meetings per year with two participants per country. Because of the multidisciplinarity of the COST 244 bis research, each nominated COST 244 bis National Coordinator will be responsible for the selection of the most appropriate participants for each particular meeting. The MC is responsible for the coordination of all activities described in the MoU, Technical Annex, for fostering cooperation and communication with other research programmes and for activities, and general science policy within COST 244 bis Action.

The MC Chairman will attempt to minimize the time spent on administrative matters during MC meetings through a distribution of working documents to the MC members well in advance of the meetings.

WGs Chairmen are responsible for the realization of the tasks from MOU in the particular areas of research covered by their WG and for the scientific profile of the Workshops.

Local organizers of workshops are responsible for both the scientific programme of the workshop and the preparation of the "position paper", which should give a "state-of-the-art" overview of the topic(s) of the workshop and summarize the results and recommendations of the workshop.

Meetings of the COST 244 Chairman and WG Chairmen have proved very effective for strategic planning and gaining a global overview of the activities and therefore will be continued in the COST 244 bis.

Within the flexibility of the MC mandate, COST 244 bis will maintain an open invitation for participation in its activities to all countries and institutes that share a mutual scientific interest.

Concerning the Workshops, COST 244 bis will keep in mind essential definition of it. Therefore, the Workshops will be tightly focused on specific topics. Scientific contributions to the Workshops will be selected through peer review. Every effort will be made to ensure that the Workshop presentations are published as quickly as possible in the form of Proceedings since they are meant to be working documents.

Workshops scheduled in parallel with MCM will be encouraged. Through cooperation with other European programmes, actions, organizations and bodies, COST 244 bis will seek additional financial support for the Workshops, as well as for other activities.

The COST 244 bis data base will be continually updated through information provided by the national research groups to the COST 244 bis Technical Secretariat. The use of e-mail will be actively encouraged as the most appropriate form of communication. The Technical Secretariat is also responsible for a preparation of meeting documents and reports, as well as an annual report to TCT, financial support, etc.

The duration of the Action will be four years with a 42-month research phase and a 6-month working-out phase.

COST 244 bis will prepare and publish a final report of its activities, providing a state-of-the-art overview and recommendations for further research and Actions.

Close to the end of the COST 244 bis a European Conference on the Biomedical Effects of EM fields will be organized.

E. Economic Dimension

On the national level participating research groups should have an appropriate infrastructure for the research activities and be prepared to commit a minimum of six man-years of effort per year.

On the basis of the 1993 average figures minimum figures per year per country are:

4 year scientists	ECU	240 000
1 year technicians	ECU	40 000
1 year student/secretary	ECU	25 000
Travel/subsistence expenses	ECU	15 000
Total per year	ECU	320 000
Total over 4 years	ECU	1 280 000

Therefore, the total expenses for the whole Action on the basis of 6 person/year participants per country, 20 participating countries for the period of 4 years is:

Total ECU 1 280 000 x 20	=	ECU	25, 6 million
+ 10 % overhead for running/operational costs		ECU	2,56 million
Total cost to national fund		ECU	28,16 million
EU overhead (over 4 years) 4 x ECU 135 000	=	ECU	0,54 million
Economic Dimension		ECU	28,7 million
Economic Dimension (at 1996 costs, considering a 15% increase)		ECU	33 million.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 251
"Improved quality of service in ionospheric telecommunication systems planning and operation (IITS)"

Date of entry into force of the project : 07.04.1995
Duration : 06.04.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	27.04.95	27.04.95
CZECH REPUBLIC	03.05.95	03.05.95
GERMANY	07.06.95	07.06.95
GREECE	03.05.95	03.05.95
SPAIN	05.04.95	05.04.95
ITALY	11.05.95	11.05.95
AUSTRIA	30.11.95	30.11.95
POLAND	09.12.96	09.12.96
SLOVENIA	05.04.95	05.04.95
SWEDEN	05.04.95	05.04.95
TURKEY	07.04.95	07.04.95
UNITED KINGDOM	05.04.95	05.04.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objectives of the Action are:

   - to demonstrate the practical improvement to terrestrial and Earth-space radio systems of COST 238 derived ionospheric models and to promote their use;

   - to further refine these models and to widen their geographical area of applicability;

   - to collect additional quantities and types of ionospheric information and to extend the models to give system performance statistics.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 300 000 at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ANNEX

GENERAL DESCRIPTION OF THE ACTION

1. Introduction

The ionosphere is a region of ionised atmosphere occurring primarily at heights of 50-1 000 km above the surface of the Earth and produced by solar-ionising radiation and energetic particles precipitating from the magnetosphere. It has a profound effect on radio waves over certain frequency bands. On the one hand it acts as a mirror in the sky, resulting in transmissions by successive reflections, particularly at HF, and thereby providing a medium for long-distance terrestrial telecommunications systems support. On the other hand it leads to deleterious effects on Earth-space links even at frequencies as high as 1 GHz, giving rise to a range of phenomena such as refraction, retardation, dispersion, absorption, scintillation and plane-of-polarisation rotation.

Unfortunately the ionosphere exhibits considerable geographic changes and has also large temporal variability on various timescales. The rapid expansion in requirements for telecommunication services in recent years has led to an explosion in the use of satellites for both fixed and mobile applications. Although there have been some notable switches from the less reliable HF services, there is evidence that the total use of the HF bands continues to rise, particularly in the roles of overseas broadcasting, in military tactical scenarios and in the less established newly developing countries. There are services besides communications involving ground-based remote-sensing systems such as over-the-horizon radars and target-detection systems in which propagation effects need to be addressed. As the range of applications to which satellite signals are put increases, so the requirements to be able to quantify and minimize ionospheric effects rise. Many cases could be cited where these are of major importance. Mention is made here for example of global positioning satellite systems, search and rescue satellites, radar altimeters for sea-surface and other geodetic measurements, antenna pointing and polarisation choice, and scintillation effects on transmission bandwidths and data rates.

Telecommunication system planning involves the assessment of circuit and service reliabilities; frequency assignment requires compatability with co-channel users; the interpretation of information collected from ground-based and satellite sensing systems can create a need to correct for propagation effects. For planning, a knowledge of the ionosphere and its influence is essential and long-term models are wanted. In principle best approaches to real-time operation would come from media probing and the use of adaptive systems, but in practice few are operational for reasons of cost, technical complexity and regulatory restrictions. In any event they require *a priori* proportion models to quantify the bounds within which they are required to function.

Radio service planning is coordinated internationally under the auspices of the International Telecommunication Union (ITU) and technical studies leading to the adoption of global propagation models for use in these tasks are developed by the Radiocommunication Sector of that body. For the past four years COST 238 (PRIME) has been engaged in the development of improved ionospheric models for the European region, making use of the more extensive ionospheric measurement data sets available in Europe than throughout the rest of the world. This proposed Action builds on the results of COST 238 by establishing a programme of work that will test the operational value of the new ionospheric models using appropriate propagation models and suitable telecommunication system performance data. At the same time it will seek to collect additional and new types of ionospheric data and will further refine the latest ionospheric models in the light of the results obtained.

2. Objectives of the Action

The COST 238 objectives, as embodied in the associated Memorandum of Understanding, state that "... A next phase of work would involve the synoptic production of model sets, near real-time dissemination of these to selected radio users and interaction with the users ...". Consistent with this, the main objectives of this Action are:

- to demonstrate the practical improvement to terrestrial and Earth-space radio systems of COST 238 derived ionospheric models and to promote their use;

- to further refine these models and to widen their geographical area of applicability (see map of Fig. 1);

- to collect additional quantities and types of ionospheric information and to extend the models to give system performance statistics.

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 Action (4 years). Not all organizations will wish to participate in all Working Groups, but the Action as a whole is seen as a common activity directed to a single goal:

Working Group 1: Validation of COST 238 models for terrestrial systems – interaction with radio users and comparison of their performance data with model results, including if possible assessment of value of real-time channel evaluation techniques; collection of additional vertical and oblique-path ionospheric data for use with instantaneous maps; testing of forecasting algorithms.

Working Group 2: Validation of COST 238 models for Earth-space systems – investigation of ionospheric propagation effects on radio systems used for navigation, geodesy and radio-astronomy.

Working Group 3: Further development of COST 238 models – to other geographical regions: by incorporation of short-term variability statistics; short-term forecasting of operational parameters; long-term trends of ionospheric change.

Working Group 4: Quantification of signal variability, noise, interference and overall reliability – measurements of spectrum occupancy at distributed European sites; terrestrial link signal fading and Earth-space link scintillation measurements; theoretical studies.

Working Group 5: Propagation channel simulators and spectrum management – refinement of available simulators using COST 238 model results; use in spectral management studies.

4. Suitability of the COST framework for the Action

The following benefits are anticipated:

(a) a natural succession to COST 238 without which results will not be fully exploited;

(b) should build on existing COST 238 teams, but also bring in appropriate new groups for the extended activities;

(c) COST provides an effective mechanism for coordinating effort and for the establishment of viable combined teams with sufficient size, expertise and resources to achieve the desired objectives, whereas no one country has the necessary available trained staff effort;

(d) direction by 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;

(e) strengthened technical and scientific effort becomes readily available at a national level with the transfer of technology from those countries with a more extensive ionospheric telecommunications research background to engineers and scientists in countries relatively new to this field of study;

(f) the creation of an infrastructure for the collection and validation of ionospheric data and the synoptic production of model sets for radio users.

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:

- attend and contribute to meetings of the MC: typically two meetings annually together with one Workshop at which results are presented and reviewed;

- be involved in an active programme fitting in with the objectives and time scale of the Action;

- take responsibility for specific items of the Action;

- seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the Action and other related COST telecommunication and teleinformatics actions;

- be responsible for liaising between the MC and national research groups in the participating countries.

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

6. Technical programme

6.1. Working Group 1. Validation of COST 238 models for terrestrial systems

Ionospheric models require to be integrated with internationally established propagation and system performance models which already exist within the ITU and the International Union of Radio Science (URSI). In particular, these include ray-training capabilities and methods of prediction of oblique-path basic and operational maximum usable frequencies (MUFs). Coordinated campaign vertical and oblique-path soundings will be inverted using appropriate true-height scaling procedures and added to the existing COST 238 measurement database for use in model improvements (WG-3). Comparisons of oblique soundings and other point-to-point link performance data with model MUF results will be investigated.

Experimental data on target ranging and location will be compared with prediction based on instantaneous maps derived using simultaneously collected vertical-sounder data. Studies of the value of super-resolution techniques for modal resolution in relation to propagation assessments will show the merits of these procedures in producing improved system performance. Results of the implementation of real-time channel evaluation techniques will be compared with forecasting estimates. Theoretical studies of broadcast coverage using both long-term and instantaneous ionospheric models will be related to listener reception coverage statistics.

6.2. Working Group 2. Validation of COST 238 models for Earth-space systems

Theoretical comparisons will be made of necessary ionospheric corrections to available navigational and geodetic satellite system data sets, as well as to the interpretation of radio astronomical measurements. These will be based both on long-term ionospheric models and on instantaneous models updated with real-time measurements of total-electron content. These measurements will also be added to the COST 238 database for the use of WG-3 in future model development. The roles of "nowcasting" and forecasting will be investigated.

6.3. Working Group 3. Further development of COST 238 models

Existing COST 238 models are restricted to the Western European middle-latitude area to avoid the problems that arise at the higher latitudes where particle precipitation in the neighbourhood of the auroral zone gives rise to added complexity, both in changes in the form of the height profiles of electron density and in the resulting marked spatial and temporal variability. Auroral effects are best incorporated in models as an addition to the benign ionosphere and this approach will be pursued to provide tools of greater Community applicability. Particular attention will be paid to investigating the merits of new indices of ionospheric state which are based on energy input towards the Earth and sector crossing of the interplanetary magnetic field. Eastwards extension of the modelled area is also of importance to the Community and may involve the use of new mapping functions to allow for longitudinal changes in the Earth's magnetic field.

A major limitation of existing models is that they are based on monthly median conditions and include no specification of short-term variability, day-to-day or on other timescales. These shortcomings will be addressed by further measurements and analyses. Long-term trends too, beyond a solar cycle, perhaps linked to secular changes in the Earth's magnetic field and to global warming need to be addressed. The use of neural networks in long-term predictions will be investigated. Ionospheric absorption over auroral paths will be studied in relation to oblique-sounding data with a view to improved modelling. The short-term forecasting of operational parameters will be given priority, perhaps also involving the establishment of a European despatch centre. Final results will be embodied in appropriate computer programs with associated handbooks.

6.4. Working Group 4. Quantification of signal variability, noise, interference and overall reliability

Existing data on signal amplitude fading, whilst extensive, is still deficient regarding correlations over adjacent paths, adjacent frequencies and between signals and noise. More measurements are needed, especially linked to oblique soundings in which the propagation modes can be simultaneously determined. A major limitation in scintillation information on Earth-space links will also be redressed.

The background to wanted signal reception often arises at HF from interference and there is an urgent need for more spectrum occupancy measurements at separated sites, in some cases with new facilities. Spectral occupancy models need to be improved and further developed, perhaps also involving theoretical studies leading to new more operationally useful parameters. Signal variability and interference statistics usefully permit the application of ways of estimating overall circuit and service reliability performances. Theoretical studies of ways of calculating these, including allowances for correlation effects, will be examined.

6.5. Working Group 5. Propagation channel simulators and spectrum management

Ionospheric channel simulators provide a means of testing the performance of telecommunication systems over a range of controlled conditions without the need for extensive field trials. Available simulators will be reviewed and the models that have been developed in COST 238 will be used to improve these as appropriate. Simulation results will be applied in various channel modelling and real-time evaluation trials associated with other Working Group activities and will also be applied to selected spectrum management studies.

7. Envisaged cost of the activity in the Action

It is assumed that Commission support will be forthcoming from EU members to participate in MC meetings and Workshops and that there will be partial support to Workshop hosts as well as for the attendance of selected invited experts. Each signatory is expected to promote an active national involvement by means of appropriate funding. In addition funding should be made available for the coordination of national efforts and the preparation of contributions to committee meetings. No major items of equipment purchase are foreseen. The total of each national contribution over the four-year period is estimated at around ECU 300 000.

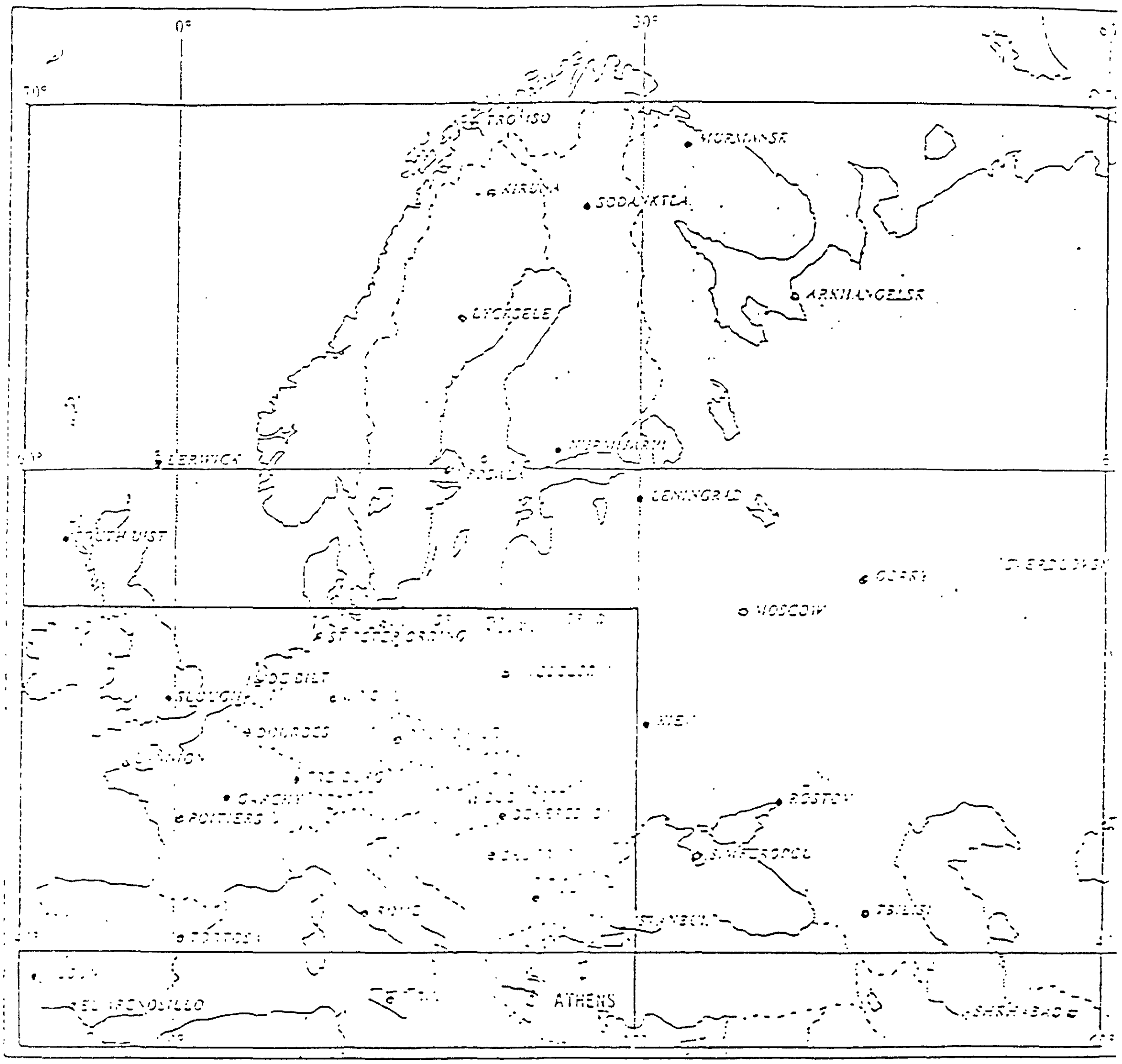


Fig. 1 – COST 238 EUROPEAN AREA AND PROPOSED EXTENSION (SHADED)

Memorandum of Understanding
for the implementation of a European Concerted
Research Action designated as
COST Action 252
"Evolution of Satellite Personal Communications
from second to future Generations Systems"

Date of entry into force of the project : 02.05.1996
Duration : 01.05.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
GERMANY	25.04.96	25.04.96
GREECE	02.05.96	02.05.96
FRANCE	25.04.96	25.04.96
ITALY	29.05.96	29.05.96
NORWAY	23.04.96	23.04.96
POLAND	25.09.96	25.09.96
PORTUGAL	15.05.96	15.05.96
SLOVENIA	23.07.96	23.07.96
UNITED KINGDOM	25.04.96	25.04.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which the Signatories are fully aware of.

2. The two main objectives of the Action are:

   - a mid-term activity focused on the adaptability of the GSM standard (second generation mobile terrestrial system) to Mobile Satellite System (MSS) considering the future requirements of an integrated third generation system (UMTS)

   - a longer-term activity dealing with the exploitation of the satellite component for the MBS able to provide services at higher rates (> 2Mb/s) than presently assumed in the UMTS.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 4 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

Action 252

Evolution of Satellite Personal Communications from second to future Generations Systems

A. General background

It is recognized worldwide that mobile and personal communications will play a significant role in the future telecommunication market and current research activities are carried out on this subject in industries, public administrations and research institutions in Europe, USA and Japan as well as in international standardization bodies. The main emphasis of those activities is towards the definition of third and fourth generation systems for mobile and personal communications to be deployed at the beginning of the next century (i.e., respectively Universal Mobile Telecommunications Systems, UMTS, and Mobile Broadband Systems, MBS). Recently it has also been proposed (e.g., in ETSI – SMG5) that an evolutionary approach from second (e.g., Global System for Mobile communications, GSM) to next generation systems would be more appropriate to save the already planned large investments. It is also recognized internationally that satellite systems are necessary to provide the required global coverage of future mobile and personal communications.

Within the European Union, it is therefore of strategic importance that efforts pursued at national level be complemented and enhanced on a much larger scale by European concerted research action aimed at the definition and development not only of a pan-European system but also of a worldwide global system.

Features expected to be implemented by the new generation systems include:

- personalized services with a capability to respond to new services, facilities and applications (e.g. multimedia and personal communications),

- mobile terminals to offer the same services, facilities and applications as a fixed terminal in a common-feel way,

- freedom to roam on a worldwide basis,

- parity of quality, performance, privacy and cost between fixed and mobile access.

These systems are intended to realize true personal mobile radio communications from anywhere and to allow people to communicate freely with each other from homes or offices, cities or rural areas, fixed locations or moving vehicles (land, sea, air). The satellite component of the future systems offers in particular an effective means for providing services to areas where terrestrial telecommunication infrastructures are not yet well advanced.

There are significant differences between COST 227 and this new proposal and, furthermore, between COST 252 Action and ACTS Programme.

The aim of COST 227 Action has been to study possible scenarios for integration between terrestrial and satellite mobile networks. To this end, various possibilities have been investigated and for each of them different technical aspects have been outlined.

The new COST Action, which is intended to be a direct follow up of COST 227, as well as SAINT and MONET, will have a different aim. Starting from the specification of the GSM terrestrial infrastructure, it will investigate the smooth migration towards satellite integration of third and fourth generation global mobile systems. It may be noted that a second generation global system could be GSM+ the Iridium or Globalstar type constellations, a third generation can be UTMS and the fourth one could be defined in this new Action COST 252.

It is true that some of the aspects that are proposed to be studied in COST 252 have already been proposed in COST 227 but it has not been possible to achieve final results. Therefore, due to its importance, the work must be continued in the new Action. The results already achieved must be re-considered and extended in the new Action and starting from the second terrestrial cellular networks the smooth migration towards the achievement of the future integrated mobile networks will be investigated.

As for the differences between ACTS Programme and COST 252 Action, it is important to note that the former will focus on implementation aspects, specific experimentation and validation of equipment and systems in order to properly evaluate the potentiality of future communication services. This activity will also consider some integrated scenarios; however, this is not the sole scope envisaged within ACTS Programme.

COST 252 Action will concentrate on a feasibility study and system specification for the future process of integration by defining the main technical aspects and requirements needed for the achievement of systems such as UMTS and MBS.

Finally, an important aspect is that COST 227 will end in April 1995, and SAINT Project (Race II Mobile Project Line) and MONET will end in December 1995. This means that within a moderate time a number of R&D studies will be available to serve as base ground-work to advance the study of integrated global mobile networks. The new incoming COST 252 Action could therefore exploit all these available results and become a forum for the work on universal mobile networks.

B. Objectives of the Action

Two main objectives are considered within this action towards the achievement of a future global communication network:

(i) a mid-term activity focused on the adaptability of the GSM standard (second generation mobile terrestrial system) to Mobile Satellite System (MSS) considering the future requirements of an integrated third generation system (UMTS);

(ii) a longer-term activity dealing with the exploitation of the satellite component for the MBS able to provide services at higher rates (> 2Mb/s) than presently assumed in the UMTS.

Benefits expected from the scientific results of this Action are:

- a degree of conceptual innovation,
- basic and applied R&D,
- European collaboration on the feasibility study and system specification towards the achievement of a global communication network,
- technical specifications,
- services integration towards multimedia applications.

C. Scientific contents of the Action

The satellite sub-system should be considered as a necessary component of the global mobile/personal communication system with the highest feasible degree of integration with the terrestrial cellular component. Geostationary and non-geostationary constellations of satellites should be considered with major emphasis on the latter ones more suitable for hand-held terminals.

For non-geostationary satellites, mobility management signalling, call set-up and resource allocation procedures must be considered in detail and their impact on the protocols of the terrestrial component must be carefully investigated.

A detailed description of the proposed topics and related technical approaches within COST 252 Action is presented below. Three main research areas are addressed by the proposed Action, each of them is covered by a specific working group.

WG1 – Strategic Scenarios and a feasibility study

A first important step towards the achievement of future satellite-terrestrial integrated systems is the study of a smooth migration from second generation terrestrial systems (e.g., GSM) to include a satellite component. This is a key point because it can meet the interests of both users and operators: on the one hand we have the interest of operators to save on the large investments for the implementation of second generation terrestrial systems; on the other hand, we have the interests of the users to be able to reuse their terminals even for future networks as much as possible. In the light of this approach, the results from the inputs from COST 231 Action ("Evolution of Land Mobile Radio (including personal) Communications") will be used as a starting point for research under COST 252 Action.

Other strategic elements for the deployment of future integrated networks will be:

- in-depth study of an integrated terrestrial/satellite system at the highest level to identify the main problems/requirements that such a network poses (inputs from COST 227 Action results);

- the ease of implementation of new services (multimedia services, personalized services);

- services integration into a network (an expected important feature for Personal Communication Networks);

- based on the recommendations of ITU, ETSI and of the outcome of RACE, the service and security requirements have to be studied more deeply and more closely for the applications;

- the use of non-geostationary orbits for the satellite component of the systems (in particular, Low Earth Orbits and Medium Earth Orbits will be considered).

All these aspects should be carefully taken into consideration when proposing possible solutions (for example, a feasibility study) towards the achievement of future global communication systems.

For achievement of the objectives of this working area it is considered important that there is cooperation with COST 248 Action, entitled "The Future European Telecommunications User", which has as its aim to study the user's attitude on future telecom services and products.

Related inputs on regulatory issues and system requirements are expected from other bodies and groups (for example, ETSI, ITU-T, ITU-R, SAINT, ACTS).

WG2 – Network Aspects

The way considered within COST 227 Action to implement an integrated satellite/cellular system is to use as far as possible in the satellite network the same procedures and protocols as defined for the terrestrial cellular one. Moreover, it is a fact that many future global coverage Mobile Satellite Systems (MSSs) will use a constellation of non-geostationary satellites.

Then, starting from these important results the main interest of the new Action will be to concentrate on the evaluation of specific problems inherent to the integration of these MSSs with terrestrial second generation systems.

Starting from the outputs of COST 227 Action and the related RACE projects, namely SAINT, MBS, MONET, etc, it is necessary to proceed with the studies to improve or modify the network architecture in order to add or improve the system functionalities. Then, it is important to envisage a further sub-tasks division within this working group as follows:

Major research areas and related objectives of this task

- The study of the network architecture:

  = definition, functionalities and role of the network entities,
  = integration/interworking with GSM evolving towards UMTS,
  = satellite/ATM integration (mobile aspects).

- The study of procedures and protocols:

  = call set-up and signalling,
  = intelligent network (IN),
  = mobility management and signalling,
  = optimization of mobile terminal location techniques.

- Resources management in the integrated terrestrial-satellite scenario considered:

  = resource allocation techniques: a performance analysis,
  = comparison and trade-off: centralized versus distributed control,
  = multimedia and personalized services.

- Activities in other bodies and groups.

WG3 – Air Interface Aspects

This task is mainly addressed to the physical and data link layers according to the OSI network model. The interest here focuses on transmissions aspects including also the characterization of the satellite channel (especially in the case of non-geostationary satellites) and technology issues in order to cope with the link budget requirements that are particularly critical in the case of hand-held mobile terminals.

Moreover, in the following years some interesting results are expected in the domain of health hazard related to the RF emissions of handsets. This should pose specific requirements on the technology (both for handset and satellites); therefore, it is important that the new COST Action be aware of these results and propose/study new technical solutions. To achieve this goal, a tight cooperation with other related COST projects is deemed as essential. In particular, we must consider cooperation with COST 244 Action, entitled "Biomedical Effects of Electromagnetic Fields".

According to that characterization the work within this group could be divided into the following topics:

- channel characteristics: optimization on non-GEO channels and propagation effects,
- multiple access techniques and inter-system interference,
- identifying GSM and UMTS commonalities for a smooth transition,
- handover priorization strategies,
- receivers: modulation, coding and equalization with variable data rates,
- gateway station,
- terminal technology including biological constraints.

D. Timetable and outputs

The duration of the proposed Action is four years. The first two years should be mainly devoted to the study of the satellite sub-system in the evolution from second generation (GSM) to third generation (UMTS) systems.

The activity concerning the integration of satellites in the fourth generation Mobile Broadband System should last all four years with an acceleration in the second half of the Action.

The scientific results of the Action should be presented at a mid-term workshop and at a final workshop open to all interested parties.

The scientific research performed within COST 252 Action will provide inputs to ETSI for its standardization activities.

E. Organization, management and responsibilities

Each working group should have a person responsible for its respective activities and coordination of the three working groups should be exercised by the management committee.

Liaisons with relevant projects within RACE and ACTS should be sought as well as with international standardization bodies (e.g., ETSI, CCIR). These liaisons are deemed essential for an effective and coordinated activity on this subject among all involved actors in Europe. The standardization bodies should benefit from inputs coming from the results of both COST Action and RACE/ACTS projects.

Moreover, as explained above, useful inputs are expected from other related COST Actions, such as COST 227, COST 231, COST 244, COST 248.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 253 "Service-efficient network interconnection via Satellites"

Date of entry into force of the project : 07.03.1996
Duration : 06.03.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.02.96	15.02.96
GERMANY	25.04.96	25.04.96
SPAIN	15.02.96	15.02.96
FRANCE	15.02.96	15.02.96
IRELAND	15.02.96	15.02.96
ITALY	07.03.96	07.03.96
NORWAY	23.04.96	23.04.96
SLOVENIA	23.07.96	23.07.96
UNITED KINGDOM	14.03.96	14.03.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to study, define, implement and test systems for LAN Interconnection through non-geostationary satellites. Problems related to satellite motion on the design of the gateways and transmission systems will be studied, suitable protocols elaborated and simulation tools developed for system dimensioning and performance evaluation. The applicability of emerging traffic, Quality-of-Service and resource management schemes and mechanisms within advanced satellite communication systems interworking with terrestrial communication networks shall be assessed and specific functions able to cope with or to benefit from the characteristics of satellite systems will be analysed in order to support their efficient integration.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 7 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ACTION 253

Service-efficient network interconnection via satellites

A. General Background

Distributed data processing has developed rapidly over the last decades due to the dramatic increase of processing power and advances in microelectronics and communications. The establishment and acceptance of standards led to a wide-spread use of local computer networks capable of supporting speeds ranging from several Mbits/s to hundreds of Mbits/s. Nowadays local area networks can be found in nearly every office environment and even in small entities of industry and R&D organizations. Furthermore, user requirements and service demands for multimedia (voice, video & data) communications over long distances are growing rapidly, as a result of the increasing internationalisation of work.

While networks can be set up easily and at comparatively low cost locally, long-distance communications at speeds relative to the LANs is still a problem. In highly developed regions (e.g. Western Europe, USA, & Japan), digital networks based on optical fibres joining major cities have been or are being deployed offering very high transmission rates to meet bandwidth demands. However, it leaves large rural and developing regions (e.g., Eastern Europe, South America, parts of Asia and Africa) without a proper infrastructure for advanced data communications.

Therefore, communication satellites have an important role to play in the regions lacking the adequate infrastructure to exchange all types of information electronically. Satellite networks can provide coverage of large areas rapidly and economically through inexpensive terminals with transmission rates ranging from 64kbits/s to 34 Mbits/s.

User requirements demand standard applications and protocols to be supported. Ideally, the user should not see any difference whether his data are carried over a LAN, some wide area ground network or via satellites. Market surveys show that TCP/IP is becoming the most widely used protocol, although large user communities still rely on SNA, Novell or Decnet. TCP/IP is the protocol of the Internet; the world's largest data network, which is growing at a tremendous rate and for which a clear trend in moving from an academic to a commercial network can be seen. The choice of TCP/IP, also for the satellite network has the advantage that all standard applications such as

- file transfer
- database access
- remote log-in
- E-mail

as well as PC and workstation platforms can be immediately supported.

TCP/IP has been designed for terrestrial networks which are characterised by low delay and error rates. This is unfortunately not true for satellite networks. The round-trip delay is about 260 ms and bit error rates can become significant in case of fading. Investigations showed that the applications mentioned above can be supported well on satellite links. The situation is more complex when highly interactive applications are supported: for instance, client-server applications or real-time interactive voice and video. To decrease the delay, lower orbiting satellites are therefore highly interesting. Non-geostationary satellites have been proposed for mobile communications, but recent studies and projects launched in the US indicate a strong move for using this new generation of satellites for fixed services as well.

Among the non-GEO satellites, the medium earth orbit (MEO) satellites seem to offer the best advantages for LAN services. With transmission delays ranging from 50-100 ms, MEO systems are very close to the delay-performance in typical LANs (40-70 ms). But because of the non-GEO nature there are several challenges that MEO systems need to overcome, before they can provide transparent LAN-to- LAN services.

Since the COST 226 action has clearly demonstrated the feasibility of LAN interconnections by GEO systems using transparent satellites and fixed low cost VSAT earth stations, it is important that this new action be carried out within the COST framework as a follow-on to COST 226. The ongoing coordination will enrich the cooperation within the European states while maintaining and advancing the expertise.

Continuing the work on LAN interconections with non-GEO satellites is important, because non-GEO systems for personal communications, now in the process of implementation, will foster the demand for new services such as interconnection of wired and wireless LANs. This demand will generate manufacturing of new types of equipment. Hence, it is important that European industry finds a forum where expertise is available on non-GEO satellite systems, and that these systems can be used for purposes other than personal mobile communications. A COST action would be the appropriate forum.

However, the inherent flexibility of those promising systems to support multi-class communication services can only be made effective, if their operations are controlled and supervised by distributed responsive intelligent control and management functions.

Traffic, Quality-of service (QoS), resources management and control are very important and will be the subject of continuing research and standardization effort.

Significant progress has recently been achieved in the area of traffic modelling, thanks to the remarkable results obtained by the Bellcore team outlining the self-similarity and fractal characteristics of some traffic flows. Assuming realistic non-Poisson or non-Markovian arrival traffic, the statistical analytical study of queuing systems must apply more efficient mathematical tools relying on the theory of unfinished work or virtual waiting time and on the theory of large deviations and entropy. A lot of effort is still required to support the analytical study of the dynamic behaviour of such queuing systems, to verify the effectiveness of control schemes.
Basic valuable results in the area of traffic, QoS and resources control are available from the recent literature, from specific RACE projects and specific COST Actions 224, 242, 226 and 228.

An effective operational early standardisation is expected during 1995, in particular from the ATM Forum, and those issues are addressed by specific Tasks under the EC Program ACTS (Area 3 : High Performance Networks).

Even if an acceptable, but still evolving functional architecture is available as the result of efforts from ITU-TSS, ETSI and RACE, most of the operational mechanisms are still an open issue, except for the Constant Bit Rate (CBR) circuit emulation service type. The promising services types such as the Real Time Variable Bit Rate (VBR) and the Available Bit Rate (ABR), still awaiting early effective standardisation will request sustained research in the future to improve their efficiency and "ease-of-use". Implementations of sophisticated, but real-time mechanisms are expected, based on the theory of effective bandwidth, on the concept of segmented feedback control and even applying the promising results from the fuzzy neural control.

The work under this COST Action, relying on the continuing efforts under other international projects, will respect the emerging and evolving standardisation framework and will focus on assessing the applicability of early proposed mechanisms within satellite systems interworking with terrestrial communication networks as well as on analysing specific internal mechanisms able to cope with or to benefit from the characteristics of satellite systems.

Relation to other international scientific programmes: the action is concurrent with programmes supported by ESA. Thus, it would be anticipated that ESA will participate in this new COST action, (although this remains to be verified), and should this be the case, ESA will coordinate the COST action with its own industrial policy. Otherwise a liaison could be set up with ESA. Other collaborations and information exchange, particularly with standarisation bodies such as ETSI, ITU and operators such as EUTELSAT, INTELSAT or INMARSAT are also expected.

B. OBJECTIVES

The underlying objective of this action is to make satellites active and dynamic components of global networks providing transparent fixed services such as LAN interconnections. To achieve this objective non-GEO satellites are considered with a view to minimised transmission delay restrictions. The aim is to provide an efficient communications system particularly for areas with inadequate ground infrastructure.

In this context the goals of the action are as follows:

- Identify problems related to satellite motion and impacts on satellite gateway and transmission system design

- Explore whether present protocols or those elaborated within COST 226 for GEO satellite networks are suitable or need to be modified, and if so in which way.

- Develop software for system simulation, dimensioning and performance evaluation for systems for LAN interconnection through non-geostationary satellites. The implementation of hardware systems and software is foreseen to provide a test-bed for verifying the transmission and access schemes as well as the performance of the protocols and applications.

- Define a limited set of satellite system generic reference architectures and configurations, coping with private or access networking scenarios, and including constellation of multi non-geostationary satellites.

- Assess recommended schemes and mechanisms in the area of traffic, QoS and resource management and their applicability within the defined satellite systems.

- Analyse and recommend specific functions to cope with the characteristics of the considered satellite systems.

- Support the implementation of the main defined schemes within an experimental (even partially simulated) satellite system

- Ensure the distribution of the results through the COST channels (TDs, Final Report, Final Symposium, optional worshops), papers, inputs to ETSI, and possible other projects or organisations as Action initiatives or concerted initiatives by participating organisations .

C. SCIENTIFIC CONTENT

To fully address the challenges that non-geostationary satellites generate due to their rapid motion, the following two working groups (WG) are proposed:

WG 1: Network Integration by Non-Geostationary Satellites

Task 1.1: Space and Earth Segment Studies

Results from COST 227 will be taken into account and the performance between LEO and MEO satellite architectures for fixed services compared.
The relevant earth segment with tracking antennae and suitable algorithms for tracking will be defined.

Whereas GEO satellites (which are well station-kept) VSATs with dish sizes below 3 m do not require tracking, MEO systems will definitely require antennae which are automatically pointed to the satellite. On the other hand such a tracking system should not contribute significantly to the overall costs of the ground segment in order to make it cost-effective and attractive to users. PCs as controllers for low-cost actuators can be used. Step-track and/or program track algorithms can be implemented.

Task 1.2: Study of transmission schemes capable to cope with Doppler shift effects.

Due to the significant relative movement between the ground station and the satellite, Doppler effects cannot be neglected resulting in frequency shifts on the carrier frequency and clock slips on the demodulated digital signal.

The transmission scheme has to be robust to cope with these frequency shifts. The tracking range of the demodulator loops have to be wide enough to keep synchronism.
In order to cope with clock cycle slips sufficient buffering has to be provided. On the other hand, the buffering must be optimised in order not to contribute noticeably to the delay. Furthermore, advanced protocols have to be provided to handle this special satellite environment.

Task 1.3: Study of access methods adequate for multi-satellite environment.

To support continuous coverage several satellites will be required and the hand-over procedures have to be taken into account by the protocol and the transmission and access scheme.

Task 1.4: Fade-countermeasures using digital (baseband) techniques, and transmission frequency considerations.

MEO satellites are likely to be operated in the Ku-band or above to handle high transmission rates through earth stations with small antennae. At these frequencies the fading effects can be significant. In order to provide reliable communications without large fade margins, efficient fade countermeasures have to be applied. Doing this on the digital level is an attractive solution. Variable transmission and coding rate systems can help to overcome the effects of fading on the expense of throughput (or bandwidth).

Task 1.5: Internetworking Problems

Problems of Internetworking between heterogeneous networks, the application of advanced techniques on bridging and routing (e.g., intelligent bridges based on parallel processing, optimum routing algorithms using neural networks or fuzzy logic, etc.) shall be studied.

Task 1.6 Design of flexible and scaleable gateway, interfacing to LAN routers, hubs and ATM switches.

To adequately serve present LANs and the ones to come, intelligent and flexible gateways are yet to be developed. Therefore effort has to be put into the development of a flexible and scaleable gateway design which allows to connect to LAN routers or hubs, including ATM switches, on the one hand, and the transmission subsystem on the other hand. The satellite gateway must also run the satellite access scheme.
Since MEO satellites of this kind will not be available within the next few years, the concept may have to be proven on the ground with a satellite simulator which models the variable delay, the Doppler effect on clock and carrier frequencies as well as the channel error and fading effects. The development of such a satellite simulator will be inevitable.

WG 2: Traffic, Quality-of-Service and Resource Management Techniques

Task 2.1

The following topics will be addressed.

- classical traffic models (Markovian, Auto Regressive Models of order 1 and 2); advanced traffic models (self-affine, fractal , Fractional Gaussian Noise, Fractional Auto Regressive Moving Average, chaotic maps, TES, applicative source models as based on tcplib for TCP or Telnet like sources, browsing application , generic video and multimedia applications.
- the congestion control schemes, based on binary feedback and rate control with linear additive increase and multiplicative decrease; the congestion control schemes, based on window control such as applied within TCP; congestion control based on more complete information than the binary scheme.
- the analytical frameworks of advanced queuing system based on the virtual waiting time and the theory of large deviations; the most recent results in the analytical study of the dynamic behaviour of queuing systems submitted to Markovian or Non-Markovian arrival traffic.
- the most recent results in the predictability of traffic with short term or long term dependence; the most recent results related to the concept and operational applicability of "effective or equivalent rate".
- the most recent applicable results in the field of advanced dynamic routing.
- the most recent applicable results in the field of fuzzy logic and neural networks.
- the most recent results in the field of satellite medium access control and impact of fade countermeasures on the transmission capabilities.

It is assumed that each different issue is well known by at least one participating organisation. The task will consist of identifying the issues and reference organisation.

Task 2.2

Considering the emerging recommendations and monitored results, the following issues will be considered when assessing the applicability of the traffic, QoS and resource control schemes and mechanisms :

- different service types : CBR, VBR and ABR.
- different congestion control schemes : avoidance, reactive, proactive; control of the arriving and accepted traffic; call admission, traffic policing and shaping, source control, segmented feedback control; monitoring of the traffic and queue behaviour as input to prediction and adaptive feedback actions.
- different "axis" for control action : path transfer capacity updating, path configuration updating, routing, splitting, enqueueing and scheduling, source control.
- different reservation / allocation schemes : from partitionning to sharing with preemption; available resource usage : priorities, fairness,..

The work will be limited to assess the applicability of recommended or emerging mechanisms, to recommend specific tuning of those mechanisms and to recommend a particular usage of a generic mechanism and even a new mechanism when the issue is left open by the ongoing standardisation.
The recommendation must take into account the constraints imposed by the layered architectures, the existing and emerging protocol stacks, the internetworking and interoperability requirements.
The recommendation must address the most suitable functional plane (User, Control or Management) in order to minimise the impact on the existing or very likely emerging protocols within the User plane.
Recommendations related to the Transport layer protocols will address the configuration and tuning of the analysed congestion control schemes.

Task 2.3 .

The generic reference satellite system architecture(s) and configuration(s) will be defined based on the work of WG 1 and COST Action (255) dealing with Techno-Economic Research in the Access Network.

Task 2.4

Having in mind the ongoing results from Tasks 2.2 and 2.3, those tasks will focus on analysing and recommending specific usage of generic techniques as well as specific techniques appropriate to deal with the pecularities of satellite systems, especially the constellation of non-GEO satellite.

In particular, the following issues will be considered :
- dynamic topology reconfiguration from mesh to star and even hybrid topologies.
- dynamic routing and adaptive control to cope with QoS, load balancing, link efficiency, multicasting, fade conditions, handover and network failure; preventive handover ; efficient support of satellite system to multipoint-to-multipoint services; traffic splitting / recombining as a means for load balancing and increased efficiency

The Task will support the implementation of some main techniques within the experimental (even partially simulated) satellite system to be developed.

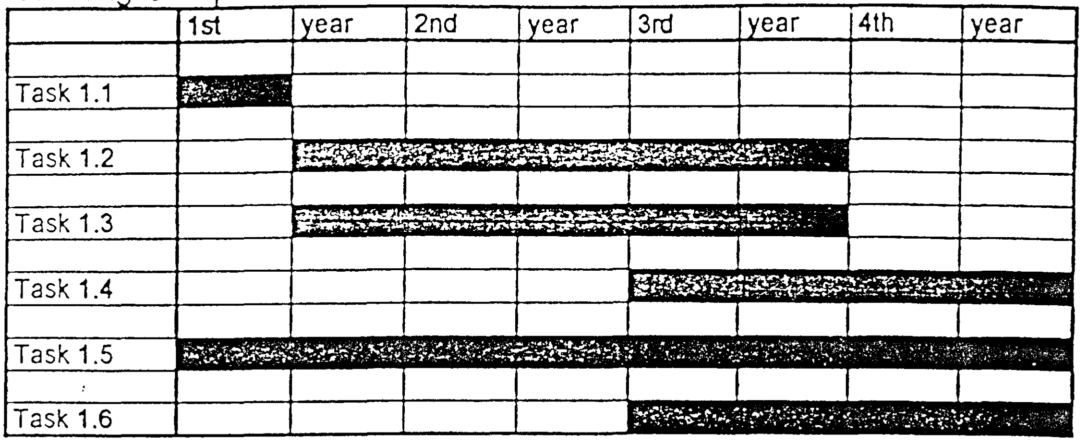
Task 2.5

The results will be distributed through TDs, presented and discussed during Management Committee Meeting. One mid-term workshop is expected, open to external experts.
A Final Report and a Final Symposium will ensure the diffusion of results to a wider audience.

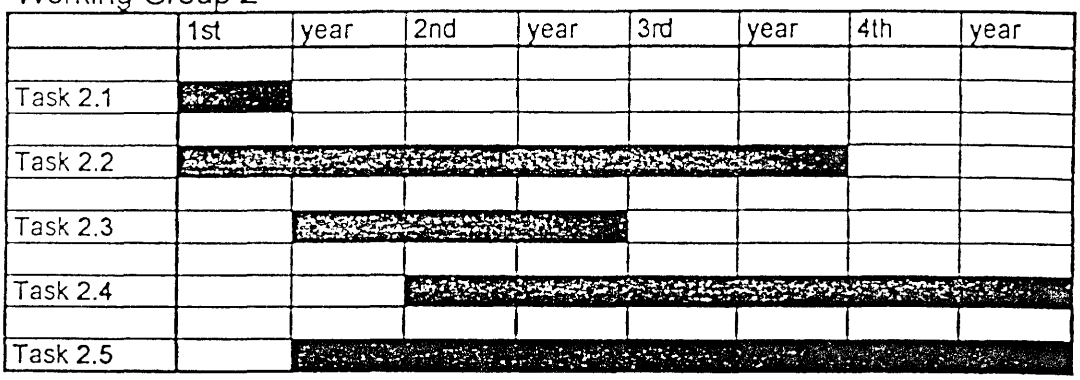
D. TIME-TABLE:

The duration of the COST action will be 4 years.

Working Group 1

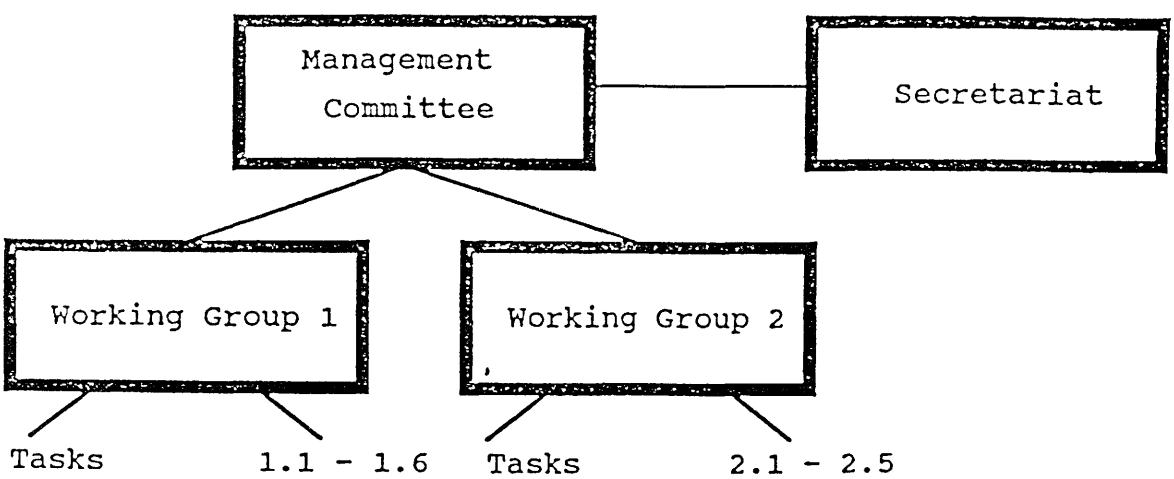


Working Group 2



E. ORGANISATION

The planned organisational structure is as follows:



Within the Action, the activities will rely on the close cooperation between the members of working groups focusing their effort on special tasks. The Working Groups will organise specific working meetings. During the Management Committee Meetings (3-4 times/year), the results will be presented, ideas will be exchanged and the future work will be reassessed and coordinated.

The MC, in concertation with COST Technical Committee "Telecommunications" will ensure that close contacts will be established with European Space Agency (ESA), ETSI, the ATM Forum, and relevant COST Actions.

Workshops will be organised to present the results to a wider audience and to harmonise with other relevant bodies.

F. ECONOMIC DIMENSION

The costs for the Action are estimated as follows:

	Man Years	ECU
MC Work	0.6	36.000 (1)
Research Work	96	5,760.000 (1)
Oper. & Running Costs		640.000 (2)
Commission Coord. Costs		240.000
		————
Total (1994 prices)		6,676,000
Total (1995 prices)		7,343,600 (3)

(1) assuming the average figure for COST countries: 60.000 ECU
12 participating organisations, 2 persons per organisation, 4 years
(2) covering hardware and software tools, particularly for simulation
(3) assuming approx. 10 % increase to estimate figure in 1995

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 254 "Intelligent Processing and facilities for communications terminals"

Date of entry into force of the project : 17.04.1996
Duration : 16.04.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.05.96	29.05.96
GREECE	19.06.96	19.06.96
SPAIN	06.03.96	06.03.96
FRANCE	06.03.96	06.03.96
ITALY	17.04.96	17.04.96
HUNGARY	06.03.96	06.03.96
NORWAY	23.04.96	23.04.96
PORTUGAL	15.05.96	15.05.96
SLOVAKIA	06.03.96	06.03.96
SLOVENIA	23.07.96	23.07.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to gain the know-how to develop and produce new communications terminals for users and networks offering appropriate advanced high performance features.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1.

COST 254

INTELLIGENT PROCESSING AND FACILITIES FOR COMMUNICATIONS TERMINALS

A. GENERAL PRESENTATION

A.1. PRESENTATION OF THE SUBJECT

Modern communications systems and networks will be used for transferring large quantities of information for different categories of user. For this to be possible, each class of user for each type of network must be connected to the information highways via suitable terminals which offer:

- a user-friendly man-machine interface;

- the ability to process and select information in a competent and intelligent manner;

- efficient and practical means of network connection.

These desiderata require a new design for such terminals which goes even beyond the idea of having intelligent units. Signal-processing techniques and their intelligent application, as well as other approaches to information-processing (expert methods, natural techniques and algorithms, etc.), are the most important technologies which will enable applications in this field to be given increased facilities.

However, it would seem impossible to design high-performance terminals meeting all these requirements.

This general approach, which will benefit from previous positive results and even develop more direct approaches, is the most likely to obtain specific advanced results in a short space of time, which constitutes a typical COST action. It should be noted, in any case, that the approach is new (generally speaking) even for some aspects which are already firmly established as subjects for current research effort (e.g. voice recognition, man-machine graphical interfaces, information source and channel coding, information selection and interpretation, information presentation, user-access to systems via terminals, aspects of terminal-to-network connections, etc.: all have points in common with signal processing, upcoming techniques for information systems, etc.).

A.2. PROPOSED ACTIONS

Research efforts over a four-year period which are aimed at defining appropriate communications terminals for each type of network and user will offer opportunities for resolving the problems mentioned above.

These efforts will include:

- defining terminal categories in agreement with their users and the corresponding networks;

- defining each one's characteristics;

- developing an integrated approach to establishing these characteristics within an appropriate architecture, including the development/adaptation/testing of algorithms, processors, etc.;

- implementing (software) prototypes and experimenting with them in real environments,

in accordance with the previously proposed timetable and arrangements.

A.3. EXPECTED BENEFITS

The principal benefit will be the acquisition of innovative know-how of high practical value for developing and producing advanced terminals for European industry; likewise, the spin-offs obtained (new algorithms, software, specific hardware support, etc.) will be of general scientific and technological importance.

It should also be noted that this project can be used for bringing together the practical results of previous research in COST 229.

A.4. IMPORTANCE OF THE COST OPERATIONAL FRAMEWORK

This is important because:

- it is the only forum at European level in which efforts can be deployed to achieve a convergence of fundamental research in the form which has been suggested;

- it is a starting point (COST 229) from which there can be easy consolidation for effective implementation of this research effort from the outset;

- from now on the COST operational framework will make it easier to keep in touch with other European initiatives which are partially related to this proposal.

A.5. RELATIONSHIP WITH OTHER INTERNATIONAL PROGRAMMES

There are points of correspondence with EU programmes, such as ACTS and TELEMATICS, even if the latter are targeted more on network aspects and their demonstration. It is also clear that some areas may be of interest to the European Space Agency and, moreover, that the results obtained may provide features which are of use in ETSI's standardization work.

B. OBJECTIVES

B.1. MAIN OBJECTIVES

As already stated, the aim is to gain the know-how to develop and produce new communications terminals for users and networks offering appropriate advanced high-performance features.

B.2. SECONDARY OBJECTIVES

During the investigations to achieve the main objectives, other discoveries of real scientific and technological importance are bound to emerge:

- new methods, and new algorithms and software;
- new DSPs and new hardware architecture;
- new concepts of terminal organization for efficient processing;
- many elements which can be adapted and applied in other fields (man-machine interfaces, image interpretation, etc., for use in production automation, control systems, etc.).

C. SCIENTIFIC CONTENT

C.1. TIMETABLE OF WORK

*Months 1 to 6: Definition of terminals (TO.O);

*Months 6 to 42: Coordination of the integration of different terminals in view of system requirements (TO.1)

*Months 6 to 30: Development of elements for each type of terminal (T1.1 to TN.1);

*Months 31 to 42: Experimental implementation with selected terminals (T1.2 to TN.2, perhaps with some exceptions between 1 and N)

*Months 1 to 42: Development of common tools (both algorithms and hardware architecture (TN+1)

*Months 43 to 48: Final results and conclusions (TO.2).

Note that the figures 1 to N correspond to the different types of terminal selected for consideration in the conception and design phase; the number is potentially large since there are several approaches for different classes of user (networks: land mobile, satellite mobile, ISDN, optic fibre broadband, ...; users: industrial worker, service-sector worker, OU-type student, etc.; even if it seems reasonable to differentiate between the levels in accordance with multimedia requirements, such as easy or priority access to machines, etc., all of which are, of course, price-related).

C.2. OUTCOME OF STAGES

TO.0:	Classification of terminals
TO.1:	Summary of system-integration aspects for all terminals
T1.1 to TN.1:	Global design for each terminal
T1.2 to TN.2:	Results of experimental phase for each terminal selected
TN+1:	Technical reports and corresponding software together with designation of elements
TO.2:	Final report

C.3. METHODS

As there is both a general aspect and specific work with regard to designing and testing selected terminals, it would be judicious to combine all conference proceedings (2 or 3 times a year, as for COST 229) with the creation of specific groups to work separately on tasks T1.1 to TN.1 and T1.2 to TN.2.

Conference proceedings could also include parallel workshops dealing partly with the work on each terminal, such as general sessions on system-integration aspects and common tools; this would seem the best way of resolving the logistical problems involved.

Similarly, for reasons of economy, documents corresponding to the results of stages TO.0 to 1 and T1.1 to TN.2 will be included as special sections in the proceedings of the conferences (each COST participant will publish its results).

The same will apply for meetings of the MC in coordination with conference proceedings.

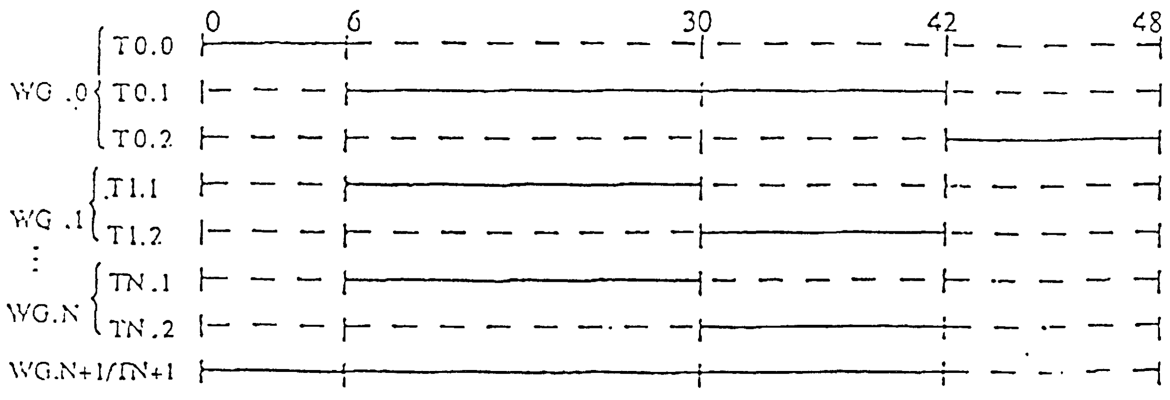
C.4. WORKING GROUPS

WG.0: to deal with TO.0, TO.1 and TO.2
WGs 1 to N: to deal with T1.1&2 and TN.1&2, respectively
WG.N + 1: to deal with TN + 1

It is expected that each participant will participate in WG.O and WG.N + 1, as well as in one or more of WGs 1 to N.

D. <u>TIME CHART</u>

In accordance with the above explanations, the time chart is as follows:



E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

E.1. TASKS AND RESPONSIBILITIES

Given the above ideas, it is clear that the coordination and responsibilities relating to WG.O and WG.N + 1 can be assumed by the Management Committee (MC). The various responsibilities are to be allocated as follows:

- WG.1 to WG.N: will be responsible for both the organization and the specific results of the corresponding work;

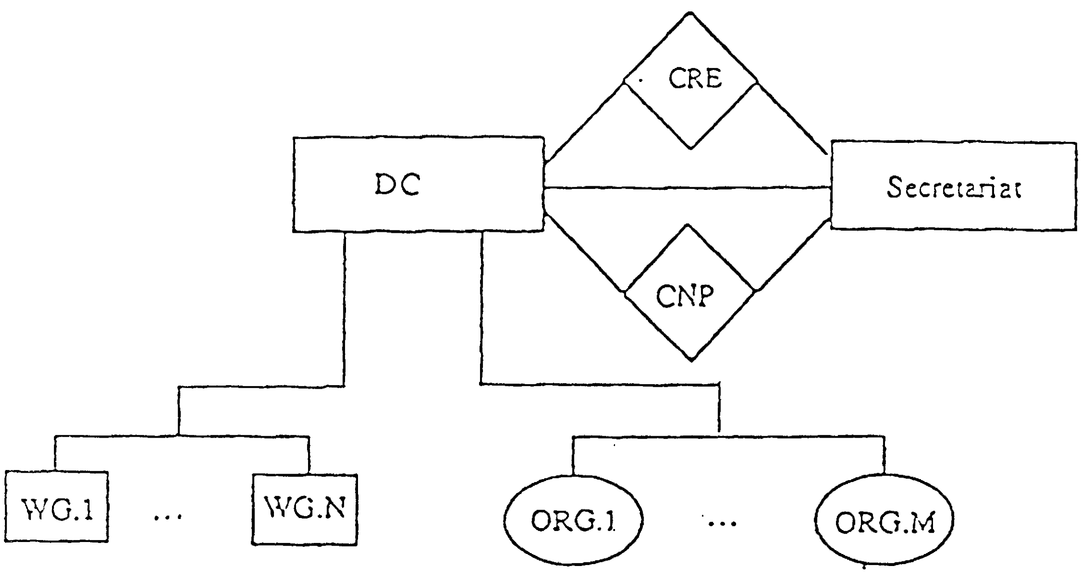
- the organizers of each conference (ORG.1 to ORG.M) will be responsible for the conference and for related local activities.

The tasks and responsibilities for new projects and external relations will be assumed by two further committees (CNP and CRE, respectively).

Needless to say, the Management Committee will manage all these activities with the Secretariat's help.

E.2. ORGANIZATIONAL CHART

As stated above:



F. ECONOMIC ASPECTS

F.1. POTENTIALLY ACTIVE COUNTRIES

Most countries participating in COST 229 have expressed interest in joining this action (if it is approved), viz.:

Belgium, Switzerland, Germany, Spain, France, Hungary, Italy, Norway, Portugal, Poland, Sweden, Slovenia and Slovakia;

giving 13 countries in all, with Greece also interested, having asked to join this new action at the end of COST 229.

Since half the countries will be signing the MOU (7), with 2 participating entities per country, each entity will have the equivalent of

* 1 scientist	ECU 60 000
* 1/2 TECHNICIAN	ECU 20 000
* 2 Ph.D students	ECU 50 000
* 1/5 secretary	ECU 5 000
	ECU 135 000

The cost for 1995 was estimated at approximately
14 x ECU 150 000 = 2 100 000/year, i.e. ECU 8 400 000 for the four years covering the action.

If recurring expenses are estimated at 20% (ECU 1 680 000) and 4 x ECU 60 000 = ECU 240 000 is added for the coordinating committee, the total sum is ECU 10 320 000 (1995 values).

Prepared and presented on 6 February 1995 by:

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Memorandum of Understanding
for the implementation of a European Concerted
Research Action designated as
COST Action 255
"Radiowave Propagation Modelling for
New SatCom Services at Ku-band and Above"

Date of entry into force of the project :	15.02.1996
Duration :	14.02.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.02.96	15.02.96
CZECH REPUBLIC	23.04.96	23.04.96
GERMANY	25.04.96	25.04.96
GREECE	21.02.96	21.02.96
SPAIN	15.02.96	15.02.96
FRANCE	15.02.96	15.02.96
IRELAND	15.02.96	15.02.96
ITALY	07.03.96	07.03.96
HUNGARY	15.04.96	15.04.96
NORWAY	23.04.96	23.04.96
AUSTRIA	10.12.96	10.12.96
PORTUGAL	15.05.96	15.05.96
SLOVAKIA	15.02.96	15.02.96
FINLAND	14.03.96	14.03.96
UNITED KINGDOM	14.03.96	14.03.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to improve the design and planning of present and future telecom systems and services through the development of tools for the evaluation of their performance. To this end knowledge of modelling of propagation effects, mapping climatological parameters and of design and simulation of satellite communication systems will need to be increased.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 5,5 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION 255

A. GENERAL BACKGROUND

Satellite telecommunication services are currently in a phase of rapid development. This poses the telecom community with difficult challenges in order to avoid potential problems with frequency spectrum allocation and interference between services.

New applications and services, from direct TV broadcasting to fixed and mobile voice and data communications using very small aperture terminals or personal communication terminals, face different demands for radiowave propagation prediction to those currently addressed in ITU Recommendations.

The basis for the propagation prediction methods currently applied (e.g. ITU-R Rec PN 618) was developed prior to these new requirements and their validation was done with very little experimental data at frequencies above 15 GHz. The methods are largely empirical and they cannot readily be extended to a different frequency domain. It should also be noted that the ITU-T Recommendations, which define standards for link quality and availability, do not take account of propagation conditions.

Previous, very successful, COST activities (COST 25/4, COST 205 and COST 210) have generated widely referenced results and influenced the work of ITU-R. The outcome of the presently proposed COST Action 255 is expected to have an impact on both, the ITU-R Recommendations on propagation in non-ionized media as well as on the ITU-T Recommendations for new satellite communication systems. The participants in COST 255 will have the advantage of early insight into evolving standards and of impairment mitigation techniques.

Two recent European experimental campaigns, OPEX (using ESA's OLYMPUS SATELLITE) and CEPIT (using the Italian ITALSAT satellite), have provided a very good new set of propagation statistics suited for model development and validation work. In parallel, campaigns such as EUTELSAT'S GECO experiment have yielded good insight into the actual performance of new impairment restoration schemes. It is therefore proposed that COST 255 build on the results of these European research activities. Comparable investigations are currently underway in the USA and Canada (using NASA's ACTS satellite) but they are several years behind equivalent European studies.

Other currently ongoing COST activities have been considered to ensure that best use is being made of existing knowledge and to avoid overlap. (See Section E regarding coordination aspects.)

This project is best carried out within the COST framework for the following reasons:

- the study requires a long-term multi-disciplinary effort involving: electromagnetic theory, atmospheric physics, climatology, propagation modelling, communication theory, coding and modulation schemes, communication service planning as well as novel test and simulation techniques;

- the COST framework provides the best means of harmonizing national research activities in the field in many countries, including Central and Eastern Europe;

- by focusing on a three-year COST activity, timely completion of the work is expected. (Note that the work is to be completed within 3 years, the Final Report should be published within 3,5 years and the MOU should remain in force for 4 years.).

A group of interested parties has defined the core activities of COST 255 as spelled out in Section C below.

B. OBJECTIVES

The main objective of the Action is to improve the design and planning of present and future telecom systems and services through the development of tools for the evaluation of their performance.

To achieve this goal it will be necessary to coordinate European research in the following areas:

(i) modelling of propagation effects in Earth-satellite paths at Ku-band and above;

(ii) mapping climatological and morpho-topographical parameters pertinent to radiowave propagation;

(iii) designing and planning of telecom systems where the satellite system is a segment.

Although primarily directed at radiowave predictions for Earth-space paths, the results are likely to be of value to predictions for terrestrial paths.

C. TECHNICAL PROGRAMME

The three main areas of activity are as indicated in Section B. Scientists and engineers, as experts from the specialist fields of radio-propagation, meteorology and telecom systems engineering, will work in close cooperation and assiduous interaction to achieve the objective of this activity. Only a multi-disciplinary approach will lead to improvement and development of the tools necessary to evaluate the performance and design of present and future telecom systems where the satellite is a component.

To assess the performance of a telecom system in its entirety through (e.g.) simulation, each of its components must be known through its time- and frequency-domain characteristic parameters.

Those parts of the system affected by the atmosphere or by the environment are the ones where present-day knowledge is more sparse or more difficult to characterize as a time-varying wide-band lossy channel. This characterization is necessary to evaluate modulation schemes, access protocols, compensation strategies and overall network system quality and performance. COST Actions 231 and 235 are in the process of providing this information for terrestrial applications; however, for Earth-satellite links this activity has not yet been carried out.

The characteristics of the propagation channel have not only strong dependencies on meteorological conditions, but also, on a larger time and spatial scale, on climatological and morpho-topographical characteristics.

Several satellite experimental campaigns using propagation beacons (e.g. OLYMPUS and ITALSAT) and radiometers have been or are being carried out across europe; however, for their results to bring about a step improvement on the technological know-how and competitiveness of European telecom industry and service providers, a multi-disciplinary approach is necessary to implement these results in system planning tools.

No new experiments are expected except for those that may be necessary in the frame of system testing. These may be carried out using mostly available equipment and satellites.

The first phase of the Action will be to review present-day and expected future telecom systems in the light of their requirements regarding system characterization and its relation to propagation parameters. This activity will be led by system engineering specialists and will be used by the propagation specialists to identify available models, data, tools, software and procedures that may be used to satisfy the requirements, as well as those areas where research and development work will need to concentrate. This phase is expected to last 6 months (see Section D).

Due to the multi-disciplinary nature of the Action, annual workshops will be organized. This form of meeting favours extensive exchange of information between the different groups of specialists and will impose strict deadlines that will favour a timely completion of the Action.

At the end of each annual workshop, the requirements defined in the first phase of the Action will be reviewed and updated so that the targets of the Action are clear at each stage of the work. These requirements, together with other relevant documentation discussed and presented at each workshop will be electronically published in the form of an Annual Report.

It is believed that adopting electronic publishing and an extensive annual review process will minimize the time necessary to produce the Final Report.

In principle, two annual meetings of the Management Committee are planned, with one of them occurring in the same period as the annual workshop. All documents submitted will be electronically published unless otherwise requested by any of the signatories.

The three main topic areas of the present proposal are:

(i) modelling of propagation effects on Earth-satellite paths. The characteristics of the transmission channel must be known in order to design and implement cost-effective telecom systems. In this area prediction models for all propagation effects, as well as their combination, will be developed and validated. The models will cover all the parameters identified in the initial review process led by telecom system specialists – see topic area (iii).

This activity is of particular importance at Ka-band (20 GHz) and higher frequencies, and for low fade margin systems where no commonly agreed models exist.

In all telecom systems, but especially in broadcasting, the variation of the probability of occurrence of propagation events with the hour of the day is of particular importance. New tools to evaluate not only the worst-month margin, but also the return period and the risk of outage for a particular service or link design, are necessary to optimize network resources.

Fade countermeasures may be necessary in particular link configurations. To assess and specify fade countermeasures for different target systems and services, a time- and space-variant model that characterizes the propagation channel needs to be developed. This characterization should cover both fixed and mobile links;

(ii) mapping of climatological and morpho-topographical parameters. Propagation models require input variables that are either of climatological, morphological or topographical nature. Presently available data regarding this area are either difficult to update due to the subjective approach presently used in the update process or exist as single datasets.

The variables to be treated in this activity will be selected after an extensive review process with the active participation from the other two topic areas.

A review of all pertinent data sources, measurement techniques, accuracy and representativeness will be carried out. Algorithms for the assimilation of new data or data from different sources or measuring instruments will be developed in this activity.

Although the mapping of all pertinent variables should concentrate on achieving a high-quality product for Europe, a global approach should be used.

This area of work will also be relevant to terrestrial paths;

(iii) assessing the performance of telecom systems. A review of present and expected future telecom systems and services will be carried out. Requirements in terms of transmission channel characterization will be defined.

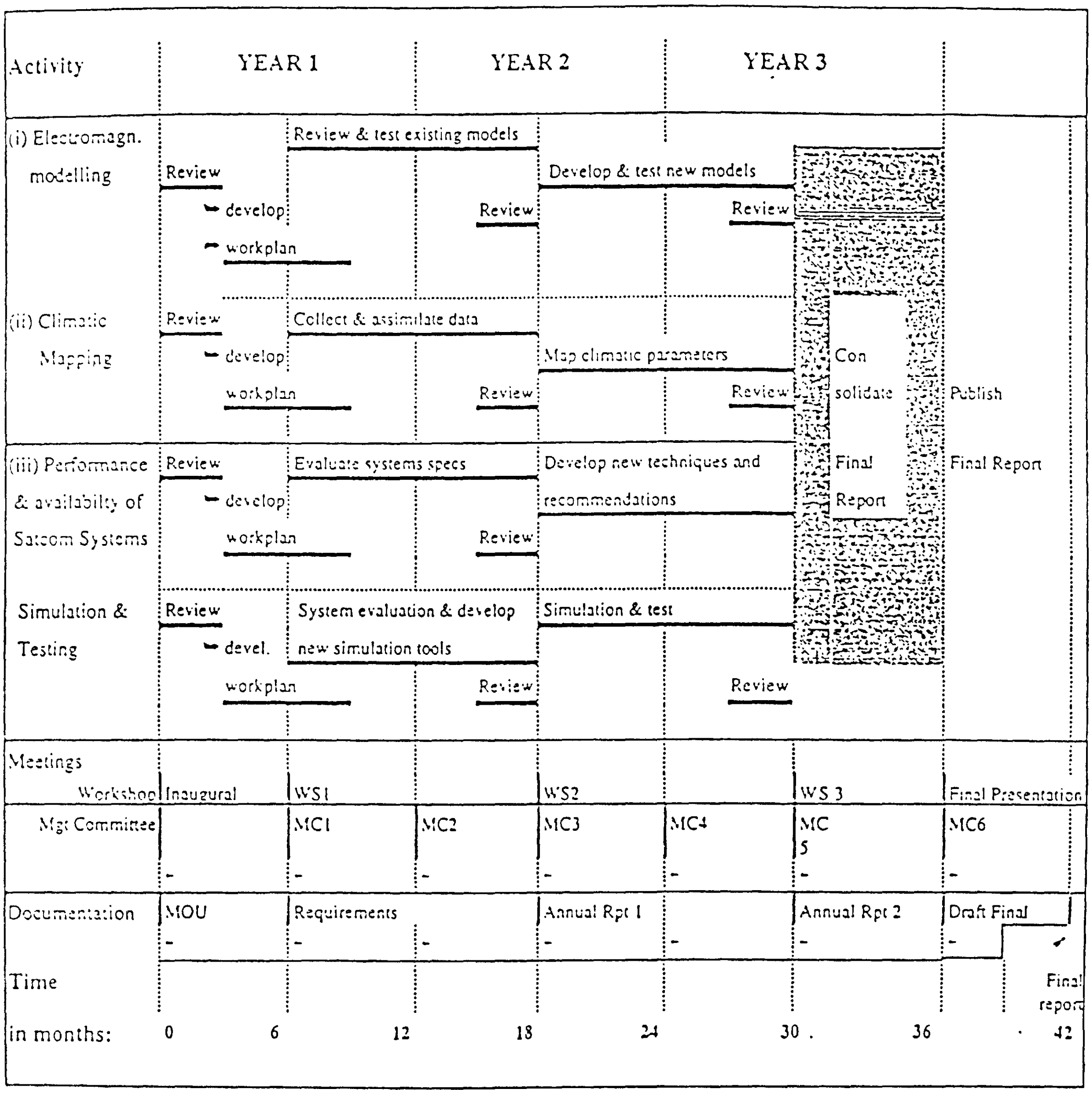
Fixed, mobile and broadcasting satellite systems will be addressed as well as coordination distance, frequency allocation and sharing issues.

The performance and quality of systems and services using different modulation and coding techniques, access protocols and countermeasures will be assessed, and the most effective ones identified. Simulation tools using realistic transmission channel models will be implemented.

Telecom networks comprosing both satellite and terrestrial segments will be evaluated even if only the modelling concerning Earth-satellite paths will be developed in this COST Action.

Conclusions and recommendations regarding systems and their related services will be formulated in terms of their technical characteristics.

D. TIMETABLE



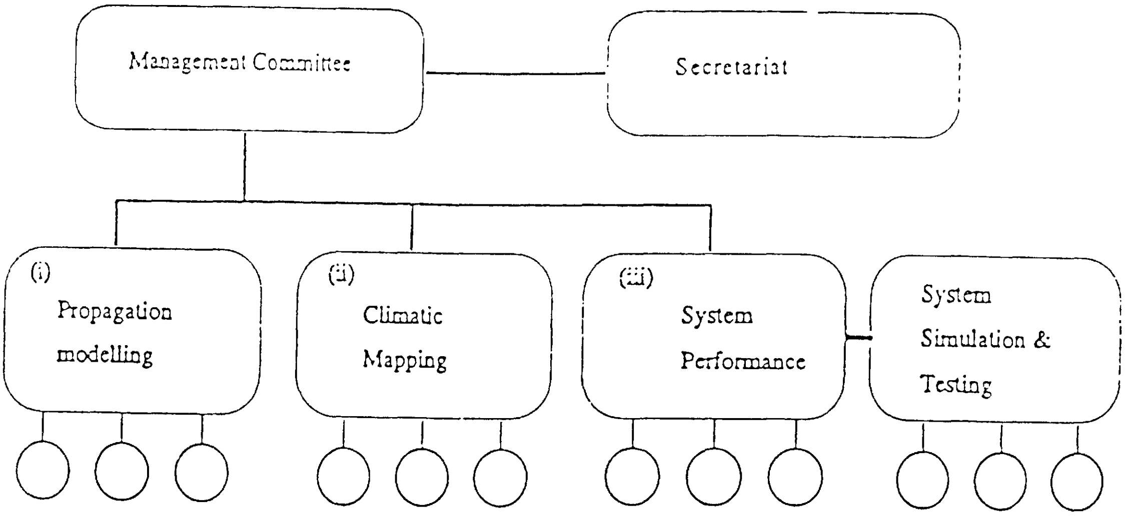
The chart above shows how the programme of work is structured. The total time of the collaborative phase is three years; an additional half year is planned for the publication of the Final Report. In order to allow for unforeseen delays, the MOU should remain in force for a total of 4 years.

E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

The work in the present project will, in principle, be divided among three Working Groups (see organigram below). A part of the "Systems" group will form a "Simulation" subgroup made up of experts in simulation and testing techniques.

The flow of information and interaction will be very high between groups (i) and (ii) while the driving requirements will flow mainly from group (iii) to the other groups.

It is expected that each Working Group will elect a Chairperson to coordinate the work within the group and represent it within the Management Committee.



The Management Committee will elect a Chair- and Vice-Chairperson, and will be responsible for interfacing with other projects (European or international) to make use of already available material and to avoid any overlap or duplication. It is expected that this process will create a close liaison with the following programmes or organizations: EU 4th Framework Programme (in particular COST 227, COST 231, COST 235 and ACTS), ITU and ETSI.

When necessary, the Management Committee may arrange technical meetings, workshops, laboratory visits and staff exchanges, inter-comparison of results between different laboratories or organizations, etc., to achieve a rapid and smooth exchange of information.

Delegates representing Signatories in the Management Committee are expected to:

- attend and contribute to meetings of the Management Committee (two meetings per year are expected);
- be involved in an active programme in line with the objectives and time scale of the Action;
- take responsibility for specific items of the Action;
- seek at least annually the advice of the Technical Committee for Telecommunications (TCT) to achieve a working liaison between the Action and other related COST telecommunication and tele-informatics actions;
- set up national working groups for specific items and be responsible for liaising between the Management Committee and national research groups in the participating countries.

F. ECONOMIC DIMENSION

Estimated number of Signatories: 10

Cost per Signatory per year:

1 year Scientist	ECU 60 000
1 year Technician	ECU 40 000
2 year Student	ECU 50 000
Travel	ECU 10 000
Total	ECU 160 000 (ECU 480 000 over 3 years)

Total over the 3-year life of the Action: ECU 480 000 x 10	=	ECU 4,8 million
+ 10% overhead for running/operational costs	=	ECU 480 000
Total cost to national funds	=	ECU 5,28 million
EU overhead (over 3 years) 3 x ECU 60 000	=	ECU 180 000
Economic dimension	=	ECU 5,46 million

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 256
"Modelling and Simulation Environment for Satellite/Terrestrial Networks"

Date of entry into force of the project : 19.12.1996
Duration : 19.12.2000

Contracting parties	Date of signing	Date of entry into force
SPAIN	19.12.96	19.12.96
FRANCE	19.12.96	19.12.96
IRELAND	19.12.96	19.12.96
TURKEY	18.12.96	18.12.96
UNITED KINGDOM	19.12.96	19.12.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to enhance existing tools as well as to develop new ones supporting the modelling and simulation of advanced emerging terrestrial and satellite networks.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 5,35 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 256

Modelling and Simulation Environment for Satellite/Terrestrial Networks

A. GENERAL BACKGROUND

Simulation plays a very important role in computer-aided modelling and design of communication networks and related systems. Networks typically comprise a variety of equipment types, communication protocols and interfaces. Continuing the work on simulation tools is imperative. It is used for evaluating the comparative performances of alternative designs for new networks and also to predict changes in network performance due to changes in network parameters. So, those tools allow experimentation before incurring the risk of building or modifying a system.

Many problems also have to be investigated that occur when one tries to integrate terrestrial and satellite networks and services. In addition, the success of the ATM Forum is a strong endorsement of ATM as a technology for the future. ATM provides a versatile, multifunctional platform that can support a variety of services and traffic types allowing a dramatic increase in user requirements and service demand for multimedia communication.

It is important to define the cost-efficient and optimal structure of the networks to be built or to be extended in order to exchange all types of information electronically. Information can be voice, video or data. Simulation techniques will play a very important role in support of dealing with these problems; it can help to achieve such a complex task. Tools have also to be developed to help in the correctness and accuracy of modelling.

Very significant effort has recently been achieved in the area of integrating graphical user interface to simulation in order to edit an architecture. A lot of effort is still required to support the integration of other tools. In addition, validation is intensively studied and will be the subject of continuing research.

It may be mentioned that most of the simulation tools widely used in the field of telecommunication do not originate from European countries.

COST 228 is scheduled to finish in January 1996. Since the COST 228 Action has demonstrated the role that simulation plays in the study of satellite and terrestrial networks, it is important that this new action be carried out within the COST system as a follow-up to the COST 228 activities. So, momentum will be maintained in the important area of simulation issues.

The ongoing coordination will enrich cooperation between European States while maintaining and advancing expertise. Many communication projects deal with simulation. Coordination will be maintained with other relevant COST activities including activities in COST 242, COST 247, COST 255 and COST 253. Inputs will be provided to those projects as appropriate.

To decrease the risk of overlapping with other activities this Action is not directly concerned with the simulation of specific systems, but the objective is to develop tools and methodology for a general applicability and reusability.

The contributions from COST 228 concern the following main issues:

- Simulation environment and basic tools. This issue deals with description, comparison and experience about simulation tools. It does not cover either simulation modelling nor simulation experiments. Simulation environments can be built around off-the-shelf "kernels" based on existing tools, or issued from new basic "kernel" developments.

- Modelling, simulation of either mobile communication systems or fixed communication systems.

- Advanced traffic source modelling.

B. OBJECTIVES OF THE ACTION

The main objective aims to enhance existing tools as well as to develop new ones supporting the modelling and simulation of advanced emerging terrestrial and satellite networks.

The following secondary objectives shall be considered:

- Define a general structure of basic models related to the target network components and implement a set of CASE tools to manage those components. Provide satellite network architecture validation using either an expert system or other types of tools. Improve the presentation/post-processing capabilities of the tools dealing with simulation results.

- Enhance the function based methodology previously developed to model protocol entities. Functional description language(s) will be designed to describe protocol entity models with a high level of abstraction.

- Take into account the emerging parallel and distributed simulation technology during the development of new tools.

- Explore different research directions for the reduction of simulation time.

- Enrich the library of reusable network components models dedicated to the terrestrial and satellite networks.

- Define new simulators.

- Develop specific tools to model and simulate very specific aspects of networks not supported by available tools.

C. SCIENTIFIC CONTENT OF THE ACTION

A task shall be assigned to each second objective, from Task 1 (SO1) to Task 7 (SO7).

Task 1

This task can be divided into four sub-tasks. The first sub-task deals with the general structure specification of basic models, with special emphasis on terrestrial and satellite networks. The second sub-task includes the development of a set of CASE tools to edit, verify and compose the models. The third sub-task will focus on validation aspects. Finally, the last sub-task will focus on tools to help a user to improve the presentation of simulation results.

Sub-task 1.1.

The general structure of basic models is related to the network components and has to be modular and take into account the concept of reusability. Indeed, a basic model, which is any communication network component at any level of detail, has to be used in different architectures and under several configurations. It has a set of interfaces, one for its interconnection and the interchange of data flows between entities modelling the various components, the second interface deals with control and measurements, and the third interface is dedicated to the supervision of simulation.

Sub-task 1.2.

Several powerful tools are necessary to facilitate the modelling process and a reduction of the modelling period. Three main tools have to be developed. A basic model editor will be used to model a target network component respecting the general structure which will be defined in sub-task 1.1. The verification of models can also be automated through a verification tool. Finally, more complex models can be built from existing basic models using the composition tool.

Sub-task 1.3.

The main purpose of a simulation environment is the study of terrestrial and satellite network architectures. Modelling these architectures accurately is not simply a case of interconnecting basic models correctly, which is a necessary but not sufficient condition. Consequently, the validation of network architectures becomes an important tool for design and implementation. In order to carry out this task, relations between basic models have to be defined with a high-level of abstraction. The concepts of interpretability, profiles, group and protocol graph will be used to define these relations. On the other hand, validation rules have to be defined in order to build the validation engine. Expert system technology can be used to implement this engine. Tools such as PDT (Protocol Determination Task) and PD (Protocol Discovery) can be used to help the modellers correct invalid architectures.

Sub-task 1.4.

The tools to be developed during this task will help the user to improve presentation of the simulation results and to produce more meaningful results thoroughly depicting the behaviour of simulated architecture. Such tools can be developed over well known and powerful statistical packages (for example SPLUS).

An animation tool can help to observe the movement of data structures and the transfer of data control, leading to a best understanding of the system.

Task 2

Sub-task 2.1.

Functional description language(s) will be designed to describe protocol entity models with a high level of abstraction. High-level language(s) including functional primitives will be designed as a sub-layer above a simulation execution language. The language(s) will be used rapidly to model protocol entities and access methods.

Sub-task 2.2.

A function based methodology was previously developed to model protocol entities and presented in COST 228. It was designed to help the modeller efficiently and rapidly build new protocols designed for the new generation of networks where several services can be provided. These new protocols can be dynamically tailored to the user's requirements. This methodology will be enhanced in several ways and a set of tools has to be developed for its support. The precedence relation and the concept of E-graph will be generalized and other relation types have to be added in order to capture more accurately the interdependence between functions. The main tool which has to be developed is the protocol pattern determination process (PPDP). PPDP will recommend a pattern of a protocol entity based on the modeller requirements which are, for example, the provision of a given service to an application. Of course, the work of this sub-task has to be coordinated closely with the previous sub-task 2.1.

Task 3

The increase in processing power and advances in microelectronics and communications makes possible distributed data and processing, and consequently the emerging parallel and distributed simulation technologies. An argument which encourages us in this direction is the fact that basic models are autonomous processes. They can be executed over parallel processors or several machines.

We will investigate the usage of parallel and distributed simulation technologies in order to reduce the simulation time without losing precision. Indeed, the ability of a simulator to allow a trade-off between simulation time and precision is an important feature.

Task 4

The work to be achieved during this task is related to the reduction of simulation time. Two sub-tasks are to be considered. One task will focus on Reusability and Hybrid Simulation Modelling, while the other will focus on the Reduced Basic Model.

Sub-task 4.1.

The simulation of complex systems may ultimately run into the slowness of the execution. One solution to this problem is to apply hybrid simulation modelling (HSM) techniques simultaneously combining analytical models with event driven simulation models. The HSM techniques were already used for particular situations but reusability was not taken into account.

In order to define more formally HSM, we refer to a classification that distinguishes four classes of HSM by considering four different interaction ways between event simulation and analytical models. Specifically, two of these classes (I and II) include the combination over time of event simulation and analytical solutions either in parallel or through a joint solution procedure. The other two classes (III and IV) consider either a pure analytical or event simulation model of the total system and use, respectively, an event simulation or an analytical solution to represent a portion of the system.

For reusability purpose, the fourth class of HSM has to be studied more thoroughly. Actually, the total system can only be resolved by event simulation with one or several parts modelled analytically.

Sub-task 4.2.

Another issue which remains for further research is how to reuse network components where each component is modelled at different levels of detail. In general, a basic model is detailed so as to reflect its exact behaviour. This approach is necessary to have a model behaviour close to a real behaviour, and to be able to derive accurate measurements from the simulation runs. However, this approach has some drawbacks because of the large size of the code resulting from the description of the detailed basic model (DBM). The main drawbacks are: (i) the simulation is very time consuming, (ii) the code describing a system is, of course, very long because the system is composed of several DBMs, each of them having a long code, (iii) during the simulation run, a large-sized memory is needed, and (iv) the end-user will be submerged with details, so that his editing work will be difficult.

In order to soften the effects of these drawbacks, it is suggested to reduce the DBM code, by eliminating, for example less significant details. Then, the code obtained will be called RBM for Reduced Basic Model. To do this, one is faced with new problems, such as: how can less significant details be chosen? Also during the construction of the system code, the question that arises is: for which component is the DBM required? Similarly, for which one is the RBM sufficient?

Task 5

The enrichment of the library of reusable network components models dedicated to satellite and terrestrial networks is a continuous work which has to take into account developed methodologies and the general structure of basic models.

During this task, we will also investigate the way to integrate components developed under a different simulation environment. This kind of work has been started with a group in COST 228. The group studied simulation aspects combining Satlab and Bones tools (with Bones extensions for features not available in Satlab).

Task 6

With the existing block oriented simulators, simulations of dynamic communication systems, especially with mobile users, or mobile base stations, is very difficult. Indeed, in block oriented simulators, the functionality of models can only be expressed by data-flow graphs. There is neither the opportunity to instantiate block diagrams dynamically during a simulation, nor the possibility to inherit from block diagrams. This task will require a more detailed analysis of the necessity of developing new tools taking into account the requirements and evolution of available tools. It is expected that those new tools will benefit from progress in the field of Object Oriented Programming.

Task 7

This task will investigate specific tools to model and simulate very specific aspects of communication networks not supported by available tools. Generally, those tools will focus on specific issues related to the physical layer of the communication systems (ex: modelling the transmission paths within a multi-cell communication system, ...).

D. TIMETABLE

The planned duration is 4 years.

The sketched schedule is as follows:

Task	Year 1	Year 2	Year 3	Year 4
1				
2				
3				
4				
5				
6				
7				

E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

Within the Action, the activities will rely on close cooperation between members of working groups focusing their effort on specific Tasks and Sub-tasks. Main working groups could organize specific working meetings.

During the Management Committee meetings (3-4 per year), the results will be presented, ideas will be exchanged and the future work will be reassessed and coordinated.

The risk of inefficient overlap with other European programmes is minimized as the Action has to focus on simulation methodology and tools with emphasis on terrestrial and satellite networks.

One of the first tasks of the Management Committee, in concertation with the COST Telecommunication Secretariat is to ensure that sufficient, even informal, contacts are set up with other relevant COST Actions.

F. ECONOMIC DIMENSION OF THE ACTION

The minimum costs for a 4-year period are estimated as follows:

	Man Years	ECU
MC Work	0,6 * 8 = 4,8	288 000 (1)
Research Work	2*4*8* = 64	3 840 000 (1)
Operating and Running Costs		400 000 (2)
Commission Coordination Cost		330 000 (4)
Total (1994 prices)		4 858 000
Total (1995 prices)		5 350 000 (3)

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(1) assuming an average figure for COST countries in 1993 of ECU 60 000 per person/year, eight participating countries, two persons and four years.

(2) covering acquisition costs of hardware and software simulation and statistical analysis tools.

(3) assuming a 10% increase to estimate the figure in 1995.

(4) including cost for external secretariat.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 257
"Impacts of new services on the architecture and performance of broadband networks"

Date of entry into force of the project : 24.09.1996
Duration : 24.09.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
CROATIA	22.11.96	22.11.96
DENMARK	14.11.96	14.11.96
GERMANY	12.09.96	12.09.96
SPAIN	19.09.96	19.09.96
FRANCE	04.12.96	04.12.96
ITALY	24.09.96	24.09.96
HUNGARY	06.09.96	06.09.96
NETHERLANDS	12.09.96	12.09.96
POLAND	13.01.97	13.01.96
SLOVAKIA	15.11.96	15.11.96
FINLAND	05.09.96	05.09.966
UNITED KINGDOM	05.09.96	05.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which the Signatories are fully aware.

2. The main objective of the Action is to improve the design of broadband multiservice switching systems and network architectures by determining optimal traffic control and resource allocation procedures and by evaluating alternative solutions.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 9 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 257

"Impacts of new services on the architecture and performance of broadband networks"

A. Background

Three successive COST Actions (COST 214, COST 224 and COST 242) have, over a ten year period since 1985, successfully fostered cooperation between European researchers in the field of multiservice network performance evaluation and design. A community of experts from the telecommunications industry and increasingly from the universities has been established and has progressed collectively in its understanding of the important traffic related network design issues brought by the new telecommunications technologies. The present MoU lays the basis for the continuing activity of this group in updating its terms of reference and in defining working procedures adapted to the present context.

The last decade has indeed seen extremely rapid evolution in telecommunications giving rise to a wide range of important and difficult network design and performance evaluation problems. Broadband multiservice networks in particular have developed from the early laboratory experiments in asynchronous switching (reported in COST 214) to the European wide ATM service offerings which are beginning to be available today. The issues raised by this evolution range from the definition of adequate traffic controls enabling the network to meet quality of service commitments to the specification of network architecture and the optimization of resource provision.

The COST multiservice network Actions have played a significant role in addressing these issues and solving some of the problems, either directly, through the cooperative research conducted and reported by the Action participants or indirectly, by the influence this activity has had on other groups working in the field, notably in RACE projects and in the standards organizations.

The pace of change presently shows no sign of abating. Indeed, the increasing interest in broadband communications, manifested notably by the activity of the ATM Forum, is leading to a much shorter interval between the definition of a service, protocol or system and its implementation in the network. The definition of the Available Bit Rate service by the ATM Forum, and its acceptance by the ITU for the BISDN, in a time frame of little more than one year is a significant example of this trend. The definition of traffic control procedures and dimensioning rules enabling cost effective provision of ABR service and its integration with other broadband bearer capabilities constitute a difficult challenge to network designers. New broadband teleservices are beginning to emerge as networking possibilities develop. No-one has yet identified the most promising broadband service but the remarkable growth in popularity of the Internet with its multimedia data bases, remotely consultable via the World-Wide Web (WWW), points to a significant potential for integrated voice, video and data communications, if the network will allow it. As broadband networks move into the operational phase there arises the need for an adapted network management capability including performance monitoring and traffic measurement procedures. Personal and terminal mobility and new service facilities offered by the Intelligent Network must also be examined through their impact on broadband network design. Emerging mobile access networks will play an increasingly important role in the design and optimization of broadband wide area networks.

These developments point to the need for continuing effort in the field of broadband multiservice network performance evaluation and design. While other European projects, in the ACTS framework and in Eurescom, will address specific broadband communications issues including some teletraffic and network design aspects, COST provides a unique opportunity for experts in this specialized field to meet together and confront their ideas over the spectrum of design issues. Experience has shown that a "critical mass" is necessary to achieve progress in understanding the most significant issues and to avoid wasting research effort in "blind alleys". The joint participation in the Action of industry and university researchers is a particularly valuable vehicle for exchange and is an assurance that the most advanced theoretical techniques are applied to important practical problems. The Action primarily constitutes a forum for pre-competitive research. However, the ultimate aim is to provide input to European telecommunications operators and manufacturers enabling them to produce cost effective networking solutions for the provision of advanced telecommunications services.

B. Objectives and benefits

The main objective of the Action is to improve the design of broadband multiservice switching systems and network architectures by determining optimal traffic control and resource allocation procedures and by evaluating alternative solutions.

To achieve this objective the Action will provide solutions to network design and performance evaluation problems in the form of mathematical models, computer tools or optimization algorithms together with quantified evaluations wherever appropriate.

A secondary objective is to identify the potential impacts on network architecture ano operation of different possible implementations of the new telecommunications services.

In addition to its direct influence on broadband network design, it is anticipated that COST 257 will further reinforce the strength of European networking research by providing a propitious environment for exchange and emulation.

C. Scientific programme

The following is a non-exhaustive list of topics identified as appropriate for research:

- development of queuing models to evaluate end-to-end performance in broadband multiservice networks, including mobile access network technology;

- investigation of traffic control and resource allocation strategies for new services considering notably the relationships between traffic description parameters, admission control procedures and quality of service objectives;

- considerations of network design and routing strategies for broadband multiservice networks exploiting the flexibility of the virtual path and virtual connection concepts;

- performance evaluation of proposed interfaces between fixed and mobile networks;

- performance evaluation of proposed broadband mobile access networks;

- comparative evaluation of different service classes (DBR, SBR, ABR, ABT, ...) used for handling specific user services;

- evaluation of traffic measurement methods and their use in broadband networks;

- network interconnection and access networks.

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

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

- Problem definition – specific performance and network design problems will be identified and accepted as PRP by the Management Committee;

- Solutions to accepted tasks of a PRP will be sought in the form of mathematical models, computer tools or optimization algorithms with quantified evaluations wherever appropriate;

- Applications of the solutions will be sought in 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 Actions 224 and 242), and others may not be identified until late in the Action. The Action 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 and identify additional points of interest to adapt the scope during the course of the Action.

D. Organization and timetable

The Action is planned to last for four years. During this period research results will be presented to the Management Committee at its meetings, approximately three times a year, and if decided appropriate at annual/bi-annual seminars. Such seminars will be opened to a wider participation of experts invited by the Management Committee.

The scope of the Action is necessarily wide. To encourage cooperation and to avoid too much dispersion of research effort, the Management Committee will, as necessary, identify a number of Priority Research Poles or PRP. Each PRP is intended to be a homogeneous grouping of research subjects to be defined by the Management Committee who will determine both the content and the resources (notably manpower) necessary for its execution. The execution of a PRP here implies the following:

- a PRP typically reflects an actual topic area considered to be important from practical or theoretical viewpoints, which has potential impacts on the actual or upcoming network design process;

- the Management Committee may assign a rapporteur to follow and to coordinate research work concerning a PRP. The rapporteur will organize a session of talks on the RPR in designated Management Committee meetings to facilitate discussion and show progress;

- tasks in a PRP may be executed by individual participants or by *ad hoc* working groups formed by several participants; in the latter case, Signatories should facilitate the organization of any necessary meetings;

- at an appropriate stage, the work performed in a PRP may be collected and published as an interim report of the Action.

Insofar 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.

The Management Committee is responsible for facilitating discussion between members on the subjects of the entire Action. To do so, the Management Committee could, when necessary, reconsider the working mode and methods and, for example, assign subgroups to prevent the audience of technical discussions from exceeding a critical size.

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

- be involved in an active programme fitting in with the objective and time scale of the Action;

- take responsibility for specific items of the Action;

- seek at least annually the advice of the Technical Committee Telecommunications (TCT) to achieve a working liaison between the Action and other related COST telecommunicatons and tele-informatics Actions;

- set up national working groups for specific items;

- be responsible for liaising between the Management Committee and national research groups in the participating countries.

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

E. Economic dimension

National experts participating in the meetings of Action COST 242 have all expressed the wish to continue their collaboration in COST 257. These experts represent the following countries:

Belgium	Switzerland	Croatia	Germany
Denmark	Spain	France	Hungary
Italy	Norway	Netherlands	Poland
Sweden	United Kingdom		

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

1) Work of the Committee	0,5 man years	50 000 ECU
2) Initial research work	2,0 man years	200 000 ECU
3) Coordinated research work	3,0 man years	300 000 ECU
4) Travel expenses		50 000 ECU
TOTAL	5,5 man years	600 000 ECU

No specific equipment purchases are necessary for this Action although it is expected that participants will dispose of general purpose computer equipment.

The overall cost of the activities carried out under the Action assuming 14 signatories is estimated at approximately ECU 9 million.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 258
"The Naturalness of Synthetic Speech"

Date of entry into force of the project :	10.12.1996
Duration :	10.12.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
CZECH REPUBLIC	10.12.96	10.12.96
DENMARK	10.12.96	10.12.96
GERMANY	09.01.97	09.01.97
SPAIN	10.12.96	10.12.96
FRANCE	10.12.96	10.12.96
NETHERLANDS	19.12.96	19.12.96
FINLAND	19.12.96	19.12.96
UNITED KINGDOM	10.12.96	10.12.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which the Signatories are fully aware.

2. The main objective of the Action is to improve the naturalness of computer generated speech in the areas of sound quality and prosodics.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 3,2 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 258

"The Naturalness of Synthetic Speech"

A. Background

Speech synthesis is potentially useful in a large number of industrial and private applications. Examples are the transmission of continuously changing information over voice lines (train and plane schedules, bank account, currency and stock quotations, etc.), voice conversion of text documents or OCR's telefax messages, voice-based database queries (inventory queries, product ordering, etc.), or messages given to car drivers or airline pilots by teleguiding systems. The concrete uses range from businessmen retrieving fax or e-mail messages from remote locations without specialized equipment, to salesmen checking whether a given product is in stock without recourse to a terminal, and to individuals verifying their current bank account balance by telephone.

Such concrete applications place high demands upon the quality of vocal transmission. For example, communication is often rendered more difficult, and demands upon the quality of voice transmission are often increased, when communicating from public phone booths or mobile telephones. Also, special demands upon such systems are made by the large number of non-native language speakers in most European countries, or by the relatively great percentage of persons who suffer from various degrees of hearing loss.

Current medium- to high quality speech synthesis systems for European languages are not yet fully adapted to such demanding transmission requirements. Much current interest thus focuses on improvements in the basic design of speech synthesis systems, improvements that is expected to lead to an increased "naturalness" of synthetic speech. These are modifications that permit systems to be (just like human speakers) adapted to specific types of transmission, or to particular communicative difficulties. For example, a list of numbers such as stock market quotations requires a different style of reading than the reciting of an electronic mail text. Or a transmission under noisy conditions requires a slower and more deliberate reading of numbers than a transmission in quiet environments. Furthermore, the sound source must closely approximate the quality of a human voice – a requirement that is not yet satisfied for the generality of European languages.

COST Action 258 builds upon the successful experience of the COST 233 Action ("Prosodics of Synthetic Speech") and proposes a somewhat enlarged range of studies that address the core issue of naturalness in synthetic speech in concrete applications. The proposed themes can be grouped into two major areas of concern, improvements in sound quality, and adaptations in the prosody of speech.

1. Improvements of the Sound Quality of Speech

   The generation of a speech waveform that very closely approximates that of a human voice poses problems related to both design and execution.

   At the initial design level, choices must be made concerning the type of voice employed for a given transmission task. For example, a voice with relatively low frequency characteristics may sound pleasant and easy to understand under laboratory conditions, but may be ill adapted to telephone transmission, which favours higher sound frequencies.

At the execution level, the essential problem concerns the concatenation and co-articulatory (contextual) integration of the component linguistic or phonetic elements. Much progress has been made during the last ten years in defining how such elements are to be selected and chained together using a variety of technologies, particularly in the concatenative approach. However, much work is still needed to generalize these improvements to other approaches and other European languages.

Furthermore, a number of potential participants of the COST 258 Action wish to explore new technologies of speech sound generation, such as improved LPC synthesis or highly structured parameter-control formant synthesis. This latter approach offers a number of advantages over the more traditional, concatenative approach, notably an ease of manipulation in changing the voice characteristics of the synthetic sound source. This permits considerably wider latitude in examining the precise relationship between voice quality and ease of understanding in a variety of concrete applications.

2. Improvement of the Prosodics of Speech

During the period of operation of the COST 233 Action, progress has been made by many participants in the determination and implementation of the prosodic features of synthetic speech. Prosodic features include changes in information, stress or accent, the timing of segmental, syllabic and phrase-level elements, as well as manipulation of voice intensity.

Most work has so far concentrated on the reading aloud of small texts or dialogues. However, applications involving lists of text items or sets of numbers in a variety of transmission environments require a wider range of prosodic features than do texts and dialogues produced in laboratory conditions. Also previous work, performed both inside and beyond the COST 233 Action, has largely left aside the question of semantic focus, i.e., which element in an utterance is to be considered to be the most important. The COST Action 258 wishes to address some of these issues.

Specific concerns than can be addressed in this context include: the examination of speech rate for optimal transmission of short text elements of varying complexity (numbers, product names, geographic locations, etc.), the determination of semantic focus in different types of text, and the syntactic and lexical determinants of word grouping ("phrasing") in the reading aloud of lists and texts.

B. Objectives and benefits

The overall objective of the project is to improve the naturalness of computer generated speech in the areas of sound quality and prosodics. For each language represented in the Action, improvements will be pursued in the naturalness of styles of speech used in typical telecommunications applications. Such improvement can be expected to lead to greater usefulness of speech synthesis in a large number of concrete telecommunications applications.

C. Technical programme

Research results and experiences are to be shared with respect to some or all of the following areas which impinge directly on the naturalness of speech:

- the examination of improvements in sound quality within a variety of approaches, such as the concatenative, LPC, parameter control synthesis, etc. approach,

- the examination of the relationship between synthetic voice/sound characteristics and ease of perception under a variety of communicative conditions,

- the examination of optimal speech rate and other timing phenomena in the transmission of synthesized elements of varying length and complexity,

- the examination of syntactic and lexical determinants of word grouping ("phrasing") in the synthetic generation of lists and texts,

- the examination of determinants of semantic focus in synthesized texts.

In support of research in this area, some of the following concrete actions may be undertaken:

- the identification of source speech material, analysis and development tools, as well as evaluation procedures,

- the development of prototype systems,

- the evaluation of communicative transmission capacities of prototype systems with different types of materials to be transmitted, different levels of listener limitation, etc.

The output of the research projects can be expected to contribute to the dissemination of knowledge in the following topic areas:

- optimal storage and selection techniques in concatenative speech synthesis systems,

- processing techniques in speech synthesis systems based on parameter control,

- sound quality and prosodic adaptations required for communicative efficiency in non-optimal speech synthesis transmission environments.

- determinants of optimal prosodic phrasing in typical large-scale applications of speech synthesis,

- methods for determining and transmitting semantic focus in synthesized text of varying complexity and structure.

D. Organization and timetable

The Action is scheduled to cover four years. At its initial meeting, the Management Committee will establish a timetable for meeting the Action's objectives in terms of the competences by the actual participants, and with respect to each major area of investigation.

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

- attend and contribute to meetings of the Management Committee: usually two to four meetings annually,

- be involved in an active research programme fitting in with the objective and timescale of the project,

- if appropriate, set up national working groups for specific questions,

- be responsible for liaison between the Management Committee and potentially existing national research groups in the participating countries.

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.

E. Economic dimension

By the beginning of April 1996, eleven countries had manifested their definite interest in participating in COST 258: Austria, Belgium, Czech Republic, Denmark, Finland, France, Portugal, Slovenia, Switzerland, Sweden and United Kingdom. The participation of three further countries (Germany, Norway and Spain) is possible, but not yet assured.

To calculate the economic dimensions of this project, the probable participants were asked to provide the following information for their country:

(a) number of full-time and part-time personnel working in areas related to COST 258, and

(b) industrial interests likely to be interested and/or capable of profiting from COST 258 activities.

While keeping in mind that employment estimates fluctuate and are difficult to establish with definiteness, particularly with respect to the larger countries, it was estimated that about 75 European scientists work in this area full-time and some 180 part-time. A total of 14 major enterprises (mostly major telecommunications firms) and 17 small or medium-sized enterprises were named.

Work on speech synthesis represents clearly an active area of interest in Europe today. Furthermore, the expected participation of 11-14 countries and some 30 laboratories is indicative of interest in the specific topics to be treated in COST 258.

The Action requires participation from laboratories already working within the area of speech research and having ongoing projects within the area of synthetic speech. The resources for taking part in this Action should represent at least one man year of a scientist, or 1-2 man years of a technician. That means, in principle, a cost of 60k ECU per year. The running/operational costs are 10k ECU/year.

The estimated travelling costs for the Action will be 100k ECU/year (assuming 10 Signatories).

With a four year project and ten participating countries (COST 233 status), this means a total investment of ECU 3,2 million invested in directly related research.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 259
"Wireless Flexible Personalized Communications"

Date of entry into force of the project : 10.12.1996
Duration : 10.12.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	04.12.96	04.12.96
DENMARK	27.11.96	27.11.96
GREECE	29.11.96	29.11.96
FRANCE	10.12.96	10.12.96
AUSTRIA	10.12.96	10.12.96
FINLAND	09.01.97	09.01.96
UNITED KINGDOM	27.11.96	27.11.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to increase the knowledge of radio system aspects for flexible personalized communications, capable of delivering different services exploiting different bandwidths, and to develop new modelling techniques and related planning tools, in order to guarantee the continuity (and quality) of service, delivered by networks of widely different capabilities and structures, across a number of different environments.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 17,7 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of three years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION OF THE ACTION

COST Action 259

"Wireless Flexible Personalized Communications"

A. General Background

Mobile communications are evolving from second generation incompatible systems towards the third generation ones, capable of accommodating a variety of services (from voice and data to video and multimedia) tailored to the customer's needs, in different environments (from macro-cells in rural areas to pico-cells, typical of in-building coverage), at different bit rates, according to the acknowledged concept of bandwidth on demand. Therefore, Personal is becoming increasingly Personalized, through the unique opportunities offered by the radio communication emerging technologies and the related advanced service provision capabilities. Such novel applications face demands for radio system aspects, network aspects, propagation issues, diversity countermeasures to the impairments experienced by the transmission channel, channel allocation strategies and planning tools, different to those addressed in the previous, very successful, COST Action 207 that significantly contributed to the development of GSM specifications. The follow-on Project COST Action 231 that is being finished after a three year extension, has concentrated on second (GSM, DCS@1800, DECT) and third generation systems (UMTS), with only a small Working-Group considering fourth generation systems with transmission rates in excess of 2 Mbit/s and providing bandwidth on demand.

This area will become the main focus of mobile radio research over the next five years and will form the central theme of the follow-on Action. COST 231 was also active in establishing and fostering relationships and cross-fertilization with several Radio Equipment & Systems (ETSI/RES) Groups, RACE Projects and the ITU-Radiocommunication Sector at the international level. The outcome of the presently proposed COST Action 259 is expected to have a similar impact, at the European and the international level as its forerunners, in the evolution of standards towards Personal Communication Services, characterized by a full exploitation of all the mobility aspects and by an increased flexibility.

The title of the Action tries to summarize these objectives, according to the following rationale:

- wireless, to account for both Access Mobility (not only related to mobile communications, but also in terms of Wireless Local Loop, in an increasing perspective of convergence between mobile and WLL technologies), and Terminal Mobility, already provided by current cellular systems;

- flexible, to account for the progressive migration towards third generation systems (UMTS) and their merging into the fourth generation one, in a vision that encompasses a number of services, provided at different bit rates (according to the user's demand) in different bandwidths;

- personalized, to stress the concept of Personal Mobility, which is the main feature of the Universal Personal Communications (UPT), in a multi-service perspective, capable to provide a wide range of user applications.

Other currently ongoing COST activities have been examined, in order to avoid any potential overlap and possibly increase the synergistic aspects. Furthermore, also EU funded Projects (ACTS, for example) have been carefully considered, to find commonalities and point out potential integration aspects, taking into account the short-medium term goals of ACTS Projects on one side, and on the other side the spirit of COST Actions, that, although committed to medium-long term research perspectives, have to maintain the necessary (and fruitful) relationships with the activities currently in progress within other bodies. At the same time all potential contributions to standardization bodies, at European (ETSI) and international level (ITU) have been examined (see Section E regarding coordination aspects for further details).

This project is best carried out within COST framework for the following reasons:

- the study requires long-term, multi-disciplinary efforts, involving: radio access technology, propagation modelling, communication theory, coding and modulation schemes, network and protocols aspects, knowledge of planning tool applications, as well as novel test and simulation processes;

- the COST framework, as clearly demonstrated in the past (thanks to its typical bottom-up approach), facilitates a remarkable harmonization of national research activities.

B. Objectives and benefits

The main objective of the Action is to increase the knowledge of radio system aspects for flexible personalized communications, capable of delivering different services, exploiting different bandwidths, and to develop new modelling techniques and related planning tools, in order to guarantee the continuity (and quality) of services, delivered by networks of widely different capabilities and structures, across a number of different environments. Furthermore, in the perspective of a fast evolving demand for interfacing the photonic (glassfibre) network with the wireless network, investigations on the mutual interactions could be carried out, as well. In fact, in the medium/long term scenario envisaged for Telecommunications by the European Commission, the time period 2000 – 2005 would be characterized by the emergence of PCS, with a full integration of user mobility, the Integrated Broadband Communications (IBC) network and the Intelligent Network(s), followed by the Photonic Network implementation at all levels (regional, national and international). In such an environment, the proposed new Action intends to play, in connection with the progressive deployment of the Universal Mobile Telecommunications System (UMTS) and the Mobile Broadband System (MBS), the role performed in the past by:

COST Action 207, in connection with the development of GSM;

COST Action 231, in connection with the deployment of DCS@1800 and the development of UMTS.

The activities will have a significant impact in terms of basic Research & Development and degree of innovation for the Signatories and the whole mobile communications community, with particular reference to the specification bodies. In addition, the typical benefits of a multi-disciplinary work should be experienced, involving a number of expected participating countries and institutions (including Central and Eastern Europe), at least equal to those currently active in COST Action 231. As a secondary but not negligible effect, the support to standardization bodies from a large community of researchers would provide further stimulations of the personal communication market growth, taking into account the impact of technologies on the life of citizens of the Member States, as well as their needs and the economical effects of such technologies.

C. Scientific programme

The above objectives will be reached by coordinating the Signatories research in several areas, which cover the above main process:

(i) Radio System aspects, including study on advanced access schemes, bandwidth on demand, equalization, interference limitation.

(ii) Network aspects, in terms of investigations on spectrum efficiency, identification of channel allocation strategies, study of efficient protocols for high data rates and distributed networks.

(iii) Propagation studies and simulations, using novel promising approaches and the development of models for a sound characterization of the short range communications radio channel (micro- and pico-cellular environments), together with concurrent validation measurements campaigns.

(iv) Research on intelligent/adaptive antennas, with particular attention on the possible diversity countermeasures they are able to offer and their influence on network planning activities.

(v) Advanced planning tools for a variety of environments, including strategies for optimized frequency assignments.

Work will be carried out according to the following tentative list of Tasks (and/or Sub-Tasks), by imposing well defined deadlines, to facilitate a timely completion of the Action itself:

TASK 1 - RADIO SYSTEM ASPECTS

The activities may be grouped as follows:

- Researches on Access Schemes, such as JD (Joint Detection)-CDMA, Slow Frequency Hopping-CDMA, CTDMA (to be considered as a sort of merging of Advanced TDMA schemes into CDMA), Multi-Carrier techniques, in a vision that ensures a progressive and smooth migration from second generation (GSM) to future generation systems; OFDM in particular, seems to be suitable for applications in distributed networks, where an efficient use of non-linear amplifiers is needed, leading to significant out-of-band radiation with non-constant envelope signals;

- Studies on flexible rates (bandwidth on demand): UMTS/MBS/WLANs should be characterized by high transport capacity at various data rates, in order to accommodate a multitude of different customized (personalized) services in different environments;

- Interference limitation studies, aimed at enhancing system performance, using "ad-hoc" interference limitation and power control techniques;

- Channel Equalization: considering that the HIPERLAN (HIgh PErformance Radio LAN) standard has adopted a constant envelope (GMSK) modulation which at 23.6 Mbit/s requires an equalizer for the indoor radio channel, research will be carried out on more efficient equalizer structures for higher order modulations.

The above studies will focus on (but not be limited to) mobile applications, in that also other potentially fast growing sectors will be properly examined, such as the radio in the local loop, in the perspective of a progressive convergence of wireless access technology and mobile radio.

TASK 2 - <u>PROPAGATION</u>

Several topics will be examined from both theoretical and experimental standpoints:

- New modelling approaches for UHF and microwave bands, based on the direct solution (using fast computing parallel machines) of Maxwell's equations (for example, the Finite Elements Method (FEM), the Finite Differences in the Frequency or Time Domain Method (FD or FD-TD), the Transmission Line Matrix Method (TLM));

- As spectrum at 5.2 GHz, 17.2 GHz and at 40 and 60 GHz has been allocated by CEPT to HIPERLAN and MBS, models will be studied for short range communications in the high microwave and millimetre-wave bands (microcellular and in-building coverage, penetration losses, tree effects, influence of obstructions and car traffic, etc.);

- Comparisons between the effectiveness in different situations between empirical/statistical and electromagnetic/deterministic models (ray tracing);

- Measurements will be performed, to validate the models, using ad-hoc channel sounders, and to get statistics on wideband parameters to be used for system simulations; this will allow the addition of new features that might improve significantly the efficiency of the computations, while retaining the required accuracy.

TASK 3 - <u>ANTENNAS</u>

Several topics will be examined:

- Studies on the effects of the surrounding environment on base station antenna radiation pattern (masts, poles, walls, etc.);

- Investigation about intelligent (smart) and adaptive Base Station antennas (in terms of their capability of suppression of interferences, pattern reconfigurability, dual polarization, etc.);

- Investigation on the possibility of using fiberoptic technologies for antenna feeding purposes in the mm-wave band;

- Macro and micro diversity techniques, with particular attention to space diversity (detection of angles of arrival of multipath components) and polarization diversity (orthogonal, slant), in order to optimize the link performance;

- Feasibility of various kinds of combined analog/digital beamforming networks for high bit rate transmissions, as it is expected that even very fast ASIC's will not be able to perform the digital processing required to follow high bandwidths in real time; therefore, an optimal distribution between analog and digital parts should be investigated in detail.

For convenience, this Task could be merged with Task 2 into a unified Task on Propagation & Antennas.

TASK 4 - NETWORK ASPECTS

This task will concentrate on the following topics:

- Spectrum efficiency and compatibility (frequency sharing with fixed services);

- Channel allocation strategies (Fixed and/or Dynamic), best suited to the network and the operating environment;

- Studies on efficient protocols for high data rates and for voice and video integration (multimedia), with specific reference to the opportunities offered by ATM access and IBC (Integrated Broadband Communications);

- Studies on the interconnecting potential and mutual relations between radio and glass fibre networks;

- Distributed Networks: in cases where no central controlling node exists, protocols must be designed to support distributed networks; this research area is at a very early stage of its development, with the two WLAN standards so far adopting protocols which are known to be inefficient in the presence of hidden nodes.

TASK 5 - MEASUREMENT ERRORS

This task (which can be considered a Sub-Task of previous Task 2 with direct liaisons with Task 1 too), will examine some topics of paramount importance, that usually are not fully taken into account in the planning process of a mobile communication system:

- Analysis of the most usual measurement techniques (Field Strength, Echo Delay Profiles, Scattering Functions, Bit Error Ratios, Frame Errors, System Quality, etc.);

- Studies on the impact of the measurements on prediction and planning tools, with the goal to evaluate what share of the discrepancies found can be due to the models and what can be due to measurement uncertainties.

TASK 6 - PLANNING TOOLS

The task will focus on:

- Definition of what actual propagation parameters are needed as an input for a planning tool;

- Studies on the impact of territorial data bases on outdoor/indoor propagation models performance, in terms of data type, format (raster, vectorial), and resolution (surface and vertical);

- Assessment of tools for cellular, micro- and pico-cellular coverage, and coverage of special ambients; these topics will be in particular addressed for systems working at the microwave and millimetre wave bands, taking into account that for future systems non-uniformity of traffic distributions and traffic capacity considerations in most cases will impose restrictions to cell planning, more than propagation constraints themselves;

- Network optimization algorithms by minimization of mutual interferences;

- Frequency assignments strategies, according to the service (or system) under consideration (re-use pattern, free allocation, underlay and overlay structures, etc.);

- Development of an advanced prototype planning tool (or a systematic planning method), capable of coping with the various different network and environmental situations.

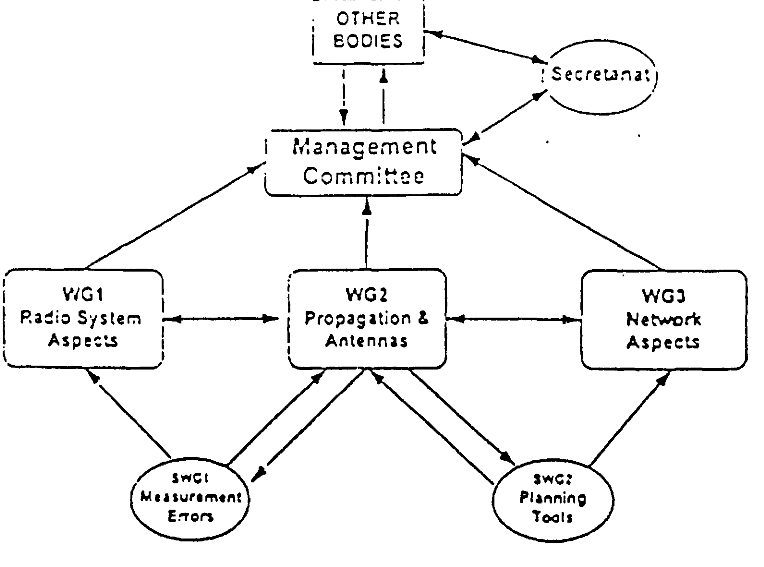
This Task may be considered as a Sub-Task of Task 2, with direct liaisons with Task 3 too.

D. Organization and timetable

D.1 Organization

The work previously outlined will be split in principle into three Working Groups, according to the block diagram reported below.

Action Organization



Researchers from universities, and engineers coming from operators, manufacturers and research bodies are expected to work in close cooperation with mutual and continuous exchange of information. The information flow and direct interaction between the Groups is expected to be very high; however, it is also foreseen that Sub-Groups dealing with Measurement Errors and Planning Tools would provide straightforward inputs to the Groups dealing with Radio System Aspects and Network Aspects, in addition to Propagation & Antennas Group; the final driving requirements will then flow mainly from these Groups to the Group in charge of Networks Aspects.

Short term missions are envisaged, to encourage the exchange of researchers between laboratories and a subsequent wider dissemination of the results, as well as workshops, to be arranged with invited speakers working in the various fields of interest to the Action and active participation to seminar and conferences, in order to increase the number of external reactions to the ideas, suggestions and proposals originated within the Action.

It is expected that each Working Group will elect a Chairperson to coordinate the work within the Group, to ensure the exchange of information with the other Groups and to the whole Management Committee.

The Management Committee will elect a Chair- and Vice-Chairperson, and will be responsible for the interactions with other European or International Bodies, for the mutual transfer of information and exchange of relevant documentation (or any available material, on specific request). It is expected that the Action will establish and foster close liaisons with the following institutions, Projects and Organizations:

- COST Actions 244BIS, 252, 255, 256, 257 and with the EU 4th Framework Programme, with particular reference to the following ACTS Projects: MOMENTS, MEDIAN, WAND, MultiPort, MUSIST, EXODUS, RAINBOW, STORMS, TSUNAMI II, BROADBAND, MICC, FRAMES, MOSTRAIN; in addition a liaison is envisaged with HPCN (High Performance Computing Networks), as defined by DG III within the Information Technologies Programme.

- ITU-R (SG 1, SG 3, SG 8 and directly TG 8/1)

- ETSI (RES2, RES3, RES10, SMG2, SMG5) and NA7 on UPT.

As already mentioned, the Management Committee may arrange, when required, technical workshops and seminars, visits to laboratories, staff exchanges, inter-working between different institutions participating in the Action, in order to speed up the development of some particular technical matter.

Delegates representing Signatories in the Management Committee are expected to:

- attend and actively contribute to meetings of the Management Committee (three meetings per year on average are foreseen, one in conjunction with a workshop), according to the objectives and milestones of the Action;

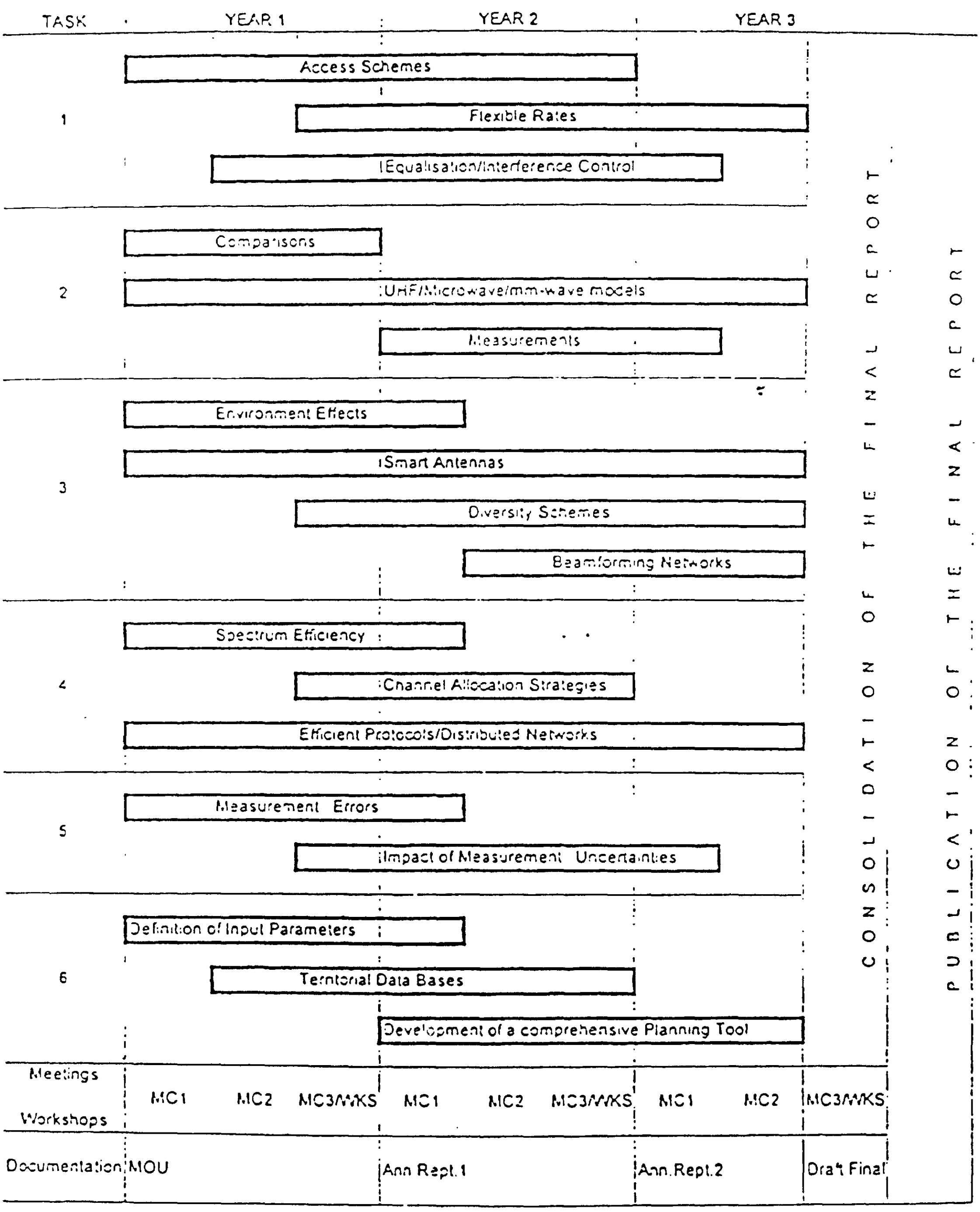
- take responsibility for specific items of the Action, when required, and act as liaisons/rapporteurs with the national research groups in their own country;

- achieve working liaisons between the Action and other related COST Telecommunication and Information Science Actions, according to the recommendations of the Technical Committee of Telecommunications (TCT).

D.2 Timetable

A bar-chart showing the time implications of the various activities outlined in Tasks 1 to 6 and the related expected outputs/results is reported in the following.

Timetable



Due to the nature of the Action, annual workshops will be organized; as usual, the Chairperson will take care of the preparation of the Annual Reports. It is in the proposers' mind to have all documentation available in electronic form for easy distribution and transmission to other bodies. Moreover, all the technical temporary documents could be in principle (subject to the approval of the interested Signatory) put in the WWW for world-wide dissemination; this requires the establishment of a site in the WWW for the Action (the experience of previous COST Actions in this respect will be of great help).

The envisaged three-year activity would produce significant results, to be summarized in the Final Report which the proposers consider should be published as a book by an external publisher (as it is being done for COST 231 Action), in order to achieve a wide dissemination of results, just before the start of FPLMTS/UMTS services, expected at the turn of the century.

E. Economic dimension

The 20 COST Countries involved in COST 231 have actively participated in the preparation of the Action, or otherwise indicated their interest.

Estimated number of Signatories (at regime, on the basis of current COST 231 participation): 20

Cost per Signatory per year (at 1993 figures):

1 Year Scientist	ECU 60 000
2 Year Technician	ECU 80 000
3 Year Student	ECU 75 000
Travel/subsistence expenses	ECU 15 000
Total per year	ECU 230 000
Total over 3 years	ECU 690 000

Costs for the 3-year life of the Action (at 1993 figures):

Total ECU 690 000 x 20	ECU 13,8 Million
+ 10% overhead for running/operational costs	ECU 1,38 Million
Total Cost to national funds	ECU 15,18 Million
EU overhead (over 3 years) 3 x ECU 60 000	ECU 0,18 Million
Economic Dimension	ECU 15,36 Million

Economic Dimension
(at 1996 costs, considering a 15% increase) ~ ECU 17,7 Million

Memorandum of Understanding for the implementation of a European Research Action on motorcycle safety helmets COST Action 327

Date of entry into force of the project : 17.05.1995
Duration : 16.11.1999

Contracting parties	Date of signing	Date of entry into force
GERMANY	17.05.95	17.05.95
FRANCE	17.05.95	17.05.95
ITALY	20.06.96	20.06.96
HUNGARY	17.05.95	17.05.95
SWITZERLAND	17.05.95	17.05.95
UNITED KINGDOM	17.05.95	17.05.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in a European research Action on motorcycle safety helmets, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an Action to promote research on motorcycle safety helmets (hereinafter referred to as the "Action").

2. The main objective of the Action is to establish the tolerance of the human head and neck to the main injuries sustained by motorcyclists and, based on this, to propose a specification for testing motorcycle helmets.

3. The Signatories hereby declare their intention of carrying out the Action 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 Action 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 Action is estimated at ECU 2 000 000 at 1992 prices.

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

SECTION 2

The Signatories intend to take part in the Action 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 other organizations (hereinafter referred to as "research contractors");

(c) by contributing to the provision of a Secretariat and/or other co-ordinatory services or activities necessary for the aims of the Action 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 co-operating in a small-scale exchange of staff in the later stages.

SECTION 3

1. This Memorandum of Understanding will take effect for four years and 6 months upon signature by at least five Signatories. This Memorandum of Understanding may expire on the entry into force of an agreement between the European Communities 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 Memorandum 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 Action 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 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 Action 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, application to sign this Memorandum of Understanding from the Governments referred to in paragraph 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 Action.

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 the 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

CO-ORDINATION OF THE ACTION

CHAPTER I

1. A Management Committee (hereinafter referred to as "the Committee") will be set up, composed of not more than two representatives of 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 co-ordinating the Action 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 Action framework will be referred for an opinion to the COST Technical Committee on Transport;

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

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

(d) co-ordinating the contributions referred to in sub-paragraph (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 amongst 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 Action, including those relating to possible special conditions to be 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.

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 Actions 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 Action, 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 said Action. 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 I, 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 Action 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 work in respect of the Action.

   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 insofar 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 extension, the Signatory will submit the case to the Committee, before the contract is concluded; thereafter 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 condition 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 Action, 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.

<u>ANNEX II</u>

GENERAL DESCRIPTION OF THE ACTION

1. <u>Introduction</u>

Motorcyclists are amongst the most vulnerable road users. Head injuries cause the largest proportion of fatalities to motorcyclists, while about one quarter of all injured riders suffered head injuries.

This action will investigate the causes and mechanisms of head injuries using accident data and mathematical modelling such that the design of motorcyclists' helmets can be optimized with regard to the protection offered to a motorcyclists' head and neck.

2. Objectives

(i) To establish the distribution and severity of injuries experienced by motorcyclists, with particular reference to the head and neck.

(ii) To establish the most significant injuries and injury mechanisms.

(iii) To establish the tolerance of the human head, brain and neck to those injuries and injury mechanisms.

(iv) To propose a specification for testing motorcycle helmets.

3. Research requirements

(i) To analyse the available accident/medical data and determine the distribution and severity of impacts experienced and identify the injury mechanisms.

(ii) To consider all available documented information on brain injuries.

(iii) To collect further accident/medical data if required.

(iv) To develop a mathematical model of the human brain, head and neck, and a typical helmet to facilitate the study of brain injury mechanisms.

(v) To determine test criteria and limits that will more accurately represent the tolerance of the human head, brain and neck to impact.

(vi) To determine a test procedure to represent more accurately the risks of a type of impact taking place.

4. Benefits of the research Action

(i) Increased understanding of the injury mechanisms to the human head, brain and neck.

(ii) Increased understanding of the tolerance of the human head, brain and neck to impacts.

(iii) Use of the information gained in (i) and (ii) such that motorcycle helmets can be improved and thereby offer better protection to the motorcycle rider.

5. Description of the research Action

(i) Conduct an in-depth literature review/search of accident data, bio-mechanical research and the development of mathematical models of the human head, brain and neck. Produce a report.

(ii) Collection of real life accident data - injuries, helmet damage, impact object, etc.

(iii) Investigate and correlate the effect of using compliant and non-compliant headforms on the damage occurring to helmets, under similar impact conditions.

(iv) Reconstruction of the impact to the helmet to replicate the helmet damage to ascertain impact energy. Consideration to be given to the effects of the headform being attached to a body.

(v) Development of a mathematical model of a brain, skull, neck and helmet to emulate impacts and injury mechanisms.

(vi) Establish the spectrum of tolerances of the human head to injury for specified injury mechanisms.

(vii) Develop appropriate test procedures to ascertain and establish the total risk of head, brain and neck injury and to maximise the protection offered by helmets.

6. <u>Work programme</u>

See attached Annex.

7. **<u>Duration of the Action</u>**

4 years and 6 months.

8. <u>Estimate of Cost</u>

ECU 2 million.

ANNEX III

ACTION WORK PLAN

Project Number : COST 327
Project Title : Motorcyclists' Helmets
Issue Date : 2 July 1993

P = Planned A = Actual

		Year 1				Year 2				Year 3				Year 4				Year 5			
Activity/Output		1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
i) Literature Review	P																				
	A																				
ii) Accident Data Collection	P																				
	A																				
iii) Investigate Headforms	P																				
	A																				
iv) Reconstruction of Helmet I. pact and Damage	P																				
	A																				
v) Development of a Mathematical Model	P																				
	A																				
vi) Establish Human Head Tolerances	P																				
	A																				
vii) Develop Test Procedures	P																				
	A																				
Major/Project Module Reports	P																				
	A																				
Progress Reports	P			#				#		#			#			##		#			
	A																				
Final Report	P			#				#		#			#			#					
	A																				
	P																				
	A																				

Critical	Noncritical	Progress	Milestones #

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 329 "Models for traffic and safety developments and interventions"

Date of entry into force of the project : 14.06.1995
Duration : 13.06.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	14.06.95	14.06.95
CZECH REPUBLIC	13.09.96	13.09.96
DENMARK	07.06.95	07.06.95
GERMANY	07.06.95	07.06.95
GREECE	06.03.96	06.03.96
SPAIN	14.06.95	14.06.95
FRANCE	07.06.95	07.06.95
ITALY	20.06.96	20.06.96
NETHERLANDS	29.06.95	29.06.95
NORWAY	06.03.96	06.03.96
PORTUGAL	07.06.95	07.06.95
FINLAND	14.06.95	14.06 95
UNITED KINGDOM	12.10.95	12.10.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The objectives of the Action are to specify an efficient methodology for the analysis of past and future traffic safety developments, on the basis of the available knowledge of the applicability of modelling techniques for the analysis of time-series in the participating countries and with the use of accident data that are available in the majority of Member States.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 1 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of three years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in point 1.

COST ACTION 329

1. Introduction

The explosive development of motorized traffic and transport in the European countries after the Second World War led, apart from all its benefits, to a tremendous loss of lives and goods. This has forced national governments to plan and execute a large number of safety actions. In the beginning, these actions were of a reactive nature: safety plans were focused on stopping or slowing down observed negative developments. From the early eighties onwards, the majority of safety programmes became strategic plans for safety improvements in the future, on the basis of the knowledge from the past. This change in policy is shown by the targeted road safety plans that are formulated in a large number of countries.

In order to develop realistic quantitative safety targets and to specify or adapt related safety programmes, it is necessary to describe safety developments, together with the underlying processes, and to understand their causes. Such an analysis of the developments over time is hindered by the lack of data over a considerable number of years. Furthermore, this analysis is also difficult for an individual country, because the development is unique within each country. Only by comparison of alternative developments is it possible to check the plausibility of causal explanations. Such explanations should cover at least the influence of changes in the amount of traffic, shifts in traffic modes and demographic changes in the population of road users.

It can be stated that, although the knowledge of modern techniques for time-series analysis is sufficient from a scientific point of view, the progress in the application of these models to safety in many countries is not. Therefore, the scientific basis for planning, monitoring and evaluating targeted safety programmes is unsatisfactory.

The understanding of the safety developments, especially at a national level, will benefit greatly from a comparison between the developments in different countries, with different conditions or different (timings of) safety actions. Such a comparison presupposes a common methodological framework for analysis as well as a common database, consisting of the necessary data for each country in the same format. Neither of these prerequisites is satisfied at this moment. Various modelling approaches have been used in different countries, on data that are often not comparable.

It is the purpose of this COST Action to discuss the most promising modelling approaches, on the basis of the outcomes of small-size comparative studies, carried out on available data. A proposal will be made for the development of such a (series of) model(s) to be used by the Member States. Finally, the necessary data for the most useful practical model(s) be defined.

2. Objectives

The objectives of the Action are to specify an efficient methodology for the analysis of past and future traffic safety developments, on the basis of the available knowledge of the applicability of modelling techniques for the analysis of time-series in the participating countries and with the use of accident data that are available in the majority of Member States, in order to:

(a) monitor traffic safety developments, to compare observed outcomes with safety targets, to detect unexpected developments, and to find new areas of concern that ask for countermeasures to be taken;

(b) make a prognosis of future safety developments, necessary to set realistic safety targets and to plan safety programmes; furthermore, to provide a reference base for safety developments to be used for measuring effects of new large-scale safety actions;

(c) make international comparisons of safety developments, to state similarities and dissimilarities on aggregated and disaggregated levels of safety, that can be used by the authorities to plan national as well as joint European safety actions;

(d) determine expected consequences for safety developments from changes in the most influential accident factors, such as the amount of traffic, demographic variables and economic trends.

3. Working programme

The programme will consist of the following steps and products:

(a) detailed plan of the activities and distribution of work;

(b) plan for comparative studies;

(c) realization of three short pilots for these studies;

(d) preparation of guidelines for modelling of traffic and traffic safety;

(e) proposal for one (or more) model(s) that could be applied in the European countries;

(f) dissemination of information to potential users.

4. Workplan

4a. Working procedure:

- Two workshops will be held each year, to exchange national experience and know-how on time-series analysis applied to traffic safety developments. Furthermore, to plan comparative studies, to discuss the outcomes of pilot-studies, to determine the data-requirements for these studies and finally to disseminate the results to potential users of the models.

- Comparative pilot studies will be carried out by small working groups to cross-evaluate outcomes of the most promising techniques, on data from different countries, in order to derive alternatives for modelling and to specify the necessary data for the application of these models.

- In the first workshop of the second year, the outcomes of the comparative pilot studies will be discussed. Furthermore, it will be used to structure the guidelines for modelling that will be developed and to prepare a proposal for the construction of a (series of) model(s).

- A proposal will be formulated for the actual development of a (series of) model(s), that fit(s) the objectives. A description will be given of the available data together with the possibilities and limitations of their use. A recommendation for the collection of necessary, but not yet generally available data will be included. This proposal will also cover the selection of criterion variables, the explanatory variables, the level of disaggregation, and the time basis for a prognosis.

- The proposal will be developed stepwise in the comparative pilot studies, starting with a simple aggregated model on already existing data. Models of different complexity will be tried out in successive steps.

- Guidelines will be developed for potential users of models for traffic and traffic safety. These guidelines describe procedures for modelling, discuss advantages and disadvantages of existing models and give recommendations on the use of data.

- The comparative studies will be carried out on existing data in comparable format for the countries involved. The IRTAD (International Road Traffic and Accident Database) database will function as the kernel for the comparative studies. Proposals for additional data, necessary to improve the applicability of the models, will be discussed in close cooperation with CARE (Community database on Accidents on Roads in Europe).

Note

The study will result in guidelines to be used for the application of the most important existing models, as well as a proposal for an improved model or models. However, before such a model should actually be built, it is recommended that full scale comparative studies will be carried out first. These additional activities fall outside the scope of this COST-activity. Possibilities for the realization of these activities within the scope of the Fourth Framework will be investigated.

4b. Content of the work

The main activity will be to compare the applicability of various modelling approaches to the data of various countries. Because of the broad scope of this task, including methodological aspects as well as the specification of the models to fit the objectives, it was decided to carry out three pilot studies, to investigate the practical implications of the plans. Special attention will be given to the availability, quality and necessity of data in all three studies. The results of the pilot studies will be discussed in plenary sessions and the conclusions and recommendations disseminated to a larger audience. The following pilot studies will be covered:

1. The analysis of serious accidents at an aggregated level

   This analysis will be based on simple measures of exposure and risk, and applied to the number of fatal accidents or accidents with serious injuries or to the number of victims in these accidents. These data will be used at a national level and collected for several countries. Different existing models will be applied to all datasets and the outcomes of the various models will be compared for each country as well as for each model. Long-term and short-term models will be investigated, with the main focus on the long-term trends. Recommendations will be formulated for the practical use of the models and on requirements for the selection and quality of data.

Interest in this study was already expressed by representatives of the following countries: Germany, Spain, France, Finland, Netherlands, Norway, Portugal and Sweden.

2. The analysis of accidents at a disaggregated level

   It will be investigated to what extent models can be applied to data on the major levels of disaggregation such as transport mode, road type, age and sex. Because not all countries have data available over a long period at the same level, or differ in their choice of relevant factors, a number of studies will be carried out with varying types or levels of disaggregation. Long-term and short-term models will be studied, with the main focus on the short-term trends. Recommendations will be formulated for specific types of disaggregation and the corresponding data requirements.

   Countries that have expressed their interest already are: Germany, Spain, Denmark, Finland, Italy, Netherlands, Portugal and Sweden.

3. The application of time-series analysis to road safety data

   The advantages, disadvantages and possible shortcomings of existing methods for time-series analysis will be investigated in detail, to make the best possible use of these models for an efficient monitoring of trends in road safety as described in the objectives. The model structure and its theoretical basis will be analysed, using issues such as univariate and multivariate modelling, static and dynamic modelling, descriptive and explanatory models, hierarchical and structural models and the modelling of long-term and short-term trends. Furthermore, it will be studied to what extent the outcomes of the models can be improved by using more detailed data or data of higher quality than the existing data.

   Countries that have expressed their interest already are: Denmark, France, Italy, Norway and the United Kingdom.

5. Timetable

The start of the activities mentioned in the Working Programme will be directly after the approval of the proposal. The timetable below gives the duration for each activity, from that date onwards:

	First year		Second year		Third year	
	1st half	2nd half	1st half	2nd half	1st half	2nd half
Detailed plan	xxx					
Plan pilot studies	xxx					
Three pilots		xxxxxxx	xxxxxxx			
Guidelines					xxxxxx	
Proposal for model(s)				xxxxxxx		
Dissemination of information						xxxxxx

6. Costs

The estimated costs for the national activities over the three-year period amounts to ECU 1 million in total.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 330 "Teleinformatics links between ports and their partners"

Date of entry into force of the project :	27.10.1995
Duration :	26.04.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	25.10.95	25.10.95
DENMARK	23.05.96	23.05.96
GERMANY	12.09.96	12.09.96
GREECE	27.10.95	27.10.95
SPAIN	25.10.95	25.10.95
FRANCE	17.04.96	17.04.96
IRELAND	17.10.96	17.10.96
ITALY	18.01.96	18.01.96
HUNGARY	24.10.95	24.10.95
PORTUGAL	12.09.96	12.09.96
SLOVAKIA	16.04.96	16.04.96
FINLAND	08.11.95	08.11.95
UNITED KINGDOM	25.10.95	25.10.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to review and to assess the development of strategies for interconnecting ports. Ports should communicate with each other and their partners in order to improve maritime freight transport operations in a global logistics system. The prospect for Europe includes inter-modal and one-stop shopping to complete the transhipment chain.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 1,5 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of two and a half years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION 330

Background Summary

Data exchange systems operating between ports have been spreading for five years. They have been proposed as projects with objectives which are open to joint information systems with participants from/to the inter-land. Even so, sophisticate and integrated inter-operators electronic trading is growing very slowly in the maritime industry.

It is vital to analyze the real logistics chain and the global intermodal linking processes, not just their specific components. It is necessary to examine the role of EDI (Echange de Données informatisées) with respect to other information exchange technologies. The implementation of EDI needs too many formal interfaces which makes it cumbersome and costly to have widespread adaptation in the transport sector. In the US only 40,000 firms regularly use EDI (Saltman Roy, National Institute of Standards & Technology, US Department of Commerce). It is understood that several organizations have "pushed" EDI. However, these firms have not necessarily followed the standard ISO/EDI but their own one-to-one systems. Thus, for general use, these systems create a "lock-out" or barrier. Given that the European Commission has supported studies on EDI for over 7 years, it is now time to consider why it is not commonplace. COST Action 330, hereinafter called the "Action", will study the barriers and/or resistance in general of this technology. New Information Technologies (NIT) are technically available. The issue is to apply them at the right time and in the right place.

The economic stakes for port communities are to engage in trans-European networks and to master the intermodal logistic chain. The collation of technical and economic data about the implementation of modern information systems and telecommunication can make ports and their partners more aware of various possibilities. This would be

- by analyzing the purpose and expected benefits of setting-up port exchange networks which fit in with trans-European networks (Bangemann and Oreja; "Telematics Applications for Application in Europe" in Christophersen Group documentation)

- by examining the kinds of partnership involved by studying the types of data transmitted.

Thus an overview of the strategic use of information systems and/or electronic trading exchanges may be given to the operators.

The Action is an economic investigation. It will study the long-run impact of IST in the field of inter-modal logistic chains which will include ports and maritime transport. Other organizations, like MIF (Maritime Industry Forum), investigate commercial interests.

Description of the Action

1. Objectives

The use of Information Technologies is indispensable for consolidating a competitive edge for the European maritime industries. Furthermore, the implementation of the Short Sea Shipping Policy aims at attracting cargoes from land to sea. It appears that the organization of modern logistics is no longer possible without using one or other of the Telematics tools.

The general objective is to review and to assess the development of strategies for interconnecting ports. We would expect ports to communicate with each other and their partners in order to improve maritime freight transport operations in a global logistic system. The prospect for Europe includes inter-modal and one-stop shopping to complete the transhipment chain.

The Action will study the strategic issues for Information Systems and Telecommunications (IST) for ports and their trading partners. It will review plans, collate information on existing and planned developments and enable knowledge to be acquired about the role of ports in implementing IST, today and in the near future. A sub-objective will be to develop a critical evaluation of the barriers to EDI and to offer a plan for its development.

The Action will also analyze the value-added port services such as trade facilitation points as a means to increase services and competitiveness (customers and clients versus commercial value-added services).

The Action will also investigate the purpose and expected benefits of setting up European exchange networks by examining the kinds of partnership involved, and the type of data transmitted. The research includes:

- the analysis of general trends, the role of the port today and as a hub in the future
- the key features and components of IST
- the interactions between small and medium size ports
- the driving forces and critical issues
- the identification of technical-economic possibilities
- the implication of regulations such as the European directives on hazardous materials.

2. The scope of the Project

The Action will consider the following:

- four geographic areas: the Baltic, the North Sea, the Atlantic Ocean, the Mediterranean and Black Sea
- inland ports (inland waterways)
- large and small firms
- automated and non-automated ports
- port authority/operator and port community
- short and deep sea shipping operations.

The Action focuses on the links and information exchanges (commercial, administrative, legal and statistical) between commercial ports and:

- partners (e.g. shipping lines, forwarders, truckers, railways, distribution centres and service partners)
- types of cargo (e.g. chemical and oil, car manufacturing, dangerous goods and bulk storage)
- inter-modal operations (road, rail, barge traffic (inland waterways) etc.)
- types of information (commercial, customs, other legal authorities (Hazmat directives, statistics))
- technical (VTS etc.).

The Action concentrates on ports as distribution centres (hubs) for improving logistics.

3. Expected results

Ports have individual needs relating to their trade characteristics and their environment. However, there are some functional requirements common to all ports. These common requirements should be identified, studied and described to establish if standardised building blocks could be developed.

The Action will:

- gather data on the introduction of innovative technologies, tools, products (in different sectors) and examine the common rationale
- look at the differences and common elements against other innovative tools, products and technologies
- describe and assess the impact of the latest technological developments
- define scenarios for the long-term telematic needs of ports and their partners
- disseminate pertinent information for commercial operations about openness including networking, multi media, etc.
- comprehensively examine the reasons for the slow take-off of the use of Telematics in general (including EDI) in the maritime sector
- design a set of recommendations allowing for the development of tools and actions to enhance and facilitate the use of Telematics (including EDI) in maritime transport.

4. Current state of knowledge in the proposed field of research

There are numerous available reports, studies and surveys on port information systems, particularly in European countries. Such documents may focus on individual ports, groups of ports in the same region or ports grouped together by some criterion. These may be regularly updated at the initiative of a port or group of ports in the same country. This will allow them to keep up with their competitors, be they national or international public bodies. These reports are generally intended for the members of the port community in question.

There is no overall survey yet of the growing deregulation in this field. It is time to analyze and evaluate the trends at the European and international level. It is time also to identify the options available for existing or potential interested partners. By so doing, it is expected to contribute to the development of national and European policies.

5. Grounds for research

There is an important range of new information technologies that can improve the logistics chain, but they often need large financial and human resources investment. This is especially the case for EDI: this explains why it does not catch on for small and medium-sized firms.

The management of implementation of new information technologies require that the economic and commercial conditions of development have to be assessed very carefully, and with strategic perspectives in mind. Here, Porter's theories (Porter, M; 1990 "The Competitive Advantage of Nations", MacMillan, London) represent a good economic view of competitive advantage and competitive strategy. His earlier theories have been applied to information systems development (Wiseman C; 1988 "Strategic Information Systems" Irwin, Homewood Il.) using as classifiers – differentiation, cost, innovation, growth, alliance and returns.

6. Organization of the Action: tasks and workplan

Task 1: Method - 4 months

To endeavour to establish the elements required to describe IST projects and their operation in consistent terms, thereby making them comparable and highlighting their features.

Task 2: Evaluation - 9 months

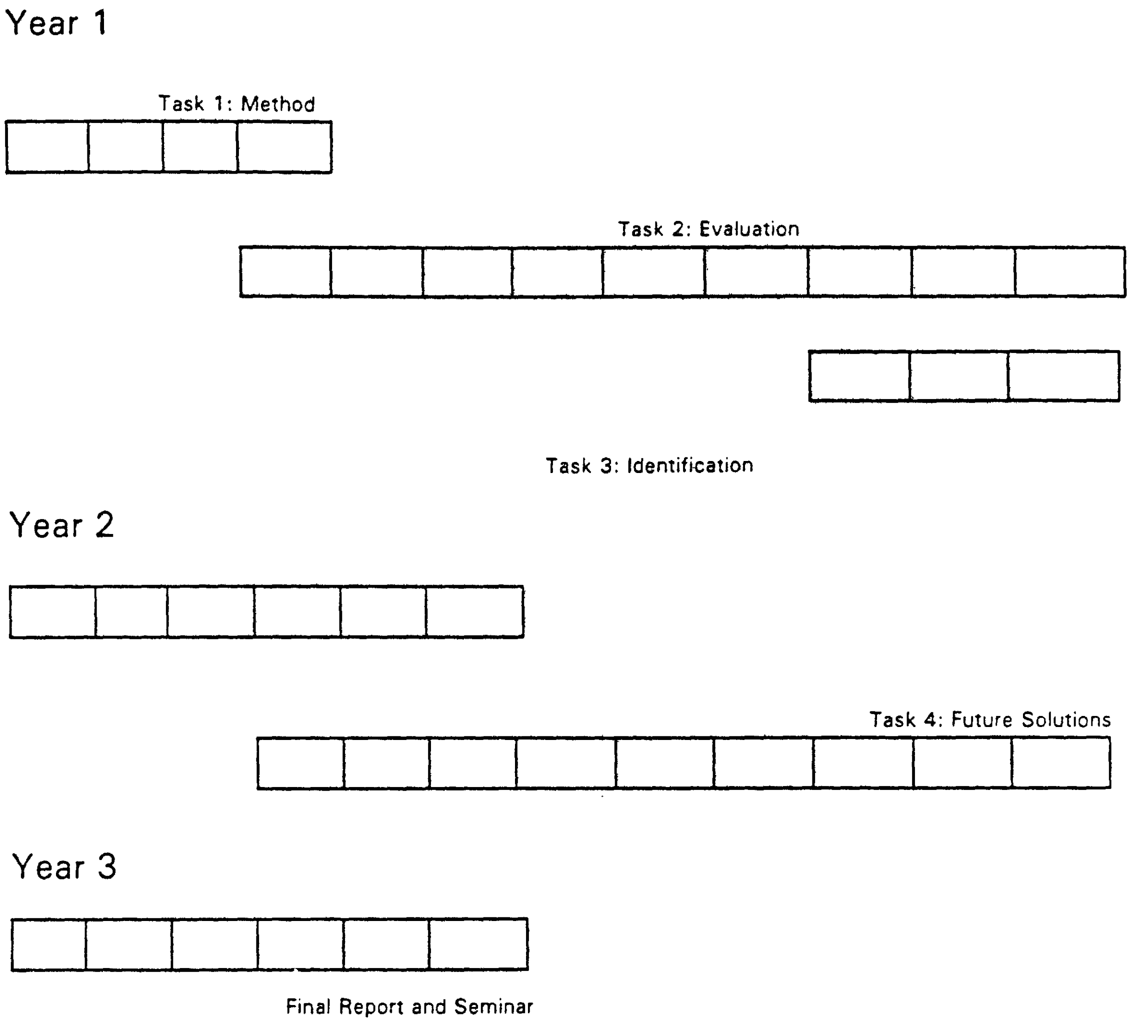
- to draw up a critical bibliography;
- categorise and assess the main projects, or realisations.

Task 3: Identification - 9 months

- to analyze the objectives of IST project;
- to evaluate the technical and other means employed;
- to analyze the economic and technical links between the various parties;
- to analyze the achievement of the projects – their success or failure;
- to analyze any lack of interactivity;
- to analyze any lack of generic modules;
- to analyze the information strategies and organization of the companies involved with the maritime transport;
- to analyze the quality of service and related cost/benefits;
- to analyze the quality and currency of the technology employed;
- to analyze the logistics organization.

Task 4: Future solutions - 9 months

- to compile an awareness of pertinent new technology;
- to assess the critical issues with respect to the impact of new technology on ports and their partners;
- to present recommendations.



Remarks: Each cell represents one month.
An intermediate report will be presented at the end of each task.

7. <u>Duration of the Action</u>

The Action will take two and a half years (1995 - 1997).

8. <u>Estimation of the cost</u>

Due to the scope and breadth of coverage of the research of the investigation and taking into account the participant numbers, the cost of the Action is estimated to be ECU 1,5 million.

9. <u>Organization of the Action</u>

The philosophy underlying the structure below is that of establishing an organization to provide the driving force for the project. This structure will comprise the COST 330 Management Committee within which a Project Group will be set up, chaired by a project leader supported by other experts knowledgeable in IST, port operations and inter-modal chains. The last-mentioned will be assured from the outset that they will have the resources needed for the duration of the project.

The Project Group will comprise about eight persons including the Chairpersons of the four regional groups (the Baltic Sea area, The North Sea area, the Atlantic area and the Mediterranean and Black Sea area). The main tasks of the Project Group are:

- to monitor the Regional Groups;
- to co-ordinate the Action;
- to report to the Management Committee;
- to prepare interim and final reports.

The main tasks of the regional groups are:

- to investigate locally tasks defined by the Project Group;
- to report their findings verbally to the Project Group with supporting written material which may be incorporated into interim and final reports.

COST 330 Management Committee

Project Group

Baltic Group	North Sea Group	Atlantic Group	Mediterranean & Black Sea Group

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 331 "Requirements for horizontal road marking"

Date of entry into force of the project :	29.03.1995
Duration :	28.09.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	26.07.95	26.07.95
DENMARK	26.07.95	26.07.95
GERMANY	26.07.95	26.07.95
SPAIN	26.07.95	26.07.95
FRANCE	25.04.96	25.04.96
ICELAND	17.01.96	17.01.96
ITALY	19.04.96	19.04.96
PORTUGAL	15.02.96	15.02.96
SLOVAKIA	26.07.95	26.07.95
SLOVENIA	29.03.96	29.03.96
SWITZERLAND	21.11.95	21.11.95
FINLAND	27.03.96	27.03.96
UNITED KINGDOM	12.10.95	12.10.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to establish an up-to-date scientific method with which, on the basis of harmonized minimum values for the essential requirements of continuous horizontal road markings, to determine the optimum pavement marking design in order to ensure that it is visible, by day and by night, in all weather conditions.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 1,3 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of three and a half years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION 331

A. BACKGROUND SUMMARY

At present, most national technical specifications in the field of road markings lay down more or less appropriate minimum values for the parameters which define their essential requirements (night-time and daytime visibility and anti-skid properties) without taking always into account the real visibility needs of drivers.

Most research in this area, both national and international, concentrates on:

- development of new marking products which meet the abovementioned requirements for as long as possible (maximum useful life), and

- design of new technologies for the manufacture of high-performance equipment for assessing those requirements.

The proposed research is quite distinct from the work of the CEN TC226–WG2 group, which is concerned with the establishment of criteria with which marking products would need to comply in order to attain the CE marking.

What is therefore needed, is an up-to-date scientific method with which, on the basis of harmonized minimum values for the essential requirements of road markings, to determine the optimum pavement marking design in order to ensure that it is visible, by day and by night, in all weather conditions.

Nevertheless, "COST Action 331" (hereinafter referred to as the "Action") should take into consideration the foreseeable time-frame for the completion of corresponding European standards (CEN TC226-WG2) so that any specific European requirements can be produced in time to provide participating countries with information to influence further developments and amendments of these standards.

B. DESCRIPTION OF THE ACTION

1. Objectives

'It is proposed to confine the project to continuous horizontal road marking (including road studs, directional arrows and chevrons). The project would cover permanent road marking.

The project would not cover vertical signs.

Discussion of the secondary objectives led to the following list being adopted:

- the state of the art in the area falling within the project's scope;

- establishment of guidelines to define road marking geometry;

- definition of road marking parameters;

- establishment of guidelines for road marking maintenance;

- identification of the visibility threshold required by the driver (including maximum luminance);

- study of the influence of road marking, visibility on the use of different colours (white and yellow);

- mechanical and noise effects produced by road marking;

- establishment of guidelines related to environmental protection and traffic flow.

2. Expected Synergic Results

In addition to helping to harmonize the level of road safety throughout the European road network, the creation of a scientific base on which to establish homogeneous criteria for the effectiveness of road markings for the various types of road in the network will:

- provide a scientific method of setting harmonized criteria for optimum design and quality of road markings;

- assess the present level of quality of road markings and establish criteria for upgrading it, if necessary (maintenance guide);

- speed up the study and development of new, more effective and profitable products (acceptable cost/benefit ratio).

Lastly, by unifying these criteria we can rationalize the application of their assessment parameters and therefore their subsequent perfection and development.

3. Current State of Knowledge in the proposed Field of Research

For the most part, the Member States (and the other leading technological countries) have not given sufficient attention to the problem of optimum road marking as an indispensable element within road safety. There has, however, been some progress, notably in Denmark, France and Germany.

Most research in this area, both national and international, concentrates on:

- development of new marking products which meet the requirements for as long as possible (maximum useful life), and

- design of new technologies for the manufacture of high-performance equipment for assessing those requirements.

No previous European research in the field of application of the Action has been executed.

4. Grounds for Research and Results Expected

4.1. The basic purpose of this research is to provide a scientific base on which to "harmonize" the quality and design of road markings and thus promote a uniformly high level of safety throughout in the European road network.

Road markings are in fact "traffic signals" with a decisive impact on driver safety, for the following reasons:

(i) they are non-verbal (their message being expressed through shape and colour) and therefore readily understood by drivers;

(ii) in poor light or bad weather the information we pick up from the environment becomes less reliable and road markings become particularly important.

Unfortunately, the absence, in most cases, of the necessary scientific base has led to significant differences in regulations on the visibility requirements and the geometry of road markings in the European Union.

It is therefore essential that a "guidance" system as clear and effective as this should be based on solid design criteria which help harmonize the level of road safety in the European road network by standardizing the essential features of its horizontal signalization.

4.2. Inter alia the following results may be expected:

- optimization of a mathematical model with which to calculate, on the basis of observation parameters and the aforementioned essential requirements of the road markings, the minimum distance at which they should be visible in any conditions (by day, by night, with clear skies, during rain, etc.);

- definition of the impact in road safety of the mechanical and noise effect of the profile road markings and the use of retro reflective road studs in horizontal signalization;

- establishment of a guideline for design and maintenance of the pavement markings.

5. Organization of the Action

5.1. Workplan

- Task 100: State of the art in the area falling within the project's scope.

- Seminar:

- Task 200: Interviews with the relevant individuals in the Member States to clarify current policies.

- Task 300: Evaluation of drivers' visual needs.

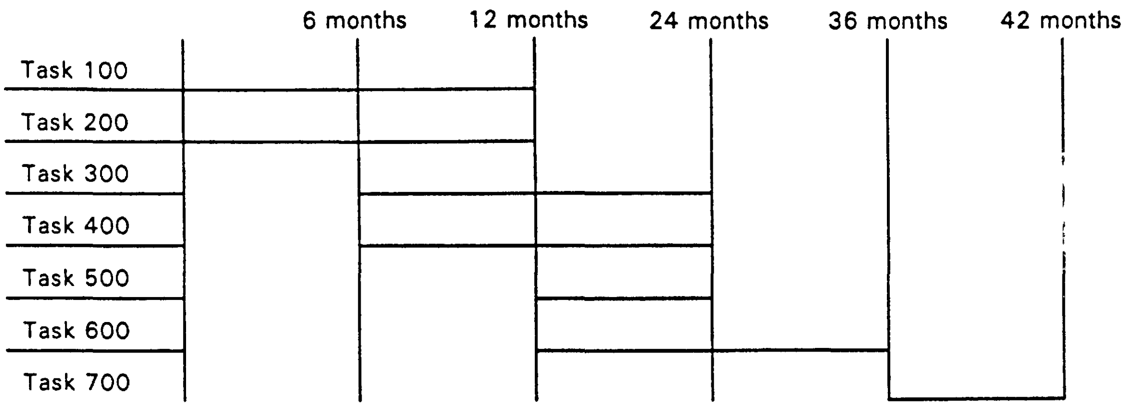
- Task 400: Impact on road safety of the mechanical, visual and noise effects of road marking.

- Task 500: Impact of road studs on road marking visibility and on mechanical and noise effects.

- Task 600: Establishment of guidelines for road marking design, application and maintenance.

- Task 700: Preparation of final report.

Timetable



5.2. Task distribution:

- each task will be coordinated by a Committee member;
- all countries volunteered to participate in the abovementioned tasks.

In particular, the tasks of the Committee will be:

- to ensure the flow of information;
- coordination and harmonization of the individual reports (each task would be covered in an interim report, which would constitute a chapter of the final report);
- supervision of the results of the different studies/activities;
- discussion and approval of the final draft report and the accompanying conclusion/recommendations;
- organization of a Workshop to disseminate the results of the Action.

6. <u>Duration of the Action</u>

The Action will last for three and a half years (1995-1998).

7. <u>Estimation of the cost</u>

The value of the "know-how", testbed results and studies that the different participants will feed into the Action is estimated to be ECU 1,3 million.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 332
"Transport and Land-Use Policies"

Date of entry into force of the project :	27.06.1996
Duration :	26.06.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
DENMARK	27.06.96	27.06.96
SPAIN	27.06.96	27.06.96
FRANCE	27.06.96	27.06.96
ITALY	13.01.97	13.01.97
AUSTRIA	10.12.96	10.12.96
SWITZERLAND	19.11.96	19.11.96
FINLAND	27.06.96	27.06.96
UNITED KINGDOM	27.06.96	27.06.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The objective of the Action is to evaluate innovatory institutional coordination arrangements between transport and regional planning projects. Local effects will be emphasized.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 1,7 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in point 1.

ACTION 332

TRANSPORT AND LAND-USE POLICIES

Innovations in institutional arrangements for coordination

A. BACKGROUND

The importance of the interaction between spatial planning and management on the one hand, and the conception and operation of transport systems on the other, is fully recognized. Many studies have, for example, highlighted the influence of land use and urban forms on the modal split (between means of transport). Similarly, we know that the spatial organization engendered by the evolution of the production process is increasing mobility requirements, both for people and goods. The development of the suburban habitat has favoured the growth of multi-car households. The growing polarization of commercial structures has also led to an increase in car use.

At the same time, transport networks contribute to a country's dynamics. High speed travel in particular, whether regional or national, road or rail, enables transport networks to be organized on a basis of connectivity rather than proximity. At urban management level, construction norms for residential and professional parking places will be a key factor in the use of public transport.

Progress in the field of transport economics and geography has led to a better understanding of the mechanisms of the interaction between transport systems and spatial organization and highlighted the dangers of a strictly sectorial approach to transport and planning policies.

Public action needs coherence; sectorial coherence (between the various technico-administrative fields), regional coherence (between the various politico-administrative levels) and temporal coherence (between the various time-scales of the administrative and planning procedures).

Research projects on the analysis of the interaction between transport and spatial organization are as numerous as projects on the institutional management of this interaction are rare. There is therefore, a great need for knowledge on this subject. The cost, in political and economic terms, of the dysfunction affecting the transport flow and the regions as a result of the absence of coherence in public action justifies considerable scientific investment.

COST cooperation is judicious for four reasons:

- first, a comparative approach would seem indispensable since the variety of professional, institutional and technical backgrounds present in the European transport sector appears to be a guarantee of methodological creativity;

- second, experiences exchange remains one of the most effective forms of innovations dissemination; from this point of view the participation of operational players to some phases of the COST Action 332 should be considered as a valuable asset;

- third, the transfer of national models – in terms of management procedures and the way in which outside expertise sought, to give but two examples – that the opening-up of Europe will gradually introduce through development companies and consultants, will create a unique opportunity for a thorough renewal of methods which must be accompanied by a scientific approach, since this is the only way to foster the synergy of the different technico-economic cultures;

- fourth, the development of large cross-boundary infrastructures under the impetus given by the European Union will alter the spatial organization of territories at stake and will encourage to bring closer institutional planning process on both sides of the boundary.

The Transport Programme of the European Union does not cover the research to be carried out within this Action. However, the results of the Action could contribute to the definition of the next Transport Programme within the 5th FP.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to evaluate innovatory institutional coordination arrangements between transport and regional planning projects. Local effects will be emphasized.

Nothing to be gained, in fact, from analysing the modalities of interaction between transport and planning if no measures exist to coordinate decisions in these two fields of public action. These arrangements for coordination are now all the more important since on the one hand today's societies propensivity to favour sector-based approaches becomes more pronounced and on the other hand competitive situations tend to be established between bodies in charge of transport and land-use policies respectively.

In scientific terms, a joint assessment of the researches carried out at the national level constitutes an undeniable more value, naturally provided that comparability conditions have been guaranteed first. This approach will lean on the main skills gathered in the COST group, i.e. geography and planning, economical geography, sociology and local government studies.

In operational terms, the formalization of the methods of coordination between transport projects and regional planning will enable authorities to avoid a considerable number of costly dysfunctions resulting from an absence of spatial and temporal coherence between sectorial policies.

Moreover, it is not improbable that methods tested in the transport sector may be applied to other fields (water, electricity, environment).

C. SCIENTIFIC PROGRAMME

The tasks which are planned are:

T1 Bibliographical studies

T1.1 Selection of documents related to the interactions transport/land use policy building up of bibliographical lists, comparison of those lists, validation of the lists and key words

T1.2 Inventorying and listing of works dedicated to arrangements for coordination between transport and land-use policies; comparison and validation of the lists

T2 Launch colloquium
T3 Case studies
T3.1 Spotting of arrangements for coordination, assessment of the case studies feasibility, mobilization of the concerned operational actors
T3.2 Inquiry works on the case studies; comparison of the first results, drafting of monographics, comparison of monographics
T4 Opinion enquiry to local political representatives
T4.1 Drafting of the terms of reference for implementing and working of the enquiry, selection of a consultant to implement the enquiry, building up of the sample
T4.2 Carrying on, working and synthesis of the enquiry
T5 Theoretical synthesis of the case studies
T6 Recommendations and operating conclusions
T. 7 Multilingual glossary
T. 8 Closing colloquium.

The aim of the launch colloquium (T2) is to mobilize operational local partners.

The enquiry to local political representatives aims to better know the representation that they have of their intervention field and the interactions of their field with other sectors of the public authorities actions. This enquiry therefore aims to help the understanding, therefore to overcome, some of the difficulties in implementing arrangements for coordination. This enquiry will make best use of the existing national and European networks, the access to which will be made easier by the signatory countries.

The theoretical synthesis of the case studies (T5) will permit to formalize the various types of institutional arrangements for coordination; their adaption relative to various interaction mechanisms which was put forward by the bibliography; the conditions of their good implementation.

The recommendations (T6) will permit to provide to the operational partners with an assessment of the institutional arrangement in the best position to answer their needs for coordination between transport and land-use policies. These recommendations will be put into perspective with the results of the enquiry (T5).

The closing colloquium (T8) aims at disseminating the results.

Research done in the case studies (T3) will be to work out the following questions:

- conditions of the institutional or organizational innovation genesis, and analysis of its specificities
- study of the implementation of the operation
- highlighting of each arrangements efficiency from the point of view of the objective of transport and land-use policies coordination.

These arrangements for coordination must correspond to innovations as regards institutions, procedures, management or any public action tool explicitly in charge of the coordination between spatial planning decisions and transport decisions. They can be related to national, regional or local territorial level and take or not the scope of legislative provisions.

In each case study the initial task will begin by recalling the institutional framework for transport and land use policies within the countries concerned.

The case studies planned during the preparation of the Action are:

Belgium: Coordination between land-use and transport policy in Flanders

Beyond the apparent coherence in terms of future priorities in transport and land-use planning that emerges from both policy documents applying to Flanders, this study intends to analyse the fundamental differences with respect to the principles and the implementation approaches coming out of these documents. So its result will be suggestions of new cooperation forms between land-use and transport planners, both at the conceptual and operational level.

Denmark: The South Scandinavian Cross Border Region

From the analysis of the implementation of the planned bridge between Copenhagen and the South Swedish city of Malmö as a tool in strategic planning, this study aims at identifying new bodies of planning that will be created as will develop this first cross-national integrated large-city region outside the European centre.

France: Coordination between transport and urban planing in new road planning schemes
("Dossier de voirie d'agglomération" or DVA)

The aim is to analyse the difficulties in implementing the DVA procedure which is an arrangement being theoretically in charge of a coherent development of both road networks and urban land-use planning.

Greece: Road Transport Infrastructure Development and Town Planning Development in Thessaloniki

Major conflicts of responsibilities and priority schemes for transport infrastructure and land-use development are observed in the greater urban area of Thessaloniki. The research will determine whether the short-term "Transport Infrastructure Development Plans" are in accordance with the previous long-term plans and with the "Land-Use Development Plan" approved in 1985 and will look into the technical and political issues involved in both those major plans of the city in view of the short-term priorities emerged by the role of the city as Cultural capital of Europe in 1997.

Italy: The procedure of "Agreement of Programme interdependancy between transport and land-use planning in Lombardia

A new legal provision, the so-called "Agreement of Programme" determines the framework for coordination between the various parties involved in urban development projects. The research will study the implementation of this legal provision in the framework of an "Agreement of Programme" involving the region of Lombardia, the national railway company and the regional railway company.

Spain: Large-scale transport infrastructure and urban development in the metropolitan region of Barcelona

In the region of Barcelona, several major transport projects – road infrastructure, High Speed Train, port and airport – encompassed in a coordinated land-use planning within the so-called "Plan Delta". The research will analyse the planning process and the spatial changes deriving therefrom.

Sweden: Social and environmental impacts of land-use and transport planning in Sweden; status and scope for improvements

The research will identify reasons for failure or success of various planning processes through a case study addressing the process of decision-making with respect to various institutional organizations in charge of transport and land-use planning, for example with focus on the urban sprawl and the fixed link between Sweden and Denmark.

Switzerland: Comparative analysis of Geneva, Lausanne and Bern

The aim is to compare the interactivity between transport and urban land-use policies in the three cities of Geneva, Lausanne and Bern. To do so the work will be carried out at federal, cantonal and municipal level.

United Kingdom: Transport and planning: Competing modes of network management

The UK project will develop a typology of social, technical, institutional and spatial conditions facilitating the development of mixed-mode transport networks and the development of local institutional provisions to manage transport demand (demand side management).

Other case studies may be carried out by countries that will join the Action after its start, in particular those that have already shown an interest (Finland, in the framework of the national strategic project "Transport and Land Use", as well as the Czech Republic).

D. ORGANIZATION AND TIMETABLE

The final breakdown of work and the setting up of working groups will be decided in the Management Committee.

Each signatory country is to be responsible for one case study (T3) and will participate in the joint assessment of the results (T5 and T6).

Each signatory country will contribute to the bibliographical analysis (T1) and the terms of references of the opinion enquiry (T4.1). The opinion enquiry will be subcontracted to a specialized consultant.

Each signatory country may also participate in the other tasks of the programme.

The tasks will be carried out according to the following time chart:

TASK	Semester							
	1	2	3	4	5	6	7	8
T1.1								
T1.2								
T2								
T3.1								
T3.2								
T4.1								
T4.2								
T5								
T6								
T7								
T8								

The total duration of the Action is four years.

E. ECONOMIC DIMENSION

Nine countries actively participated in the preparation of this Action. On the basis of the information available during the preparation of the Action, those countries planned to earmark an average three man months per country and per year. The countries which transmitted this information are Belgium, Denmark, Spain, France, Greece, Italy, the United Kingdom, Sweden and Switzerland. The coordination costs will be partly financed by the Commission.

The estimate of the total costs including the coordination costs is ECU 1 700 000.

This estimate is valid only if the nine abovementioned countries participate in the Action. Any withdrawal or other participation would alter this estimate.

Memorandum of Understanding
for the implementation of a European Concerted
Research Action designated as
COST Action 333
"Development of New Bituminous Pavement Design Method"

Date of entry into force of the project : 06.03.1996
Duration : 05.03.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	06.03.96	06.03.96
CROATIA	21.06.96	21.06.96
DENMARK	15.05.96	15.05.96
GERMANY	12.09.96	12.09.96
SPAIN	06.03.96	06.03.96
FRANCE	25.04.96	25.04.96
ICELAND	06.03.96	06.03.96
HUNGARY	06.03.96	06.03.96
NETHERLANDS	12.09.96	12.09.96
AUSTRIA	29.05.96	29.05.96
PORTUGAL	13.06.96	13.06.96
SLOVENIA	23.07.96	23.07.96
SWITZERLAND	03.12.96	03.12.96
FINLAND	10.07.96	10.07.96
UNITED KINGDOM	06.03.96	06.03.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to contribute to the development of a coherent, cost-effective and harmonized European pavement design method which will open new possibilities for European industry to collaborate in the field of pavement design and construction.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 2 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of two years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in point 1 above.

ACTION 333

"Development of New Bituminous Pavement Design Method"

A. BACKGROUND

A.1. Overview

The COST 333 Action "Development of New Bituminous Pavement Design Method", aims at the development of a coherent European pavement design method that takes into account the actual axle loads used by trucks in the Community and the use of new materials. The COST action will focus on information gathering, identification of requirements and selection of design elements, then work will continue under the FEHRL project (PAV-DES), where the design elements will be developed further and a mature design method will be produced.

The overall project (PAV-DES), was initiated as part of the Strategic European Road Research Programme (SERRP), which is being set up by the Forum of European National Highway Research Laboratories (FEHRL). Three other SERRP projects are already under way as COST Actions (COST 323, 324 and 325). Two of these projects - COST 323 "Weigh in Motion of Road Vehicles" and COST 324 "Long Term Performance of Pavements" - are closely related to COST 333.

One of the principal benefits arising from this COST Action will be the creation of an approved, carefully considered framework enabling far more effective proposals to be submitted under research Task 7-4/24 of the Transport RTD Programme. In order to understand the difference between the two activities, the COST 333 work has been defined in this report, and the further work proposed under PAV-DES and Research Task 7-4/24 is summarized as follows:

- development of a prototype design method
- assessment of the prototype design method
- modifications of the method
- full assessment of the method
- production of a comprehensive design guide.

The COST Framework has been chosen for this work for the following reasons:

- the way forward, which will be determined as a result of the work, should be agreed between the technical representatives of national governments;

- preferably, agreements should be made as widely as possible within Europe, and not only within the existing European Community;

- the work is seen as being more appropriate to be undertaken within COST than under more market oriented programmes like EUREKA.

A.2. State of the art

There is an increasing trend in Europe towards the use of more analytical methods of pavement design. The traditional empirical methods that they are replacing cannot respond rapidly to changes in traffic, relative material costs or innovative changes in methods for construction or materials. On the other hand, analytical methods are flexible and can respond to these changes more easily.

At present, analytical pavement design methods are quite different in the various European countries, although based on similar theoretical concepts. Most methods use multilayer linear elastic models to calculate stresses and strains induced by axle loads, using as failure criteria fatigue of the bound layers (generally a function of the tensile stresses or strains in the bottom of the layers) and the deformation of the subgrade (given as a function of the vertical strains in the subgrade).

Structural models based on multilayer linear elastic analysis are known to only approximate the real pavement response to axle loads, due to non-linear behaviour of soils and granular materials and visco-elastic response of bituminous materials.

The tests used to characterize the structural behaviour and deterioration of pavement materials and soils differ from country to country, which makes joint research difficult.

Some efforts have already been made in a joint project financed by the SCIENCE Programme (*A European Approach to the Road Pavement Design*), in which results on the mechanical behaviour of soils and granular materials obtained with different apparatus from different countries (F/NL/P/UK) were analysed. However, this project dealt only with some of the materials used in pavements, and not with pavement design in general.

The present project will be linked with other SERRP projects on pavement materials (BIT-MAT, GRAN-MAT and ALT-MAT). Joint research to develop pavement distress models is already underway through COST 324).

The work which is being carried out on COST 323 is also linked to this project, and it is expected to provide input regarding loads induced by vehicles to the pavement's structure. The effect of different suspensions on pavement performance is studied in the OECD-DIVINE project. The standardization works of CEN/TC 227 will also allow this situation to evolve through cooperation.

B. <u>OBJECTIVES AND BENEFITS</u>

B.1. Objectives

The main objective of the Action is to contribute to the development of a coherent, cost-effective and harmonized European design method which will open new possibilities for European industry to collaborate in the fields of pavement design and construction. The key elements are as follows:

- to contribute to the development of a coherent European pavement design method, which will take into account the future uniform maximum axle loads of trucks in Community Member States and the standardization of requirements for road materials (CEN/TC 227);

- to increase the possibilities which arise from using new improved materials, or alternative materials, through developing design guidelines with better theoretical understanding, in parallel with the use of performance based specifications for road materials. Industry, users and the environment, will benefit from this approach;

- to develop cost-effective design for the European road network. This will provide the possibility of developing a whole life cost model which takes into account construction maintenance and user costs;

- to avoid duplication of efforts in the field of pavement design, and also to allow different countries to benefit from each other's past experience in this field;

- to open new possibilities for European industry to collaborate in the field of pavement design and construction through the harmonization of pavement design.

B.2. Benefits

The growth in weight and volume of traffic beyond the level on which existing design methods are based, as well as the use of new or alternative materials, justifies the need for new and improved design methods. The benefits will involve reducing the time and/or cost of constructing and/or maintaining pavements.

Also, there is pressure towards the use of heavier axle loads, in connection with the use of road friendly suspension, which is not incorporated in current design methods. COST 333 will contribute significantly to a more integrated European approach in this area.

C. SCIENTIFIC WORK PROGRAMME

The final goal of PAV-DES is to produce a design method for road pavements, for use throughout Europe. However, it is recognized that this will be a big effort which may involve the development of new improved models, as well as the validation of the method, through the interpretation of pavement performance data and the realization of specific experiments in full scale pavement trials and accelerated load testing facilities.

Given the limited financial support from COST, the COST 333 Action will focus on information gathering, identification of requirements and selection of design elements. Once this is achieved, it will be possible to develop a second part of the PAV-DES project, where the design elements will be developed and a design method will be produced and validated.

The activities to be performed within the COST 333 Action will be divided into 3 main tasks, in the following way:

TASK 1 Information Gathering (6 months)

1.1. Review the terminology and requirements of the main components of the pavement.

The terminology and the requirements associated with the main components of the pavement will be reviewed. The foundation, wearing course and the main structural layers will be covered separately. A review of the main mechanism of pavement deterioration and the factors that influence them will be undertaken and the work being carried out by COST 324 and CEN/TC 227 will be taken into account.

1.2. Review of current European pavement design methods

A separate review would examine the various pavement design methods used throughout the world with a fuller comparison between the methods used by European countries.

TASK 2 Identify Requirements (12 months)

This task will determine what is required to enable the performance of the various pavement components to be predicted. This work will be based on recent results from measurements of pavement response to loads, as well as results from studies regarding traffic loads, pavement performance and material behaviour. Feed-back from other related projects underway, on a European level, namely COST 323 (WIM-LOAD), COST 324 (PAV-LIFE) and other SERRP projects now being started may be incorporated.

The requirements will address the following sub-tasks:

2.1. Assessment of traffic;

2.2. Climatic effects;

2.3. Material properties

2.3.1. Soils (subgrade)
2.3.2. Granular materials (unbound)
2.3.3. Bituminous materials
2.3.4. Cement treated materials
2.3.5. Other materials;

2.4. Structural models;

2.5. Performance models;
2.5.1. Fatigue cracking
2.5.2. Rutting
2.5.3. Roughness
2.5.4. Others (surface cracking, reflective cracking, etc.)

TASK 3 Selection of design elements (6 months)

The nuts and bolts of the design method will be selected and the final report will be prepared. This may lead to further development of performance and structural models to cover the full range of conditions throughout Europe, as well as the incorporation of a probabilistic approach.

D. ORGANIZATION AND TIMETABLE

D.1. Organization

The COST 333 Management Committee will report to the Technical Committee on Transport. It will appoint Task Leaders for each of the major tasks, and each of these Task Leaders will manage the effort of nominated individuals in working groups in order to generate the deliverables described. The Task Leaders, and working group members, will report to the Management Committee at appropriate times. The organization structure for the Action is shown in Figure 1.

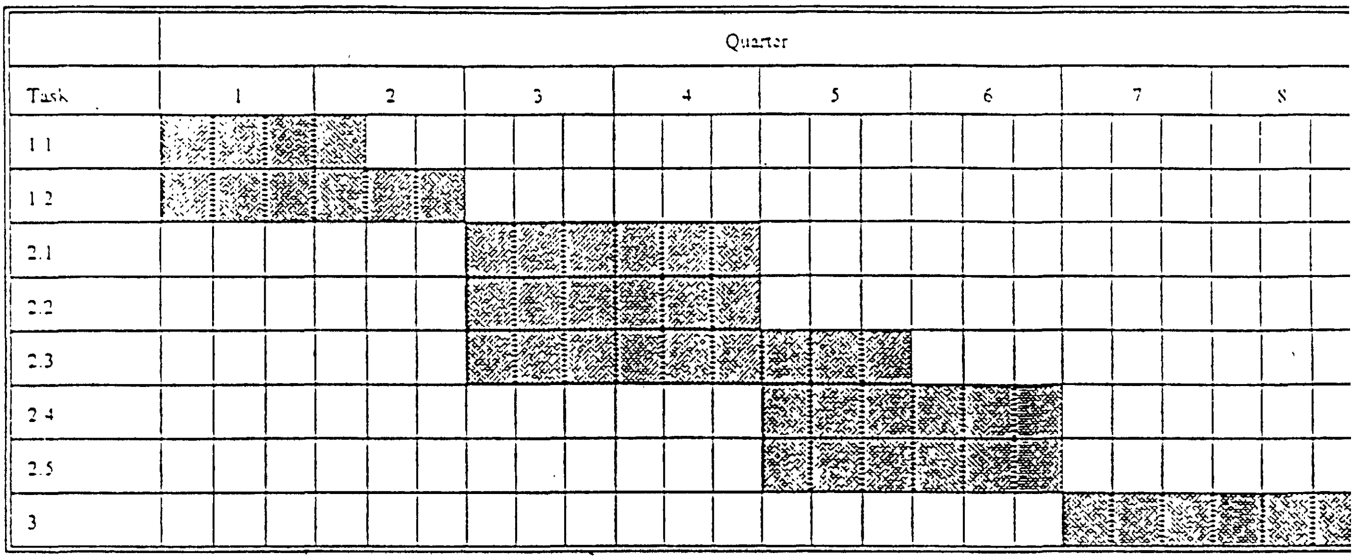
Figure 1: Organization Structure (see diagram supplied)

The Technical Sub-Committee anticipates that a small number of Short Term Scientific Missions would be desirable to enhance the quality of the deliverables within the sub-tasks in Task 2. Further, it may also be appropriate to hold a seminar at a mature stage in the programme in order to improve external awareness of the work, and dissemination of the results. These activities will be dependent on budget availability at national and Commission level during the 1997 and 1998 financial years.

D.2. Timetable

The COST 333 Action will take two years to complete from signature of the Memorandum of Understanding. The timetable for the tasks is shown in Figure 2.

Figure 2: COST 333 Programme Chart



Each of the tasks has its own programme of sub-tasks which is not described in this document.

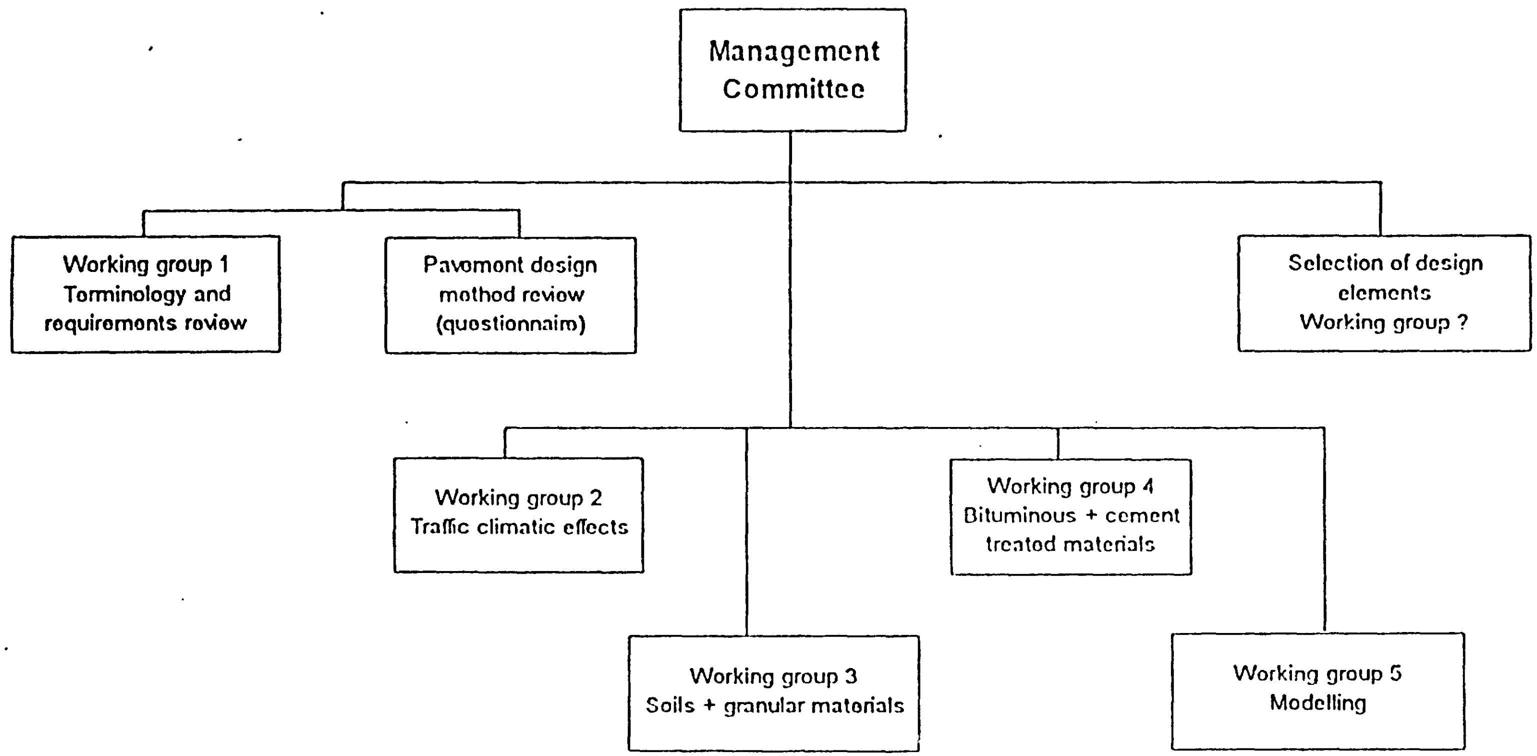
E. ECONOMIC DIMENSION

The COST 333 Action has been prepared with the benefit of active participation by representatives of the following countries:

Austria	Belgium
Denmark	Finland
France	Netherlands
Portugal	Slovenia
Spain	Sweden
Switzerland	United Kingdom

Estimates have been provided by the national representatives which suggest that the overall cost of activities associated with the Action, at 1995 prices, is around ECU 2 million. This estimate includes manpower and other costs likely to be incurred at national level, based on both present and historic input. It also includes an amount to cover the anticipated Commission funding level. The Action will probably involve 16-18 person years of effort. This estimate is valid under the assumption that all the countries mentioned above, and no other countries, will participate in the Action. Any departure from this scenario will change the total cost accordingly.

Figure 1: COST 333 Organization structure



NB : Task 3 Is dopondont on tasks 1 and 2
Task 2 is dependent on task 1

Memorandum of Understanding for the implementation of a European Concerted Research Action COST Action 334 "Effects of wide single tyres and dual tyres"

Date of entry into force of the project :	12.09.1996
Duration :	12.09.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
DENMARK	05.09.96	05.09.96
FRANCE	05.09.96	05.09.96
ICELAND	13.09.96	13.09.96
HUNGARY	08.11.96	08.11.96
AUSTRIA	17.10.96	17.10.96
FINLAND	05.09.96	05.09.96
UNITED KINGDOM	05.09.96	05.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to establish the relative effects of wide base single tyres and dual tyres assemblies in respect of road pavement damage, vehicle operating costs, vehicle safety and comfort and environment (particularly noise).

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 3,7 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of three years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES

A. BACKGROUND

A.1. State of the Art

Wide base single tyres on heavy vehicles are not a recent innovation. Although they have been available to vehicle operators for many years, there has been an apparent reluctance on the part of many operators to adopt them as standard equipment, perhaps because vehicle operators have been mistrustful of the performance of wide base single tyres.

Over the past ten years, as economic pressures on operators have increased, the adoption of wide base single tyres as fitments to heavy goods vehicles has become more widespread. They offer the vehicle operator lower unladen weights and, on the larger heavy goods vehicles, this can represent a significant payload advantage. The advantages of wide base single tyres have overcome the previous reservations of vehicle operators, and this has led to their very much wider use on the national and international fleets of heavy goods vehicles.

Studies of the potential of such tyre equipment to bring about structural wear in road pavements have indicated the possibility of increased wear. This has given rise to concern that the use of wide base single tyres does not adequately comply with the principle of cost recovery which applies in many Member States to construction and maintenance costs for the national road network.

The question of the possible contribution to road wear of wide base single tyres has received considerable world-wide attention. Generally, however, reported work has been either based on the use of models of pavement response and response measurements, or has involved the use of limited experimental work in which direct comparisons with the wear caused by conventional dual wheel assemblies were made. Only one study is known (carried out in the USA) in which long term testing of a full scale pavement has been used to compare the wear effects of the two tyre types. Unfortunately, this test was carried out on a pavement that is not typical of those used in Europe, and under conditions which make the translation of results to European conditions of truck weight and climate extremely difficult.

Against their possible effects on road wear, the use of wide base single tyres on heavy goods vehicles brings some clear advantages. In particular, their lower weight enables the multi-axled vehicle to carry significantly more payload than if it were equipped with dual wheels, and the reduced rolling resistance, with consequent improvements to fuel consumption, make the tyre attractive to vehicle operators.

Little is known of the possible effects on safety of vehicles equipped with wide base single tyres, and this aspect will need to be examined. The ride and handling (including braking) characteristics of such vehicles may be adversely or helpfully affected although, again, little is known on this at present. The fitting of wide base single tyres on vehicles designed to use them, for example, may lead to a wider wheel-wheel distance on an axle, conferring greater roll stability on that vehicle, with consequently reduced road wear. However, few if any experimentally driven results are available, and only limited modelling of the possibility has been undertaken.

Finally, it has been suggested that the use of wide base single tyres may have effects on noise emissions from the road/tyre surface, and that their use may lessen the increasing problem of tyre disposal. Again, these effects need to be quantified, so that informed overall judgements on the use of wide base single tyres can be made.

Based on work carried out in a number of European countries, work is now going on in the UK and the Netherlands that will evaluate the effects of the use of wide base single tyres in those countries. Nevertheless, none of these studies will, by itself, address all of the issues surrounding the use of wide base single tyres. In addition to long term experimental testing of a wide range of pavement types for road wear effects, there is a strong need to initiate work on the development of simple, but adequate, models of vehicle operating costs able to deal with tyre parameters. The use of techniques to evaluate overall effects on pavement construction and maintenance costs is also necessary, as is measurement of the effects of the use of wide base single tyres on noise emissions.

A.2. Research Requirements

Given that the consequences of the use of any type of tyre may affect either the road; or the vehicle, or both, it follows that both of these areas must be considered in any research programme undertaken. Similarly, the proposed work is likely to be based on the current state of the art in tyre technology, but should recognise that future developments may bring about improvements to the overall performance of wide single, or any other, tyres.

In the case of the effects on the road, it is particularly important to quantify exactly what are the road wear effects of using the different tyre types. At a time when specialized and costly road surfacings are being used on many roads throughout the EU, any potential for increased road wear becomes a significant economic factor. In the course of the work, due account will need to be taken of the type and thickness of pavement construction, the nature of deterioration, etc. At the same time, any effects on noise emissions from these different types of pavement will need to be examined.

The distribution of contact pressure across wide single tyres and dual tyre assemblies may also have effects on the potential for surface rutting of the pavement, and for friction between the tyre and the road. Techniques now exist that may assist such investigations, and there is a need to examine these effects in detail. The possibility of a "road friendliness" test for tyres could therefore be based on these, and other, aspects noted earlier and be included in any future modifications to European Directive 85/3.

From the point of view of the vehicle operator, and perhaps at a wider level, the costs of the increased damage may be offset by savings arising from increased productivity, vehicle safety and reduced rolling resistance. Such research will need to include, as part of its effort, an examination of the effects on these parameters of the nature of the tyre, the tyre and axle configuration, the location of tyres on the axle, etc.).

To assist national and international policy-makers in the formulation of appropriate measures, further work needs to be carried out which will qualify all of the effects, and develop techniques for assessing overall advantages and disadvantages.

COST offers the most appropriate framework within which to undertake this work because agreement is necessary between the technical representatives of national governments. Also, it is desirable that there is input from, and dissemination to, the COST countries which are not yet a part of the EU.

B. OBJECTIVES AND BENEFITS

B.1. Primary Objectives

The main objective of the Action is to establish the relative effects of wide base single tyres and dual tyre assemblies in respect of road pavement damage, vehicle operating costs, vehicle safety and comfort and environment (particularly noise).

Quantified and reliable information on this topic will enable national governments, and the EU, to consider the policies that might apply in respect of the use of wide base single tyres, the recovery or distribution of any additional costs or benefits arising from their use, and any necessary harmonization of safety or environmental standards.

The Action will also contribute strongly to the development of vehicle operating cost models and to the wider use of whole life cost models for road pavements.

B.2. Secondary Objectives

The Action will generate information that will be useful in several other respects. These will include, for example, data (where available) on tyre wear for input to a vehicle operating cost model, the effects of tyre type, tyre and axle configuration on payload stress and information on rolling resistance of different tyre types.

The information obtained through the Action will also assist in the design of vehicles intended for use with wide single tyres.

On a broader scale, more effective network management should become possible as a result of reduced wear to the pavement.

B.3. Benefits

The anticipated benefits of the Action are as follows:

* A contribution to European harmonization on vehicle weights and dimensions.

* Benefits to European industry, and to road users, from maximizing the efficiency of road transport within the EU, and greater competitiveness of European industry through improvements to road wear, vehicle operating costs, safety and environmental issues.

* Stimulation of the development of new technological ideas in tyres, vehicles and road pavements.

* Provision of valuable input data to other COST Actions now running (COST 323, 324 and 333 in particular).

* Encouragement of cooperation between teams of workers having different expertise, and with access to different facilities.

C. SCIENTIFIC PROGRAMME

C.1. Specification of Requirements

Some work has already been undertaken, particularly on the question of the pavement structural wear caused by wide base single tyres. This work needs to be set in the European context so that road owners, vehicle operators and policy makers are able to agree, if necessary, on standards for the use of these tyre types.

The principal requirement is therefore to develop guidelines and/or specifications for the use of wide single tyres on heavy goods vehicles in Europe.

Given the limited extent of the work carried out to date, specific requirements for the research activity to be undertaken fall into the following categories:

* Specialist input of knowledge from members of the Management Committee, to establish the current state of knowledge in Europe.

* Design of experiments or modelling that will establish the relative technical and economic effects of wide base single and dual tyres on pavement wear, vehicle operating costs, vehicle safety and road noise.

* Application of modelling techniques that will combine these effects and enable judgements to be made on the overall advantages of the use of wide base single tyres.

* Extension of the results to:

    - the wide range of pavement types and thicknesses that apply in European countries;

    - the range of climatic conditions applicable in Europe;

    - the assessment of national or international actions that may be required in order to harmonize differences;

    - consideration of a possible "road friendliness" test for tyres.

These research elements will require consideration of the experimental and modelling facilities that are necessary and available, data on the incidence of the use of wide base single tyres (and other types) and coordination of the research activities of a number of Member States.

Finally, the Management Committee will need to carefully examine the relationship of the work proposed to that being undertaken in other COST Actions, notably COST 323 (Weigh in Motion), COST 324 (Pavement Performance) and COST 333 (Bituminous Pavement Design).

C.2. Work Programme

It is anticipated that the implementation of the Action will comprise the following tasks:

1. A comprehensive literature search to establish the extent, and quality, of information available on the effects of wide base single tyres on pavement wear, vehicle safety and noise emission.

2. Evaluation of the information derived from the literature survey.

3. Continuation of the existing, and specification of the future, experimental work necessary to confirm the relative wear effects on pavements of wide base single and dual tyres.

4. Specification of a model, and its parameters if necessary, to evaluate the effects on vehicle operating costs of the use of wide base single tyres. Also, development and validation of the model.

5. Assessment of the effects of tyre type on safety, load and driver comfort, and environmental effects.

6. Use of existing, validated models of whole life costs of pavements, together with the model developed in Task 4, to examine the total financial consequences of the use of wide base single tyres on heavy goods vehicles.

7. Examination and evaluation of, and reporting on, selected "case studies" in different Member States, using readily available input data.

8. Development of guidelines for minimization of road wear, and maximization of the safety, comfort and environmental effects, and vehicle related cost benefits, associated with the use of wide base single and dual tyres in Europe.

D. ORGANIZATION AND TIMETABLE

D.1. Organization

The Management Committee will report to the Technical Committee on Transport. The work programme will be coordinated by the chairman of the Management Committee, supported by at least one vice-chairman. In addition, a coordinator will be appointed for each of the eight tasks mentioned in Section C.2. Each task coordinator will determine the work breakdown structure of his/her task. The organization structure of the programme is shown in Figure 1.

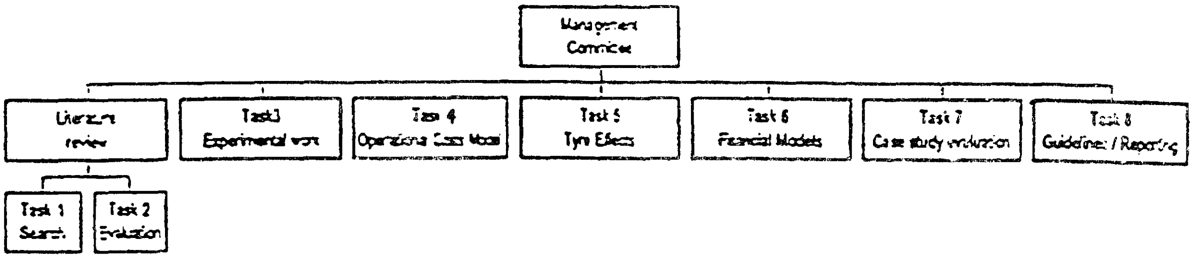


Figure 1: COST 334 Organization Structure

A detailed programme of support activities has not yet been determined, but it is expected that short-term scientific missions and/or other mechanisms will be utilized in a cost-effective way, subject to budgetary constraints.

D.2. Timetable

The total duration of the Action will be three years. The programme chart in Figure 2 shows the relative timing of the tasks in the work programme.

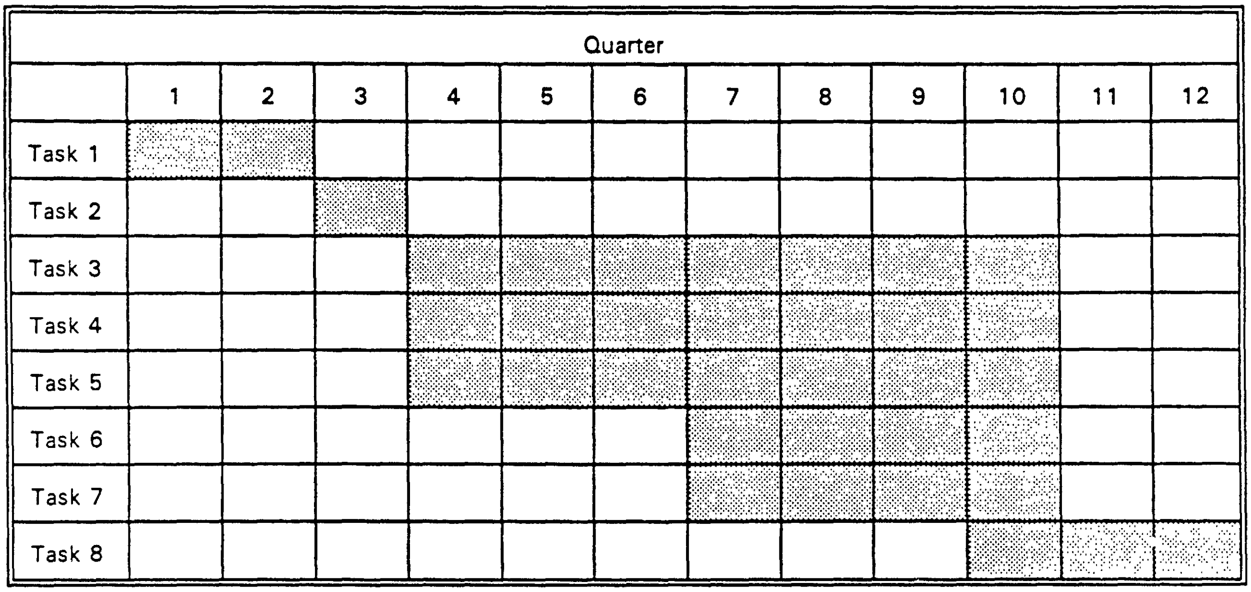


Figure 2: COST 334 Work Programme

E. ECONOMIC DIMENSION

The COST Action 334 has been prepared with the benefit of active participation by representatives of the following countries:

Austria	Belgium
Denmark	Finland
Germany	Netherlands
Spain	Sweden
United Kingdom	

There is substantial financial input to COST 334 related research in a number of countries at present. This has been estimated on a country by country basis, along with a national figure for the coordination costs financed over the COST budget of the Commission. Estimates have been submitted in terms of manpower and other costs (including equipment, travel and subsistence and running costs) at 1995 prices.

The overall cost of such activities, over the duration of the Action, has been estimated at MECU 3,7. This estimate is valid under the assumption that all countries mentioned above, but no other countries, will participate in the Action. Any departure from this scenario will change the total cost accordingly.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 335
"Passenger accessibility of heavy rail systems"

Date of entry into force of the project : 14.10.1996
Duration :

Contracting parties	Date of signing	Date of entry into force
DENMARK	03.10.96	03.10.96
GERMANY	03.10.96	03.10.96
SPAIN	14.11.96	14.11.96
FRANCE	03.10.96	03.10.96
ITALY	14.10.96	14.10.96
SWITZERLAND	19.11.96	19.11.96
FINLAND	31.10.96	31.10.96
UNITED KINGDOM	03.10.96	03.10.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to produce guidance for governments and railway operators on best practice in achieving full accessibility to their services and facilities. The Action will address both technical and economic issues and, in particular, the extent to which totally independent access can be achieved.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 2,5 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least 5 Signatories.

5. The Memorandum of Understanding will remain in force for a period of 3 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST 335

PASSENGER ACCESSIBILITY OF HEAVY RAIL SYSTEMS

A. BACKGROUND

Justification

Disabled and elderly people can only plan and undertake journeys if they can be confident that all stages of the journey will provide compatible levels of accessibility. Rail travel, both local and long distance, is an obvious field in which compatibility between access provisions is required. Without it, the scope for disabled and elderly people to make use of the European rail network is very limited.

There has already been some useful work at a European level in this area. A joint working party of the UIC and the ECMT has drawn up guidelines on access to rolling stock for EuroCity and other International services. In addition, the UIC itself has set up a working group of national railways to look at the scope for compatibility between practices and specifications in this area.

While this work is making a valuable contribution to technical understanding of these matters, its remit does not extend to the wider social and political considerations.

The purpose of the Action is therefore to provide a framework for this wide-ranging approach and to give renewed impetus to this key area of transport policy.

A COST Action is a particularly appropriate forum for this work because it can bring together a wide range of participating countries on the basis of sharing expertise and experience and of working together to formulate new technical and policy directions.

This forum will also encourage the implementation of this approach in line with the development of the Task Force "Trains and railway systems of the future" recently initiated by the European Union.

Scope

The approach is based on non-discrimination. It is in line with the European Union Green Paper on the Citizens' Network calling for developing public transport systems with higher quality and equitable access for all.

Measures for accessibility – such as self-opening doors, ramps etc. – will increase the quality for other people as well. Measures for quality – such as good information, serving meals at seat, train taxis etc. – will increase the accessibility for disabled and elderly people as well.

There is a substantial actual and potential passenger market for the railways in this area. The term "disability" covers a wide range of very different impairments – physical, sensory and cognitive. Some definitions relate to medical conditions; it is, however, more appropriate in a travel-related context to consider functionally-based criteria to describe the wider range of people who might have difficulty in travelling. Additionally, there are many people who are not disabled, but to whom policies and facilities designed for disabled people would be helpful.

These include:

- elderly people;
- people encumbered by luggage, pushchairs, heavy shopping, small children, etc.;
- those unable to speak or understand the local language, such as tourists.

On the previous broad definition the scope of "disability" would include:

- people with mobility handicaps including:
  = wheelchair users;
  = people with severe or slight walking difficulty;
  = people unable to climb steps;
  = people with difficulties in gripping and balancing;
- people with sensory impairments including blind people and those with impaired vision;
- people with impaired hearing and profoundly deaf people;
- people with speech impairment or without speech;
- people with cognitive difficulties.

<u>Potential market</u>

There is inconsistency between countries in both the detailed definitions of disability and in how measurement is effected. It is, therefore, difficult to collate international statistics with any precision. The current consensus view, however, is that approximately 12% of the population of the European Union is disabled. (This is derived from both formal and informal studies).

This represents some 41 million disabled people in the EU alone and over 50 million in Europe as a whole.

The corresponding figure for the USA is 43 million disabled people.

Within these figures some other useful points can be noted:

- wheelchair users represent only around 6-7% of the total number of disabled people;
- approximately two-thirds of disabled people have a mobility handicap, i.e. around 7,5% of the population;
- approximately two-thirds of disabled people are elderly (i.e. aged 60 or over).
- a significant number of disabled people will travel with at least one other person.

The correlation between disability and age is an important one. Around 20% of the total European population – approximately 76 million people – are currently aged 60 or above. Eurostat forecasts indicate that this will grow to 110 million, or 28% of the total population, by the year 2000. This is coupled with an absolute decline in numbers of those aged under 60.

From this data, the combined total of disabled and elderly people is approximately 24% of the total European population, i.e. around 100 million, and this figure is expected to rise to over 130 million, above 30% within 25 years.

In order to understand how to reach this potential market it is necessary, on the one hand, to conduct an in-depth market study and, on the other hand, to identify the requirements for design and refurbishment.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to produce guidance for governments and railway operators on best practice in achieving full accessibility to their services and facilities. The Action will address both technical and economic issues and, in particular, the extent to which totally independent access can be achieved.

Secondary objectives will include the raising of awareness among train operators of the actual and potential size of the market for rail travel among disabled and elderly people and giving them a clear indication of the wide range of issues involved in realizing that market potential.

The Action will also consider the implications of its recommendations both for public spending and for competitiveness in the commercial environment.

There will be particular emphasis on the scope for and benefit of cooperation between policy makers, manufacturers, operators and users in moving towards solutions that are both effective and sustainable.

C. SCIENTIFIC PROGRAMME

The Action needs to include a systematic evaluation not only of the facilities and services relevant to the station and rolling stock, but to the whole journey from door-to-door. For many people with mobility difficulties, journeys can only be undertaken if every link in a chain of accessibility is complete. This chain starts with information about the journey before the person has left home and ends only once they have reached their final destination.

In order to draw together all the necessary information, the Scientific Programme will include the following elements:

Economic aspects:

- defining the market;
- the commercial case for accessibility;
- costs of measures, public or private financing, social issues;
- marketing opportunities (niche and core market developments).

Pre-travel information:

(Particular reference to the need to standardize information between operators regarding the continuous provision of transport chain information. Relevant data can be drawn from the RICA Report on transport information for people with disabilities).

- content (what facilities, what services, what help, who to contact);

- quality (accuracy, accessibility, ease of understanding);

- format (large print, braille, audiotape, text telephones);

- availability (interactive terminals and others including teletext, minitel, local radio, local press, etc.).

Access to and within stations:

(Particular reference to establishing both the fundamental minimum requirements and the optimal requirements for accessibility and the importance of compatibility between stations.)

- ease of access (reduction of internal movements, ease of the intermodal connections);

- ticket purchase (including reservations);

- waiting areas;

- toilet facilities;

- catering;

- information and signing (including audible, visual, real time).

Interface between station and rolling stock:

(Emphasis on user needs and functional requirements and on compatibility between cross-border requirements will be done. After the inventory of national situations, the recommendations for achieving a more coherent network will distinguish between new and old facilities).

- platform height (European pre-standardization);

- tactile marking/surfaces;

- boarding/alighting equipment;

- other boarding/alighting aids;

- rolling stock technology to minimise horizontal/vertical gaps;

- luggage transfer.

Rolling stock design:

(For single and double deck trains, for suburban and long distance including the couchette train. In this area relevant data can be drawn from the UIC/ECMT Guidelines).

- doorway width/height;
- gangway width;
- seating layout;
- wheelchair space;
- toilet facilities;
- catering;
- lighting;
- position of handholds;
- colour contrasts, etc.;
- on-train information;
- access to emergency facilities.

Staff:

(With reference to the close link between rolling stock design and the role of staff)

- availability;
- skills and training;
- health and safety issues.

Fare structures:

(With reference to the economic, competitive and deregulation environment of the railways).

- information;
- incentives to travel/fare concessions;
- through ticketing (including transferring between modes).

Group travel:

- availability of wheelchair spaces;
- booking arrangements;

- training/information to the users.

Compatibility and inter-modal transfer:

- compatibility between systems of information, facilities, ticketing, luggage registration;

- transfer/transit information (facilities, availability of staff).

Regulatory framework:

- legislation/regulation;

- codes of practice/guidance;

- maintaining and monitoring standards.

D. ORGANIZATION AND TIMETABLE

The exchange of information will be supported through technical visits and circulation of documents. Common work will be achieved through working groups which will be set up where appropriate.

The following phases will be included:

Phase 1

- To gather and analyse experience from participating members on topics identified above and to identify gaps in knowledge and experience on these topics.

- To draw up principles for good practice under each topic and to develop an evaluation methodology.

Phase 2

- To stimulate the collection of data to fill gaps in knowledge and experience identified in Phase 1.

- To assess scope for compatibility/coordination of existing practices and standards.

Phase 3

- In the light of the results of Phase 2; to establish best practice in each area through case studies, codes of practice and guidelines.

- To disseminate and promulgate best practice to governments and operators.

The dissemination plan includes an opening seminar during Phase 1, an interim report after Phase 2 and a conference after Phase 3.

The estimate of the total duration of the project is three years. Each phase is expected to last one year.

E. ECONOMIC DIMENSION

The economic dimension of the Action is the sum of the national costs incurred by the countries participating in the Action, the costs incurred by international organizations participating in the Action, and the coordination, which will partly be paid by the Commission.

The national costs comprise the personnel costs arising from the involvement of staff in the Action, translation costs not covered by the Commission, acquisition of equipment where necessary and travel expenses not covered by the Commission.

Nine countries and two international organizations actively participated in the preparation of this Action. They are Spain, Finland, France, Italy, Ireland, the Netherlands, the United Kingdom, Sweden, Switzerland, International Union of Railways (UIC) and the European Disability Forum (EDF). On the basis of the information available during the preparation of the Action, they planned to earmark an average of ECU 78 000 each and per year.

The estimate of the total costs including the coordination costs partly paid by the Commission is ECU 2,5 million.

This estimate is valid only if the abovementioned countries and organizations participate in the Action. Any withdrawal or other participation would alter this estimate.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 336 "Use of Falling Weight Deflectometers in pavement evaluation

Date of entry into force of the project : 10.07.1996
Duration : 09.07.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
CROATIA	19.06.96	19.06.96
DENMARK	19.06.96	19.06.96
SPAIN	19.06.96	19.06.96
FRANCE	27.06.96	27.06.96
IRELAND	17.10.96	17.10.96
ICELAND	13.09.96	13.09.96
ITALY	14.10.96	14.10.96
HUNGARY	19.06.96	19.06.96
NETHERLANDS	27.06.96	27.06.96
PORTUGAL	19.12.96	19.12.96
FINLAND	10.07.96	10.07.96
UNITED KINGDOM	05.09.96	05.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is the development of a European common code of good practice for use of falling weight deflectometers in pavement evaluation.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 1,9 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of three years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

USE OF FALLING WEIGHT DEFLECTOMETERS IN PAVEMENT EVALUATION

A. BACKGROUND

This Action deals with a device used for measuring the bearing capacity of a road pavement, and also with the post processing procedures required for actual assessment of the strengthening overlay need evaluated at road project level.

This type of device is called a Falling Weight Deflectometer, FWD.

The FWD is already used in many EU countries and, in the US/SHRP programme, it is chosen as the authorized equipment for bearing capacity assessment of pavements.

Use of FWD testing is a growing requirement in modern pavement maintenance management, and it has already been implemented as a routine procedure in some European countries, and in others as equipment used in research or special investigations.

Three types of apparatus are most commonly used (two Danish and one Swedish), and a few non-production machines also exist. This situation, which gives a variety in testing results and procedures, must be harmonized to make exchange of results and experience possible.

Different procedures and usage have been investigated by a FEHRL [1] FWD group for three years with the aim of creating guidelines for making measurements with FWDs. This work has resulted in a common FEHRL FWD publication.

Participants in COST 336 maintain close links with work being undertaken within associated international projects, such as those operated within the OECD and US/SHRP programmes. Interchange between such activities and COST 337 will be on a selective basis, as with each of the Actions initiated by FEHRL.

The COST framework has been chosen as the most appropriate coordination funding mechanism in this area for the following reasons:

- It is desirable that as many of the nominated COST countries benefit from the work as possible; not only those within the EU at the present time.
- In order to create an effective common code of good practice, it is desirable to have agreement between the technical representatives of national governments.

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(1) Forum of European National Highway Research Laboratories

B. OBJECTIVES AND BENEFITS

B.1. Primary Objectives

The main objective of the Action is the development of a European common code of good practice for use of falling weight deflectometers in pavement evaluation.

This will encompass the following activities:

- Expand FEHRL harmonization proposal to incorporate strengthening evaluation on the basis of FWD-tests.
- Establish common requirements for calibration of measurements and machines.
- Describe the potential for use of FWDs in evaluation at network level.
- Establish a preparatory basis for pcssible European standardization in the field.

The situation today is such that usage and experience in pavement evaluation, by FWD means, is very different among the European countries which utilize this equipment, and needs in this area should be addressed. Further to this, there is a need for the identification of common requirements for calibration and correlation of the various machines on the market.

B.2. Secondary Objectives

The Action will also contribute to the achievement of a number of wider objectives. Examples are as follows:

- Lack of dependence on individual FWD types.
- A more harmonized market for organizations involved in bearing capacity testing by means of FWD.
- Extended knowledge of FWD testing on roads with flexible and rigid pavements.

B.3. Benefits

The FWD has been developed in Europe, and is now in world-wide use. Much of the expertise and knowledge on FWD operation is available in European countries, and taking advantage of this position will address certain shortcomings in the US/SHRP approach which have already been identified as a result of European experience.

Previously, many countries had carried out parallel research in the field, and formulated national standards and procedures will effectively be taken into account within the COST Action.

The Action will allow less experienced countries (including CEE and NIS) to enhance their capabilities in this area, and will promote the exchange of services within the field of pavement strengthening evaluation in the EU single market. Thus, a formulated Common Code of Good Practice will be a prerequisite.

Finally, the Action will contribute to the pooling of the abilities of several COST countries with experience in the proposed research field.

C. SCIENTIFIC PROGRAMME

The Action is a continuation of the successful FEHRL FWD Activity group which drafted the FEHRL publication No 1: "Harmonisation of FWD Measurements and Data Processing for Flexible Road Pavement Evaluation at Project Level". This was the result of three FEHRL FWD Seminars held in The Netherlands, France and Denmark with contributions from 14 European countries.

The Action comprises four tasks:

TASK 1: Post-Processing of FWD Data

This task will give a complementary description of the post processing of FWD data at project level to the following items which had not been covered until now:

(i) The calculation of in-situ layer stiffness.

(ii) The correction of layer stiffness to standard conditions.

(iii) The calculation of critical stresses and strains.

(iv) The estimation of residual structural lives and the required thickness of strengthening overlays.

The sub-tasks necessary to achieve this are as follows:

- Collection of existing information.
- Determination of elements to be documented.
- Evaluation of the existing post processing models.
- Specification of a post processing model.
- Definition of the term "residual life".
- Calculation of in-situ E modulus.
- Normalization of pavement parameters.
- Assessment of critical stresses and strains.
- Calculation of residual structural life.
- Evaluation of the required thickness of strengthening overlays.
- Generation of guidelines for post processing procedures.

Having completed this task the benefit will be a harmonized description of how FWD Measurements are post processed, enabling effective exchange of FWD consultancy services within the Single Market. It will also give participating countries a better method for pavement condition evaluation and maintenance of roads.

Hence, maintenance costs will become more effective when appropriate decisions can be made and this will lead to saving of much money for the EU countries.

TASK 2: Applicability of FWDs at Network Levels

This task will extend the work on harmonization of FWD measurement already carried out by the FEHRL FWD Activity group for executing measurements at project level. It will involve the description of how and when FWDs should be used at network level, and will provide estimates for the timing of maintenance and strengthening requirements to road agencies.

The sub-tasks necessary to achieve this are as follows:

- Collection and assessment of existing information.
- Drafting of guidelines for FWD use at network level.
- Organization of a seminar on use of FWDs at network level.
- Dissemination of information to seminar participants.
- Generation of a task report.

Having completed this task, the benefit will be the specification of circumstances under which FWD measurement can be used effectively for network level evaluation.

TASK 3: FWD Calibration

This task will focus on quality assurance of FWD measurements, from a calibration point of view, in three areas:

(i) Calibration of the complete FWD measurement system.

(ii) Description of an instrumented calibration station for calibration checks on real pavements.

(iii) Normalization of data from different FWD types.

This work will be carried out under the following task headings:

- Creation of an inventory of current calibration procedures.
- Assessment of existing calibration approaches.
- Investigation of the effect of load pulse shape and width on deflection peak value.
- Investigation of FWDs with different load pulse widths.
- Evaluation of load pulse and peak value investigations.
- Assessment of procedures for normalizing FWD values.
- Assessment of the calibration approach and activities.
- Description of requirements for an FWD calibration station.
- Verification and validation of the prescribed procedures.

- Preparation of the calibration protocol.
- Documentation and reporting of results.

Having completed this task, the deliverable will be a set of guidelines for achieving the level of precision required for FWD testing.

TASK 4: Finalization of Deliverables and Reporting

This task is the concluding and production stage of the proposed work programme. It will provide the following deliverables:

(a) Guidelines for the post-processing of FWD data at Action level.

(b) Proposal for applicable procedures for use of FWDs at network level.

(c) Calibration protocols for FWD machines.

(d) Requirements for FWD calibration stations.

D. ORGANIZATION AND TIMETABLE

D.1. Organization

The work will be organized and supervised by the Management Committee which will probably meet, on average, three times per annum. The Management Committee will report to the Technical Committee on Transport.

Working groups will be set up and assigned responsibility for completing Tasks 1, 2 and 3, together with their share of task 4. Each working group will typically consist of 5-7 people. This organization structure is shown in Figure 1.

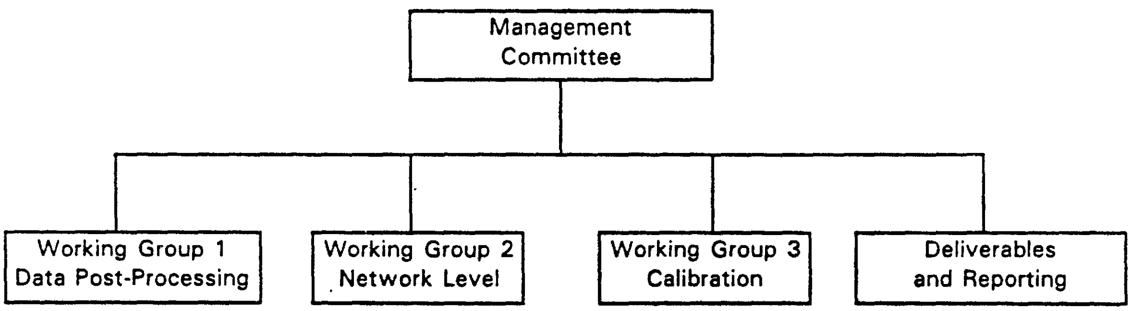


Figure 1: COST 336 Organization Structure

Each of the three working groups will exist in parallel throughout the life of the Action, and will eventually submit individual sections to the final report. The coordinating activities associated with the final report will therefore be a relatively brief activity during the final few months of the Action.

It is anticipated that a small number of short term scientific missions would be desirable to support the work in Tasks 1 and 3. Also, a seminar in the latter stages of year 1 would be a highly desirable part of the work of the Task 2 working group. Budget availability at the time will be taken into account when formulating these, and any other, requests for financial support.

D.2. Timetable

The duration of the COST 336 Action will be three years and the timetable for the tasks and sub-tasks is shown in Appendix A.

E. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action:

Austria	Belgium
Denmark	Finland
France	Ireland
Netherlands	Portugal
Slovenia	Spain
Switzerland	United Kingdom

It can therefore be seen that this is a very strongly supported Action in a very specialized technical area.

On the basis of national estimates provided by the representatives of these countries, and taking into account the coordination costs of the Commission, the overall cost of the activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 1,9 million. There are likely to be 15-20 man years of effort involved.

This estimate is valid under the assumption that all the countries mentioned above, but no other countries, will participate in the Action. Any departure from this scenario will change the total cost accordingly.

Appendix A

Task 1 Work Programme

Sub-Task	Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
Collecting Info												
Determine Elements												
Evaluation Model												
Choice of Model												
Norm. of Parameters												
Res. Lifetime												
Cal. of E-Moduli												
Cal. Stress & Strain												
Cal. of Res. Life												
Est. of Overlay												
Reporting, Task 4												

Task 2 Work Programme

Sub-Task	Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
Collecting Info												
Prep. Draft of Guide												
Seminar FWD Proc.												
Circ. of Draft												
Reporting, Task 4												

Task 3 Work Programme

Sub-Task	Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
Inventory on Proc.												
Eval. of Calib. Appr.												
Effect of Pulse&Peak												
Load Pulse Width												
Eval. of Pulse&Peak												
Normalize values												
Calibration Approach												
Calibration Station												
V&V of Approach												
Calibration Protocol												
Reporting, Task 4												

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 337
"Unbound granular materials for road pavements"

Date of entry into force of the project : 13.09.1996
Duration : 13.09.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
SPAIN	12.09.96	12.09.96
FRANCE	12.09.96	12.09.96
IRELAND	04.12.96	04.12.96
ICELAND	13.09.96	13.09.96
NETHERLANDS	12.09.96	12.09.96
PORTUGAL	19.12.96	19.12.96
FINLAND	12.09.96	12.09.96
UNITED KINGDOM	12.09.96	12.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to develop the measurement of structural properties of unbound materials, to establish the most important factors affecting performance and to derive values to be used in pavement design.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 6,7 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

UNBOUND GRANULAR MATERIALS FOR ROAD PAVEMENTS

A. BACKGROUND

A.1 State of the Art

Unbound granular materials are generally used as base and sub-base courses in road pavements. As a base course they play a structurally important role, especially on medium and low volume roads. As a sub-base, they protect the soil, and act as a working platform and an insulating layer against frost action. The unbound material may be natural material like gravel or sand or crushed rock, or may be the by-product of an industrial process such as crushed slag, crushed concrete or crushed concrete mixed with crushed masonry.

Research on unbound materials has been undertaken mainly at national level because there are no strong international organizations with these particular interests. Furthermore, international trade in these materials has been limited up to the present time.

Unbound materials have been quite readily available in Europe but, for environmental reasons, sources of supply have decreased over time, resulting in price increases and a decrease in quality. Generally, the use of by-products like slag, crushed concrete and masonry should be encouraged and, as these materials have been relatively cheap, there has been relatively little interest in improving associated processes at either national or European level. Taking these factors into account, the scarcity of unbound materials remains more severe in Europe than elsewhere in the world.

Although they are non-visible elements of pavement construction, the correct functioning of the lower, unbound granular layers is vitally important. Pavement failure due to inadequate support of upper layers, or to rutting, will usually necessitate complete pavement reconstruction, and not just remediation of the pavement surface where the problem is visible.

This Action will be able to benefit from the results of a previous EU "Science" programme entitled "A European Approach to Road Pavement Design". The participants were Laboratoire Central des Ponts et Chaussées (LCPC) in France, Laboratorio Nacional de Engenharia Civil (LNEC) in Portugal, Pavement and Geotechnics Research Group of the University of Nottingham, in the United Kingdom, and the Road and Railroad Research Laboratory at the University of Delft in the Netherlands.

There is a pan-European agreement which states that asphaltic layers should be described in terms of stiffness, fatigue and deformability under repeated loading, but no such agreement exists for materials which comprise the lower pavement layers. Therefore, material characteristics, characterization methods and laboratory techniques, material models, and analytical techniques have yet to be addressed on a pan-European basis in this area.

The unbound granular materials industry, dominated by quarrying companies, has generally produced materials according to the present standards but, because they are not road contractors, they have shown very little commercial or technical interest in the behaviour and performance of the 'in situ" materials once they have been laid.

Although the previous EU "Science" project proceeded well in characterising the modulus (stiffness) of materials, some questions were left open, and it was seen that there existed an identified need to further develop repeated load triaxial testing. Characterization of the in situ modulus (unlike bituminous materials, the moduli of unbound materials are strongly dependent on state of the stress and the properties of underlying materials) is still unclear. Although the Falling Weight Deflectometer can be used to measure the modulus, the results are often different from those in laboratory tests. The connection between these different types of assessment is still rather poorly understood.

Performance under moving axle loads remains difficult to test in a laboratory. Thus the interdependence of basic variables is also not well understood.

A.2 Use of the COST Framework

To date, only research laboratories (often part of a national road administration) and universities have studied the behaviour and long term performance of these materials. Therefore, use of the COST framework is highly appropriate, in order to ensure that the technical results of this work are approved by national governments within Europe, effectively disseminated and used extensively for technical and commercial advantage.

Very little international cooperation has taken place in this field, mainly as a result of a lack of suitably equipped organizations. Even repeated load triaxial tests have tended to be country-specific, and results can thus be complicated and difficult to interpret. Also, there are very few test facilities and these are expensive to use. It would therefore be desirable to combine the contribution of the different test facilities and laboratories in order to provide a unified, internationally acceptable strategy for interpretation and implementation. Thus, the framework for international cooperation provided by COST would be very valuable in creating the environment necessary to improve the application of modern scientific methods to this under-researched and crucially important element of our road pavements.

B. OBJECTIVES AND BENEFITS

B.1 Primary Objectives

The main objective of the Action is to develop the measurement of structural properties of unbound materials, to establish the most important factors affecting performance, and to derive values to be used in pavement design.

Throughout Europe environmental pressures are limiting the availability of good quality, crushed rock material. At the same time there is increased pressure to use waste and by-product aggregates of marginal quality as well as conventional aggregate formerly rejected as unsuitable. Because of the volumes required there are limited possibilities to improve material quality, and it is therefore very important to find the actual performance of each material so that it may be used optimally; the best material not being used where a lower quality aggregate can be shown to be more appropriate at the time.

It should also be noted that dissemination of the results of the Action will be an important objective, to ensure that both private and public sector decision makers have the opportunity to take full advantage of the findings.

B.2 Secondary Objectives

The primary objective given above requires a fundamental, as opposed to empirical, approach to material assessment. Thus, secondary objectives are to develop appropriate measurement technologies to help in the standardization of mechanical testing of unbound materials, and also to stimulate the use of secondary materials.

B.3 Benefits

The Action will lead to considerable benefits throughout Europe, in the following areas:

* Increased knowledge of unbound materials and their performance.

* Increase cost-effectiveness in using unbound materials.

* More economic and reliable pavement construction.

* Increased possibilities of international trade as the properties are better known.

* Increase possibilities of using alternative and marginal materials from which industry, as well as the environment will benefit.

* Harmonization of European measurement methods on unbound materials.

Cooperation between research teams will therefore allow countries to benefit from the experience of other countries with respect to unbound materials. The use of a common approach to determine the performance of these facilities will also help to facilitate the work of consultants and contractors on a pan-European basis in this area.

C. SCIENTIFIC PROGRAMME

C.1 Description of the Action

The Action will contribute to the Strategic European Road Research Programme (SERRP), which is being established by the Forum of European National Highway Laboratories (FEHRL).

The programme consists of the following parts:

1. Initial determination of functional requirements of the base and sub-base layers of road pavements; involving compaction properties, stiffness (load spreading capacity), permanent deformation resistance, drainage behaviour and integrity (e.g. abrasion and wear resistance).

2. Review of tests, test procedures, models and materials used in different European countries.

3. Determination of future requirements for the improved use of base and sub-base materials and also outline specifications.

4. Pan-European coordination of national government testing activities.

5. Generation of guidelines for future test procedures.

6. Recommendation of modelling methods (including resilient and permanent deformation).

7. Creation of guidelines for future research to be undertaken.

8. Evaluation and reporting.

The results of this work will provide an effective guide and baseline for subsequent research work at both national and European level.

C.2 Relationship/Complementarity with other Programmes

The proposed research will enhance the work done in the EU "Science" project, and will also include new countries which have experience in using unbound materials, and also have laboratory facilities, but which have not previously participated in international cooperation in this field.

COST is seen as the most effective method available at present for creating an effective technical framework at European level, thus enabling subsequent research work to be undertaken more efficiently and effectively. However, it provides only coordination funding, and nothing for research. As the laboratory and field testing of unbound materials is expensive and, as comparative tests need to be made in laboratories in different countries, funding will be difficult to source at national level. Therefore, researchers in this area will be seeking national and Fourth Framework Programme support funding for further work. It is expected that this will involve a proposal to Task 7-4/23 (Road Infrastructure Materials) within the Transport Research Programme. However, the success of COST 337 will not have any dependency upon such future activities.

The associated tasks to be undertaken outside of the COST 337 work programme are likely to be as follows:

1. Specific comparisons of previous research on unbound granular materials performed by the participating laboratories.

2. Selection and preparation of standard unbound granular materials including by-products like slag and crushed concrete.

3. Implementation of an inter-laboratory test programme for repeated load triaxial, and other performance related, testing of unbound materials, including tests in small scale accelerated facilities.

4. Development of improved constitutive and performance models, drawing on a comparison of data with that from previous tests.

5. Implementation of in situ, and full scale accelerated, testing of unbound layers, with results related to performance in the laboratory, and in situ under vehicle loading.

6. Recommendations leading to the specification of the most appropriate tests for each property and material (especially by-products).

7. Evaluation and reporting.

8. Dissemination of the results, and input to CEN.

In addition to those for general testing and experimental work, the following specialized facilities and mechanisms would be used:

* Repeated load triaxial tests.

* Dynamic (Laboratory/In Situ) Test Facilities.

* Small Scale Accelerated Testing Facilities.

* Full Scale Accelerated Testing Facilities.

The activities described above are the principal components of the GRAN-MAT initiative within the SERRP at the moment.

Cooperation with other COST Actions is very important, mainly COST 324 (Long Term Performance of Pavements), COST 333 (Development of New Bituminous Pavement Design) and COST 336 (Use of Falling Weight Deflectometer in Pavement Evaluations).

D. <u>ORGANIZATION AND TIMETABLE</u>

D.1 Organization

The COST 337 Management Committee will report to the Technical Committee on Transport. The programme has been split into eight main tasks, but it was only seen as necessary to set up five different working groups to carry out the work. Each of these tasks will have a leader appointed, and he will agree the most appropriate representation on his working group. The working groups will report to the Management Committee, from time to time, as appropriate. The organization structure for the Action will be as shown in Figure 1.

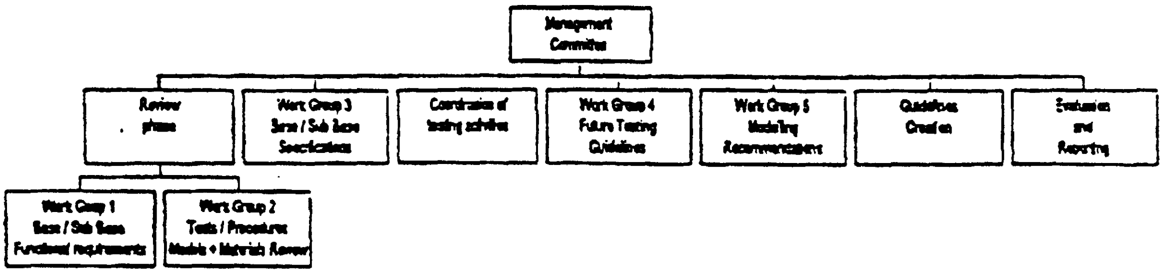
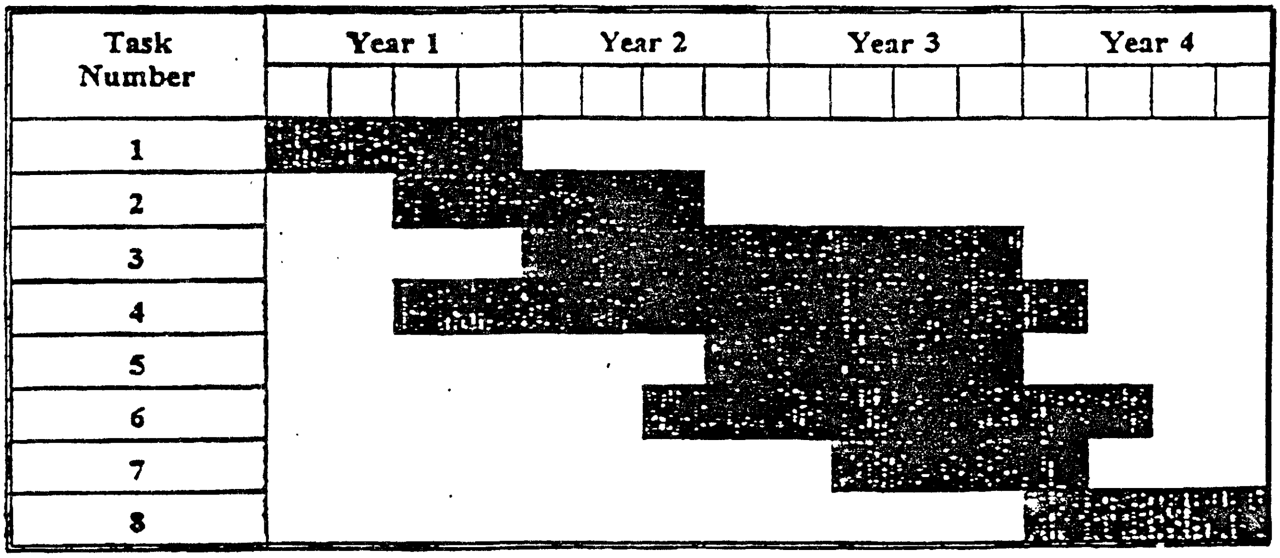


Figure 1: COST 337 Organization Structure

Although a detailed programme has not yet been agreed, it is anticipated that the use of technical support mechanisms (short term scientific missions, studies, etc) would be highly desirable in producing the deliverables within the major work packages. Requests for such support will be subject to general budget availability.

D.2 Timetable

The COST 337 Action will take four years to complete, from the signature of the MOU. The timetable for the Action is shown in Figure 2.



E. ECONOMIC DIMENSION

The COST 337 Action has been prepared with the benefit of active participation by representatives of the following countries:

Belgium	Finland
France	Netherlands
Portugal	Slovenia
Sweden	United Kingdom

The total costs associated with carrying out the proposed programme of work, at 1995 prices, are estimated to be MECU 6,7. This estimate has been arrived at by asking each of the scientists involved to assess their countries' expected financial involvement in the Action.

This estimate is valid under the assumption that all the countries mentioned above, but no other countries, will participate in the Action. Any departure from this scenario will change the total cost accordingly.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 40
"European Sea Level Observation System (ESS)"

Date of entry into force of the project :	12.09.1996
Duration :	12.09.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.09.96	12.09.96
DENMARK	05.09.96	05.09.96
GERMANY	12.09.96	12.09.96
FRANCE	05.09.96	05.09.96
ITALY	24.09.96	24.09.96
NETHERLANDS	12.09.96	12.09.96
PORTUGAL	30.10.96	30.10.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to:

   - coordinate the further implementation of geodetic (space) techniques for sea level monitoring and fixing of all tide gauge benchmarks along the European coastline;
   - arrange agreements at a European level for the long term assembly, storage and exchange of uniform sea level and related data.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 15 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 40

"European Sea Level Observation System (ESS)"

A. GENERAL BACKGROUND

Mean sea level is measured at over 1 000 tide gauges around the world; the oldest sea level records contain over 300 years of sea level information. From the tide gauge records it is clear that the global mean sea level has been rising slowly (about 15 cm/cy) but gradually over the last 100 years. However, significant variations are observed between the tide gauges. Many mechanisms can be responsible for these variations.

At present, relative sea level rise is a subject of major concern for many countries in (North-) western and Southern Europe. The reason for this is the expected acceleration of sea-level rise due to climate change. Although no one really questions a future acceleration of sea level rise, major uncertainties still exist about its magnitude. Best estimates range from 30 to 100 cm/cy. Many vulnerable low lying coastal zones around the world (many of which are densely populated and of great economic importance) are seriously threatened by these rates of sea level rise.

The uncertainty in the predictions is one of the reasons for continuous monitoring of the mean sea level. Monitoring and modelling are important means for detecting what is really going on. Precise sea level measurements can help us to understand and quantify the various causes of sea level rise and to improve the oceanographic and climatological models that underlie the sea level predictions. Improved modelling will enable researchers to reduce the uncertainties in their predictions.

An important application of actual sea level information is the monitoring of storm surges. For the modelling of storm surges, which is very important in view of risk assessment, hourly mean values of sea level are required. In general, agreements on the exchange and storage of the hourly mean values are lacking at present.

Dense tide gauge networks are available for the purpose of sea level monitoring in most European coastal states. However, not all tide gauges comply with the international standards as yet.

At present, national funding is available for sea level monitoring and maintenance of tide gauge networks in most (but not all) countries. However funding from international agencies (e.g. EU) is also absolutely essential. Whereas the emphasis these days still is on national campaigns, some international projects have also been carried out in recent years in various regions. These projects could not have been realized without Community funding. Also in the future funding from international agencies will be required.

When monitoring relative sea level rise, we measure the change in sea level relative to the land. Eustatic sea level rise as well as land subsidence can be responsible for the relative rise. In reality, both mechanisms play an important role. Discriminating between these contributions is the first step required for quantifying, understanding and modelling the mechanisms. The fixing of tide gauges to a well defined reference level is thus of paramount importance. Levelling has for a long time been the only technique available for tide gauge fixing.

Developments in technology
Over the last decades, new technologies have become available for scientists and managers. For the sea level community, especially the developments in geodetic space techniques offer unique and promising perspectives to overcome some of the problems that have limited progress in monitoring and modelling capabilities for many decades. Advanced point positioning techniques such as the Global Positioning System (GPS), and satellite radar altimetry have proven to be of great (potential) value for sea level research.

In modelling climatological and atmospheric processes, to which mean sea level is directly related a tendency towards global models is observed. GPS (in combination with VLBI and SLR) offers the opportunity to establish regional and even global tide gauge networks with a common reference level, which is of prime importance for monitoring the global scale variations in mean sea level rise. The Global Sea Level Observing System (GLOSS) network is already operational for this purpose, and provides researchers around the world with very valuable information. Also on smaller (regional) scales, the application of GPS for the establishment of regional networks is very promising. Rates of sea level rise can differ significantly from the global average. Dense tide gauge networks are therefore needed in vulnerable coastal zones, but at present are not yet available everywhere.

GPS has proven to be an excellent tool for connecting these gauges. Over the last years, many countries have performed national campaigns for testing the GPS capability for fixing tide gauge benchmarks. In addition international campaigns are being organized, and around the world some regional densifications of the GLOSS network have been established.

Radar altimetry enables the determination of the (variations in the) 3D pattern of the sea level surface. From these variations in sea topography, information can be gained on changing patterns in ocean currents. Also for smaller scale applications, radar altimetry is expected to be a very powerful technique. Oceanographic modelling in, for instance, the North Sea basin may substantially benefit from the developments: altimetry can provide us with information on sea surface topography across the entire basin, which allows a better calibration and further improvement of tidal models. In the "old days", only tide gauge data could be used for this calibration.

B. OBJECTIVES OF THE ACTION

The main objective of the Action is twofold. Firstly, to coordinate the further implementation of geodetic (space) techniques for sea level monitoring and fixing of all tide gauge benchmarks along the European coastline; secondly, to arrange agreements of a European level for the long term assembly, storage and exchange of uniform sea level and related data.

In general, NOSS intends to serve as an umbrella, under which various sea level activities can be coordinated. The developments in the field of monitoring technology, as well as the requirements for research and management, urge for an integrated implementation of these technologies in sea level monitoring, and for further international agreements on data storage and exchange.

The most important outcome of NOSS is expected to be an "organism" that guarantees and coordinates long-term monitoring activities and data exchange around the North Sea and along the entire European coastline.

The main objectives of this Action can be divided into two groups: objectives concerning the technological aspects of sea level monitoring, and objectives concerning the management and research activities that can benefit from the improved monitoring capabilities.

The main technological objectives are:

- optimization of tide gauge networks,
- implementation of geodetic fixing of all tide gauge benchmarks (subject to funds being made available by national and/or international agencies),
- establishment of regional sea level monitoring network.

The main management/research objectives are:

- data production for determination of detailed spatial pattern of sea level rise,
- improvement of the tidal modelling capabilities,
- data production for better understanding of climatological contribution to sea level rise,
- improvement of flood warning capabilities by real time exchange of tide gauge data.

C. GENERAL PROGRAMME OF THE ACTION

For the implementation of these NOSS objectives in Europe, a dual approach is preferred:

1. The definition and testing of guidelines, standards and rules and full implementation in the North Sea and surrounding area;

2. Once NOSS is operational in Northwest Europe, extension of the monitoring networks and implementation of the standards over other parts of the European coastline (including the Mediterranean) is foreseen.

The background for this dual approach can be found in the monitoring networks and supporting facilities that are already available in Northwest Europe. Most countries in this region operate dense tide gauge networks, and work (including cooperative efforts) is already being done, or is intended, on all topics that NOSS focuses on. Therefore the conditions in this area are the most favourable for the further development of guidelines and procedures, and the testing of the NOSS outcome in practice.

Once the best way has been found for achievement of the NOSS objectives in the North Sea region, implementation along other parts of the European coastline is foreseen. It will be obvious that during the "North Sea-phase" of the Action the exchange of information and experiences with colleagues in the other European coastal states will have high priority.

The programme of this COST Action will consist of five work packages. It must be emphasized that NOSS merely focuses on the coordination of the activities within these work packages. These activities as such are not part of this proposal, and funding for these activities will have to come from other (e.g. national and/or Community) sources.

Work package 1: Height reference systems and fixing tide gauge bench marks

New technologies have become available over the last decades for establishing global and continental height reference systems in which land subsidence can be monitored and to which tide gauge bench marks can be connected. Most of these have their origin in space geodesy (e.g. GPS, SLR, VLBI), but also other techniques provide us with essential information. For absolute height measurements, absolute gravimetry is the only technique available at present. Absolute height measurements are important for the discrimination between eustatic sea level rise and land subsidence.

In many countries GPS is already being applied, or planned, for the fixing of tide gauge benchmarks. International standards and guidelines are still lacking however. The main objectives in this work package will concern the design of an integrated monitoring system, combining different techniques and information. In addition attention will focus on the definition of international standards of measurement and data assembly and the coordination of international surveying campaigns. Important related work in this field has already been undertaken, or is being planned/discussed (EUVN, EPTN), under auspices of the EUREF (European Reference Frame) commission of the IAG (International Association of Geodesy). Also the IGS (International GPS Service for Geodynamics) should be mentioned, which plays a crucial role in GPS by providing users with the essential precise orbit information.

Work package 2: optimization of tide gauges networks

Many European countries have well equipped tide gauge networks for the purpose of monitoring sea level. In some countries however, there are no operational tide gauges for various reasons. Establishment of tide gauges at new locations can give information that is of great value for oceanographic modelling and other applications. In addition, old tide gauges may need some technical improvements in order to enable the delivery of sea level data that comply with international standards. The objective in this work package is the establishment and maintenance of high quality tide gauge networks that can provide researchers and managers with the information they need. Countries with much experience and know-how in this field will assist others through cooperative efforts in instrumentation etc. Establishment of tide gauges on a long term basis, in accordance with certain (GLOSS?) standards, will have special attention.

Work package 3: radar-altimetry

Satellite altimetry has already shown its great potential in oceanographic research on large scale phenomena. With new technological development and new satellite missions coming up, the application of satellite altimetry on smaller scales (such as the North Sea basin) seems very promising.

This work package focuses on the use of altimetry for the determination of sea surface topography on regional scales. Satellite altimetry in principle allows the integration between tide gauge station across continental shelf seas (North Sea) and along the European coastline. The combination of data from different satellite mission is one of the major problems in this field to be solved.

Work package 4: storage and exchange of data

At present monthly and annual mean sea level data from many tide gauges around the world are being stored at the Permanent Service for Mean Sea Level (PSMSL), Proudman Oceanographic Laboratories, UK. For the calibration of tidal models and for storm surge warning applications, hourly and real time sea level data are required. Between several countries, bilateral agreements have been made on the exchange of these data. Standardization of procedures and rules on the storage and exchange of data are required.

Work package 5: coordination

The former work packages primarily deal with the assembly and exchange of data. Obviously, the requirements of researchers and managers must be the basis for the monitoring activities and data exchange. The objective of this working group is to ensure a close liaison between both groups.

Schematically, the relation between the work packages can be described as follows:

Northwest European Sea-Level Observing System - NOSS

Management Committee

Subject/ Work package:	1. Tide gauge fixing/land subsidence	2. Mean Sea Level	3. Currents/ sea topography	4. Storm surges
Techniques:	Space geodetic techniques, gravimetry	Tide gauge, gravity field	Altimetry, gravity field	Tide gauge
Relevant projects/ Organizations:	EUREF EUVN, EPTN	EuroGLOSS		Fixed Monitoring Network North Sea

5. Meta-information dissemination

As a result of the NOSS intention to serve as an umbrella for a variety of sea level related activities, it is not possible at this stage to give a definite description of the work packages. New technologies, or technologies that are being developed at present, may come on stream in the next few years that prove to be very beneficial. This may, in the course of the programme, lead to (minor) changes in the contents of the work packages.

D. TIMETABLE AND ORGANIZATION

It is anticipated that this COST Action will take four years. All five work packages will run in parallel, and will (in the beginning) focus on the North Sea and surrounding area.

After two years, the extension of the NOSS initiatives towards the other parts of the European coastline will be initiated (as described in B). Also at this stage, an evaluation review will take place.

In the NOSS Management Committee the national sea level authorities will be represented. The Management Committee has an important task in ensuring the liaison between the work packages and the development in related programmes such as (Euro)GLOSS and (Euro)GOOS (Global Ocean Observing System). Coordinators will be appointed by the Management Committee for the five work packages.

During the entire project, close liaison will be maintained between the five working groups.

Working groups will meet every year. After two years there will be a plenary meeting of the five working groups. At this plenary meeting, the results that have been achieved over the past years can be presented to the other working groups. Progress reports to the COST Committee can be prepared at this meeting, and the implementation of the outcomes along the other parts of the European coastline can be discussed. At the end of the project a conference will be held.

E. ECONOMIC DIMENSION OF THE ACTION

The costs of the activities under the work packages are roughly estimated at ECU 15 million over four years (equivalent to around 75 man/years). For several reasons it is not possible to give a better estimate at this stage. Firstly, NOSS intends to serve as an umbrella for sea-level activities, and it is rather arbitrary to decide which costs involved in these activities contribute to the economic dimension of this action; secondly, the contents of the work packages are not yet definite, thirdly, NOSS will make partial use of multi-purpose equipment (e.g. tide gauges) and developments in technology, which allows only a rough estimate of the economic dimension for NOSS. Fourthly, the number of participating countries is not yet known.

It should be emphasized that NOSS focuses on the coordination of the sea-level activities, and that funding for these activities has to come from other sources. Funding from national as well as international agencies will have to be made available in the future to establish a dedicated sea-level monitoring "organism" for the long term monitoring and research purposes.

F. RELATION TO OTHER PROGRAMMES

Progress in space techniques has resulted over the last decade in an intensified international cooperation in research and sea level monitoring. Under auspices of the Intergovernmental Oceanographic Commission (IOC) a global tide gauge network has been established: the GLOSS. The GLOSS network consists of over 300 tide gauges around the world. In the long term, it is the intention that sea level will be recorded at these sites to a set of standards specified by the GLOSS programme. The same holds for the fixing of the tide gauge bench marks, i.e. standards specified by GLOSS/IAPSO working groups. The data that are gathered by the GLOSS network are stored at the Permanent Service for Mean Sea Level.

One of the main characteristics of the GLOSS network is the (more or less) equal distribution around the world, and consequently the relatively large distance between adjacent stations (over 1 000 km). For studies on regional aspects, this density of the GLOSS network obviously is not sufficient. Recently, a proposal has been launched for the densification of the GLOSS network along the entire European coastline (EuroGLOSS). The density of this network can best be described as intermediate. Several arguments for this intermediate density are given in the EuroGLOSS project proposal. However, from several studies it is clear that relative sea level rise varies over smaller scales. This can partly be explained as being due to (surprisingly) small scale variations in land subsidence. As one of the main topics in the present NOSS proposal, a further densification of the GPS-fixed tide gauge network in Europe is foreseen.

The GLOSS network forms a subset of the GOOS, which has been developed by the IOC and the World Meterological Organization (WMO). GOOS covers a wide range of activities related to the oceans and continental shelves around the world. The proposed COST Action can be regarded as a valuable contribution to the GOOS objectives. The word "Ocean" in the title is somewhat misleading in that GOOS does not only focus on the oceans, but also on the continental shelf. For the European component of GOOS, EuroGOOS has been developed over the last years. The implementation of EuroGOOS is being initiated at present.

Finally, some international efforts should be mentioned that have been performed over the last years, which could not have been realized without Community funding. One of those is the SELF (Sea Level Fluctuations: geophysical interpretation and environmental impact) project should be mentioned. In this project several institutions have cooperated in order to connect, in a global reference frame, an ensemble of selected tide gauge stations in the Mediterranean area in order to be able to contribute to estimate sea level changes. The application of geodetic space techniques and absolute gravimetry played a central role in the project.

Other projects (such as EUROGAUGE and the Baltic Sea project) had similar objectives.

Memorandum of Understanding
for the implementation of a European Research Action
on the use of marine primary biomass (macroalgue)
COST Action 49

Date of entry into force of the project : 08.03.1995
Duration : 07.03.1999

Contracting parties	Date of signing	Date of entry into force
DENMARK	07.06.95	07.06.95
GERMANY	03.03.95	03.03.95
GREECE	03.05.95	03.05.95
SPAIN	23.02.95	23.02.95
FRANCE	05.09.96	05.09.96
IRELAND	23.02.95	23.02.95
ITALY	10.04.95	10.04.95
NETHERLANDS	29.06.95	29.06.95
NORWAY	23.02.95	23.02.95
PORTUGAL	06.09.95	06.09.95
SWEDEN	23.02.95	23.02.95
UNITED KINGDOM	17.05.95	17.05.95

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in a European Action in the field of the use of marine primary biomass, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an action to promote research into the field of the use of marine primary biomass (hereinafter referred to as the "Action").

2. The main objective of the Action is to:

1) Co-ordinate current national and European activities in the field of the use of marine primary biomass derived from macroalgae;

2) Provide a collaborative network covering Western and Eastern European countries, to match with existing industrial activities in the field of macroalgal use;

3) Initiate new research projects on Genetic Improvement, Intensive Cultivation, Application of Algal Products in Biotechnology and Biotransformation of marine primary biomass.

3. The Signatories hereby declare their intention of carrying out the Action 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 Action 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 Action is estimated at approximately ECU 17,8 million at 1994 prices.

6. The Signatories 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 Action 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 co-ordinatory services or activities necessary for the aims of the Action to be achieved;

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

SECTION 3

1. This Memorandum of Understanding will take effect for five 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 Action is subject to the prior agreement of the Management Committee referred to in Annex I.

2. This Memorandum 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 Action will notify the Secretary-General of the Council of the European Union 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 Action 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 paragraph 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 Action.

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 Union 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 Union. The Secretary-General will transmit a certified copy to each of the Signatories.

ANNEX I

CO-ORDINATION OF THE ACTION

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 co-ordinating the Action 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 the Signatories by the competent public authorities or bodies; any proposed changes to the Action framework will be referred for an opinion to the Committee of Senior Officials on Scientific and Technical Research (COST);

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

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

(d) co-ordinating 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 Action, including those relating to possible special conditions to be 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.

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 Actions 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 Action, 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 said Action. 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 I, 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 Action assigned to them under Annex II (hereinafter referred to as "the research results") will be under 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 work in respect of the Action.

   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 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 the present 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 Action, 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 terminated 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.

ANNEX II

GENERAL DESCRIPTION OF THE ACTION

I. GENERAL BACKGROUND

I.a. Current state-of-the art

Several important factors contribute to the increasing interest world-wide in marine farming. A growing concern regarding food shortage in the next decades, increasing pollution of coastal waters, and fear of global warming due to carbon dioxide emission are typical examples of international concerns which involve oceans and coastal waters.

National programs related to marine production, such as fish-farming, shrimp cultivation, mussel growing seaweed farming, ocean ranching, etc. have been initiated in many countries (Japan, China, USA, France, Norway inter alia). Studies on marine eutrophication/pollution have been undertaken in even more countries, and international programmes are ongoing which cover the Baltic Sea, the North Sea, the Mediterranean Sea and several other areas.

The role of the ocean in carbon cycling has long been acknowledged, and considerable efforts are now devoted to the provision of data needed to quantify the capacity of the marine system for binding of carbon dioxide. A recent proposal by US scientists involves large-scale cultivation of seaweed to bind carbon dioxide and the use of the biomass for provision of energy and raw material instead of the present use of fossil carbon sources.

Japanese workers claim that increasing the net primary production in the sea by fertilization will reduce atmospheric carbon dioxide. At the same time countries around the Baltic and the North Sea have decided to reduce drastically the input of nutrient salts of N and P in an attempt to improve the quality of the corresponding waters. In this context special emphasis should be placed on the position of the Mediterranean and Eastern European countries.

The marine primary biomass holds a key position in marine production. Large-scale cultivation and utilization of seaweed and other marine algae as the basis for improved use of the production potential of coastal waters and the ocean requires genetic improvement of the plants, new cultivation technologies, novel bioconversion processes and detailed knowledge of the biochemistry of the algae.

The COST 48 Action has laid the scientific basis for further work towards multipurpose use of marine production as outlined above and the general opinion nowadays is to emphasize on the farming aspects in the wide sense. It would secure the leading position that the European research groups have gained in this field. The scientific content of this new proposal will be further developed in point III.

Achievements of the past COST Action 48 on "Marine Primary Biomass"

COST 48 research on aquatic primary marine biomass (marine macroalgae) was pursued under the European Communities Biotechnology Programme (BAP) from 1985-1989 and continued in association with the BRIDGE Programme (Biotechnology Research for Innovation, Development and Growth in Europe) for the years 1990-1994.

In its first period COST 48, co-ordinated research from thirteen European countries in basic and applied studies related to biotechnology of marine macroalgae, i.e. Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Sweden, The Netherlands, and United Kingdom.

Also during the second period thirteen European countries were actively involved in the COST 48 collaboration.

Important advances in the field of biotransformation of marine biomass, in phycocolloïd structure and engineering and in application of phycocolloïds as immobilizing agents in biotechnology were achieved (Co-ordinator: S. Paoletti, Trieste, Italy).

COST 48 co-ordinated research also contributed significantly to the development of fine chemicals (growth substances, plant hormones and immunologically active polysaccharides) from seaweeds (Co-ordinator: G. Blunden, Portsmouth, UK) and to intensive cultivation of selected species (Co-ordinator: Joanna M. Jones, Port Erin, UK).

The most spectacular results came, however, in the field of molecular genetics and in protoplast production, fusion and plant regeneration. During its second period the COST 48 laboratories involved in these studies have made a formidable breakthrough. Large-scale preparation and purification of viable protoplasts from a number of brown and red algae have become routine and provide material for physiological, biochemical and genetic work. A considerable number of algal genes have been identified, cloned and sequenced. Fusion and regeneration procedures have been developed for several species, and the techniques and experience gained in studies of higher plants are now applicable in algal studies as well (Co-ordinator: B. Kloareg, Roscoff, France).

In the field of production and utilization of entire seaweeds progress has been made in:

(a) bioconversion of seaweeds; utilization of seaweeds grown in waste water. Aerobic digestion of seaweeds and use of integrated disposal technology, mixing composting and methanization of algal biomass. Use of macroalgae (Ulva sp.) in compost mixtures of manure and forestry residues (widely used in France) (Co-ordinator: J. De Waart, Zeist, The Netherlands);

(b) control of eutrophication (green tides of macroalgae) of European coastal waters. Documentation of the state-of-the-art and initiation of joint research project in the framework of European programmes (Co-ordinator: W. Schramm, Kiel, Germany);

(c) food and feeding from macroalgae: relevance of algae as human food is increasing in Europe. Search for technologies to improve food quality and avoidance of (unwanted) polyphenols (Co-ordinator: S. Mabeau, Pleubian, France).

I.b. Why the co-operation should be carried out within the context of COST

COST 48 offered a framework for co-operation in Research and Development allowing both the co-ordination of national and international research projects and the participation of non-EC member countries in Community programmes. Co-ordination is accomplished by organizing workshops and scientific meetings. In stimulating mutual co-operation COST 48 funds have been used as "seed money" for the start and the continuation of a considerable number of European research programmes.

In this context COST 48 has been very successful, specifically over the last 5 years: many activities gained momentum, annual workshops have been organized, scientific networks have been developed, roughly 100 laboratories, spread all over Europe are directly or indirectly participating in COST 48 actions.

The economic interest in the exploitation of marine resources increased substantially over the past decade. Prolongation and reorientation of some activities of COST 48 will be in the interest of fostering further biotechnological research and development on marine macroalgae.

Our new project is necessary to meet the future challenges at all levels of integration, from the molecular and biochemical level to the physiology of seaweed individuals and the ecology of populations of seaweed. Although the number of activities with COST 48 was substantial we want to continue in this multidisciplinary direction. From our point of view, the scientific content should not have to be split up in separate COST Actions: all participants of COST 48 use "the language of phycology", which makes co-operation fruitful from the molecular level up the ecosystem level.

I.c. How the proposed Action relates to other international scientific programmes

The proposed COST Action relates to other international programmes in the field of COST Environment (e.g. COST 647), and participates actively in the E.C. programme ENVIRONMENT. The proposed Action participates also in several networks between leading European universities and research institutes.

II. OBJECTIVES OF THE ACTION

The COST Action will achieve two main objectives:

1) to promote and co-ordinate competitive research on the biological, technological and economic use of primary marine biomass derived from macroalgae (seaweeds);

2) to provide a collaborative network covering Western and Eastern European countries, to match with existing industrial activities in the field of macroalgal use.

A holistic strategy for attacking the above problems covering food production, energy provision, biomass for industrial chemicals, eutrophication problems and carbon binding should be aimed at on an international basis. Future COST activities concerned with primary marine farming should be considered in this context.

This new COST Action will secure efficient exploitation of the unique position European research groups have obtained in this field and allow them to continue to lead the development in this fundamental segment of algal biotechnology and ecology.

III. SCIENTIFIC CONTENT

In this COST Action we will put emphasis on genetic improvement, intensive cultivation, biotransformation of algal biomass, the application of marine macroalgae and algal products in biotechnology and establishing the role of macroalgae in coastal eutrophication.

The scientific content of this four year programme (1994-1998) will focus on:

1. Genetic Improvement of Marine Macroalgae

    1.1. Protoplast fusion and plant regeneration
    1.2. Gene identification, cloning and structural studies
    1.3. Gene splicing, introduction of genes into algal protoplast
    1.4. Quantitative genetics of seaweeds.

2. Intensive Cultivation of Improved Seaweeds

    2.1. Physiology of growth and biomass production
    2.2. Techniques for intensified cultivation

3. Application of Algal Products in Biotechnology

    3.1. New uses of phycocolloïds
    3.2. Production of low molecular weight fine chemicals.

4. Biotransformation of primary marine biomass

    4.1. The role of macro-algae in coastal eutrophication processes
    4.2. The intermediate position of macro-algae in waste water treatment
    4.3. Conversion to methane: including regulation of anaerobic processes and genetic improvement of involved microorganisms
    4.4. Bioconversion to alcohols, fatty acids, etc.; including processes and microorganisms
    4.5. Partial bioconversion to food and feed for humans, cattle and fish.

Besides the specific activities to be derived from the working plans of the three Working groups (see point V "Organization and Management"), the programmes for 1994 and 1995 contain a number of general, concrete aims:

1. Preparation of a "Directory of European Research and Economic Activities in the field of Marine Primary Biomass";

2. Preparation of the draft of a major "European Research Programme in Marine Primary Biomass";

3. Initiation of a collaborative network directed at stimulating research activities in Central and Eastern European countries.

IV. TIMETABLE

The time required to execute the scientific programme will be four years. The evaluation of the progress of the action will be performed by annual meetings, dealing with specific subjects from the Action programme. The schedule for these meetings is as follows:

1994 : Genetic improvement of specific marine macroalgae. Application of technologies from molecular biology and genetics in the field of marine macroalgae

1995 : Application of biotechnology in the field of macroalgal components (phycocolloïds and fine chemicals)

1996 : Biotransformation and utilization of seaweeds; the search for novel technologies

1997 : Competitive multidisciplinary research on marine macroalgae from the molecular to the ecosystem level.

A final meeting will be held in 1998 to evaluate the achievements of this COST action. International experts from outside Europe will be invited to participate and to provide a critical statement on the achievements gained.

Schedule:

- Working group 1: 2 to 3 meetings (workshops) per year
- Working group 2: 2 to 3 meetings (workshops) per year.
- Working group 3: 2 to 3 meetings (workshops) per year.
- Management Committee: 1 annual meeting.
- Annual Evaluation Meeting for specific aspects of the COST Action: 1 annual meeting, to be combined with the Management Committee Meeting.
- Meeting for Final Evaluation of the COST Action (including experts from non-European countries): 1 meeting.

V. ORGANIZATION AND MANAGEMENT

The Action will be divided into the following 3 Working groups:

1) Genetics improvement and intensive cultivation of marine macroalgae
2) Phycocolloïds and fine chemicals from marine macroalgae
3) Production and utilization of entire marine macroalgae.

Co-ordinators of these Working groups will be appointed by the Management Committee. The Working Groups will organize regular meetings (Workshops) to co-ordinate and promote research activities.

Annual Evaluation Meetings will be organized:

1) To promote co-operation between the participating institutions;

2) To evaluate the progress in the Working groups and to check the international competitiveness and applicability of the results gained;

3) To stimulate and manage the process of publishing the results in internationally refereed scientific journals.

Emphasis will be placed on promoting research on marine primary biomass from macroalgae in Eastern European countries, by organizing Workshops on the development and applicability of novel experimental approaches and technologies.

The Management Committee, representing the participating countries, will meet at least once a year, preferably in conjunction with the Annual Evaluation Meeting.

VI. ECONOMIC DIMENSION OF THE ACTION

Estimated costs of personnel paid from national sources, and involved in research on the use of primary marine biomass (note: man-year = human year):

–	Personnel from Western European countries	:	120 man-years scientists
		:	60 man-years technicians
–	Personnel from Eastern European countries	:	10 man-years scientists
		:	10 man-years technicians

–	Estimated personnel costs:	80 man-years x ECU 60 000	= ECU 4,8 million
		80 man-years x ECU 40 000	= ECU 3,2 million
		40 man-years x ECU 20 000	= ECU 0,8 million
	Annual laboratory equipment investments and consumables		= ECU 6 million
	Overhead costs		= ECU 3 million
	Total estimated costs covered from national sources		= ECU 17,8 million

Memorandum of Understanding
for the implementation of a European Concerted Research Action designated as COST Action 517 "Cleaner metals for industrial exploitation"

Date of entry into force of the project :	19.06.1996
Duration :	18.06.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.06.96	19.06.96
SPAIN	12.03.95	12.03.95
NETHERLANDS	05.06.96	05.06.96
SLOVENIA	06.06.96	06.06.96
FINLAND	19.12.96	19.12.96
UNITED KINGDOM	05.06.96	05.06.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to support:

   - the implementation of quantitative assessment methods for the inclusions content of metals and more particularly inclusions below 200μm;

   - the understanding of the relationship of the morphology of impurities with microstructure, mechanical properties and fitness for use of metals.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in point 1 above.

ANNEX

GENERAL DESCRIPTION OF THE ACTION

A. BACKGROUND

The role of impurities as determinants in limiting the quality performance, service life, processability, fabrication and joining of metal products and components is well appreciated and metal cleanliness has been the subject of research for many years, though the emphasis has been upon steel alloys. A sample list of references is given at the end of this Annex.

Defects in some or many forms including porosity, solutes, cracks and segregates as well as inclusions are continually introduced and eliminated during manufacture and if present at the final stage can lead to rejection of a component or premature failure. They are common to all metals and bear upon all industrial sectors e.g. the presence of inclusions limits the fatigue-life of gas turbine discs in aero-engines, affects the processability of aluminium and steel-can body stock in packaging and automotive manufacture and the surface quality and machinability of cast ferrous and aluminium components for the automotive and valve industries.

While significant advances have been made in the understanding of a metal's cleanliness, its relationship with the manufacturing process and its effect on overall properties, there is now general recognition that much more needs to be done. It is becoming increasingly clear that the cleanliness of a metal that is acceptable today will not necessarily meet the standards of tomorrow and that as Japan and the US improve cleanliness, European companies will need to keep pace or risk losing competitiveness.

Technical exchange missions to the US have shown that a considerable effort is being mounted to improve the cleanliness of their metals and, for instance, they have major R&D programmes to reduce the inclusion content of their products for the gas turbine industries and the speciality metals and aerospace industries have similar programmes. Japan is known to be targeting a broad spectrum of metals with improved cleanliness for a variety of industry sectors. Detailed knowledge is lacking here compared with knowledge of events in the US.

The fact is that the performance requirements of metals are becoming evermore demanding since applications are becoming increasingly testing. Metal products nowadays need to satisfy not only the customer's existing needs, which in themselves require different levels of metal cleanliness, but future needs. Furthermore, the technologies still to be developed need to be anticipated. This means that a position needs to be reached where the relationship between a metal's cleanliness and its properties is fully understood scientifically, where component manufacturers can transfer that understanding into technical and economical processes and where end-users can design components whose cleanliness is not only consistent but whose quality and fitness for use is definable and guaranteed. This situation does not exist at the moment.

A study by the UK's Centre for the Exploitation of Science and Technology ("Competitive Metal Processing") in 1991 clearly established the link between the potential competitiveness of the metals supply and engineering industries and their ability to control cleanliness and identified significant opportunities for better and more competitive products in various metals through a range of industrial applications in the automotive, biomedical, packaging, aerospace, power (nuclear and non-nuclear) and defence sectors. The design, control and measurement of metal cleanliness was identified as being an important issue in the development of many wrought alloys, not only for safety critical applications but also for a whole range of less demanding applications. It also showed its increasing importance in cast and other near-net-shape products. To exemplify this, the cleanliness and consistency of cleanliness has recently been highlighted by Castings Technology International in the UK as being particularly important in the machinability of steel castings when high volume runs and computer-controlled machine boats are involved.

During the study, three Technical Advisory Groups, comprising industrialists and academics, consulted over 60 companies, representing manufacturers and users of metals, as well as research organizations and universities. Additionally they commissioned a study "Defects in Metallic Materials" by the UK's National Physical Laboratory where case studies were made on 45 applications of metals including steel, nickel-based alloys, noble metals, refractory metals, Titanium and other non-ferrous metals where cleanliness was a limiting factor in achieving optimum performance.

There is little doubt therefore that the manufacture of engineering components from alloys of the right cleanliness could improve the competitive position of many companies in Europe. End-users are increasingly sourcing their materials from the best suppliers often outside Europe, who can demonstrate competence in the basic understanding of their processes enabling such manufacture. This will continue to be the case in the foreseeable future since materials processing and engineering companies will continue to use metals in large quantities, given that newer alternative materials are still some way off full realization. The world market for metals with improved properties and quality exceeds by far that for alternative materials even though the projected rate of growth is less (ref. Advanced Materials: Policies and Technologies, Challenges - OECD Paris 1990).

It is against this background that a COST action on "Cleaner Metals" is put forward. The work is particularly suited to COST since the problem is common to all countries and a programme is amenable to work-sharing in its truest sense, since both metal manufacturers and end-users have interest in, and facility for, participation. Whilst some overlap with other European initiatives is inevitable, given the broad nature of the subject, care has been taken in preparing this programme to minimize it. For instance, the assessment methods cited later address different problems from those encompassed in COST 501 (non-contact methods were not addressed) and no other initiative deals with the subject as a concerted action nor with "fitness for use" as a generic theme. Work within the ECSC steel R&D programme has mainly dealt with non-contact methods of cleanliness assessment for steel and has focused on the development of manufacturing techniques to minimize defects. Close relationships between actions will be kept with related activities through personal contacts and joint workshops.

B. SCOPE OF THE PROJECTS AND GENERAL PROGRAMME OF WORK

The scope of the programme and the general programme of work flows from the opportunities available to clean metals and their application. It is limited to conventional grades of metal and not those requiring super cleanliness. In the course of its preparation an international meeting of 60 experts from 6 countries was held in London and additional written expressions of interest were received from a further 20 experts representing in total 10 countries. Since then, many discussions have been held with various experts and end-users throughout Europe. Expressions for the need for a COST action on the cleanliness of commercial grades of metal is particularly high in industry but also in academia and research organizations. Interest in a programme has been expressed by companies in the UK, France, Germany, Spain, Italy, Sweden, Finland, Netherlands and Belgium.

In the course of the various discussions, it has become clear that whilst much work has been carried out on the measurement of metal cleanliness, and the relationship between cleanliness and properties and performance in service, there are significant gaps in the scientific and technical knowledge base. Most of the present measurement techniques do not take full advantage of new technological developments and many of the established relationships are semi-empirical, which do not allow for specifying a metal with a fitness for use in a new application.

The general areas of work which have been identified as most important at this time are estimated to cost ECU 10 million over 4 years, equivalent to around 50 man yrs/yr (allowing for 5% running/operating costs and ECU 60 000 per year coordination costs). The proposed work packages will be finally decided by the Management Committee but will be centred upon:

Work Package 1 (Estimated Cost ECU 3 million)

Development of quantitative assessment methods for the inclusion content of metals; particularly inclusions below 200μm and extending to low volume fractions. Especially important are:

(a) Non-contact methods, primarily for use "on line" and possibly based upon a metal's characteristic acoustic, optical or magnetic properties etc., with a target inclusion size of 80-20μm.

(b) Metallographic and concentration methods for laboratory assessments, exemplified by selective matrix electrolytic dissolution.

Modern computational methods of signal analysis will be most important for (a).

Work Package 2: Ferrous Metals (estimated cost ECU 4 million)

The relationship of the total morphology of impurities with microstructure, including grain boundaries, with mechanical properties and fitness for use and the scientific reasons for such relationships.

Such properties include:

toughness
fatigue strength
magnetic susceptibility
surface condition.

rupture ductility
creep rupture
hot workability

Work Package 3: Non-ferrous Metals (estimated cost ECU 3 million)

The relationship of the total morphology of impurities with microstructure, including grain boundaries, with mechanical properties and fitness for use and the scientific reasons for such relationships.

Such properties include:

toughness
fatigue strength
magnetic susceptibility
surface condition.

rupture ductility
creep rupture
hot workability

In the case of work packages 2 and 3, three dimensional modelling may need to be developed to predict the influence of all microstructural features, including inclusions, on an advancing crack. The level of cleanliness and microstructural condition might then be related to fitness for purpose more effectively.

For grain boundaries, the proposed work includes the determination of the structure and composition of grain boundaries, the measurement of impurities segregating to grain boundaries and the relationship of structure and composition to grain boundary cohesion.

Inevitably these areas of research will lead to a reassessment of the levels of cleanliness achieved by present processes and the understanding of their effects and to the need for improvement in terms of control. But these are seen as possible longer-term objectives and, perhaps, the basis of a separate programme.

C. TIMETABLE AND ORGANIZATION

It is anticipated that the programme will be over 4 years, each work package proceeding in parallel, with an evaluation review after the first 2 years. Milestones will be identified by the Management Committee depending upon the number and diversity of the projects submitted. Close liaison will be maintained between the ferrous and non-ferrous elements within work package 1 and between work packages 2 and 3 with yearly workshops to review overall progress. Three coordinators will be appointed by the programme's Management Committee to oversee the progress of the work packages and to ensure liaison between them and related activities in other European actions. Yearly reports (or more frequent as required) will be made to the Materials ad hoc Technical Committee of the Senior Officials and to the Management Committee, and a conference will be held when the action is completed. Provision will be made for scientific missions as allowed for by the COST administration, and, in evaluating projects, special attention will be paid to how the new technology will be transferred to industry and how it will be exploited.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 518
"Molecular Materials and Functional Polymers for Advanced Devices"

Date of entry into force of the project :	21.06.1996
Duration :	20.06.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.06.96	19.06.96
SPAIN	19.06.96	19.06.96
SLOVAKIA	19.06.96	19.06.96
SLOVENIA	20.06.96	20.06.96
TURKEY	21.06.96	21.06.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is:

   - The study, preparation, and improvement of well known and/or new molecules or polymers able to give two- or three-dimensional organized systems and which show two, or even more, functionalities.

   - The development and improvement of current techniques for the preparation and study of three-dimensional organized systems and thin films materials, including all the aspects of fabricating and processing of unconventional polymer materials.

   - The development of theoretical methods for calculation of properties in the organized systems.

   - The design of advanced devices.

   The expected advanced molecular or polymeric based devices are interesting for a wide variety of industrial sectors such as medical and analytical instrumentation, biotechnology, chemicals, microelectronics, aerospace, automotive, etc.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 20 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 4 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

TECHNICAL ANNEX

ACTION 518

1. Background

Until now the interest of molecular materials has been restricted to some properties presented by bulk organic compounds. This was the case of certain polymers and composites for their exceptional mechanical and/or insulating properties or of dyes dispersed in various matrices. Functionally active molecular and polymeric materials have not received all the attention they deserve.

The greatest benefits that will arise from exploitation of molecular materials will be linked to the opportunity to create combinations of properties. Examples could be association of magnetism and transparency or mesomorphism and electrical conductivity.

As compared to conventional materials based on continuum lattice solids, in these materials:

- it is easier to modify their physical properties by minor changes in the molecular composition (versatility),
- different properties may be associated at the molecular level for the elaboration of supramolecular ordered materials,
- functionality may be envisaged at any scale from the molecular size to bulk through thin films and clusters in rigid frameworks,
- some physical properties potentially superior and original condensed phases may be obtained by modification of the basic molecules,
- there is generally better and easier processability,
- they present environmental compatibility: recyclability, low toxicity, they may be biocompatible,
- there is no strategic dependence on the raw materials.

Much effort is currently being devoted in Japan and in the USA in this field. In order to be competitive with these countries, the precompetitive research in a coordinated European action should be fostered.

Besides several industrial centres, there is in Europe a large number of academic research groups involved in this wide field. A preliminary survey has obtained around 150 positive responses with constructive suggestions in this area.

Various national initiatives have been started by several countries (Germany, France, United Kingdom, Italy, Spain, etc.). The international collaboration was however divided into several fields: macromolecules, electronic processes, non-linear optics, ferromagnetic materials, organized molecular films, nano-structures, liquid-crystalline phases, etc.

The aim of this COST action is to initiate and promote a coordinated European effort for the development of advanced molecular and/or polymeric materials possessing functional properties with European companies. In particular it should stimulate research on molecular assemblies (crystalline, quasi-crystalline, and amorphous solids, liquid crystals, Langmuir-Blodgett and epitaxially grown films, and other surface induced organization, plasma polymerized films, membranes, etc.) and polymers which show useful and/or unconventional optical, magnetic and electrical behaviour. Besides the environmental friendliness and stability, interesting functional properties are for example bistability, non-linear and cooperative phenomena.

There are several general areas of research to be considered of primary interest. These include the following:

1. The study, preparation, and improvement of well-known and/or new molecules or polymers able to give two- or three-dimensional organized systems and which show two, or even more, functionalities. Special emphasis will be given to the problems arising from the additivity of two functionalities, stability in front of external agents (O_2, hv, etc.), biocompatability,

2. The development and improvement of current techniques for the preparation and study of three-dimensional organized systems, thin films materials, including all the aspects of fabricating and processing of unconventional polymer materials, eventually at a nanoscale,

3. The development of theoretical methods for calculation of properties in the organized systems,

4. The design of devices such as:

   - Smart windows: transparent windows at variable transmittance (*polyaniline/PAMPS/*WO_3)
   - Resists
   - Chemical sensors
   - Gas sensors: detection of gases in air (10-1000 ppb), oxymetry and medical imaging;
   - Pressure sensors
   - Magnetic sensors and magnetic imaging
   - Submicron electronic devices (FET, Schottky diodes)
   - Optical storage, magnetic storage, energy storage (battery, super-capacitors) devices
   - Screens and displays (visual LC, electrochromism).

Advanced molecular or polymeric based devices, as those described in the present proposal, would be of interest to European Industry. Private corporations and companies potentially interested in such devices belong to a wide variety of industrial sectors such as: medical and analytical instrumentation, biotechnology, chemicals, microelectronics, aerospace, automotive, etc. Reasons for such interest come from the novel applications and expectatives existing nowadays for these new tailored components. Already in 1993 about 20 industrial companies sent a letter of intent confirming their interest in such a research.

2. Scope of the projects and general programme of the work

The unique possibilities of interdisciplinary cooperative research under the scheme of a COST action should be stressed in the definition of scope which was discussed at the workshop of European experts on the subject. Specific goals concerning research on materials of industrial interest still demanding basic research and on materials with combined or crosscoupled properties are desirable. The industrial contacts have allowed priorities which lead to the formation of the following work-packages to be defined.

- Work-package 1

  Dyes, electro-optics, non-linear optical organic and polymer materials. Especially important are:

  - pigments and colorants
  - dyes for optical data storage
  - development of new chromophores for telecommunications
  - nanotechnologies for new integrated optical devices
  - photopolymerizable materials
  - bistable systems in LB films (information storage)
  - non-linear optics with LC polymers and conjugated polymers
  - photoconductors such as molecular photodiode
  - electroluminescence of conjugated polymers

- Work-package 2

  Insulating, conducting and ferromagnetic molecular and polymer systems

  - electrical insulators
  - conducting adhesives for electronic applications
  - conducting polymers as electrodes of great stability and long life in batteries
  - intercalated highly conducting low-dimensional systems
  - electronically conducting liquid crystals
  - molecular semiconductors in thin films for electronic devices (radicals)
  - conductivity in mesomorphic systems
  - molecular and polymer ferromagnets for telecommunication applications
  - bistable systems for data storage
  - magnetism and transparency (or luminescence)
  - spin induced by light

- Work-package 3

  Chemical sensors based on the modification of the preceding properties

  - conducting polymers
  - polymer electrolyte films
  - metallo-organic complexes

Within these three work-packages, the focus is put on the following phases:

1. Organized or amorphous thin films (submicronic)
2. Nanostructures and nanoparticles in amorphous matrices
3. Liquid crystals.

3. Timetable and organization

The implementation of the Action should be organized in three steps:

1. Design of systems and characterization of involved compounds.

   This step should be done in close cooperation with the COST Chemistry Action D4 entitled "Design and Preparation of New Molecular Systems with Unconventional Electrical, Optical, and Magnetic Properties". The present project is clearly oriented toward Materials aspects of the molecular engineering. The complementarity between D4 and this Action should enhance their own efficiency.

   As this project is largely concerned with polymers, connections with the Network on "Polyconjugated Materials" in the Esprit Program should exist. The coordination with the activities of this network will be initiated as proposed by the Network Chairman Professor G. Zerbi.

2. Developments of devices.

3. Industrial transfer with continuous feedbacks to step 2.

   The organization is taking into account the interdisciplinary nature of these objectives and the necessary implication of industries. The participation in the Management Committee should be largely open to industrial partners.

   The present project should have a duration of 4 years. The following time-table is proposed

   - September 1995: call for proposals;
   - January 1996: evaluation and formation of the structure;
   - Spring 1996: kick-off meetings of working-groups.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 712 "Microwave Radiometry"

Date of entry into force of the project :	29.05.1996
Duration :	28.05.2000

Contracting parties	Date of signing	Date of entry into force
GERMANY	25.04.96	25.04.96
FRANCE	24.07.96	24.07.96
ITALY	29.05.96	29.05.96
NETHERLANDS	25.04.96	25.04.96
FINLAND	30.04.96	30.04.96
UNITED KINGDOM	25.04.96	25.04.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to improve the application of microwave radiometry to the understanding and monitoring of:

   - the hydrological cycle, and
   - tropospheric/stratospheric exchange.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 712

MICROWAVE RADIOMETRY

Application of microwave radiometry to atmospheric research

1. Introduction

The effects of human activities on weather and climate are receiving increased recognition by the scientific community and decision makers. The behaviour of the atmosphere and its links with other components of the Earth's system is closely related to the hydrological cycle. Successful prediction of weather and simulation of climate require a thorough understanding and an adequate monitoring of various aspects of this cycle, including the dynamic, radiative and chemical processes involved.

Microwave radiometry is particularly well suited to providing information to help the relevant research and monitoring activities. Microwave radiances sensed by instruments outside the atmosphere (i.e. on satellites) and within the atmosphere (i.e. on the surface, on aircraft, etc.) are sensitive to several important parameters of the hydrological cycles:

- **in the troposphere**: temperature, water vapour, cloud liquid water content and ice and precipitation,
- **at the surface**: sea-surface temperature and wind, sea-ice, snow cover, vegetation and soil moisture, and
- **in the middle atmosphere**: temperature, water vapour and atmospheric constituents affecting the concentrations of water vapour (and ozone).

Microwave instruments have been flown on satellites for many years. Sensors operating now include the Microwave Sounding Unit (MSU) on the NOAA satellites, the Special Sensor Microwave Imagery (SSM/I) on the DMSP satellites and the microwave component of the Along Track Scanning Radiometer (ATSR/M) on ERS/1. Research activities to use these data have been undertaken at several institutes in Europe. Many have led to fruitful results and some applications are already operational. However, the true potential of these data is very far from being fully exploited. Also, data from several new instruments will become available in the next few years, including: the Advanced Microwave Sounding Unit (AMSU), the Medium-resolution Imaging Microwave Radiometer (MIMR) and various limb sounding instruments. Extensive efforts are required to develop powerful data analysis procedures for existing and new instruments. For all these activities support is sought through the COST mechanism.

2. Objectives of the Action

The objectives of the Action are various and cover the different aspects of the scientific problems outlined above. The main aims are to improve the application of microwave radiometry to the understanding and monitoring of:

- the hydrological cycle, and
- tropospheric/stratospheric exchange.

This will include research to understand and to model the atmospheric processes involved in these phenomena. These scientific objectives will be achieved through developments in the following areas:

- improved models of the interaction of microwave radiation with the Earth's atmosphere and surface,

- improved retrieval, analysis and assimilation techniques, through which atmospheric and surface parameters are estimated from the data,

- verification and validation studies, through which the accuracy and characteristics of the data analysis techniques may be assessed,

- improved measurement facilities and techniques, including ground-based, aircraft-borne and space-based systems.

The Action will support the above activities through sharing of information on state-of-the-art methods and facilities, and through exchange of data and software where appropriate.

3. Content of the Action

The Action will be divided into 4 projects. Tasks under each project are listed in the table below.

3.1. Development of radiative transfer models

To make effective use of microwave radiance measurements of the atmosphere-surface a good radiative transfer model (RTM) is a prerequisite for calculating radiances of each radiometer in use or under development (MSU, AMSU, MIMR, future limb sounders, etc.). With the launch of AMSU now imminent a good forward model for the AMSU channels is urgently required if we are to make the best use of this new data source. RTMs in the microwave region are still under development, and specific elements of the RTMs which are in need of improvement are:

- surface emissivities (i.e. sea, land, ice, snow)
- clouds (water and ice) and precipitation
- gaseous absorption (e.g; oxygen line mixing, water vapour continuum)
- refraction (limb sounding).

There are two different kinds of RTMs which have to be developed further: accurate, but slow, physical models including all the details of the physics, and fast parametric models which have to be used for real-time applications which require many thousands of RTM calculations without a major loss of accuracy. Both kinds of models need to be comprehensively tested, compared with others, validated by independent measurements, improved where necessary and distributed to interested Meteorological Services and Research Institutes in Europe. The work of the microwave group of the ITRA (Intercomparison of Transmittance and Radiance Algorithms) campaign which is carrying out a comparison of microwave RTMs will be a key element in the comparison of physical models. Groundbased and airborne microwave radiometer data can provide useful validation data for these models.

The development of microwave RTMs, model comparisons and validation and distribution to European Meteorological Services will be promoted and coordinated by this COST Action.

3.2. Retrieval, analysis and assimilation techniques

To exploit the wealth of information from present and planned data, particularly from satellites, it will be necessary to develop powerful systems for analysing the data. Atmospheric and surface parameters may be estimated from the radiometric data using several techniques: the term "retrieval" is usually used to describe methods in which a parameter (or a vertical profile of parameters) is estimated at a single location, whereas the term "analysis" usually implies the estimation of 2- or 3-dimensional fields. "Data assimilation" describes analysis methods in which a forecast model is used to provide the prior or "background" information for the estimation process. Therefore, techniques in these three areas are highly interrelated.

The estimation theory underlying optimal, physical-statistical methods applicable to such retrieval/analysis problems is well established, and so theoretical work to derive new methods is not needed. However much work is still required on the details of the implementation of such methods for different data types (e.g. nadir and limb sounding data over a wide range of frequencies) and for a range of applications. Also there is scope for continuing work on simplified (sub-optimal) schemes. Although these may often provide adequately accurate results at much lower computational cost, validation campaigns have shown that, often, their applicability is limited and further improvements are necessary.

From measurements at microwave frequencies, information may be obtained on the 3-dimensional fields of temperature and water vapour (troposphere and middle atmosphere), on cloud liquid water and cloud ice, and on precipitation. Information on sea-surface wind speed, sea-ice and other surface parameters may also be obtained. In the stratosphere, unique information (mainly from limb sounding measurements) is available on several constituents important in ozone chemistry. Improvements in retrieval/analysis procedures are required in all these areas. As part of this work, improved understanding and modelling of the associated radiative transfer problems (as discussed above) will be necessary.

Several European groups are already active in these areas, but existing efforts are far from exploiting the full potential of even the currently-available data. The COST Action will provide a forum for exchange of information and for promoting new collaborative initiatives on appropriate retrieval/analysis techniques.

3.3. Assessment of the methods

Beyond the comparison of retrieval and analysis methods, the performances of these methods, when applied to satellite, airborne and groundbased radiometers, must be rigorously assessed:

- to determine their accuracy (systematic and random errors),
- to learn about their performances in various weather situations.

The assessment can be carried out in different ways, which can support each other:

- taking into account the instrument characteristics (calibration performances, antenna pattern), results of the methods to be investigated must be compared with independent measurements and/or analyses, carefully selected to verify their adequacy to microwave data;

- results of the above methods, applied to the same spaceborne instrument, must be also checked in terms of the spatial coherence of the obtained fields, and sensitivity to variations of the relevant atmospheric parameters (humidity, temperature, wind, clouds, ...).

For both aspects, the selection of case studies is an important point. Field campaigns about atmospheric processes over the oceans could be opportunities, as they provide good description of phenomena at small and meso-scales, with the larger scale environment given by increased meteorological network assimilated into meteorological models.

NWP models could also be used for comparison of products retrieved by different methods and for assimilation studies, because both can give interesting information on the problems with the satellite products and the models.

3.4. Measurement facilities and techniques

Measurements from the ground, from aircraft or balloons and other satellites are needed to test and validate radiative transfer models before they can be used for developing satellite data analysis schemes, and parameter extraction methods. Such "ground truth" is also of extreme importance for the validation of space based measurements. Intensive field campaigns (e.g. EMAC of MACSI) will help to obtain observations from controlled test sites against which satellite data can be compared.

Comprehensive prelaunch tests are required to characterize individual instruments, in particular their radiometric calibration, spectral response, field of view and pointing all as a function of scan angle.

For these reasons facilities available for this purpose should be identified and their use for these activities as detailed above be promoted as part of this COST Action.

For future developments theoretical studies should ask for specific measurements in order to ensure progress in the development of new microwave instruments. Based on both theory and existing measurements, new measuring techniques and instruments for future projects might be recommended as part of the Action.

Project 1	Project 2	Project 3	Project 4
Development of radiative transfer models (RTM)	**Retrieval, analysis and assimilation techniques**	**Assessment of the methods**	**Measurement facilities and techniques**

– Development of improved accurate physical RTMs
– Development of improved fast parametric models
– Improvement of RTM elements i.e.
  – surface emissivities (i.e. sea, land, ice, snow)
  – water and ice clouds precipitation
  – gaseous absorption
  – refraction
– Model comparison and validation
– Model distribution to European Meteorological Services
	– Development and improvement of retrieval/analysis methods for different data-types (e.g. nadir and limb sounding at different frequencies)
	– Development and improvement of retrieval/analysis methods for different applications (e.g. temperature, cloud liquid water)
	– Development and improvement of simplified retrieval/analysis schemes
	– Promotion of exchange on information for retrieval/analysis techniques
	– Promotion of new collaborative initiatives on retrieval/analysis techniques
		– Intercomparison of different retrieval and analysis methods
		– Comparison of model results with independent measurements and analysis
		– Comparison of model results for different atmospheric situations
		– Checking of special coherence of obtained fields
		– Promotion of field campaigns over the ocean for verification purposes
			– Identification of facilities capable of getting ground truth data for validation purposes and promotion of their use for this activity
			– Identification of facilities which can carry out prelaunch tests of microwave instruments and promotion of their use for this activity
			– Promoting the understanding of microwave radiometry techniques
			– Carrying out of theoretical studies for recommendations of new measuring techniques and instruments

4. Timetable

The proposed length of the Action is four years. All projects will continue in parallel during this period.

The first year will be devoted to inventories and firmer specifications in the different projects. During the second, the third year and the first half of the fourth year, the specific tasks of each project are carried out. The last half year of the Action will be used to summarize the results of the projects and to produce a Final Report.

At least one major workshop would be arranged during the first half of the Action and another one during the last year of the Action (**see figure 1**).

5. Organization, Management and Responsibilities

A Management Committee would be set up following the appropriate number of Signatories to the Action Memorandum of Understanding. A chairman would be elected and instructed to draft an outline Action plan based upon the items specified in Section 3 (The content of the Action). This plan would be approved by the Action Management Committee and submitted to the Technical Committee for Meteorology.

The Action would include cooperation between European meteorological organizations and research institutes.

The Action will consist of four projects. The Management Committee will elect coordinators for each project (**see figure 2**). The scope and content of the projects will be reviewed and if necessary amended by the Management Committee during the first year, in the light of the inventories of existing methods and the current interests of participation in the Action.

The Action Management Committee would report annually to the COST Senior Officials through the Technical Committee for Meteorology, but would provide short verbal or written reports to each meeting of the Technical Committee. The Management Committee will meet at leas twice per year.

Two workshops including all projects are foreseen during this Action. The projects may have their specific workshops as seen appropriate. A detailed Final Report would be written based on a series of technical reports produced by projects throughout the period of the Action.

6. Economic Dimension of the Action

As the Action will involve several meteorological institutes in most countries, a broad participation is expected, probably varying from 2 to 4 man years per country. Assuming the involvement of 10 countries, the estimate of annual scientific personnel cost is roughly ECU 2,2 million (30-40 man years). Annual overhead costs are estimated at ECU 0,3 million. Thus, the total cost of the four-year Action is approximately ECU 10 million.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 713 "UV-B Forecasting"

Date of entry into force of the project : 07.03.1996
Duration : 06.03.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.02.96	15.02.96
CZECH REPUBLIC	23.04.96	23.04.96
DENMARK	15.02.96	15.02.96
GERMANY	25.04.96	25.04.96
GREECE	19.04.96	19.04.96
SPAIN	15.02.96	15.02.96
ITALY	07.03.96	07.03.96
AUSTRIA	10.07.96	10.07.96
POLAND	28.08.96	28.08.96
FINLAND	15.02.96	15.02.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to establish tested and standardized UV-B radiation forecasts for public information in Europe.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 3 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST Action 713

UV-B FORECASTING

1. General background

The harmful effects of intense UV-B radiation (280 to 315 nm) on various forms of life on earth are well documented. In particular it is well-known that excessive exposure of the human skin to UV-B radiation will increase the risk of developing skin cancers. In recent years a worldwide increase in the incidence of skin cancers has been observed among the white population. High UV-B levels may also cause eye diseases and may effect the human immune system. Therefore a life-style with increased exposure to intense sunlight implies a risk to public health.

The long term reduction of column ozone amounts which has been observed during the last two decades over middle and high latitudes is also a matter of concern because it is believed to cause an increase in the UV-B irradiance on Earth. But even after a complete recovery of the ozone layer, other factors which contribute to the extinction of UV in the atmosphere may be equally important for the variability on different time-scales of UV-B irradiance near the surface. Therefore long term programmes of reliable UV-B observations and public information should be set up for reasons similar to those concerning other hazardous atmospheric phenomena.

In the "Environment and Climate" Community research programme much work is devoted to a European UV-B measuring network. Some steps taken within the World Meteorological Organization (WMO) Global Atmospheric Watch (GAW) also aim at a quality improvement of UV measurements and the establishment of a global UV monitoring network. Furthermore, a number of countries in the northern as well as in the southern hemisphere have established operational UV-B forecasts as part of a public awareness programme. Various empirical models or radiative transfer models for the calculation of UV radiation near the surface are in use. These models take into account the solar zenith angle, the ozone column density and Rayleigh scattering. But other important parameters such as various types of cloudiness, aerosol loading in the stratosphere and the troposphere, vertical distribution of ozone, surface albedo and column densities of NO_2 and SO_2 may be included.

An important aspect in UV-B forecasting for public awareness is the way in which the information is presented to the public. Many countries use an index to indicate the intensity of the erythemally weighted UV-B irradiance whereas others use the time required to obtain a sunburn for a specific human skin type. At a WMO meeting on UV-B measurements, data quality and standardization of UV indices (Les Diablerets, Switzerland, July 1994), it was recommended to use a UV index similar to the index used in Canada. Many European countries started (or will start in the near future) an operational UV-B forecasting programme. From a survey which has been carried out by the Danish Meteorological Institute it appears that in these countries various ways are used to present the UV forecasts to the public.

Differences also exist among the European countries that already have implemented or plan to implement an operational UV-B forecast in the radiative transfer code used to calculate the UV-B irradiance at ground level and the methods used to obtain the various input parameters to this code. One of the important input parameters is the total column ozone amount which is mostly predicted from its correlation with one or several meteorological parameters such as the temperature at a certain pressure level, the altitude of the tropopause, the height of a certain pressure level, or the vertically integrated potential vorticity. Again, the choice of how the column ozone amount is predicted varies among countries.

The development and implementation of UV-B forecasting programmes in different European countries lead to an overlap of efforts and a lack of harmonization. A coordination between the various existing and planned programmes of UV-B forecasting is therefore highly desirable. This can be achieved in the framework of a COST Action.

2. Objectives of the action

The final goal is to establish tested and standardized UV-B radiation forecasts for public information in Europe. To achieve this goal a number of steps have to be taken. They can be summarized as follows:

2.1 To provide the necessary input data for the UV forecasting with a quality relevant for public information.

2.2 To test and to optimize models for the calculation of UV radiation near the surface.

2.3 To implement a validation of forecasted ozone amounts by high quality ground-based ozone measurements and/or by satellite data.

2.4 To improve the methods to include cloudiness in UV forecasts.

2.5 To implement a validation of the final product for public information.

2.6 To follow the WMO/WHO (World Health Organization) recommendations concerning issuing the final product for public information.

3. Scientific content of the action

3.1 Input data for public UV-forecast

Various meteorological variables as well as time and site dependent variables are needed to make UV forecasts. In order of importance the main variables are:

- solar elevation: has a strong influence on the daily and seasonal course of UV radiation at the surface. This variable can be readily calculated using astronomical formulae.

- Clouds: mostly decrease ground level UV irradiance, although under special cloud conditions an increase of the irradiance may also be observed. Cloud forecasts are provided with variable accuracy; also satellite pictures can be helpful.

- Ozone: daily variations in the total column ozone (which may amount to 30% in Europe) and in the vertical distribution of ozone cause variations in ground level UV radiation. Ozone forecasts are based on the correlation between its column amounts and certain atmospheric variables. The forecasts require reliable ground based observations of total column amount of ozone but the vertical distribution may be desirable also; on a larger scale the forecasts may be improved by using satellite ozone data.

- Aerosol: its effect on ground level UV irradiance may amount to 15%, depending on local and regional aerosol sources. The quantification of this effect could be improved by means of backward trajectory studies.

- Albedo: becomes significant for UV-B radiation only at values higher than 10% (e.g. at snow-covered surfaces). Input data in models may be improved by using satellite data.

Research and sensitivity studies are needed to assess the impact of these variables on ground level UV irradiance. For this purpose the Management Committee of the Action will:

(1) implement sensitivity studies to assess the relative importance of each of these variables;

(2) implement studies to improve the quality of the input data with emphasis on aspects relevant to UV forecasts issued to the public and paying proper attention to the outcome of sensitivity studies.

3.2 <u>Test/optimize models for computing UV radiation</u>

UV-B forecasting models that are currently in use can be divided into three types:

- Empirical models: models to compute UV irradiances based on fits of several years of UV observations; the input variables are usually solar elevation and ozone.

- Simple parameterized models, e.g. the well known Green's model; ozone, solar elevation, and sometimes aerosol are used as input.

- Sophisticated radiative transfer models: among these are the so-called doubling/adding method and the discrete ordinate method. They have in common the fact that the atmosphere is characterized in as detailed a way as possible (by profiles of temperature, humidity, ozone, sulphur dioxide, aerosol, scattering and absorbing properties of atmospheric constituents, etc).

UV-B forecasts from the participating countries should be made consistent to some extent. For this purpose the Management Committee of the Action will:

(1) implement studies to test the models, compare computed UV irradiances to each other and to observed UV irradiances, and make improvements if needed;

(2) implement studies to optimize the models by considering operational (computer time) and scientific (input data quality) aspects.

3.3 Implementation of validation of ozone forecasts

To make a UV forecast, it is necessary to make a forecast of the amount of ozone in the atmosphere first. Various methods are used, e.g. based on the height of certain temperature levels or the tropopause, or using column integrated potential vorticity; all these methods need to be validated. For this purpose the Management Committee of the Action will:

(1) make an inventory of the methods that are currently used to make a forecast of the amount of ozone and implement a validation scheme;

(2) examine the feasibility of developing chemical-dynamical models for ozone forecasts;

(3) take the necessary steps to exchange high quality ground-based total ozone measurements among the participating countries, for the validation of ozone forecasts;

(4) employ large-scale ozone fields measured with satellite instruments for validating forecasted ozone fields. Currently total ozone amounts from TOVS (TIROS Operational Vertical Sounder) are available. In the first half of 1995 the ERS-2 satellite will be launched with the GOME (Global Ozone Monitoring Experiment) which will allow for the first time to make accurate ozone measurements from a European satellite. In the future ozone measurements from other European instruments (such as SCIAMACHY) will be available.

3.4 Cloudiness in UV forecasts

The largest short-term variations of the spectral UV radiation at the surface are caused by changes of cloudiness. Therefore it is important to forecast the influence of the expected cloud conditions on the UV index. Unfortunately there are still many problems to overcome in the assessment of the influence of clouds:

- The spectral attenuation factor for spectral global radiation by cloudiness is not well-known.

- The forecast of cloudiness according to the type and amount of clouds is a difficult task.

- A proper forecast of the time of cloud appearance (at least within 4 hours around noon) is critical since the daily course of biologically effective UV radiation at the surface has – compared to visible radiation – a relatively pronounced maximum at local noon.

The National Meteorological Services that are engaged in an operational UV forecast take the effect of cloudiness into account by a number of different methods (e.g. by forecasting a UV-B index for clear sky conditions and by applying simplified attenuation factors for different classes of cloud cover).

The problems related to cloudiness in UV forecasts need to be tackled. For this purpose the Management Committee of the Action will:

(1) implement studies to improve the accuracy of cloudiness attenuation factors;

(2) implement studies to improve the forecast of cloudiness and local cloudiness effects;

(3) implement the development of "last hour" forecast procedures using now-cast cloudiness, for public information at sunbathing sites;

(4) make recommendations for worst case assumptions for public information, if the cloudiness forecast is very uncertain.

3.5 Implementation of validation of final products

As it is a recognized practice in the meteorological community to predict only quantities that can be experimentally verified, a number of measures are unavoidable before UV forecasts on a continental scale become meaningful. For this purpose the Management Committee of the Action will:

(1) support and make use of the efforts within WMO and Community research programmes, to determine calibration procedures for UV instruments and to improve the quality of UV measurements;

(2) prepare proposals and support efforts on the exchange of reliable UV radiation observations with a short time delay among the participating countries, the minimum exchangeable information being the UV index at local solar noon as recommended by WMO (see point 3.6);

(3) select a suitable algorithm for the quantitative assessment of the quality of UV forecasts;

(4) take measures so that the validation of UV forecasts can be continued after this COST Action has expired;

(5) provide experimental data – preferably from locations where the seasonal variation of the surface reflectance is large – on possibilities to forecast UV irradiances falling on tilted surfaces;

(6) assess the possible role of ECMWF in UV-B forecasts.

3.6 WMO/WHO recommendations concerning UV forecasts

At a WMO meeting on UV-B (Les Diablerets, Switzerland, July 1994) the following recommendation regarding a forecasted UV index was formulated:

> "Create a standard UV index based on the following criteria:
>
> Utilization of the C.I.E. (1987) action spectrum normalized to 1,0 at 297 nm.
>
> A minimum requirement to report irradiance values at local solar noon.
>
> The index is expressed by multiplying the weighted irradiance in W/m2 by 40,0 (this will lead to an open-ended index, which is normally between 0 and 16)".

To facilitate the understanding of UV-B forecasts by the public when travelling from one country to another, it is desirable that all European countries issue (at least) the same type of index to indicate the expected amount of erythemally effective UV-B radiation at the surface, which is currently not the case. For this purpose the Management Committee of the Action will take the necessary steps to adopt the WMO/WHO recommendations concerning a common UV index.

4. Timetable

The Action will last for four years. Since the improvement of radiative transfer models and the validation of forecasted parameters will be a continuous and interactive process, it is likely that most of the Action areas specified in section 3 will be investigated in parallel.

5. Organization, management and responsibilities

A Management Committee will be set up following the appropriate number of signatories to the Action Memorandum of Understanding. A Chairman will be elected and tasked to draft an outline project plan based upon the items specified in section 3. This plan will be discussed and approved by the Management Committee and submitted to the Technical Committee for Meteorology.

In order to carry out the work a limited number of working groups will be formed with the responsibility to carry out specific tasks. A tentative structure of working groups is as follows:

Management Committee of COST Action No 713 on UV-B forecasting

Working group No 1 Data	Working group No 2 Models	Working group No 3 Validation
Will be mainly concerned with the tasks described in sub-sections 3.1 and 3.4.	Will be mainly concerned with the tasks described in sub-section 3.2.	Will be mainly concerned with the tasks described in sub-sections 3.3 and 3.5.

The Management Committee will meet at least twice per year. Progress reports will be produced on an annual basis and a detailed final report will be published at the end of the Action. It is expected that at least one workshop will be arranged during the Action. The Management Committee will report formally on an annual basis to the COST Senior Officials Committee through the Technical Committee for Meteorology, and will also provide short reports at each meeting of the Technical Committee either verbally or in written form.

6. Economic dimension of the action

It is expected that about 12 countries will participate and that each country will allocate up to 4 man-years (mainly by scientists) to the Action, which means that the total Action cost will amount up to about ECU 3,2 million including overheads.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 714
"Directional Spectra of Ocean Waves"

Date of entry into force of the project : 12.09.1996
Duration : 12.09.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
SPAIN	12.09.96	12.09.96
FRANCE	12.09.96	12.09.96
NETHERLANDS	12.09.96	12.09.96
NORWAY	12.09.96	12.09.96
FINLAND	19.12.96	19.12.96
UNITED KINGDOM	12.09.96	12.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to improve the measurement and use of the directional information of sea-states.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 4,8 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST 714

DIRECTIONAL SPECTRA OF OCEAN WAVES

A. BACKGROUND

Global scale measurements of sea state has long been pointed out as a pressing need in several domains. Firstly, systematic measurements of surface wave fields would be very useful to further improve the prediction of sea state and ocean storms from wave forecast models. Secondly, for navigation and maritime industry both the prediction of wave fields and the climatology of sea states have to be known. Thirdly, management of the coastal areas requires a better knowledge of the characteristics and climatology of water waves generated in the open ocean. Finally, in the perspective of our understanding of the coupled ocean-atmosphere system as a whole, and of the evolution of our climate, the influence of surface waves must be considered since they play a role in the energy and mass transfers at the interface between ocean and atmosphere.

It is recognized that improvements in all these domains will come from wind and wave measurements combined with numerical wave prediction models.

Modern remote-sensing techniques have already been developed with this aim. However they suffer from different drawbacks which are recalled hereafter.

Satellite-borne radar altimeters now provide information on a nearly operational basis on significant wave height (quantity related to the energy of the waves) and surface wind speed.

Recent work shows the usefulness of such measurements in assimilation schemes for numerical wave forecast models. However, as suggested by these studies, the main weakness of this approach lies in the lack of information concerning the wavelength and direction of the waves. Information solely about significant wave height limits the impact of the assimilation. These shortcomings clearly indicate that directional spectral information have to be taken into account in order to improve the quality of the analysed wave field and its forecast.

Today, Synthetic Aperture Radar (SAR) provides the only existing opportunity to measure the directional ocean wave properties from a space borne sensor. Unfortunately, it is well known that the wave-like patterns visible in an SAR image of the ocean surface may be considerably different from the actual ocean wave field: distortions frequently occur on the mapping due to the displacement of the surface scatter during the formation of the image. As a result, the extraction from a SAR scene of meaningful properties of the two-dimensional wave spectra is not straightforward and relies on assumptions which have not all been verified. To overcome this problem, new methods have been proposed to combine SAR data and numerical wave model spectra to retrieve from the SAR images, directional wave spectra constrained by the model information. These methods have been validated, but several remaining problems must be solved or clarified to demonstrate their potentialities from an operational point of view.

Although SARs are not ideal to measure directional spectra, deployment in space of these radar systems will continue because they have other applications over the continents. Therefore, it is important to further progress in the inversion and use of SAR observations over the ocean.

In parallel, alternative systems have to be studied. Airborne radar-systems based on a technique which does not present the limitation of the SARs have demonstrated their capabilities to obtain the directional spectra of ocean waves. The extension of these types of radar to space borne systems has already been proposed. Preliminary studies have shown its feasibility. Further studies are necessary to simulate the expected performances of such systems, and to prepare the use of this type of observation into assimilation schemes of wave prediction models.

For all these topics there is a need for coordinated analysis between remote-sensing observations, sea-state modelling, and in situ measurements of wind and waves. Coherent data sets from a dedicated field campaign would bring valuable information to carry out these studies.

Considering that we will be able in the future to obtain directional wave spectra over the ocean basins on an operational basis, methods have to be developed to assimilate these data into numerical wave models. Assimilation of observations into wave models is much more recent than assimilation into Global Circulation Atmospheric Models (GCAM). For the assimilation of directional wave spectra, only limited studies have been performed until now. Therefore, there is an important need to develop assimilation techniques for the specific case of wave forecast.

Finally, in the domain of engineering applications (maritime industry and navigation), there is a need to use wave spectral information. However, the links between the engineering and scientific communities must be developed; the potential advantages of using new measurement techniques are not well known, by the first one, and the exact requirements for the observations are not well known by the last one.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to improve the measurement and use of the directional information of sea-states. To achieve this, six activities have to be carried out:

1. to further improve the retrieval of wind and wave information from SAR data alone

2. to improve the inversion schemes which provide directional wave height spectra from SAR image spectra using external data (numerical model, in situ observations)

3. to define and propose new missions as alternatives to SAR observations, for the measurement of the directional spectra of ocean waves at a global scale

4. to define new, or use existing, field experiments

5. to develop further strategies for the analysis, validation and assimilation of waves observations into numerical models for sea-state prediction

6. to develop the relations between the scientific and the engineering communities for application purposes.

The expected benefits of this Action are manifold. This Action will be a significant contribution to the improvement of weather and surface wave conditions prediction, based on the use of satellite data into numerical models. Benefits are also expected in a better understanding of the radar signals backscattered from the sea surface. Moreover, the Action should contribute to the definition of new instrument concepts for the measurement of the ocean waves spectral parameters. It should also serve as guidelines for future field experiments. Finally, it would contribute to tighten the links between the world of scientists and the world of engineers in marine technology, by proposing exchanges between the two communities.

C. SCIENTIFIC PROGRAMME

The Action is divided into six activities (six research tasks) detailed below and summarized in Table 1.

1. Improvement of the retrieval of wind and wave information from SAR signals alone

Space borne SAR has the capability of high resolution measurements ($\sim$10 m to 1 km). This advantage is not yet widely exploited to obtain information on the scattering mechanisms, and to improve SAR image spectra inversion into wave spectra. Recent studies have shown that the statistics of the backscattered signal amplitude are sensitive to the physical conditions on the surface (wind and waves), as well as the imaging conditions (incidence angle, frequency, polarization). Moreover, these statistics provide one with information on the non-linear effects of wave imaging. It must also be noted that SAR instrument potentially captures sub-resolution scale information on the frequency of breaking waves during the along-track temporal integration of the backscattered signal. For this Action, cooperative studies will be undertaken to develop statistical analyses of the SAR images in order to gain knowledge in both scattering process and modulation mechanisms which both affect geophysical parameters derived from SAR image spectra, such as the significant wave height, and the peak wavelength and direction.

The account of speckle noise is also quite important for the retrieval of meaningful wave spectra from SAR images. Recent developments have shown that the use of cross-spectral analysis between successive looks can decrease the effect of speckle noise on the wave spectra retrieval. Moreover, this technique seems promising to resolve the 180° ambiguity in the wave propagation direction. These new methods will be more extensively tested in order to develop their use in the future.

The current theory to transform SAR image spectra into wave spectra is based upon a transfer function which takes into account three modulation effects: the velocity bunching (effect due to the motion of scatters), the hydrodynamic modulation and the tilt modulation. Theoretical expressions for these functions have been proposed in the literature. They are described in terms of the radar parameters and surface characteristics (distribution of motion scatters, coherence time, hydrodynamic interaction between long and short waves, wave spectral distribution for short waves). Direct experimental estimates of the modulation transfer function are few, but most of them show disagreements between theory and observations. From these experimental studies, new transfer functions have been proposed for various radar and surface conditions. They will be introduced in the SAR transformation and the sensitivity of the results to variation of the modulation transfer function will be extensively tested. Further experimental studies will also be proposed to assess the modulation transfer function (see task 3).

2. **Improvement of the inversion methods, which make use of external data (numerical model, in situ observations)**

Several aspects of the inversion algorithm for SAR images are still under discussion. The first one deals with the transfer function for the hydrodynamic modulation which is not quite well known (see point 1 here above). A second point deals with the estimation of the azimuth cut-off wave length due to the motion of scatters. Third, questions on the dependence of the inverted wave spectrum upon the first guess remain. Improved inversion methods have already been proposed. Further studies will be developed to compare this algorithm to a complementary approach based on an adjoint modelling. Both suffer the same limitation due to the necessity of a first guess information. The combination of existing data from overlapping space and time regions (like the combination of ERS-1 SAR, SIRC SAR, aircraft measurements and buoy data) would be beneficial to settle the questions addressed above.

One of the main applications of directional wave spectra is in a combined wind and wave data assimilation for which an operational implementation of the inversion algorithm is presently under way. As one of the requirements is low computing time, any possible speed up of the inversion technique is desirable. An alternative approach might be the use of neural networks for operational purposes. However their potential use and advantage in terms of computing time has yet to be demonstrated. The data set for their training could again be provided by wave spectra inverted from SAR image spectra.

3. **Definition and proposal of alternative missions for the measurement of the directional spectra of ocean waves on a global scale**

Because the SAR imagery for the measurement of directional ocean wave spectra has important limitations, there is a need to envisage alternative space-borne systems better adapted to this measurement. Following the call for ideas from the French Space Agency, a proposal called VAGSAT has been made to develop a radar based upon a real-aperture technique. The idea is to use a radar pointing at small incidence angles ($\sim 10°$ from nadir), using the real aperture of the antenna, and scanning in order to cover the horizontal plane over 360° in azimuth. Obtaining the directional spectra of the waves relies on an analysis of the modulation of the radar signal backscattered within the antenna footprint.

In order to prepare this possible mission, several studies will be undertaken. In particular, an analysis of the global performance of the measurements following the principle of VAGSAT as compared to SAR measurements will be carried out. Studies about the statistics of the ocean wave field are also necessary to be undertaken as a preliminary step to the development of assimilation techniques. Finally, constraints on the sampling strategy will be defined with the help of sea-state forecast model outputs.

4. **Definition and use of field experiments**

Field experiments are essential to progress in the study and use of ocean surface waves observations. For most of the topics described here, the combined use of in situ observations to measure surface and atmospheric parameters (e.g. wind, wind stress, waves, atmospheric stability) and remote sensing techniques from ground, platforms, aircraft and satellites would be of great interest.

In the context of this Action, we propose to make an inventory of the existing data bases, and to facilitate access to them. In parallel, we will work on the definition of new experiments to study aspects not covered by previous field experiments. We will take into account in the definition of these experiments, the existing instrumental possibilities of the different countries participating to the Action.

The main experimental objectives are listed hereafter.

Among the different unresolved problems, the behaviour of the hydrodynamic modulation is an important one, because the uncertainty in this term affects both the determination of wave peak directions and of significant wave height from SAR images. Moreover, it probably affects other microwave measurements such the upwind/downwind difference in radar cross-section measured from wind scatterometers. Further experimental studies are necessary to better know this hydrodynamic modulation in various situations of wind, waves, current, atmospheric stability, and for various radar conditions (polarization, incidence angle, radar frequency). This will also be useful to prepare the use of future SARs which will enable observations over a large diversity of incidence angles, radar frequencies and polarization.

Other effects on the radar signal, like the breaking of large waves or the effect of rain are poorly documented from in situ measurements. Further studies are necessary for example to investigate the relationship between breaking wave events, Doppler radar signal, speckle noise level. Concerning the rain effects, most of the existing studies concern either laboratory measurements or statistical analyses of satellite data. In situ measurements are necessary to examine the effect of an actual rain on the surface and on the radar signal.

Field experiments are also essential to better investigate the spatial evolution of wave fields. First, the directional behaviour of the waves and of the associated radar signal is not well known in fetch-limited situations. The JONSWAP experiment performed in the 70s provided very little information on this aspect. It would be very useful to propose a new experiment aimed at this topic. Closed sea conditions with frequent fetch-limited situations, like in the Baltic Sea or in the Mediterranean Sea would be the most adequate to carry out such an experiment. A second goal for the study of the spatial variability of wave fields is related to the development of the combined use of sea-state models and space-borne measurements. Indeed, SARs provide information on the wave spectra from a scale (~ 10 km) much smaller than the models (100 to 200 km), but with samplings depending on the satellite possibilities. With the recently proposed VAGSAT system, the obtained wave spectra would be representative of a scale similar to that of models. In order to use models and observations in a complementary way, it is necessary to study the variability of the wave field at scales ranging from about 10 km to about 200 km. This variability may be important in the vicinity of large storms and atmospheric fronts. Experimental studies devoted to this problem should help to define sampling strategies for future satellites, and to progress in the combined use of remotely sensed and modelled wave spectra.

5. Strategies for the analysis, validation and assimilation of satellite observations into numerical models for sea-state forecast

Numerical models of ocean surface gravity waves have been used for many years to produce analyses and forecasts of wave conditions. Until recently, because observations of waves were sparse, the wave field analyses were produced without reference to observations of the waves themselves, but were diagnosed from the wind field. Following the launch of ERS-1, many meteorological centres have introduced schemes to improve the starting states used by the wave models. These schemes combine the satellite observations of wind and wave height with the fields from the wave model, allowing correction of errors caused by weaknesses in the physics represented by the wave models and the winds used to drive them. Although the altimeter observations have been very useful for operational wave forecasting, their impact will remain limited because many assumptions have to be made to relate the observed wave height to the full wave spectrum that is needed by the wave model. Direct assimilation of wave spectra, from SAR or other sources, would not need these arbitrary assumptions, but the techniques to achieve this on an operational basis are not yet available. Therefore, there is a need for international cooperation to develop and assess methods for assimilating directional wave spectra. This development will benefit from the techniques already existing for GCAM, but specific studies have to be carried out to take into account the specificity of the wave prediction models. In particular one difficulty is that the assimilation process has to modify in a consistent way both the initial state and the forcing of the model (wind or friction velocity). Various configurations of assimilation can be envisaged (assimilation of wind and waves together, assimilation of waves alone, assimilation of observations provided by different kinds of sensors (altimeter, SAR, VAGSAT, ...)), and the impact of the assimilation must be evaluated in each case in order to propose an optimal strategy.

Although the variational technique seems presently too difficult to implement assimilation of observations into wave models on an operational basis, studies on the respective performance of the variational technique and of the more classical optimal interpolation method must be analysed.

One of the difficulties is to develop a method which will modify in a consistent way both the initial state of the model and the forcing parameters (wind or friction velocity). Methods to reduce the number of variables in the assimilation scheme have also to be further developed: the "spectral partitioning technique" must be adapted to several kinds of observations (buoys, SARs, VAGSAT) and its use in various assimilation schemes has to be validated. Besides, a method allowing a combined processing for the inversion of SAR spectra and for their assimilation has to be explored. Finally, an assimilation scheme taking into account several complementary remote-sensing systems (radar-altimeters, wind scatterometers, SARs or other wave spectrometers) has to be envisaged.

An intermediate step to these studies will be to agree on methods for comparing ocean wave spectra from different sources (buoy observations, radar observations, model outputs).

The outcome of this component of the Action is expected to be a definition of statistical methods that participants will use to compare wave spectra to validate the models and new observing methods, and collaboration between centres developing data assimilation techniques for wave spectra resulting in a consensus on the suitability for various applications of the methods used for data assimilation.

6. Development of the relations between the scientific and the engineering communities

An important task of this COST Action is also to develop the relations between the scientific community which defines the sea-state measurements, analysis, and modelling works, and the users community which needs sea-state information to design ships, offshore and coastal constructions, to improve sea-keeping and optimize ship routes. The relevance of wave spectral information both to model assimilation, as well as to end user applications, will be addressed by means of a dialogue between data providers/producers and representatives of the marine engineering and industry. A cross disciplinary workshop will be held one year into the run time of the Action. Scientific designers from ship, offshore and coastal construction will be invited to voice their views on the relevance of wave spectral information. Further, key representatives of the operational side, i.e. ship masters and harbour captains will be invited to do the same. These sectors of industry have international coordination committees which will be approached in order to find the individual experts. Their views will be significant for both science and data production in the scope of wave spectral information.

Table 1: Tasks associated with the six identified activities

Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6
Improvement of the retrieval of wind and wave information from SAR signals alone	Improvement of the inversion methods for SARs	Definition and proposal of alternative missions for the measurement of the directional spectra of ocean waves on a global scale	Definition and use of field experiments	Analysis, validation, and assimilation of satellite observations into numerical models for sea-state forecast	Development of the relations between the scientific and the engineering communities
- Develop statistical analyses of SAR image pixels - Develop new types of signal analyses (cross-correlations) - Test new transfer functions	- Perform sensitivity tests of the inversion methods with respect to the first-guess - Validate the inverted products	- Analyse the performance of the VAGSAT concept (intrinsically and with respect to SARs) - Study the wave field variability, and propose sampling strategies	- Make an inventory of the existent data base, and facilitate access to them - Define and propose new experiments	- Adapt methods of assimilation of observations to the specific case of wave prediction models - Propose a common approach to validate models, and new observing methods and to estimate the impact of assimilation	- Promote the links between users and the scientific community through diffusion of information and workshop organizations

D. ORGANIZATION AND TIME-TABLE

The Action will last for four years. Since there are important interactions between the six activities described in Section C they will be investigated in parallel, within working groups. Results will be presented, where appropriate, during a workshop and will be published in the form of reports, according to the schedule given in Table 2.

The Action will carry out these activities through sharing the information on the state-of-the-art methods and facilities, and through exchange of scientists, data and software where appropriate.

Table 2: Schedule proposed to report (workshops and written document) on the on-going work

Year 1	Year 2	Year 3	Year 4
- State of the art concerning activities 1 and 2	- Inventory of existing field data (activity 4) - Progress in activities 1 and 2	- Status of new instrumental projects and of the associated studies (activity 3) - Communication between the scientific and the engineering community (activity 6)	- Proposition of new experiments (activity 4) - Progress in validation and assimilation studies (activity 5)

The Management Committee (MC) will prepare a detailed workplan based on Section C, for approval by the Technical Committee (TC). The MC will produce an annual in-depth progress report for the TC. For each of the TC's meetings, other than the one where the in-depth report will be examined, it will prepare a short written progress report.

The Action will insure that European organizations dealing with meteorology, oceanography, space and marine engineering, will be involved.

At the end of the Action the MC will publish a final report.

E. ECONOMIC DIMENSION

Experts from six countries have participated in the establishment of the Technical Annex: Finland, France, Germany, the Netherlands, Norway and United Kingdom. When the TC on Meteorology approved the Action, at its 11th meeting, six delegates made known that they will advise their respective governments to sign the MoU.

On the basis of six countries joining the Action, and considering information given by countries having participated in the writing of the Technical Annex, it is expected that, as a mean value, each country will contribute with the equivalent of three scientists working full time for the duration of the Action. Therefore, for each of the four years of the duration of the Action, the equivalent of eighteen full-time scientists will participate, leading to an estimate of the scientific personnel cost of ECU 4 million. Annual overhead costs being estimated at ECU 0,2 million, the minimum total cost of the Action will be of ECU million 4,8.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 824 "Gametic embryogenesis"

Date of entry into force of the project :	08.03.1995
Duration :	07.03.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	23.02.95	23.02.95
CZECH REPUBLIC	30.03.95	30.03.95
DENMARK	23.02.95	23.02.95
GERMANY	08.03.95	08.03.95
GREECE	15.03.95	15.03.95
SPAIN	08.03.95	08.03.95
FRANCE	08.03.95	08.03.95
IRELAND	25.04.96	25.04.96
ITALY	07.04.95	07.04.95
HUNGARY	08.03.95	08.03.95
NETHERLANDS	12.04.95	12.04.95
NORWAY	23.05.95	23.05.95
AUSTRIA	30.11.95	30.11.95
POLAND	11.06.96	11.06.96
PORTUGAL	07.06.95	07.06.95
SLOVAKIA	22.03.95	22.03.95
SLOVENIA	01.03.95	01.03.95
SWITZERLAND	21.11.95	21.11.95
FINLAND	05.04.95	05.04.95
SWEDEN	17.05.95	17.05.95
UNITED KINGDOM	17.05.95	17.05.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to promote and coordinate precompetitive research on gametic embryogenesis.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10,2 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ACTION 824

A. General background

The value of obtaining doubled haploid plants for plant breeding has been extensively acknowledged. The introduction of *in vitro* techniques for the induction of androgenesis or gynogenesis has significantly facilitated the production of doubled haploids as a support to plant breeding programmes, resulting in the early release of varieties.

The application of this new approach to plant breeding (and propagation) is encountering many difficulties, particularly in the field of whole plant regeneration from a microspore. It will not be possible to benefit from, and fully exploit, this new technique and opportunity without a fuller understanding of the processes involved.

The primary aim of this proposed Action is to coordinate research and development in Europe aimed at overcoming the various bottlenecks which restrict the full application of haploid culture technique to crop breeding and propagation. Breeding, including haploid production and genetic engineering, will have an impact only after 20 to 30 years.

The new COST Action will bring together scientists from several European laboratories. The participants hope for a well-established network, cooperation and strong connections among the laboratories, and for a strong cooperation between the official and private laboratories.

Links have to be established with the International Association for Plant Tissue Culture, the International Association for Plant Reproduction, the International Society for Horticultural Science and the European Association for Research on Plant Breeding (EUCARPIA).

The new COST action group will establish a joint working group with COST 822 (Development of integrated systems for large scale propagation of elite plants using *in vitro* techniques).

B. Objectives for the Action

Foster increased cooperation in Europe, in part through yearly meetings, in research on gametic embryogenesis in order to:

(a) Primary objectives:

Increase the use of gametic embryogenesis in plant breeding, including the extension of this technology to additional crops. Obtain quality control of regenerants (albinos, aneuploids, spontaneous diploidisation). This will be achieved by joint experiments and annual meetings.

Develop systems for the genetic transformation of gametic cells as a method for obtaining genetically modified crops.

Further the understanding of the molecular, biochemical and physiological processes underlying gametic embryogenesis.

(b) Secondary objective:

An important secondary objective is that the understanding of gametic embryogenesis will increase our understanding of embryogenesis in plants in general (zygotic as well as somatic embryogenesis).

C. Scientific content for the Action

The three proposed primary objectives form the basis for the organization of the Action into three working groups.

In Working Group 1 "Anther, microspore and ovule culture" the focus is on the establishment of optimized *in vitro* culture systems using excised anthers, isolated microspores or pollen, excised ovules or isolated embryosacs or egg cells to regenerate haploid plants in various species.

The application of anther culture in species of importance in Europe is hampered by the rather low embryo induction and plant regeneration frequences as well as by strong genotypic effects. This lack of efficiency is mainly caused by strong genetic control which can be modified by environmental factors such as donor plant conditions, temperature, media composition and culture conditions. The success of the relatively simple anther culture technique depends on the complex interactions of a high number of inducing factors. Further investigations are necessary to analyse the factors determining the balance of gametic to sporophytic development. Anther culture may be the technique of choice for the breeder if a sufficient number of doubled haploid plants can be produced from the various genotypes of interest.

The ultimate central goal of this COST Action will be to set up protocols in various species for the high-efficiency production of green, haploid plants in anther culture as well as in isolated microspore or pollen cultures, by exchanging and using protocols and know-how from the established model species *Brassica napus, Nicotiana tabacum* and *Hordeum vulgare*. Since the requirements for setting up successful anther or microspore cultures differ from species to species, subgroups will focus on dicots, cereals, non-cereal monocots and woody species. This subdivision is, however, preliminary. Depending on the progress, it may be necessary to regroup the activities and include for instance legumes or *compositae*.

Ovule culture is a less frequently used technique for haploid production but with great potential. An extension of this technique is the isolation and culture of embryo sacs and even egg cells.

Since microspores and embryo sacs are products of meiosis, a population of plants derived from these structures represents some of the genetic variability produced by this meiosis. Selection can therefore be performed during *in vitro* culture of "gametes" from plants produced by specific crosses. There is little experience with such a type of selection, a procedure that is quite unlike the *in vitro* selection utilizing somaclonal variation. Since large numbers of individuals are required for selection, the microspores, i.e. the male "gametes", rather than the ovuless, are the cellular targets of choice.

An important, and as yet insufficiently investigated aspect of doubled haploid breeding, is the quality of the regenerated plants. In some species, such as cereals, spontaneous diploidisation takes place. Although beneficial at first sight, there is evidence that spontaneous diploids are sometimes less fertile. Somaclonal variation, mostly as chromosome losses, may be the cause of this reduction in fertility. Again in cereals, albinos are produced, often in high frequency. In tetraploid wheats, such as *Triticum durum*, hardly any green plants are produced. In other species not much is known about the effect of somaclonal variation (sometimes called gametoclonal variation) on the quality of the doubled haploid plants, but such effects cannot be excluded. The *in vitro* culture systems have, therefore, to be adapted in such a way as to minimize these and other forms of somaclonal variation. To do this, techniques have to be developed that allow early detection of variant forms during the plant production process. These techniques will be developed within the working group "Fundamental aspects of gametic embryogenesis". On the basis of these detection techniques, the *in vitro* systems will be optimized for efficient and non-deleterious methods of diploidisation.

In Working Group 2 "Transformation of gametic cells" the progress obtained in Working Group 1 "Anther, microspore and ovule culture" will be utilized to produce transgenic plants. At present, the optimized systems of pollen culture existing in tobacco, rape seed and barley are being used to produce transgenic plants. Potentially, transformation via microspores or ovules may be more generally applicable, even in those species that cannot easily be regenerated from somatic explants. Transformants obtained via haploids are homozygous in one step, saving time for the breeder. A further bonus: once a breeder is using anther and - in the future - pollen culture for doubled haploid production, it makes sense for him/her to use the same regeneration technique also for gene transfer, particularly since he/she should be able to rely on the quality of the regenerated plants.

There are two specific problems with transformation of "gametes" (microspores and ovules). The microspore wall and even more so the tissue layers surrounding the ovule represent barriers to DNA delivery that may require specific adaptation to the various DNA delivery devices. Second, since there is little or no experience with selection during gametic embryogenesis (see working group on "Anther, microspore and ovule culture"), the conditions for proper selection procedures have to be worked out. This pertains e.g. to the use of appropriate constructs (promoters, selective agents/resistance genes) and to the timing of the application of selection pressures. No subgroups will be formed initially, but such groups may later be formed on the basis of groups of plant species.

In Working Group 3 "Fundamental aspects of gametic embryogenesis" two different aspects will be considered. In a subgroup called "Cytogenetic and molecular analysis of events leading to genetic variation", the problems with the quality of the regenerants mentioned in connection with the working group "Anther, microspore and ovule culture" will be addressed. Cytogenetic techniques such as flow cytometry, *in situ* hybridisation, classical chromosome analysis, but also molecular techniques (e.g. PCR) will be required to detect various forms of somaclonal variation. Of particular interest will be the timing and mechanisms of spontaneous diploidisation, chromosome losses and the occurrence of chloroplast deletions. A functioning feed-back is required to enhance the exchange of information between the two working groups.

A second general topic within this working group is the molecular analysis of embryogenic induction and embryo development. Since it is generally recognized that gametic embryogenesis requires shock treatments to initiate embryogenesis, the molecular events of stress-induced gene expression are of particular interest. Various strategies will be used for isolating early and late genes of microspore and haploid ovule embryogenesis. These genes can be compared with genes isolated from somatic and zygotic embryos. A specific problem for late development is the arrest of already formed embryos in some species. Basic physiological research may be necessary to analyse the underlying causes.

In addition to these primary objectives, a secondary objective is to add to our understanding of plant reproduction in general, specifically of gametogenesis and embryogenesis. An understanding of microsporogenesis and ovule development is required since these processes are the starting points for the respective induced embryogeneic pathways. Embryogenesis *in vitro* has phenotypically a striking resemblance to zygotic embryogenesis. Whether and to which degree this is reflected at the molecular level has still to be shown. A further field to which this Action will contribute is stress research. Starvation, cold and heat treatments are all able to induce embryogenesis in one species or another. A molecular analysis of embryogenic induction will inevitably yield an understanding of stress-induced gene expression.

D. Timetable

The Action is scheduled for five years. It is anticipated that the research programmes described above will run in parallel, building on previous achievements of each laboratory and on international communication.

E. Organization, management and responsibilities

The Management Committee will be responsible for initiating the inter-Action cooperation with appropriate working groups. An annual planning and evaluation session will be organized for each working group, and the Management Committee will oversee the general direction and progress of the interaction between working groups and their relationships with other COST Actions. Each working group will be organized with two Joint Coordinators who will be responsible for coordinating the research programme and organizing meetings of their working group. It is expected that each working group will meet annually. The Group Coordinators, in conjunction with the Management Committee, will be responsible for the Annual Report for submission to the COST Senior Officials.

Proposed working groups:

(1) Anther, microspore and ovule culture

(2) Genetic transformation of gametic cells

(3) Fundamental aspects of gametic embryogenesis

Implementation and publishing

Each working group will be organized with two coordinators who will be responsible for coordinating the research programme and organizing workshops, conferences and seminars of their working groups. Coordination will be required also to organize conferences together with other COST Actions. Within the working groups, a group leader will organize meetings and workshops of his/her subgroup.

The final results will be published by the preparation of reports from the group leaders, supplemented by reports from the coordinators of the working groups. In conjunction with the Management Committee the coordinators will submit the final report to COST Senior Officials.

F. Economic dimension of the Action

So far, 66 laboratories in 17 different countries have expressed their interest in this COST Action.

It is estimated that the yearly total personnel costs will be ECU 8 500 000, with ECU 1 700 000 for running/operational costs. These costs will be covered from national resources.

This estimate is on the basis of information given in COST scheme No 2 and information from national experts. It does not include the United Kingdom, Denmark, Ireland and Iceland, although there is information that they also plan to take part in this COST Action.

Memorandum of Understanding
for the implementation of a European Concerted Research Action designated as COST Action 825 "Mammary Gland Biology"

Date of entry into force of the project :	29.06.1995
Duration :	28.06.2000

Contracting parties	Date of signing	Date d'entrée en vigueur
BELGIUM	05.07.95	05.07.95
DENMARK	29.06.95	29.06.95
GERMANY	29.06.95	29.06.95
GREECE	27.11.96	27.11.96
SPAIN	29.06.95	29.06.95
FRANCE	29.06.95	29.06.95
IRELAND	13.09.95	13.09.95
ITALY	19.07.95	19.07.95
HUNGARY	13.07.95	13.07.95
NETHERLANDS	29.06.95	29.06.95
NORWAY	27.03.96	27.03.96
AUSTRIA	30.11.95	30.11.95
SLOVENIA	29.03.96	29.03.96
SWITZERLAND	21.11.95	21.11.95
SWEDEN	29.06.95	29.06.95
UNITED KINGDOM	06.09.95	06.09.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to promote contacts and interdisciplinary cooperation between European scientists working on mammary gland biology.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 13 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION 825

Mammary gland biology studies are a very long-established tradition in Europe where histological and physiological work on lactation originated. Currently, most European countries support mammary gland research. However, this important research potential might remain inefficient because of geographical dispersion and lack of communication between laboratories.

A. GENERAL BACKGROUND

Current research on the mammary gland is directed towards the study of the functioning of normal and tumoral mammary epithelial cells, including interaction between the surrounding cells, extracellular matrix and interstitial tissue.

Phases of differentiation occurring during puberty and pregnancy are required for the functioning of the mammary cell. The extracellular matrix surrounding alveolar cells is of the utmost importance to the working of the normal cell. Extracellular matrix is involved in transformations of mammary cells which generate tumoral and cancerous cells. Consequently, understanding the role of this matrix is an important point in research on breast cancer.

Understanding how hormones act, from the control of gene expression, to post-transcriptional control of synthesis and secretion of milk components (with consequences for milk quality) involves cellular and molecular studies.

Understanding of utilization of nutrients necessitates nutritional and cellular physiology studies.

Modifications of the environment of the cell (infection, inflammation) provoke cell reactions. Programmes of pathological and immunological research study defence mechanisms.

All these areas of research overlap. They are supported by different European countries. To date, the researchers who have expressed interest in participating in COST belong to 11 countries of the Member States and they represent all the previously mentioned disciplines. Consequently, the research groups interested in mammary gland biology research are dispersed throughout most European countries. Furthermore, they are also often independently managed (health, fundamental research, agriculture, agri-food sector) and exchanges between groups may not exist. therefore, we are convinced that it is particularly timely and necessary to establish a European organization in order to promote contacts and exchanges between laboratories involved in research on mammary gland biology as well as a better understanding between academic and industrial institutions. Only the COST programme allows the creation of such a network in Europe.

Presently, only a small number of specific cooperation projects are supported by European exchange programmes (for example: UK ⇔ Spain, France ⇔ UK, France ⇔ Spain, France ⇔ Hungary). Therefore, they are de facto restricted to very specialized subtopics and involve a limited number of laboratories.

A few international scientific programmes allow researchers to meet. these meetings are held every other year, either in the USA (Gordon Conference on Mammary Gland Biology) , or alternating between Europe and North America (Fédération Européen de Zootechnie - American Society of Animal Science - FEZ/ASAS) and European investigators can rarely attend.

It is important to note that the EC supports scientific programmes on specific points of research. the biotechnology programme "Bovmap" (bovine gene mapping project), will enable characterization of genes with economically important traits (quality of biological products including milk, resistance to disease, ...). Among Biomedical and Healthy Research Cancer programmes, several support studies on breast cancer. It will be important to promote interaction between participants in these programmes and those in the COST project. These contacts will be facilitated by the fact that researchers involved in these biotechnology and biomedical programmes are also participating in the COST Action. There is neither competition nor conflict between fundamental research currently supported by EC and the proposed COST programmes.

B. OBJECTIVES

Main objective

To promote contacts and interdisciplinary cooperation between European scientists working on mammary gland biology.

Secondary objectives

- To promote multidisciplinary meetings between research groups in the following areas:
  - Physiology: development – apoptosis – growth factors – hormones – milk ejection
  - Nutrition: supply and uptake of nutrients
milk composition and nutrition of the young
fatty acid and tumours
  - Breast cancer: tumour cells – tumour markers
  - Pathology and immunology: infection – virus – inflammation
  - Molecular Biology: control of gene expression – transcription factors – transgenesis
  - Cellular and Developmental Biology: differentiation – inter- and intra-cellular signalling – secretion.
- To encourage application of mammary gland research. Since researchers in the previously described areas are very specialized in their individual disciplines, success is likely to depend upon establishment of a context of complementary and multidisciplinary research. Participation of industrial representatives in the meetings will allow on one hand the economic development of these scientific results and, on the other hand, definition of the needs of industrialist. this will also promote complementary development of know-how and financing arrangements between the industrial and the fundamental research sectors. We can expect to benefit in the areas of health, product processing and nutrition.

C. SCIENTIFIC CONTENT

To reach our objectives, we propose the following activities:

- setting up a working group which will produce and publish a directory of laboratories, groups and individual researchers working on the biology of the mammary gland. At the same time as the directory, laboratories will be able to publish an annual research report including laboratory references, team composition, research themes and recent progress. Through this annual report, outside members will get necessary information to establish cooperations and exchanges.

- setting up a working group responsible for a newsletter containing information on meetings, highlights of recent key findings, relevant publications, new points of general interest and offers of exchanges and cooperation.

- setting up a working group to organize interdisciplinary conferences. Proceedings of these meetings will be produced. In the first instance, in accordance with the scheme COST II from the participating countries, two main scientific areas are proposed:

  1. Supply of nutrients and effectors to the mammary gland

     The supply of nutrients, growth factors and hormones is linked to the control of mammary blood flow, and affects the proliferation of mammary cells. This step of development of the mammary gland is a prerequisite to reach optimal milk synthesis and secretion. Blood flow scan be regulated by hormones and be locally controlled by vasodilatotors and vasoconstrictors. Regulation of nutrient uptake, the nature of these nutrients and their utilization is the nutritionists' field. Physiologists study hormonal regulation and utilization of nutrients.

  2. Cellular proliferation and expression of the differentiated state of mammary cells

     Methods for the study of cells in culture is a common theme of interest for cellular and molecular biologists, physiologists, pathologists and nutritionists. Mammary cell lines (normal or tumoral) are used by pathologists and cellular/molecular biologists to study numerous activities; for example proliferation, gene expression and hormonal responses. However, because of genomic modification or loss of hormonal receptors in these cell lines, they may not be suitable for all types of study.

     Primary cells in culture are very good tools to study the differentiated state and the role extracellular matrix. However, also in this particular case, alignment and harmonization of techniques are necessary.

     To study production of lipids, proteins and transport of blood constituents (immunoglobulins, hormones) polarized cells, which offer independent access to apical and baso-lateral compartments, are necesssary. Such polarized cultures are obtained with certain cell lines but in the case of the mammary epithelial cell, establishment of a good system of polarized secretory cells needs additional work. It is also a good example of the necessity to coordinate experimental methods between laboratories. Scientific meetings will facilitate harmonization of techniques and the spread of know-how between participating groups.

Another specific topic will concern applications of molecular biology methods to mammary tissue (histochemistry, in situ hybridization, etc ...)

Reports will be made after the meetings.

- setting up a working group which will organize exchanges of scientists (if possible also involving industrial collaborators) during the COST programme.

D. TIMETABLE

The action is planned for five years. The management committee will meet as soon as the programme starts.

Starting point:	First plenary assembly:
	– creation of the different working groups,
	– organization of the meetings (place, frequency, scientific themes).
0,5 year	– mailing of the 1st newsletter.
	– meeting of the working groups.
1 year	– plenary assembly: state of the art on the directory, the newsletter and the organization of scientific meetings,
	– meeting of the working groups followed by mailing of the 2nd newsletter, the 1st announcement of the scientific meeting and the 1st release of the directory.
1,5 year	– 1st scientific meeting,
	– plenary assembly and meeting of the working groups,
	– mailing of the 3rd newsletter and of the proceedings of the scientific meeting.
2 year	– mailing of the 4th newsletter and the new release of the directory.
2,5 year	– 2nd scientific meeting,
	– plenary assembly and meeting of the working groups,
	– mailing of the 5th newsletter and of the proceedings of the scientific meeting.
3 year	– mailing of the 6th newsletter and the new release of the directory.
3,5 year	– 3rd scientific meeting,
	– plenary assembly and meeting of the working groups,
	– mailing of the 7th newsletter and of the proceedings of the scientific meeting.

4 year – mailing of the 8th newsletter and the new release of the directory.

4,5 year – 4th scientific meeting,

– plenary assembly and meeting of the working groups,

– mailing of the 9th newsletter and of the proceedings of the scientific meeting.

5 year – plenary assembly and meeting of the working groups followed by the production of a concluding document summarizing the action,

– mailing of the 10th newsletter and the new release of the directory.

E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

The management committee will initiate the working groups. Each working group will include at least two coordinators.

- working group responsible for the building of the directory,
- working group responsible for publication of the newsletter,
- working group responsible for the organization of scientific meetings,
- working group responsible for the management of exchanges.

The management committee will coordinate the project in accordance with the schedule. Publication and mailing of the annual directory, the biannual newsletter and the proceedings of meetings will be supplemented by annual reports drafted jointly by the management committee and the coordinators of the different working groups.

F. ECONOMICS

Total cost for the support to this project is estimated at ECU 13 000 000, keeping in mind the number of countries presently involved. However, certain Member States (for example Austria, Greece, Poland and Portugal) have not yet been contacted as yet and might be interested; this would increase, by 10-20 men/year, the number of participants. The estimated costs will be borne by the different countries involved in the action.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 826 "Ruminants' Mycoplasmoses"

Date of entry into force of the project : 05.07.1995
Duration : 04.07.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	05.07.95	05.07.95
CROATIA	12.10.95	12.10.95
CZECH REPUBLIC	23.04.96	23.04.96
GERMANY	29.06.95	29.06.95
GREECE	28.06.95	28.06.95
SPAIN	29.06.95	29.06.95
FRANCE	05.09.96	05.09.96
IRELAND	25.04.96	25.04.96
ITALY	19.07.95	19.07.95
HUNGARY	13.07.95	13.07.95
NETHERLANDS	25.10.95	25.10.95
AUSTRIA	31.10.96	31.10.96
PORTUGAL	06.09.95	06.09.95
SWITZERLAND	21.11.95	21.11.95
SWEDEN	12.10.95	12.10.95
UNITED KINGDOM	29.06.95	29.06.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to promote and coordinate research in the field of biochemistry, genetics, immunology and molecular mechanisms of pathogenicity of important mycoplasmoses of ruminants. The research is designed to lead to new technological developments for the diagnosis of these diseases, thus preventing considerable socio-economic injury in Europe and ensuring animal welfare.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 14 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

Action 826

A. GENERAL BACKGROUND

Mycoplasmoses are infectious diseases due to mycoplasmas, fastidious bacteria-like organisms, some of them being highly pathogenic, contagious and causing severe herd infections particularly in ruminants. In particular, contagious bovine pleuropneumonia (CBPP), contagious caprine pleuropneumonia (CCPP) and contagious agalactia of small and large ruminants, caused by different *Mycoplasma* species, are considered to constitute a particular threat and need to be controlled by specific diagnostic and epidemiological approaches. In addition, it is recognized that the quality of diagnostic methods for the detection of the diseases is insufficient and causes severe problems. During the 62nd General Assembly of the Office International des Epizooties (OIE) held in Paris on 16-20 May 1994, the socio-economic impact of mycoplasmal infections in bovine, ovine and caprine species was considered to be of very great importance worldwide. Therefore, the OIE recommended giving high priority to the research on contagious bovine, ovine and caprine mycoplasmoses with the aim of developing new, efficient and reliable diagnostic procedures (OIE Resolution XI, 1994).

These contagious mycoplasmoses are already known to be present in Europe. Contagious agalactia in small ruminants has been endemic for many years in Mediterranean countries and in Switzerland. Reports from different countries on agalactia and bronchopneumonia in cattle, due to *Mycoplasma bovis*, point out the emergence of the problem in Europe. Contagious bovine pleuropneumonia (CBPP), endemic in Africa and Asia, was present in France until 1984 and has been recorded in Portugal since 1983, in Spain since 1989 and in Italy since 1990. The prevalence of contagious caprine pleuropneumonia (CCPP) is more obscure. Its occurrence has been reported in a few African and Middle East countries and also from Turkey.

The presence of such mycoplasmoses is known to be of great economic importance for the affected countries. In view of the insufficient diagnostic methods available, the introduction of a single market in Europe has considerably enhanced the risk of spreading such diseases in Europe. Consequently, the spread of diseases could give rise to high costs for eradication, and would thus considerably weaken the agronomical competitiveness of Europe.

New technological developments for diagnostic tools depend on solid knowledge of the biology of the infectious agents. However, due to the great technical and scientific difficulties encountered with this group of organisms and also due to the small number of specialized laboratories, fundamental scientific data on bovine, ovine and caprine mycoplasmas are very poor.

Scientific activity on highly contagious mycoplasmoses is basically focused on European countries, since North American countries, in particular USA, which generally provide considerable contributions in the field of molecular pathogenicity of infectious diseases are free of most of these infections and do not carry out research in this field. This remains therefore an important task and challenge for Europe.

Relatively few laboratories in Europe are at present active in the research on mycoplasmas. Their research areas range from experimental infections to analysis of variability of immunogenic proteins, development of immunoassays, DNA sequence analysis of 16SrRNA genes, development of PCR methods and biochemical purification of structural membrane proteins. A few other institutions carry out applied tasks such as pathology, diagnostics, epidemiology and surveillance. Although current research contributes to a better understanding of this group of mycoplasmas, definite progress can only be reached by intensive collaboration between the respective research groups and institutions making applied efforts with the exchange of information, the coordination of research projects and the standardization and evaluation of diagnostic procedures. Currently there are no international coordination programmes in this field.

The proposed action is innovative, interdisciplinary of very great importance for the whole European continent. Its benefits can easily be shared among all European countries, and the standard procedures drawn up as well as the introduction of new, more efficient methodologies will help tremendously to facilitate the control of the disease and thus avoid the spread of the diseases. The veterinary services will obtain efficient tools for the surveillance of the disease, particularly in international animal exchanges and trade. Therefore, this Action is highly suitable to be incorporated in the framework of COST.

B. OBJECTIVES OF THE ACTION

The main objective of the Action is to reduce the considerable socio-economic effects in Europe due to several forms of ruminants' mycoplasmoses, to ensure animal welfare, and to strengthen European status in international agronomical exchange by:

- Promoting and coordinating research activity (biochemistry, genetics, immunology, molecular mechanisms of pathogenicity) of ruminants' mycoplasmoses.
- Developing efficient diagnostic tools.
- Gaining much needed information on basic research of animal mycoplasmas.
- Transferring technology between countries and thus enhancing the competitiveness of European scientific activity.
- Developing diagnostic tests which can be commercialized.
- Obtaining a better insight in the epidemiological situation in different countries.
- Recommending basic approaches for the development of efficient vaccines.

C. SCIENTIFIC CONTENT OF THE ACTION

Taking into account the complexity of the topics involved, the task will be achieved by several **working groups** which should convene in different workshops. Within these working groups, researchers with a common interest will form *common research teams*. Furthermore, the **exchange of qualified researchers** between laboratories will be encouraged.

Working Groups

The activity of each group will be managed by a **coordinator** assisted by a substitute. Members of the group will be the different national experts participating in the Action. Additional experts on specific topics may also participate in the activities of the group. Three different working groups are proposed:

Working Group 1 (Research)

The main activity of this group will be the coordination of the on-going research in different participating laboratories and the stimulation of new scientific approaches. Within the mycoplasmas to be studied priority will be given to members of the "mycoides cluster", *Mycoplasma agalactiae* and *Mycoplasma bovis*. The fields of research are:

> Genetics: molecular phylogeny, genetic variation, gene structures, gene maps, gene cloning and expression, molecular biology.
>
> Biochemistry and Physiology: Immunogenicity and variability of surface proteins, surface carbohydrates, metabolites and toxic factors.
>
> Immunology and Pathogenesis: Humoral and cell mediated immune response, immunological mediators, mitogen activity, auto-immunity, pathology, pathogen-host interactions.

All research fields are highly interactive and have to be discussed in the presence of all the scientific specialists.

Working Group 2 (Diagnostics)

This Working Group will develop, evaluate and coordinate the use of diagnostic procedures for field applications. This activity will be closely connected with new knowledge issued from Working Group 1 (Research).
The main objectives are:

> Evaluation of currently used diagnostic procedures.
>
> Elaboration of standardized protocols for diagnostic techniques.
>
> Evaluation of new techniques *in vitro*.
>
> Exchange of standardized material, in particular antigens and sera.
>
> Multicentric comparative analyses.
>
> Organization of collections of strains and immunoreagents and establishment of data banks.

Working Group 3 (Field Applications)

This Working Group will evaluate the practicability of the different diagnostic procedures in field situations. This activity is strongly dependent on the activity of the Working Group 2 (Diagnostics) and should consequently be coordinated. The objectives of this group are:

Evaluation and validation of different diagnostic procedures including new developments concerning the detection and identification of the infectious agents and their immunological responses in defined animal populations, with documented epidemiological and pathological data.

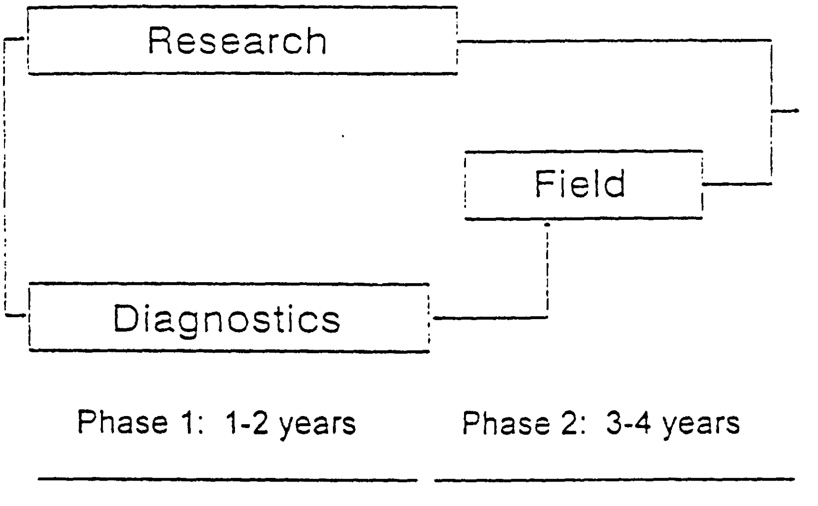
Drawing up protocols and recommendations for an efficient field diagnosis of contagious mycoplasmoses with emphasis on the reliability of the diagnostic tests (specificity, sensitivity, cutoff values, predictive values) and their proper use in control programmes.

Development of schemes for collection and analysis of epidemiological data (electronic data exchange).

Organization of training courses for peripheral laboratories involved in the diagnosis of mycoplasmoses.

D. TIMETABLE

The duration of the Action is planned for 5 years. An evaluation of the progress will be made after the second and fourth year. Annual reports will be presented to the COST Secretariat. We consider a phase 1 (1-2 years), during which Working Group I (Research) and Working Group 2 (Diagnostics) will start to work in parallel (see diagram). During phase 2 (2-3 years) the Working Group 1 (Research) will still continue its activity, but the Working Group 2 (Diagnostics) will successively integrate its activity into Working Group 3 (Field Applications).



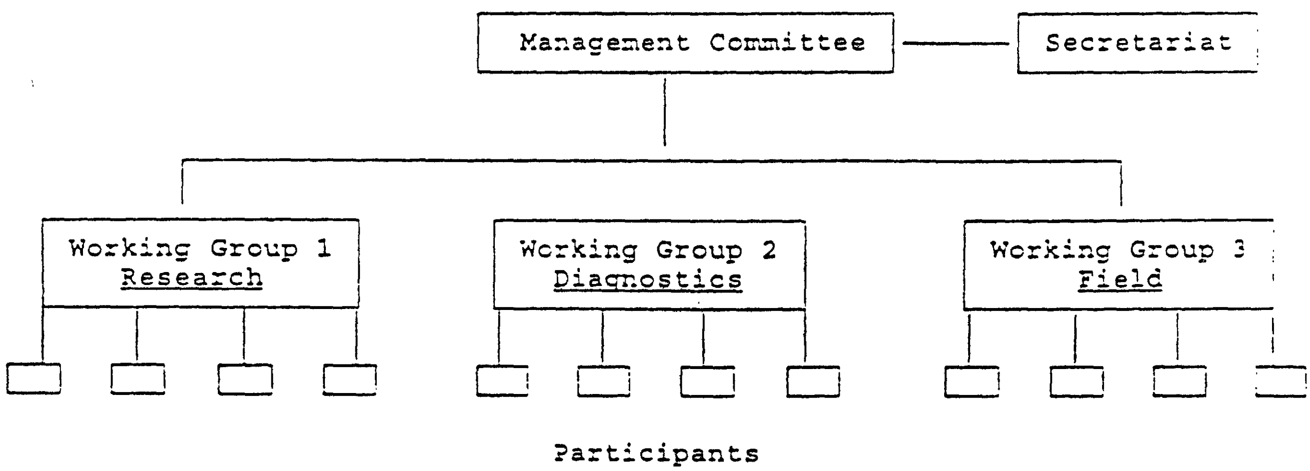
E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

The organization and coordination of the Action will be ensured by the **Management Committee**, assisted by the **COST Secretariat**. The Management Committee will consist of at least one representative of the signatory countries. The first task of the Committee will be to designate its president and the coordinators of the three working groups and to define the strategy and the programmes for each working group. During the course of the Action, the Management Committee will regularly supervise and coordinate the different activities and prepare annual and final reports. The Management Committee will meet annually. If a Technical Committee is designated, yearly meetings with the management committee will be planned.

Each **Working Group** will have a coordinator whose responsibilities are to follow the progress of the programmes, to make a short report of each meeting and to assure the information of the management committee. Coordinators are members of the Management Committee. The coordinators will be assisted by a substitute who represents the coordinator in case of absence. The coordinators will furthermore propose to the Management Committee the organization of work-shops and training courses. Each Working Group will organize its own working schedule to fulfil the proposed objectives, and nominates scientific leaders for handling specific topics.

The Working Group will organize one workshop of 2-3 days annually in different participating countries. The workshops and training courses will be organized by the coordinator and members of the working group, in collaboration with the COST Secretariat, upon approval of the management committee. Proceedings of the workshops and manuals of training courses will be published in collaboration with the COST Secretariat. The coordinator will assist scientists in their demands for exchange visits between different laboratories.

Organizational chart:



The Management Committee will define the modalities of publication of common work within the Action. Reports from each working group are submitted by their coordinator to the Management Committee for approval.

All recommendations for standardization of diagnostic procedures and validation of new techniques elaborated by the working groups will be coordinated by the Management Committee and will be available to interested national, European and international institutions, in particular to the Office International des Epizooties (OIE) for information of Veterinary services.

The Management Committee will regularly inform the OIE on the progress of the activity in the working groups 2 and 3 (Diagnostics and Field Applications) via the coordinators of these groups.

The Management Committee will assist in diffusing the common results of the Action in international congresses.

Special attention will be paid to the manner of transferring new technologies, elaborated by common efforts within the COST Action, to industry and to the possibilities of exploitation. Basically, newly drawn up standard procedures within the common COST efforts should be public domain.

F. ECONOMIC DIMENSION OF THE ACTION

The economic dimension of the action is estimated on the basis of current activities of the interested groups. The estimation includes manpower and national and international research grants already available or expected to be available in the near future for the work planned.

In each of the 11 participating countries, 3-5 persons are expected to devote their work to projects relating to this COST Action.

The total economic impact includes:

Scientist:	18 persons x ECU 60 000		ECU 1 080 000
Technicians:	15 persons x ECU 40 000		ECU 600 000
PhD Students:	15 persons x ECU 25 000		ECU 375 000
Total Personnel per year			ECU 2 055 000
TOTAL Personnel in	5 years	5 x ECU 2 055 000	ECU 10 275 000
TOTAL Investment	5 years		ECU 1 600 000
TOTAL Running costs	5 years		ECU 1 900 000
Coordination costs (COST)	5 years		ECU 300 000
TOTAL economic dimension			**ECU 14 075 000**

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action 827 "Regulation of voluntary feed intake in fish"

Date of entry into force of the project :	17.01.1996
Duration :	16.01.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.01.96	16.01.96
GREECE	17.04.96	17.04.96
SPAIN	17.01.96	17.01.96
FRANCE	19.06.96	19.06.96
ICELAND	17.01.96	17.01.96
NORWAY	19.02.96	19.02.96
PORTUGAL	15.02.96	15.02.96
FINLAND	16.01.96	16.01.96
SWEDEN	16.01.96	16.01.96
UNITED KINGDOM	20.03.96	20.03.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objectives of the Action are:

   - to promote, coordinate and harmonize pre-competitive research on the factors affecting voluntary feed intake in fish;
   - to provide the necessary know-how for increasing the competitiveness of European research at a crucial moment for the development of new management techniques in fish feeding;
   - to promote new feeding strategies in fish farms.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 25 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION 827

REGULATION OF VOLUNTARY FEED INTAKE IN FISH

1. BACKGROUND

1.1. CURRENT STATE-OF-THE-ART OF RESEARCH IN THE FIELD

There is currently considerable scope for applying studies on voluntary feed intake in fish. In fish farming, it is of prime importance to define feeding strategies which provide the best growth performance and the optimum feed conversion ratio. Self-feeding strategies seem particularly promising. The match between the feed intake capacity and the amount of feed presented determines the amount of non-ingested feed, which is a source of pollution and lost revenue for the fish farmer. Moreover, optimizing the various factors which stimulate ingestion improves growth performance and feed utilization and therefore decreases the amount of waste per unit of biomass produced.

Considerable advances have been already made in this field during the last decade thanks to the development of computer controlled demand feeders specifically adapted to aquaculture. Several laboratories in France, Greece, Spain, Norway and Sweden have simultaneously developed demand feeders for their own research needs and initiated programmes on voluntary feed intake in fish. International collaboration quickly followed, especially between France and Greece, and later Spain, with COMETT grants.

Although the research involved is fundamental, its purpose is strictly applied. Voluntary feed intake studies should therefore be carried out under experimental conditions close to the farming conditions of each species. Growth performance should also be measured under all conditions. This approach requires that voluntary feed intake be measured according to objective criteria. Computer controlled demand feeders are well adapted to this purpose. That is why the network can initially be restricted to laboratories using this technique.

1.2. WHY THE COOPERATION SHOULD BE CARRIED OUT WITHIN THE CONTEXT OF COST

The need for a more formal collaboration under a COST network was discussed at the Aquaculture '94 symposium held in Bordeaux from 23 to 27 March 1994. The symposium included a session on demand feeders organized by one of the proponents. This session enabled several of the laboratories working on this topic to make presentations and highlight the essential aspects of research to be carried out on voluntary feed intake in fish under a COST network.

The diversity of economically relevant biological models makes it necessary to establish relationships between laboratories mastering each of these models. Moreover, because of its complexity, research in the field of voluntary feed intake in fish calls for a multi-disciplinary approach that can be achieved only by combining scientific expertise and resources from several Member States. This Action will effectively promote such coordination, resulting in more efficient use of both Community and national funds in order to develop and maintain a European approach to understanding the factors affecting voluntary feed intake in fish.

2. OBJECTIVES OF THE ACTION

This Action will achieve three main objectives:

- to promote, coordinate and harmonize pre-competitive research on the factors affecting voluntary feed intake in fish;
- to provide the necessary know-how for increasing the competitiveness of European research at a crucial moment for the development of new management techniques in fish feeding;
- to promote new feeding strategies in fish farms.

3. SCIENTIFIC CONTENT

The Action will cover five main areas.

3.1. TECHNICAL ASPECTS IN STUDYING FEED INTAKE

The possibility of monitoring each food demand as a discrete event, when food is continually available, is a prerequisite for the study of voluntary feed intake. In the early 1970's some authors trained fish to hit a rod to obtain food for short term studies of food preferences and feeding behaviour. These first devices were not computerized, but the results obtained were very promising. During the last decade, new self-feeder systems were designed in different European laboratories in such a way, that each time a fish activates a rod, an electric pulse is generated and, through an interface (computer or electronic device), triggers an electric feeder that delivers a predetermined amount of food. Each system developed by the different laboratories have their own advantages and disadvantages, and can be more or less adapted to different fish species or experimental conditions.

3.2. ENVIRONMENTAL FACTORS AFFECTING FEED INTAKE

The environment of the fish is probably the factor whose effect on dietary feed intake has been best studied worldwide. Many studies show that in each species, there is an optimal temperature corresponding to maximum voluntary feed intake. Similarly, it is known that an oxygen deficiency decreases voluntary feed intake. Low concentrations of contaminants and various pollutants affect voluntary intake negatively.
Eco-toxicology is mainly oriented towards defining legal doses for various chemical components or the impact of a pollutant on some behavioural factor, but the threshold of each pollutant above which voluntary feed intake decreases is of vital importance for properly managing fish feeding.

Eco-tolerance programmes based on voluntary feed intake criteria are being initiated by several proponents of the network.

3.3. BEHAVIOURAL FACTORS AFFECTING FEED INTAKE

Behavioural factors often decrease voluntary intake and may even lead to feed refusal. Many examples of this have been described by some of the proponents. Examples involve the fish stocking rate, the sex-ratio, the demographic structure of the fish population, the presence of another species close to or within the production unit, the effect of human interventions. Learning behaviour, as well as the way fish are operating the trigger of the self-feeder is also strongly species-dependent.

Studies on fish behaviour in relation to self-feeding techniques will be conducted.

3.4. CHRONOBIOLOGICAL FACTORS AFFECTING FEED INTAKE

Chronobiological aspects are particularly important and several teams proposing the network devote a major part of their research to studying them. These studies show that feeding rhythms are controlled by an endogenous clock in some of the studied species, and that some environmental cues, like light/dark alternation or temperature, are acting as "zeitgebers". As a consequence, the feeding time itself is an important factor in terms of feed intake. Feeding time also affects nutrient utilization, and the level of nitrogen excretion.

3.5. DIETARY FACTORS AFFECTING FEED INTAKE

Palatability of feed has a major effect on feed acceptance. It is noteworthy that antibiotics decreases feed palatability. Feeds based on plant proteins rather than on animal proteins may also lead to palatability problems. This has important economic and environmental consequences because using plant proteins reduces both feed production costs and amount of phosphorus in the waste. It is therefore worth studying how to improve the palatability of these feeds, using different feedstuffs, or feeding stimulants. Demand feeders are particularly well adapted to investigating the effect of feed composition on feed intake because they put the animals in a choice situation. This was used by some proponent laboratories of the COST network for testing the ability of fish to discriminate between diets poor in zinc or in essential amino acids and non-deficient diets.

The effect of dietary composition on voluntary feed intake will be an important field of research in the network.

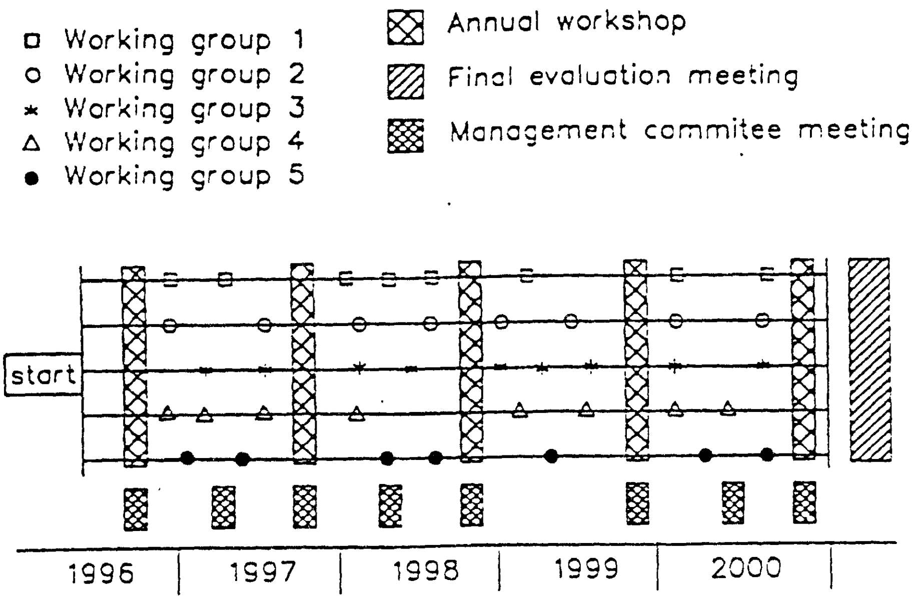
4. <u>TIMETABLE</u>

The time required to pursue the scientific projects will be five years. The evaluation of the progress of the action will be by annual meetings on specific subjects. The first three meetings will be:

1996: methods for studying voluntary feed intake in fish
1997: environment and self-feeding relationships
1998: appetite in fish.

A final meeting will be held in winter 2001 to evaluate the achievement of the action. International experts from outside Europe will be asked to participate and provide a critical analysis on the achievements.

Diagram:



5. ORGANIZATION AND MANAGEMENT

The action will be divided into five working groups covering the five main orientations described in the scientific content:

WG 1. Technical aspects in studying feed intake. The aim of this working group will be to share technical information and to harmonize technological and methodological approaches among laboratories.

WG 2. Environmental factors affecting feed intake.

WG 3. Behavioural factors affecting feed intake.

WG 4. Chronobiological factors affecting feed intake. This working group will consolidate research on feeding rhythms and will try to elucidate the relationships between feeding time and feed intake.

WG 5. Dietary factors affecting feed intake.

Coordinators of these working groups will be designated by the Management Committee. These working groups will meet regularly to coordinate and promote research activities.

Annual evaluation workshops (see Time-table) will be held:

- to review the results achieved and will include Officials from the EC Commission;
- to promote cooperation within the participating institutes;
- to finalize publications; and
- to evaluate progress achieved in practical applications.

The Management Committee will meet at least once a year, if possible in conjunction with the annual workshop, or in conjunction with research group meetings.

The final evaluation of the action is specified in the section "4. Timetable".

6. ECONOMIC DIMENSION OF THE ACTION

Scientific staff:	40 man-years x ECU 60 000 =	ECU 2,40 million
Technical staff:	15 man-years x ECU 40 000 =	ECU 0,60 million
Doctoral students staff:	10 man-years x ECU 25 000 =	ECU 0,25 million
Total staff:	65 man-years	ECU 3,25 million
Laboratory equipment and consumable:		ECU 1,25 million
Overhead costs:		ECU 0,50 million
Total estimated costs covered from national sources:		ECU 5 million/year

Memorandum of Understanding
for the implementation of a European Concerted
Research Action designated as
COST Action 828
"Seed science in the field of genetically controlled stress physiology"

Date of entry into force of the project :	29.05.1996
Duration :	28.05.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.05.96	29.05.96
CZECH REPUBLIC	13.09.96	13.09.96
DENMARK	23.05.96	23.05.96
SPAIN	23.05.96	23.05.96
IRELAND	17.10.96	17.10.96
ITALY	20.06.96	20.06.96
HUNGARY	23.05.96	23.05.96
NETHERLANDS	12.09.96	12.09.96
NORWAY	12.09.96	12.09.96
AUSTRIA	31.10.96	31.10.96
POLAND	28.08.96	28.08.96
SWITZERLAND	23.12.96	23.12.96
UNITED KINGDOM	23.05.96	23.05.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is that the research concentrates on discovering genetically determined physiological responses to stress effects in Europe. Based on the results achieved to date, generally valid for a whole species, the genetic variability of varieties and hybrids is examined. Biochemical and biophysical methods are applied to study the cause and effect relationships of stress physiology.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 22 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION

ACTION 828

SEED SCIENCE IN THE FIELD OF GENETICALLY CONTROLLED STRESS PHYSIOLOGY

A. BACKGROUND

Seed marketing is one of the most profitable branches of agriculture. In the USA and Canada the scientific centres providing the research background in this field are coordinated by excellently functioning national organizations. Research results receive immediate publicity at workshops and conferences held by local and intercontinental organizations. Consequently, the research is translated into profit in terms of overseas seed production and sales without delay.

Although the activity of world organizations dealing with seed quality extends also to Europe, the question nevertheless arises of whether seed research in the field of genetically controlled stress physiology is adequately represented on this continent. The special Seed Science Workshop of the 3rd Congress of the European Society for Agronomy (ESA), held in Abona-Padova, Italy, in September 1994 sought answers to this and related questions. While emphasizing the salutary effect of FIS, ISTA and UPOV on European seed quality, the near 50 representatives from 13 countries unanimously agreed that the European seed research in the field of genetically controlled stress physiology lacks a proper organization or representation. The Executive Committee of ESA put Hungary in charge of preparing the establishment of a Seed Science Division. For this purpose, a Seed Science Symposium was held in Keszthely, Hungary, from 3 to 7 September 1995 with the participation of 14 European countries representing 61 departments of universities, institutions and seed companies.

It also became clear from the discussions that in Europe research in genetically controlled stress physiology takes place generally in isolation in universities, research institutes and seed companies. It is characteristic of the research that (a) it serves the business interests of the companies, and that (b) basic research is omitted from these programmes. Therefore, this requires coordination. These are the facts that justify the setting up of a new COST Action, which would coordinate practice-oriented basic research, while respecting the interests of the companies. The COST Action would support the work of the planned division.

Since the whole question is based on seed production and processing practice and on the possible stress effects, the research programme must be designed accordingly. The research programme must be flexible, since different types of stress will be encountered in different species and at different growing sites. Consequently, the programme will be decided upon by the participants, leaving it open for those joining the programme at a later date to expand the research in various directions.

B. OBJECTIVE AND BENEFITS

The main objective of this Action is that the research concentrates on discovering genetically determined physiological responses to stress effects in Europe. Based on the results achieved to date, generally valid for a whole species, the genetic variability of varieties and hybrids is examined. Biochemical and biophysical methods are applied to study the cause and effect relationships of stress physiology.

The secondary objective is practice-oriented. The programme takes seed production practice as its starting point, both when expressing the questions to be answered and when utilizing the results. Considering the fact that the biotic and abiotic stress factors occurring during seed production and processing influence seed quality and production profitability, stress physiology will be the focus of attention in the programme. A great deal of variability has been observed within individual species as regards stress tolerance, so the stress physiology research is complemented with research into genetically determined stress physiology. The practical advantage of the research is ensured by the fact that in exposing cause and effect correlation, a knowledge is acquired of biochemical and biophysical responses which provide a good model of the responses observed in practical parameters (yield, germination percentage, etc.).

The benefit of this Action is that an expansion of knowledge in the direction of genotype-dependent stress physiology opens up the possibility of elaborating physiological screening methods suitable for mass analysis, which could thus be used as routine tools both in breeding and in production and quality control. Since the elaboration of such methods is based on the genetic variability of the public gene pool, rather than on the jealously guarded private genetic bases of the seed companies, there is no encroachment on ownership rights.

C. SCIENTIFIC PROGRAMME

This part of the Action is detailed for each working group separately including the plant species as well as the detailed general benefits.

Studies on the effect of stress during the following stages of seed production for different genotypes (varieties, hybrids) within the species

Stress effects can be observed

(a) during seed production
(b) at harvesting
(c) during seed drying
(d) during storage
(e) during classification
(f) during seed coating, packaging and transportation.

The most important stresses during the above stages are caused by

A. the environment

(1) water shortage during production
(2) flooding during production
(3) air dry during flowering and grain filling period
(4) humidity during the whole process (from (a) to (f))
(5) high temperature during production, seed drying and storage
(6) low temperature before harvesting

B. treatments

(1) nutrient supply during production
(2) population density during production
(3) leaf injury during production, especially at flowering and grain filling period
(4) mechanical injury caused by elevation, harvesting machine etc.
(5) coating during the seed preparation.

Stress factors may lead to a reduction in

(i) seed value
(ii) the performance of progeny generations

This may be manifested in both the quantitative and qualitative characters of the plants.

It cannot be expected that each part of the programme will be connected with all of points (a)-(f) and (i)-(ii), but there must be a connection with one point from each group. It is obvious from the questions considered what practical advantages are to be expected from answering them.

The individual parts of the programme must contain research into the physiological background of the practical results

The tools used in biochemical, biophysical and molecular biological research must be applied in studying the cause and effect relationships of the phenomena observed. Since each part of the programme is linked to one of points (a)-(f) and (i)-(ii), it is desirable for basic research into cause to cover both groups of problems, or at least one problem from one of the groups.

Advantages of the research

Since these advantages can be expressed in general terms, what follows is valid for all the plant species discussed below.

(1) More profitable seed production
(2) Reduction in the risks involved in seed production
(3) Improvement in the performance of progeny generations due to seed of good biological value
(4) The discovery of cause and effect relationships may facilitate the identification of methods from which

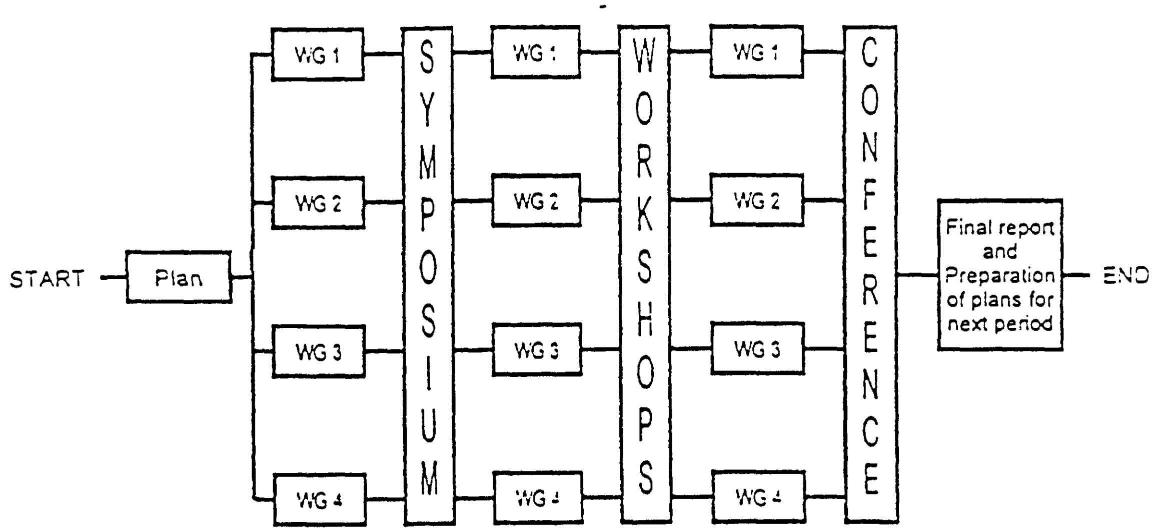
- cheap, rapid screening procedures can be developed
- the performance of the mature plants can be predicted from that of the seed or of plants in the early stages of development
- the above can be used to develop breeding methods aimed at improving seed value or for genetic analyses linked with further basic research.

D. ORGANIZATION AND TIMETABLE

A Management Committee (MC) including the elected Chairperson, Vice-Chairperson, Working Group (WG) coordinators and representatives appointed by the Signatories of the MoU will be set up following the signing by the appointed number of signatories to the MoU. This Committee will work out its rule of operation at its first formal meeting in accordance with existing COST regulations. The MC meets twice each year to review progress and take remedial action if required.

The partners will elect a Chairperson and a Vice-Chairperson who will be responsible for coordinating activities and ensuring that the Action direction meets the overall objectives. The following four WGs will be formed; (1) Field Crops of Cross-Pollinated Species (Maize, Sorghum, Sunflower), (2) Self-Pollinated Field Crops for Grain Use (Cereals and annual legumes), (3) Field Crops for Forage (Grasses and perennial legumes), (4) Horticultural Crops with an elected WG-leader of each, who assists the Chairperson and Vice-Chairperson and takes specific responsibility (e.g. offering short-term missions or other exchange of scientists between research groups) for ensuring that the work is of a high standard.

The Action will facilitate fast information exchange which will be distributed among participants by electronic-mail, fax or in meetings. Original results will be disseminated to the scientific community, when possible, by joint communications in recognized scientific journals. Annual Reports will be produced for the COST Senior Officials, and a detailed Final Report will be written. The exact programme is demonstrated in the time table below:



6 months	12 months	12 months	18 months	12 months

E. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: (1) Belgium, (2) the Czech Republic, (3) Denmark, (4) Finland, (5) France, (6) Germany, (7) Greece, (8) Hungary, (9) Italy, (10) The Netherlands, (11) Norway, (12) Poland, (13) Spain, (14) the United Kingdom.

On the basis of national estimates provided by the representatives of these countries and taking into account the coordination cost to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 22 million, 60 man/year included.

This estimate is valid on the assumption that all the countries mentioned above, but not other countries, will participate in the Action. Any departure from this assumption would change the total cost accordingly.

Memorandum of Understanding
for the implementation of a European Research Action
on the improvement of the quality of the
production of raw milk cheeses
COST Action 95

Date of entry into force of the project : 01.02.1995
Duration : 31.01.1999

Contracting parties	Date of signing	Date of entry into force
DENMARK	15.06.96	15.06.96
GREECE	12.01.95	12.01.95
SPAIN	12.01.95	12.01.95
FRANCE	12.01.95	12.01.95
IRELAND	08.03.95	08.03.95
ITALY	21.03.95	21.03.95
NORWAY	15.02.95	15.02.95
AUSTRIA	17.04.96	17.04.96
PORTUGAL	01.02.95	01.02.95
SWITZERLAND	14.09.95	14.09.95
SWEDEN	12.01.95	12.01.95
UNITED KINGDOM	27.03.96	27.03.96

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in the European Research Action on the improvement of the quality of the production of raw milk cheeses, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an action to promote research into the study of the dominant micro-flora in raw milk cheeses and its effect on the organoleptic qualities of those products (hereinafter referred to as the "Action").

2. The main objective of the Action is to establish a communications network enabling exchanges to take place between European research teams working on the subjects referred to in paragraph 1.

3. The Signatories hereby declare their intention of carrying out the Action 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 Action 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 Action is estimated at approximately ECU 4,3 million at 1994 prices.

6. The Signatories 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 Action 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 co-ordinatory services or activities necessary for the aims of the Action to be achieved.

SECTION 3

1. This Memorandum of Understanding will take effect for four 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 Action is subject to the prior agreement of the Management Committee referred to in Annex I.

2. This Memorandum 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 Action will notify the Secretary-General of the Council of the European Union 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 Action 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 paragraph 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 Action.

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 Union 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 Union. The Secretary-General will transmit a certified copy to each of the Signatories.

ANNEX I

CO-ORDINATION OF THE ACTION

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 co-ordinating the Action 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 the Signatories by the competent public authorities or bodies; any proposed changes to the Action framework will be referred for an opinion to the Committee of Senior Officials on Scientific and Technical Research (COST);

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

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

   (d) co-ordinating 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 Action, including those relating to possible special conditions to be 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.

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 Actions 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 Action, 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 said Action. 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 I, 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 Action assigned to them under Annex II (hereinafter referred to as "the research results") will be under 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 work in respect of the Action.

   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 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 the present 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 Action, 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 terminated 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.

TECHNICAL ANNEXES TO THE PROJECT

I. GENERAL CONTEXT

A. Advantages and benefits of the COST Action

For some years, specific research programmes have been emerging designed to improve the quality of the production of traditional sheep's cheese, in order to enhance the value of the product and to help to maintain the socio-economic fabric of the regions of production.

These research programmes, which are very few in number, in particular compared with those conducted on cheese from cow's milk, are currently confined to one production area and concern one particular type of cheese.

Moreover, despite the similarity between concerns and research topics, exchanges between the various teams of researchers are often extremely limited.

The latter two points mean that there is at present a dissipation of means and a lack of harmonization of analysis methods and results which might impede the possibility of establishing an overall European policy in this field.

The establishment of a COST programme should enable :

- initially, information networks to be set up which would make it possible, through a synergistic effect, to make national research programmes more effective and to exploit them better;
- later, through the setting up of a working party, research methods and results to be harmonized in order to produce technical development instruments at European level (in particular with regard to the production of cheese from raw milk and démarches in respect of registered designation of origin).

This harmonization of data and methods should make it possible, if appropriate, to set up a European research programme.

B. Description of the current situation

Research specific to milk and sheep's cheese has hitherto been conducted mainly by industrialists in the dairy field working on pasteurized milk. Research topics have therefore concentrated almost exclusively on the study of:

- the physical and chemical properties of milk and their consequences for cheese production technology;
- production problems associated with contamination by flora (problems of milking hygiene and the state of health of ewes), in particular heat-resistant flora.

The characterization of natural microflora in milk has been studied very little, but recent work on microfiltered milk (almost totally devoid of its flora) has shown that the flora has a decisive influence on the flavour of cheese from raw milk.

The progress of research in this field varies considerably between production regions:

France
Many teams, particularly at the INRA (National Institute for Agricultural Research), are working on sensory analysis, and on the microbiology of maturing and the mechanisms by which the taste and texture of cheese (soft or hard) made from cow's, goat's or ewe's milk are formed. Work is under way to identify the effect of non-lactic flora on the flavour of soft interior-ripened cheese and hard pressed cheese.

Spain
The Instituto del Frio and the University of Navarra, together with trade organizations (Consejo Regulador de la Denominación de Origen Queso Idiazabal and Queso Mahon) are carrying out work on isolating strains, sensory characterization and the study of maturing, in particular on goat's milk such as Majorero (Canary Islands) and cow's milk (Mahon).

Switzerland
The federal dairy research centre (Liebefeld-Bern) devotes itself to microbiological and physico-chemical work and sensory analysis in respect of hard pressed cheese.

Austria
Studies relate more particularly to the texture of pressed cheese. A new programme is under way to study the role of milk flora and heat treatment on a traditional cheese, Vorarlberg Käse.

Ireland
The food chemistry and microbiology departments, which have for some time been engaged on research into cheese-making technology, are more particularly specialized in the study of the proteolysis of maturing and the part played by the various enzymatic systems and, inter alia, the effect of lactic and non-lactic flora on proteolysis.

Sweden
The Research Laboratory of the Association of Swedish Dairies, involved in FLAIR and IDF work, is studying in particular the proteolysis of cheese.

Portugal
The dairy industry technology department (milk section) is taking part in European programmes, in particular on the characterization of lactic bacteria (Eclair programme) and is working with the trade on the study on improving the quality of traditional cheese from sheep's milk (Serra da Estrela) or from cow's milk (São Jorge, Azores).

Italy
In Sardinia, the Istituto e Caseario per la Sardegna has already isolated and characterized the strains of Pecorino Romano and Pecorino Fiore Sardo, two registered designation of origin cheeses.

Greece
The Universities of Athens and Salonika are actively engaged in European programmes (FLAIR, Eclair) designed either to develop biochemical sensory characterization methods for cheese, or to establish and characterize collections of strains of lactic bacteria.

With regard to the sensory descriptive analysis of registered designation of origin cheeses, Ossau Iraty, Pecorino Sardo, Idiazabal and Serra da Estrela have assessment grids. At the same time, work undertaken in the context of the Eclair programme on six registered designation of origin cheeses from cow's milk (Comté and Beaufort in France, Parmiggiano Reggiano and Fontina in Italy, Appenzell in Switzerland and Mahon in Spain) have made it possible to develop a guide to analyzing the texture of pressed cheeses [24].

The establishment of descriptors for cheese is under way in the context of the FLAIR programme "SENS" (025/COST 902), in which in particular France, Italy, Spain, Switzerland, Greece and the United Kingdom are taking part. An assessment guide for texture has already been published.

II. OBJECTIVES OF THE ACTION

The main objective of the Action is to establish a communications network enabling exchanges to take place between research teams in various countries working on two particular areas :

- the study of the dominant microflora in milk and traditional raw milk cheeses and its effect on the specific, particularly organoleptic, qualities of those cheeses;
- the sensory characterization of those cheeses.

Those exchanges will make it possible :

- for the various research teams to complement each other and work in synergy, which will facilitate progress in the research referred to earlier;
- a critical comparison of the various analysis methods used in microbiology which should result in harmonization of those methods;
- adaptation of a method of sensory analysis involving, inter alia, the drawing up of a common lexicon of sensory descriptors adapted to raw milk cheeses.

The establishment of the communications network will make it possible in the long term to set up a permanent network of European laboratories involved in the study of registered designation of origin/protected designation of origin cheeses.

The research areas associated with this COST Action relate directly to a quality objective.

Subsequent exploitation of the results will enable not only lactic fermentation agents, but also other bacterial strains, selected for their technological and organoleptic value, to be made available to farm-based or industrial processors. This will represent a significant technical improvement, as their use will make it possible not only to forestall production accidents, but also to preserve, or even affirm, the typical nature of the cheeses. The development of those fermentation agents will therefore make it easier to control the production quality of raw milk cheeses, as regards both the sensory and the hygiene aspects.

Furthermore, the establishment of sensory assessment grids specifically adapted to traditional cheeses, which are necessary for studying the organoleptic value of the strains, will constitute an effective instrument for quality control of the products.

Better control over quality, and a specific characterization of these traditional cheeses will certainly have repercussions from a socio-economic point of view. They will enable better exploitation of the products and a strengthening of the commercial policy governing registered designations of origin.

The possibility of controlling production quality by using selected strains will also help to organize processors on the basis of the collections of lactic bacteria they use. With regard to traditional sheep's cheeses, these various aspects will provide considerable support for production centres which are all situated in rural areas in difficulty (mountain, Mediterranean or island areas).

III. SCIENTIFIC CONTENT OF THE ACTION

The topics on which exchanges will take place may be divided into four largely interdependent areas :

- Study of microflora in raw milk and raw milk cheeses (isolation, identification and characterization);
- Work on the application and adaptation of a sensory analysis method specifically for traditional cheeses;
- Study of the connection between specific microflora and the particular sensory characteristics of those cheeses;
- Study of the possibilities for preparing and utilizing selected fermentation agents with a view to distributing them among processors.

The signatories will be committing themselves to conducting research projects which will enable them to play a constructive part in those exchanges.

As a preliminary to that action programme, and in order to provide a reference framework for the whole initiative, the various parties concerned expressed the wish that a document be drawn up describing the production technologies peculiar to each production area, explaining in particular the stages which, from milking to maturing, can influence the nature and activity of the flora.

A. Study of microflora

(a) Discussion of biochemical and technological methods of isolating, conserving, identifying and characterizing strains;

Isolation of microflora (bacteria, yeasts, fungi) could be carried out using either the milk or the cheese, and at different stages of production and maturing.

The objective being harmonization of the methods used, the working party concerned will compare the methods and techniques employed.

Comparison of isolation methods could be carried out on the basis not only of the nature of the matrices for enrichment and isolation or, where appropriate, of the carrier, but also of procedures for preparing samples, incubation, etc.

With regard to methods of conservation, freeze-drying and deep-freezing (-80°C, -20°C) are currently used. Apart from comparing those methods, a comparison could also be made of the importance of the nature of the medium.

Identification and characterization of the strains can be carried out only by studying various characteristics. The presence or absence of certain characteristics enables the micro-organism to be identified by comparing it with a reference collection of strains.

The characteristics may be :

- phenotypic and biochemical in nature (morphology, colouring, spectrum of sugars utilized, growth, acid production, proteolysis, etc.);

- molecular in nature (study of the genome by methods such as DNA-DNA hybridization, comparison of restriction profiles by pulsed-field electrophoresis; study of the other cell components by methods such as electrophoresis for the characterization of soluble proteins, IR spectroscopy for the characterization of the other cell components, etc.). The large number of characteristics which could permit identification or assessment of the technological value is therefore obvious.

In order to harmonize the methods, the working party concerned will therefore first have to determine the various characteristics used for identification and technological characterization of the strains, and then compare the various methods used for determining those characteristics. In particular, for the technological characterization of the strains, one or more reference matrices will have to be selected.

For those methods of isolating, conserving, identifying and characterizing local strains, there are also plans to study, by means of inter-laboratory trials, the reproducibility of one or more of them by using a reference sample which could also serve as a standard sample.

The harmonization of culturing could be achieved by comparing not only culture matrices, but also incubation methods.

Work already carried out in the context of Eclair programme No 0190, on the isolation and sensory characterization of lactic bacteria from fermented cheese and milk, will serve as a methodological basis.

(b) Drawing up of a common inventory of strains according to their characteristics

The information collected by the participants on their collections of strains will be consolidated and entered in existing data bases available at European level (MINE network). The distribution of strains (free or restricted) will be left to the discretion of the participants.

B. Application and adaptation of a method of sensory analysis and drawing up of notation grids highlighting the particular characteristics of raw milk cheeses

To attain this objective, a common lexicon of descriptors of the typical characteristics of the cheeses will be compiled and a common tasting method will be devised on the basis of work and results already obtained in the context of the FLAIR programme "SENS" (025/COST 902).

The selection of a term which is both descriptive and discriminant for sheep's cheese will necessitate a survey of the terms currently used in each region by producers, technicians and consumers.

C. Study of the link between specific microflora and the particular sensory characteristics of raw milk cheeses

In order to define the specific effect of raw milk flora on the sensory quality of cheese, two approaches are possible :

- Eliminating the flora by microfiltration and comparing the quality of the cheese obtained from raw milk and from microfiltered milk.

- Eliminating the flora by heat treatment and comparing the quality of the cheese obtained from raw milk and from pasteurized milk.

A combination of these treatments would also be possible.

The second option, however, has the disadvantage of also altering the milk's enzymatic system. Work on the effect of that system (activation of plasminogen, modification of redox enzymes, lipase inhibition) on the flavour of cheese should also be considered by a number of participants.

Test cheeses will be characterized from the sensory and chemical standpoints and compared with traditional cheese.

D. Study of the possibilities for preparing and utilizing selected fermentation agents with a view to distributing them among processors

The ultimate objective of the programme will be to examine the possibility of developing fermentation agents which will make it possible to control production while still reproducing the particular characteristics of traditional cheeses.

As regards the working parties, it would be helpful to establish one specifically responsible for compiling sensory assessment grids enabling the particular features of traditional raw milk cheeses to be highlighted, with separate subgroups for the various types of cheese, in particular sheep's and goat's cheeses. The other working party or parties would concentrate more on the microbiological aspect of the problem.

Within each working party, one member would be made responsible for co-ordination and communication of the results.

These various points will be discussed in detail at the first Management Committee meeting.

V. ECONOMIC ASPECTS

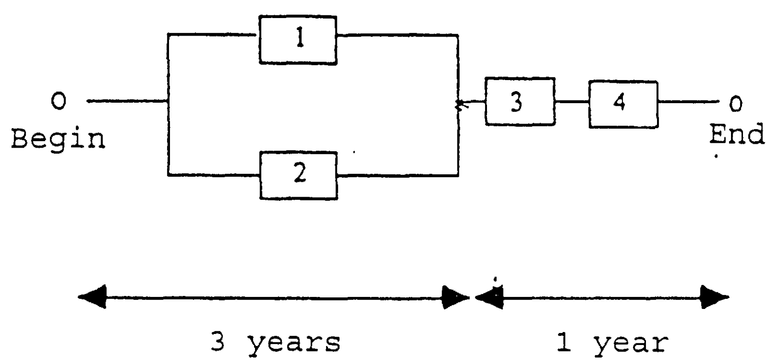
Country	Man-months	Cost (x ECU 10^3)
France (*)	200	365
Spain (*)	247	766
Greece (*)	294	800
Italy	132	570
Ireland (*)	28	137
Austria (*)	70	100
Portugal	90	200
Sweden	43	360
Switzerland	63	460
Total	1 167	3 758

(*) Marginal cost

General expenses, estimated at 15% of expenditure on staff amount to ECU 563 700.

The general expenses represent expenditure on co-ordination of action, transport, organization of working party seminars, publications and translation.

The exchange programme is scheduled for a four-year period and could run as follows:



*	:	Existence of collection of strains
1	:	Work on microbial strains
2	:	Work on sensory analysis methods
3	:	Study of influence of strains on sensory characteristics of cheese
4	:	Work on the feasibility of developing fermentation agents made from selected strains.

IV. ORGANIZATION AND MANAGEMENT OF THE ACTION

The Management Committee, made up of one representative for each signatory country, will meet at least once a year. That representative should preferably be the scientific co-ordinator for the research projects undertaken by the various bodies taking part.

One of the permanent representatives will be responsible for co-ordination between the various countries and therefore for organizing and leading the meetings.

The Management Committee will carry out the tasks set out in Annex I, Section I, point 2 and, more specifically, will be responsible for organizing working parties, seminars, etc. (topic, date, venue, duration, speakers, etc.) on the basis initially of two meetings per year and two seminars for the Action.

Memorandum of Understanding
for the implementation of a European Research Action on validation of predictive models of microbial growth and survival in food matrices and throughout the food chain
COST Action 914

Date of entry into force of the project : 12.01.1995
Duration : 11.01.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	04.05.95	04.05.95
DENMARK	12.01.95	12.01.95
GERMANY	06.03.95	06.03.95
GREECE	07.02.96	07.02.96
SPAIN	01.02.95	01.02.95
FRANCE	14.06.95	14.06.95
IRELAND	13.09.95	13.09.95
ICELAND	17.01.96	17.01.96
ITALY	12.01.95	12.01.95
HUNGARY	12.01.95	12.01.95
NETHERLANDS	05.04.95	05.04.95
NORWAY	19.02.96	19.02.96
SWEDEN	12.01.95	12.01.95
TURKEY	14.07.95	14.07.95
UNITED KINGDOM	12.01.95	12.01.95

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in the European Research Action on validation of predictive models of microbial growth and survival in food matrices and throughout the food chain, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an Action to promote research into the field of validation of predictive models of microbial growth and survival in food matrices and throughout the food chain in Europe (hereinafter referred to as the "Action").

2. The main objective of the Action is to promote and co-ordinate precompetitive research on the validation of predictive models of microbial growth and survival in food matrices and throughout the food chain in Europe.

3. The Signatories hereby declare their intention of carrying out the Action 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 Action 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 Action is estimated at approximately ECU 3,75 million at 1994 prices.

6. The Signatories 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 Action 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 co-ordinatory services or activities necessary for the aims of the Action to be achieved;

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

SECTION 3

1. This Memorandum of Understanding will take effect for four 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 Action is subject to the prior agreement of the Management Committee referred to in Annex I.

2. This Memorandum 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 Action will notify the Secretary-General of the Council of the European Union 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 Action 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 paragraph 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 Action.

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 Union 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 Union. The Secretary-General will transmit a certified copy to each of the Signatories.

ANNEX I

CO-ORDINATION OF THE ACTION

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 co-ordinating the Action 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 the Signatories by the competent public authorities or bodies; any proposed changes to the Action framework will be referred for an opinion to the Committee of Senior Officials on Scientific and Technical Research (COST);

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

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

(d) co-ordinating 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 Action, including those relating to possible special conditions to be 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.

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 Actions 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 Action, 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 said Action. 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 I, 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 Action assigned to them under Annex II (hereinafter referred to as "the research results") will be under 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 work in respect of the Action.

   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 insofar 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 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 the present 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 Action, 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 terminated 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.

GENERAL DESCRIPTION OF THE ACTION

General Background

There are strong, and increasing, demands from consumers for foods that are more convenient, fresher, more natural, less heavily processed, less heavily preserved (e.g. containing less salt, less sugar) and less reliant on additives and preservatives. It is essential that the growth and/or survival of micro-organisms that can spoil, or limit the shelf life of, these, as well as traditional foods, are controlled. At the same time, there is considerable public concern at the high level of foodborne disease in Europe. That concern includes the morbidity and mortality resulting from foodborne illness, and the substantial economic costs involved in its treatment and control.

Improved control of microbial growth and survival are essential if European States are to improve the quality and safety of the food supply with respect to microbial contamination, and to export with confidence, avoiding problems of microbiological hygiene. With the changes in food processing technology, the traditional inspectional approaches to control are proving relatively ineffective. End-product testing is costly, slow and, because of the enormous numbers of units produced and the relatively few that can be tested, offers little assurance of safety, taking into account the statistics of sampling and the sporadic occurrence of the microbes of concern. "Predictive Microbiology" is a powerful tool that can underpin improved control in food processing and distribution, including for new processes where no history is available e.g. high hydrostatic pressure as a means of food preservation. Approaches to modelling microbial responses have developed so much in recent years that a unified database for the food industries, regulatory authorities and other interested parties is conceivable. This would provide a safer food supply for consumers, improved control of shelf life/stability of products for consumers, manufacturers and distributors, and greater assurance of safety for regulatory authorities.

Concerted Action No 5 (Cost 905) "Predictive modelling of microbial growth and survival in foods", which terminated on 31 December 1993 (extended to 31 March 1994), introduced young scientists across Member States to the concept of modelling microbial growth responses and began to develop databases of the responses of key micro-organisms to the processes and conditions to which they are exposed in food processing. Accumulation of relevant microbiological data was standardized and co-ordinated and new approaches to modelling those microbial responses were developed, so that microbial death, survival or growth could be "predicted" using simple computer software. Widespread use of that software is leading to improved control of shelf-life of perishable products and greater assurance of food safety. The Concerted Action initially represented 33 laboratories from the following Member States: Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, UK. There has also been participation by experts or interested parties from Hungary, Iceland, Norway, Sweden and Switzerland. Many of the participants in these programmes will continue modelling work. In addition, complementary research is underway in labs in the USA, Canada and Australasia.

Progress towards a single European database was slow and difficult, largely because participants were funded by a variety of sources, each with specific research requirements. Consequently, progress was uneven, and the direction of research could rarely be changed. A co-ordinated programme in the UK funded by the Ministry of Agriculture, Fisheries and Food has resulted in a computerized model-base, "Food MicroModel", intended for use by the food industry and other interested parties. "Food MicroModel" includes only foodborne pathogenic bacteria, while the FLAIR Concerted Action covered a wide range of representative food spoilage bacteria, yeasts and moulds. Data generated might ultimately be used in a single system.

Nevertheless, Concerted Action No 5 (COST 905) successfully demonstrated to both research and food industry interests the potential of modelling to improve food safety and shelf-life. The sharing of knowledge and skills has particularly benefited those with no previous experience of modelling in the context of food microbiology. Doubt and scepticism has been replaced by acknowledgement of the benefits and potential of modelling and by enthusiasm to extend the approach. There is gradual recognition that the errors of predictions are of the same order of magnitude as the errors of microbiological experimentation in foods.

Models developed in laboratory media, and taking account of the pH value, the water activity and the storage temperature, have proved appropriate to many foods i.e. the predictions of growth responses from the models are very similar to actual measures of growth or survival published in the scientific literature, thereby "validating" the model.

There is an urgent need to extend those comparisons to broad ranges of foods, representative of European practices and tastes. If foods are identified where the models appear not to be appropriate, details must be systematically recorded, and the reasons for the differences identified. Some food structures may play a role in determining the microbial response and additional research may be needed.

It is crucial that effort be co-ordinated, with carefully planned international collaboration to minimize unnecessary duplication and maximize returns in the shortest reasonable time.

The relevance of mathematical modelling to food microbiology to improve control of food safety and quality has been demonstrated clearly. It is hoped that consideration may be given to continued collaboration within available funding to develop a facility that would benefit both large companies and small and medium-sized enterprises in the food industry in Europe.

A final authoritative report on modelling in the Concerted Action will be published in 1994, promoting modelling as a user-friendly, cost-effective means of improving control of shelf-life and safety of foods.

A major success of the collaborative ventures undertaken so far has been the introduction of similarities of approach (e.g. the use of standard "protocols"), the sharing of information and even the initiation of "inter-laboratory modelling", such that output has been maximized and overlap and repetition minimized. With the introduction in 1994 of the first database(s) and model bases that can be used by the food industries and other interested parties it is most important that this international collaboration is not lost, and that a network of scientists working in Europe and other parts of the world, continue to collaborate and share common approaches, so that output and progress are maximized.

We therefore propose a COST Action to ensure that effect collaboration of laboratories undertaking microbiological modelling work in Europe (list) and would also plan to invite key colleagues in non-European countries (list) to be associated with the initiative. An ultimate objective would be to foster the development of a truly international data- and model-base.

<u>Objectives of the proposed action</u>

There are four key, but inter-related, objectives:

- Validate predictive microbiology models in a wide range of European foods;
- Evaluate instrumental methods for data capture for advanced predictive microbiology;
- Explore mixed population effects in microbial predictive modelling;
- Develop modelling of microbial survival to effectively eliminate pathogens from foods while maintaining quality.

Scientific content

- Validate predictive microbiology models in a wide range of European foods

  Predictive microbiology models are being incorporated into substantial databases, and used to help industry and other bodies to ensure with greater certainty the safety and keepability of foods. Generally three or four factors (pH, water activity, temperature) are sufficient to explain microbial growth or survival responses. However, unknown factors in foods occasionally influence those responses, resulting in predictions that are over-cautious. This is an unexpected and important additional outcome of the modelling programme undertaken so far, and suggests a new, original avenue for research.

  It is proposed therefore, to target those unknown factors, and to concentrate effort on foods where mis-matches between predicted and observed effects occur. The derived second generation models will contribute to improvements not only in safety assurance, but also shelf-life control, hazard analysis (HACCP) procedures etc, and will lead to greater confidence in new and competitive product innovations.

  Foods used in challenge tests will be classified by their agreement with, or difference from, models developed in laboratory media. Physical or chemical factors will be identified which make the identified foods, or food product groups, less conducive to bacterial growth than predicted by models derived from media, and these factors explored to determine if their manipulation could improve the safety and stability of foods.

- Evaluate instrumental methods for data capture for advanced predictive microbiology

  Databases used in predictive microbiology have predominantly used viable counts of microbes. Although accurate, these are slow and expensive. Alternative techniques will be explored (e.g. absorbence; turbidimetric methods; impedence; ATP-luminescence; detection-quantification of metabolic products e.g. by GLC; microscopic image analysis techniques; use of "microreactors"; epifluorescence; specific microscopical techniques for rapidly quantifying fungal growth). Some of these techniques are rapid and cheap, and can deal with the large numbers of samples that are necessary for effective model-building, but there are doubts about the relationships of many of the measurements to viable count techniques, which still therefore form the basis for confidence in current models.

  We propose to validate rigorously a wide range of modern rapid techniques in media and food systems and to validate and ensure confident "data conversion" schemes. This would promote the use and acceptance of appropriate rapid instrumental methods in future modelling studies to develop models containing all the relevant factors that control microbial responses.

- Explore mixed population effects in microbial predictive modelling

  Several classes of foods, including those meat-, dairy- and vegetable-based foods that are deliberately fermented, and also some foods that are not deliberately fermented, carry high numbers of innocuous or beneficial micro-organisms. These influence the potential for growth and survival of others, e.g. food-poisoning or spoilage micro-organisms, in ways which are not yet predictable from current microbiological modelling approaches.

We propose to develop techniques for studying mixed microbial populations, then to generate data and derive new models that will take account of the micro-microbe interactions that occur in foods. This will build on, and improve the value of, models that have already been developed.

- Develop modelling of microbial survival to effectively eliminate pathogens from food while maintaining quality

  Whilst predictive modelling so far has concentrated on factors affecting microbial growth, the whole area of inactivation/survival has received far less attention e.g.: in stored foods; in foods during processing by heat (microwaves/ohmic), by irradiation, by surface sprays and "dips"; and by new techniques such as the application of high hydrostatic pressure and high voltage discharges. Survival/inactivation is already very important in ensuring food safety and stability and, as the elimination or control of food poisoning micro-organisms from the most-often contaminated foods becomes an increasingly achievable target, predictive survival/inactivation modelling will increase in significance and value.

  We propose to develop suitable methodologies and to model the survival/inactivation of key organisms of food poisoning and spoilage significance in a range of conditions relevant to the main European food commodities and product types, and to major existing, new and "emerging" processing technologies.

<u>Timetable</u>

The planned duration of the project is four years. The detailed time schedule and lists of targets (tasks, milestones), including the definition and creation of working groups to study specific topics, will be established at the first meeting of the Management Committee. Progress will be reviewed annually, achievements documented, and targets for the following year defined.

First year:
The Working Groups (defined for example by interest in particular micro-organisms, food categories or measurements techniques) will develop a realistic working plan, leading to a plan of action for each year, covering both the overall objective and specific topics.

Second year:
After the annual evaluation, further meetings will be organized to optimize the research effort.

Third and fourth years:
The direction of research will depend on the annual evaluations by the Management Committee. A final meeting summarizing the achievements will conclude the Action.

<u>Organization and Management</u>

A Management Committee will be established following the signing of the Memorandum of Understanding by the appropriate number of signatories. At its first formal meeting, this Committee will define its rules of operating in accordance with existing COST regulations. The Management Committee will meet not more than three times per year.

The Action will be co-ordinated by a Chairperson in collaboration with the Action (secretary) scientific officer, who will be responsible for co-ordinating activities and ensuring that the Action meets its overall objectives. Leaders of Working Groups will be selected for each theme within the scientific programme.

The Action co-ordinator and leaders of Working Groups will form a Steering Group which will meet at six monthly intervals to review progress and take action as required.

Information exchange between participants will be facilitated by use of fax or electronic mail.

Original results from the research will be disseminated through joint communications in recognized scientific journals.

It is anticipated that 2 or 3 Workshops per year will be arranged during the COST Action, ideally at one of the participating laboratories, and from which Proceedings will be produced.

A final meeting will conclude the Action.

Annual Reports will be produced for the COST senior officials and a detailed Final Report, based on reports produced throughout the Action, will be compiled.

Economic dimension of the Action

Participation in the FLAIR/COST Action comprised 33 laboratories, with interest expressed by 5 others. Relevant research is in progress in a further 4 European network laboratories. Consequently the estimated effort in the joint European network is of the order of 75 man-years per annum, at an estimated total cost of 3 750 000 ECU/year.
This budget is covered by national sources in participating countries.

Memorandum of Understanding for the implementation of a European Research Action on consumer oriented quality improvement of fruit and vegetable products COST Action 915

Date of entry into force of the project : 12.01.1995
Duration : 11.01.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	08.03.95	08.03.95
CZECH REPUBLIC	23.04.96	23.04.96
DENMARK	27.01.95	27.01.95
GERMANY	08.03.95	08.03.95
GREECE	03.04.96	03.04.96
SPAIN	01.02.95	01.02.95
FRANCE	08.03.95	08.03.95
IRELAND	08.03.95	08.03.95
ITALY	12.01.95	12.01.95
HUNGARY	12.01.95	12.01.95
NETHERLANDS	12.01.95	12.01.95
NORWAY	15.02.95	15.02.95
AUSTRIA	21.02.96	21.02.96
PORTUGAL	12.01.95	12.01.95
SLOVENIA	27.01.95	27.01.95
SWITZERLAND	21.11.95	21.11.95
FINLAND	27.01.95	27.01.95
TURKEY	27.03.95	27.03.95
UNITED KINGDOM	27.01.95	27.01.95

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in the European Research Action on consumer oriented quality improvement of fruit and vegetable products, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an Action to promote research into the field of consumer oriented quality improvement of fruit and vegetable products (hereinafter referred to as the "Action").

2. The main objective of the Action is to promote and co-ordinate precompetitive research on consumer oriented quality improvement of fruit and vegetable products in the whole production chain in Europe.

3. The Signatories hereby declare their intention of carrying out the Action 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 Action 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 Action is estimated at approximately ECU 35 million at 1994 prices.

6. The Signatories 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 Action 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 co-ordinatory services or activities necessary for the aims of the Action to be achieved;

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

SECTION 3

1. This Memorandum of Understanding will take effect for five 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 Action is subject to the prior agreement of the Management Committee referred to in Annex I.

2. This Memorandum 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 Action will notify the Secretary-General of the Council of the European Union 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 Action 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 paragraph 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 Action.

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 Union 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 Union. The Secretary-General will transmit a certified copy to each of the Signatories.

ANNEX I

CO-ORDINATION OF THE ACTION

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 co-ordinating the Action 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 the Signatories by the competent public authorities or bodies; any proposed changes to the Action framework will be referred for an opinion to the Committee of Senior Officials on Scientific and Technical Research (COST);

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

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

(d) co-ordinating 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 Action, including those relating to possible special conditions to be 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.

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 Actions 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 Action, 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 said Action. 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 I, 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 Action assigned to them under Annex II (hereinafter referred to as "the research results") will be under 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 work in respect of the Action.

   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 insofar 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 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 the present 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 Action, 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 terminated 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.

<u>**ANNEX II**</u>

GENERAL DESCRIPTION OF THE ACTION

<u>General Background</u>

Within the Agri-Food industry in recent years changes have occurred which have had a major impact on its structure. In many sectors of this industry we are dealing with a changed market situation in which production levels are larger than market demands. This holds true also for fruit and vegetable commodities and products. As a consequence the role of the consumer becomes increasingly important. Generally the consumer is better informed and there is a growing demand for products with specific and constant quality characteristics. Also the consumer perception of quality has changed in that it encompasses not only product characteristics such as flavour, texture, healthiness, nutritional value and appearance but also aspects related to production methods such as the use of agrochemicals, type of packaging material etc.

To meet these demands a new type of approach is needed.

Improved quality of the end-product requires quality throughout the production chain and collaboration between the various scientific disciplines active in this field.

Recent developments in the area of biotechnology and biochemical and molecular aspects of plant physiology have shown that there are good perspectives for improvement of product quality by objectivation of quality measurement and development of technological methods to meet consumer demands for specific and constant quality for fruit and vegetable commodities and products.

The importance of the proposed COST Action lies in the integral approach in the whole production chain. Activities in links of the chain are important but they should be considered as links within a total of activities, aiming at the development of systems of "Quality Modelling" and "Integrated Chain Control".

Fruit and vegetables have received limited attention by a study under the FLAIR programme (AGRF.0029- The influence of endogenous enzymes on the flavour quality and shelf-life of vegetables and herbs; AGRF.0031- Study of the characteristics of raw material for the manufacturer of ready-to-use-fruits) but do not consider the effect of processed product. This project would fill this information gap.

In the COST Action-94 a network of researchers originating from institutes, universities and industries was established. The transfer of results from research to small and medium-sized enterprises and journals through the organization of workshops, seminars and symposia as well as by exchange of young scientists between participating laboratories proved very valuable.

The Action finishes at the end of 1994 and the following results should be mentioned.

There were 8 meetings of the Management committee in 6 countries (EU, EFTA and Slovenia and Turkey), one further meeting is planned for October 1994.

Five different workshops were organized. These workshops were focused on the working area of the COST-94 Action on "Post-Harvest treatment of Fruit and Vegetables" and they were specially organized in countries to attract more interest and participants for this area of research and the COST Action.

The first workshop was held in Karlsruhe and dealt with physiological, biochemical and molecular aspects of ripening processes in fruits and vegetables. The second was held in Istanbul and dealt with modified atmosphere packaging methods and storage diseases and spoilage of fruit and vegetables. The third was held in Milan and dealt with controlled atmosphere storage methods. The fourth meeting was held in Louvain and dealt with Systems development and Operations technology. The fifth workshop was held in Ljubljana and dealt with quality criteria for fruit and vegetables. The meetings attracted a lot of attention of local scientists which were encouraged to contribute to the meetings by presenting their work. Many contacts were established between scientists from the organizing country and scientists from other countries participating in the meetings. In total scientists from 20 different countries participated in the workshops.

The final meeting will be in the form of a three-day symposium to be held in Wageningen next October. In this symposium a review will be given on the previous workshops by the respective organizers. In addition there will be ample opportunity to present new scientific developments. Finally several speakers are invited to present an outlook of the perspectives in the various working fields covered by the workshops held within the framework of the COST 94 Action.

Four proceedings books (Karlsruhe, Istanbul, Milan and Louvain) have been prepared for publication and two more will be published (Ljubljana, Wageningen). Meetings have resulted in more co-operation between participants on specific subjects such as Modified Atmosphere Packaging of mushrooms.

Objectives of the proposed Action

1. Tailoring the quality of fruit and vegetables and their products to meet consumer demands.

2. Understanding the relationship between quality perception and the underlying biochemical and physiological processes.

3. Identify the relationship between raw material properties and quality of end-product.

Scientific Content

1. CONSUMER QUALITY DEMANDS

Consumer perceived quality of fruit and vegetables encompasses intrinsic and extrinsic factors. Intrinsic quality parameters relate to the physical-chemical properties of the product itself such as texture, flavour, nutritional value and appearance whereas extrinsic quality parameters are associated with the production methods such as use of agrochemicals and type of packaging material.

Topics:

- Development of objective, non-destructive and fast quality measurement systems to monitor quality changes in the production chain and predict shelf-life;

- Development of intelligent storage and handling systems to optimize product quality;

- Improvement of packaging systems from both a product oriented and environmental approach;

- Improvement of biological and physical methods to control spoilage.

2. UNDERSTANDING THE RELATIONSHIP BETWEEN QUALITY PERCEPTION AND THE UNDERLYING BIOCHEMICAL AND PHYSIOLOGICAL PROCESSES

Post-harvest quality of fruits and vegetables and their products is by definition associated with prevention of quality loss caused by processes such as ripening, senescence.

Recent developments in the area of biotechnology enable new approaches to minimize quality loss and develop environmentally friendly storage and handling systems.

Topics:

- Identify the physio-chemical, biochemical, physiological and microbiological basis of quality perception;

- Interaction between product quality and stress factors such as temperature, relative humidity, atmosphere and light.

3. IDENTIFY THE RELATIONSHIPS BETWEEN RAW MATERIAL PROPERTIES AND QUALITY OF END-PRODUCTS

In recent years new tools have emerged from molecular biological research which can be applied to get a better understanding of the impact of raw material composition on end-product quality and a suitable adaption of production systems.

Topics:

- Identify biochemical and molecular determinants of end-product quality;

- Design new production systems based on raw material properties.

4. MODELLING OF QUALITY AND INTEGRATED CHAIN CONTROL

The approach outlined in the first three paragraphs will result in models integrating pre-harvest and post-harvest conditions and production systems, which can be used by the different links in the production chain to meet consumer demands. Quality modelling systems describe quality changes in relation to environmental conditions. These systems can be used to predict product quality under a given set of environmental conditions. Integrated chain control systems are support systems for decision makers. They describe all aspects of the production chain and link product quality and economical benefit enabling optimization of product quality.

Topics:

- Development of "Quality Modelling" systems;

- Development of "Integrated Chain Control" systems.

<u>Timetable</u>

The project is planned for five years. The specific time schedule and lists of tasks (including the definition and creation of working groups for studying specific topics) will be established at the first meeting of the Management Committee. There will be a yearly evaluation describing what is achieved and which goals should be reached the next year.

First year:

Working groups will develop a working plan, which will result in a plan of action for the first and following years, covering specific themes and special subjects.

Second year:

After the yearly evaluation scientific meetings (workshops, symposia) will be organized following the working plan.

Third, fourth and fifth year:

Depending on the results of the yearly evaluation by the management committee the original working plan will be followed. A final meeting summing up the achievements will conclude the Action.

ORGANIZATION AND MANAGEMENT

A Management Committee will be set up following the signing by the appropriate number of signatories to the Memorandum of Understanding. This Committee will work out its rules of operation at its first formal meeting in accordance with existing COST regulations. The Management Committee meets as a maximum three times per year to review progress and take action if required.

The Action will be co-ordinated by a chairperson in collaboration with the Action (secretary) scientific officer who will be responsible for co-ordinating activities and ensuring that the action will meet the overall objectives. Working group leaders will be selected for each theme within the scientific programme.

The information exchange between participants will be facilitated through the use of fax and/or electronic mail.

Original results for the research will be disseminated through joint communications in recognized scientific journals.

It is anticipated that 2 or 3 workshops per year will be arranged during the COST Action, preferably at one of the participating laboratories. From these workshops proceedings will be produced.

Within the COST Action collaborative short-term research projects will be initiated between participants.

To reinforce the research activities falling within the COST Action initiatives will be taken to start collaborative projects within the Eureka-Euoragri umbrella.

Annual reports will be produced for the COST senior officials and a detailed Final report, based on reports produced throughout the Action, will be written.

ECONOMIC DIMENSION OF THE ACTION

From the interest to date shown in this COST Action the estimated effort in the joint European network is about 120 man/years, which involves a total estimated cost of approximately 7 000 000 ecu/year.

This budget is covered from national sources in participating countries.

Memorandum of Understanding
for the implementation of a European Research Action
designated as
COST Action 916
"Bioactive plant cell wall components in food"

Date of entry into force of the project :	03.04.1996
Duration :	02.04.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.05.96	29.05.96
DENMARK	03.04.96	03.04.96
GERMANY	23.05.96	23.05.96
SPAIN	03.04.96	03.04.96
FRANCE	25.04.96	25.04.96
HUNGARY	15.04.96	15.04.96
NETHERLANDS	12.09.96	12.09.96
NORWAY	12.09.96	12.09.96
AUSTRIA	19.09.96	19.09.96
SWITZERLAND	19.11.96	19.11.96
FINLAND	03.04.96	03.04.96
SWEDEN	03.04.96	03.04.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to reach an understanding of the significance for human health of bioactive plant cell wall components in food, so as to facilitate the selection of appropriate plant varieties and improve the pertinent industrial processes.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 60 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ACTION 916

Bioactive plant cell wall components in food

A. BACKGROUND

Specific food items have different beneficial effects but this has so far been inadequately interpreted. Most of the research so far has been done on the effect of isolated nutrients. The relative importance of the non-nutrient components for preventing diseases is now being recognized, and awareness is increasing. Instead of isolating compounds and then incorporating them into food, another approach is to keep the food as natural as possible. To consider the whole food with these important bioactive components could be useful to both agriculture and industry for preparing wholesome foods and could be a way of counterbalancing the concept of functional or designer-foods.

A lot of epidemiological data ascribe differences in health patterns as being due to unrefined food. The early studies explained these as being caused by inadequate supply of dietary fibre. There is a broad consensus now in all nutrition circles in Europe to recommend a substantial increase in daily dietary fibre intake. Little, however, is known about the various physiological effects of the great number of bioactive cell wall components which are present in unrefined food. These compounds, such as polyphenols, phytates and phytosterols form chemically heterogenous groups with different physiological effects. Some of them, such as phytic acid and polyphenols, show antioxidative properties. It is also assumed that some of these components are involved in the prevention of colon cancer and atherosclerosis.

One common functional characteristic of the target compounds is the ability to combine with metal ions, which may have direct or indirect nutritional and physiological effects. Another common property of phytates, polyphenols as well as phytosterols is their influence on the intestinal digestion. They interfere with digestion enzymes but also bind metals, essential trace elements and toxic trace elements. Another effect is related to the interference with cholesterol absorption, with relevance to coronary heart disease prevention. Due to simultaneous occurrence it is often not possible to distinguish the actions of the compounds from each other. Model studies and purified model compounds are needed in order to gain more clarity on various physiological and toxicological properties.

As the awareness of bioactive compounds in foods of plant origin is continuously increasing, various compounds suggested to be physiologically important will be included in the planned concerted action. Up to now three major groups of bioactive compounds have been recognized.

Polyphenolic compounds, which have been reported to have antioxidative properties and have been related to the health promoting effect of red wine. The high occurrence of such polyphenolic compounds in Mediterranean diets remains to be elucidated.

The degradation of these substances in the human gut is unknown. Their antioxidative properties need to be tested in different *in vitro* and *in vivo* systems.

Unrefined cereals and legumes contain high amounts of phytate and other inositol phosphates. These are known to influence the bioavailability of essential but also toxic minerals. The action of the different inositol phosphates formed during food processing are not properly known today. It also seems that inositol phosphates affect the absorption of other nutrients which may be of significance for lowering the risk for development of diabetes, colon cancer and atherosclerosis.

Plant sterols or phytosterols are known to diminish cholesterol absorption. Some phytosterols may reduce the risk of developing colon cancer.

The bioactive compounds may have beneficial or harmful effects in the diet. The present knowledge is, however, insufficient to lead to dietary recommendations or advice to agricultural and food industrial activities regarding their intake. Joint European efforts are needed to identify the most bioactive compounds, their occurrence in foods and mechanisms of physiological action.

As these bioactive non-nutrient substances have already been shown to have important health benefits, the aim of this action is to contribute in the prevention of our modern diseases such as cancer, heart diseases and diabetes. This will be done by stimulating the agriculture and food industry in Europe to select more health-beneficial plant raw materials, and by providing information to optimize the industrial food production processes for prevailing or enhancing the beneficial factors.

B. OBJECTIVES AND BENEFITS

This COST Action will combine the efforts of European countries in studying the occurrence, process-induced changes and physiological effects of bioactive cell wall components, such as polyphenols, phytates and phytosterols.

The main objective of the Action is to reach an understanding of the significance for human health of bioactive plant cell wall components in food, so as to facilitate the selection of appropriate plant varieties and improve the pertinent industrial processes.

Such an understanding could be achieved by studying the occurrence, process-induced changes and physiological effects of bioactive plant cell wall components, such as polyphenols, phytates and phytosterols.

On the basis of the knowledge thus obtained, it should be possible:

- to select safer and more health-promoting plant varieties in agricultural production as well as in food industry;

- to improve the industrial processes so as to maintain the activity of the bioactive components in food while minimizing the formation of harmful components.

By organizing European research cooperation on these issues and exchanging the results, the Action can be expected to promote harmonization and standardization of the research methods used and thus to raise the quality of research within the field of the Action.

C. SCIENTIFIC PROGRAMME

In the very beginning of the action [illegible] information about the ongoing research projects in the field [illegible] respective countries. This will involve projects concerned [illegible] the tasks set out below. The Action will next address the following [illegible].

The first task is to set up or optimize [illegible] to identify and quantitatively analyze bioactive components in plant cell walls/plants. This will give a background for studying the variation of these compounds in different raw materials and also for monitoring the changes due to food processing. It should also provide model compounds and isolated fractions to be used as reference materials.

The second task is to study the fate of bioactive components in industrial food processes and the subsequent effects of their physiological effects. The research findings ought to be implemented into consumer products. The adequate information flow between research institutes and food industry will be taken care of by joint seminars, but also by providing appropriate publications.

The third task is to evaluate the physiological effects of both the model compounds and [illegible] in whole foods. This will be done both by [illegible] studies, as well as epidemiological studies or total diet studies.

Data will be collected concerning the analyses, the fate of industrial processing and on the physiological properties of various polyphenols, inositol phosphates and phytosterols at the first stage [illegible] in vitro as well as of in vivo studies will be [illegible] the state of the [illegible] in the fields of polyphenols, inositol phosphates and of phytosterols. Towards the end of the Action the physiological role of these components as part of the whole food in the daily diet will be discussed.

D. [illegible]

[illegible] meetings, seminars and publications

	1st year	2nd year	3rd year	4th year
Management Committee meeting		x x	x x	x x
Conferences		x	x	x
Seminars			x	
Publications			x	x
Short-term scientific mission and laboratory exchange			x	
Report to the COST [illegible]			x	

(*) The Consensus Conference

The duration of the Action is planned for 5 years.

The following working groups are planned to be set up:

- working group on analytical methods for identification and quantification of bioactive plant cell wall components;

- working group on the fate of bioactive plant cell wall components in industrial food processes;

- working group on the evaluation of physiological effects.

Conferences will be arranged once or twice ever year, during which links to the food industry will also be made. The topics of these conferences will follow the developments and new knowledge which will be produced during the Action. The multidisciplinary approach will be essential in order to achieve adequate interactions between the working groups.

Publications will be produced as proceedings of the seminars and conferences, but also as publications of scientific work from joint projects.

Short-term scientific missions and laboratory exchanges will be supported and encouraged already at the beginning of the activity in order to establish close links between the participating institutes.

The Management Committee of the Action will meet twice a year to review progress, discuss future activities, coordinate all proposed activities in order to avoid duplication and ensure proper tuning of activities, and will also ensure that the Action will meet the main objective. The Chairperson and the working group leaders will have a specific responsibility for ensuring the high scientific standard of the Action.

The Chairperson and the Scientific Secretary will be responsible for preparing and distributing agenda and minutes of Management Committee meetings, publishing proceedings of workshops and seminars, organising meetings and workshops, disseminating results, establishing links with other related projects and Actions, and publishing reports of activities.

The most important ongoing activities related to the Action are:

the AIR concerted action Profibre 1995-1997 on resistant starch and non-starch polysaccharides has excluded from the Profibre Project oligosaccharides and substances related to dietary fibre. This means that bioactive substances, referred to in this COST Action, are not included in their activities.

The COST-98 Action on "The effects of antinutrients on the nutritional value of legume diet" deals with legume lectins which are not included in the concerted Action on: "Bioactive plant cell wall components in food".

Cooperation possibilities will be elaborated during the running time of the Action.

E. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Italy, Norway, Spain, Sweden, Switzerland, the Netherlands and the United Kingdom.

On the basis of national estimates provided by the representatives of these countries and taking into account the coordination costs to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 60 million.

This estimate is valid on the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action 917
"Biogenically Active Amines in Food"

Date of entry into force of the project : 13.09.1996
Duration : 13.09.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.09.96	12.09.96
CZECH REPUBLIC	19.09.96	19.09.96
GERMANY	12.09.96	12.09.96
SPAIN	12.09.96	12.09.96
ITALY	14.10.96	14.10.96
HUNGARY	13.09.96	13.09.96
NETHERLANDS	23.10.96	23.10.96
UNITED KINGDOM	12.09.96	12.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to improve our knowledge on the importance and contribution of biologically active amines in the diet to growth and health by establishing their bioavailability and clarifying their physiological functions.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 60 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

BIOGENICALLY ACTIVE AMINES IN FOOD

A. BACKGROUND

Biologically active amines may have both beneficial and harmful effects, and present knowledge is not sufficient to make any recommendations to either healthy individuals or to those on medication or suffering from cancer. We must therefore improve our knowledge on the importance and contribution of biologically active amines in the diet to growth and health.

An interdisciplinary, joint European effort, which combines expertise in the fields of biochemistry, microbiology, food technology, cellular and molecular biology is needed to clarify the physiological functions of biogenic amines. Although polyamine research is highly developed in the United States and Japan and, in spite of large sums of money already invested in this field of science, the importance of dietary amines is not yet recognized by these countries. It is hoped that, based on European expertise and the information gathered in Europe, we will be in a position to be able to give advice on safety limits of biogenic amines and on polyamine requirements.

It has been known for some time that amines possess biological activity. They are formed during normal metabolic processes in living organisms and are therefore present in our everyday food products. However, the characteristics and biological functions of amines are very diverse. They can be categorized as biogenic amines (serotonin, putrescine, cadaverine, agmatine, tyramine, histamine, phenylethylamine and tryptamine) or natural polyamines (putrescine, spermidine and spermine). Both polyamines and biogenic amines are present in our food, but have different effects: polyamines appear to be essential while biogenic amines are mostly detrimental.

Biogenic amines are formed and degraded during normal cellular metabolism. They can also be produced by bacteria by decarboxylation of free amino acids. Therefore, all foodstuffs produced using fermentation processes or exposed to bacteria or microbial contamination during processing or storage can contain large amounts of biogenic amines. Biogenic amine formation requires only free amino acids, a microorganism containing decarboxylase activity and conditions allowing bacterial growth. Since biogenic amines play a variety of physiological roles, such as regulation of body temperature, stomach volume and pH, and can alter brain activity, they have the potential to exert profound effects on health and well-being. Biologically the most effective biogenic amines are tyramine, which is vasoactive, and histamine, which is both vasoactive and psychoactive. High biogenic amine consumption is dangerous. It can lead to nausea, respiratory distress, hot flushes, sweating, heart palpitation, headache, bright red rash, oral burning, hyper- or hypotension so that the biogenic amine content of foods should be kept at a very low level.

In contrast, the natural polyamines through their involvement in signal transduction and in nearly every step of DNA, RNA and protein synthesis, are essential for growth and cell proliferation. Their importance in reproductive function is evident even from their names (spermidine and spermine). Recent work has contradicted earlier beliefs that polyamines needed for growth were exclusively synthesized in situ. It is now apparent that the source of polyamines accumulating in the small bowel or other organs under the influence of hormones or growth factors, might be of (a) de novo biosynthesis; (b) the diet; or (c) bacteria resident in the gut lumen. As with semi-essential amino acids, our diet is very important and the major source of polyamines. Human health and proper nutrition is based on a healthy gut. Since the intestina epithelium has the highest cell turnover, polyamines are vital for the proper structure and function of the entire digestive tract and for maintaining its metabolic activity. Other organs of the body also require polyamines for their growth, renewal and metabolism. Although every cell can synthesise polyamines to some extent, it appears that the body relies on a continuous supply of polyamines from the food. Because polyamines are so important for proliferation, cancer growth also requires polyamines, most of which comes from the diet. Potentially, dietary polyamine intake could be limited by manipulating the polyamine content of certain foodstuffs or designing low polyamine diets.

Both polyamines and biogenic amines appear to share similar routes of uptake and metabolism. They are readily absorbed by the gut but during the uptake process they can be eliminated by mono- di- and polyamine oxidases as part of the normal detoxification process. However, the activity of these enzymes is dependent on the state of the gut (ontogenic development, differentiation/maturation), which influences absorption and bioavailability of these biologically active amines. Normally, the healthy gut is capable of eliminating biogenic amines from the diet, but this system has limited capacity. If overexposure to biogenic amines occurs, some might get through the gut into the systemic circulation without oxidation and exert toxic effects. At the same time absorption of dietary polyamines is essential for maintaining the structure and integrity of the gut and for supporting growth.

Because biologically active amines in food can influence our health and well-being, their interaction with our gut and body must be studied carefully. This is the aim of this Concerted Action.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to improve our knowledge on the importance and contribution of biologically active amines in the diet to growth and health by establishing their bioavailability and clarifying their physiological functions.

The scientific outcome, by providing fundamental data for our understanding of food-gut interaction, makes an important contribution to general health. It will produce information on basic biochemistry, physiology, nutrition and digestive physiology. There is also scope for medical applications, such as formation of a low polyamine, anti-cancer diet to provide a higher quality life-style for cancer patients, or giving nutritional advice to people on certain types of medication which makes them sensitive to biogenic amines. Both human and animal health can benefit from the results.

By organizing European research cooperation on these issues and exchanging methods, results and other information the Action will promote and harmonize research in Europe and raise the quality of research within the field of the Action.

It is anticipated that health and well-being of the members of European countries will improve as a result of the accumulation of unique knowledge on polyamines and solutions are found concerning the problem of the presence of biologically active amines in food. By providing a competitive edge for European science, pharmaceutic as well as food- and feed companies could benefit from the results in the near future.

C. SCIENTIFIC PROGRAMME

Initially, participants will collect information about ongoing research in this field and identify experts to be involved in the Action. Since the area of research identified is broad, several sub-topics will be addressed in parallel and grouped together in the following five Work Packages:

Work Package 1 – Physiology and metabolism of biologically active amines: to collect information on uptake, metabolism and physiological function of biologically active amines:

- to establish the bioavailability and clarify the physiological functions of biologically active amines and the size of the body polyamine pool;

- calculate the half-life polyamines and to identify the sites and determine the capacity of uptake of biologically active amines by the different parts of the gastrointestinal tract;

- to determine the levels of toxicity of biogenic amines and establish signs of polyamine deficiency;

- to explore the role of body polyamine pool in regulation of growth and metabolism of the intestinal tract and other internal organs and establish the effects of lectins and other antinutritional factors in food and their polyamine requirements;

- to formulate low- and high-polyamine content diets to meet the special health needs of specific patient groups, i.e. for slowing down unwanted (tumour) growth or help recovery from injury (operation/burns);

Work Package 2 – Polyamines and tumour growth: to study the effects of polyamine-free diet on tumour growth in experimental animal models and in human studies:

- to formulate low- and high-polyamine content diets to meet the special health needs of specific patient groups and to explore the role of body polyamine pool in regulation of growth and metabolism of the intestinal tract and other internal organs.

Work Package 3 – Transgenic plants: University researchers and seed companies will cooperate to create transgenic plants in which the amine content and the enzymes involved in amine metabolism are modulated to satisfy special dietary needs:

- to create transgenic cereal plants with low polyamine content to be used in formulation of a nutritious but low polyamine diet for cancer patients and to help in the formulation of low- and high-polyamine content diets.

Work Package 4 – Biologically active amines in food processing: to measure the biogenic amine content of food during storage and processing:

- to determine the levels of toxicity of biogenic amines and establish signs of polyamine deficiency;

- to select bacterial strains with low biogenic amine formation capacity for the fermentation and food industries and to participate in the formulation of low- and high-polyamine content diets.

Work Package 5 – Production of biologically active amines by bacteria: Microbiologists involved in nutritional research, toxicological testing and industrial production will concentrate on estimating the biogenic amine production capacity of bacterial cultures used by the food industry:

- to identify the sites and determine the capacity of uptake of biologically active amines by the different parts of the gastrointestinal tract and assess their amounts;

- to determine the levels of toxicity of biogenic amines and to establish signs of polyamine deficiency and to select bacterial strains with low biogenic amine formation capacity for the fermentation and food industries.

The research work to be carried out within these Work Packages will improve our knowledge on the importance and contribution of biologically active amines of the diet to growth, establishing their bioavailability and clarifying their physiological functions and to determine which age-groups are the most vulnerable to polyamine deficiency and exposure to biogenic amine toxicity: to determine the relative contribution of biologically active amines derived from food and luminal bacteria and to develop new strategies for the assessment of food quality, safety and wholesomeness, which ultimately will lead to improvements in health and quality of life. Thus, as a whole, contribute toward the achievement of the main objective of the Action as defined in Section B.

D. ORGANIZATION AND TIMETABLE

To achieve our objectives, the following working groups will be responsible for coordinating the research work within the five Work Packages described in Section C.

Working Group 1	–	Physiology and metabolism of biologically active amines
Working Group 2	–	Polyamines and tumour growth
Working Group 3	–	Transgenic plants
Working Group 4	–	Biologically active amines in food processing
Working Group 5	–	Production of biologically active amines by bacteria

Meetings, workshops and publications

	Year 1	Year 2	Year 3	Year 4	Year 5
Management Committee meetings	x	x x	x x	x x	x x
Working Group 1 seminar		x		x	
Working Group 2 seminar	x		x		x
Working Group 3 seminar		x		x	
Working Group 4 seminar	x		x		x
Working Group 5 seminar		x		x	
Annual workshop	x	x	x	x	x
End of Year Report	x	x	x	x	x
Final evaluation meeting					x
Final Report					x

The duration of the Action is planned for five years.

A Management Committee will be set up to work out the rules of operation at the first formal meeting. The Chairperson(s) and leaders of the Working Groups will also be nominated at that meeting. The Management Committee will meet twice a year to oversee progress, coordinate and advise on future activities in the Working Groups. The Chairperson(s) and Working Group leaders will ensure the high scientific stanoard of the Action and ensure that the objectives are achieved.

The Chairperson and the Scientific Secretary will be responsible for preparing and distributing the agenda and minutes of the Management Committee meetings to all members, organizing group meetings, workshops and seminars. It will also be their duty to publish proceedings, prepare Annual Reports for the COST Officials and to write the Final Report.

E. ECONOMIC DIMENSIONS

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Austria, Belgium, Denmark, Finland, Germany, Hungary, Italy, Norway, Spain, Sweden, Switzerland, the Netherlands and the United Kingdom. On the basis of national estimates provided by the representatives of these countries and taking into account the coordination cost to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 60 million.

This estimate is valid on the assumption that all the countries mentioned above, but no others, will participate in the Action. Any departure from this will change the total cost accordingly.

National research funds are provided by nearly every European country to study polyamines and biogenic amines.

Memorandum of Understanding
for the implementation of a European Research Action
on learning disorders as a barrier to human development
COST Action A8

Date of entry into force of the project : 12.01.1995
Duration : 11.01.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	08.03.95	08.03.95
DENMARK	24.05.95	24.05.95
GERMANY	12.01.95	12.01.95
GREECE	12.01.95	12.01.95
SPAIN	04.05.95	04.05.95
FRANCE	31.05.95	31.05.95
ICELAND	22.05.96	22.05.96
ITALY	12.01.95	12.01.95
HUNGARY	12.01.95	12.01.95
NETHERLANDS	12.01.95	12.01.95
NORWAY	06.03.96	06.03.96
AUSTRIA	20.03.96	20.03.96
PORTUGAL	12.07.95	12.07.95
FINLAND	12.01.95	12.01.95
SWEDEN	30.03.95	30.03.95
UNITED KINGDOM	08.11.95	08.11.95

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in the European Research Action on learning disorders as a barrier to human development, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an Action to promote research into learning disorders as a barrier to human development (hereinafter referred to as the "Action").

2. The main objective of the Action is to establish European multidisciplinary research cooperation on learning processes and their disorders in order to contribute to the understanding of early reading failure, particular of dyslexia taking into account especially the language and other cultural differences related to literacy.

3. The Signatories hereby declare their intention of carrying out the Action 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 Action 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 Action is estimated at approximately ECU 5 million at 1994 prices.

6. The Signatories 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 Action 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 Action to be achieved;

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

SECTION 3

1. This Memorandum of Understanding will take effect for three 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 Action is subject to the prior agreement of the Management Committee referred to in Annex I.

2. This Memorandum 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 Action will notify the Secretary-General of the Council of the European Union 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 Action 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 paragraph 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 Action.

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 Union 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 Union. The Secretary-General will transmit a certified copy to each of the Signatories.

ANNEX I

COORDINATION OF THE ACTION

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 Action 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 the Signatories by the competent public authorities or bodies; any proposed changes to the Action framework will be referred for an opinion to the Committee of Senior Officials on Scientific and Technical Research (COST);

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

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

(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 Action, including those relating to possible special conditions to be 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.

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 Actions 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 Action, 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 said Action. 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 I, 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 Action assigned to them under Annex II (hereinafter referred to as "the research results") will be under 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 work in respect of the Action.

   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 insofar 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 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 the present 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 Action, 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 terminated 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.

General description of the Action

1. Introduction

The achievement of literacy is of crucial importance in European cultures. Literacy is fundamental for progress within the educational system and for subsequent opportunities for employment and social fulfilment. It is well established that a proportion of children encounter extreme difficulty in learning to read and spell. This is often despite well-developed abilities in other areas of mental development. This learning disorder, called "dyslexia", constitutes a serious educational and social disadvantage to the individual and his or her family and creates a demand for remedial intervention by the educational agencies. Help is needed in one form or another by a not insignificant percentage of our children of which a relatively large proportion will still have reading problems at the adult age.

The proposed action arises out of the widespread scientific interest in learning disabilities in each of the participating countries. These interests encompass a number of complementary approaches which if studied in cooperation may offer fundamental insight regarding the roots of dyslexia as well as the practice of prevention and treatment. The aim is to combine these approaches in order to construct an improved technology for the definition and amelioration of learning disorder which takes adequate account of the particular features of each of the languages and cultures involved. In addition, the opportunity for crosslinguistic comparison as well as integration of the research methodologies offered by such a cooperation may uncover new ways to understand the nature of dyslexia.

2. Areas of research

(a) Cultural and linguistic variation

Although the European languages all employ alphabetic writing systems, they vary significantly in their phonological and morphological characteristics and in the orthographic system by which writing symbolizes sound or meaning. These variations affect the task of literacy acquisition and the educational methods which are used.

The first objective is to specify contrasts in the phonology, morphology and orthography of the participating languages which may constrain the course of reading development and the types of dyslexia which can be observed.

(b) Linguistic awareness

A widely held view is that the acquisition of literacy depends on a capacity for reflection on the abstract segmental structure of the speech. Methodologies for the investigation of phonological, morphological and grammatical awareness in children and its relation to literacy have been developed at several centres in the participating countries.

The second objective is to perfect a set of procedures for the assessment and encouragement of linguistic awareness which take account of language-related variations in literacy acquisition.

(c) Reading and spelling functions

Reading and spelling are complex mental functions which are established over a period of years. In order to understand the problems of dyslexia it is necessary to know about the normal course of the acquisition process. Theoretical and experimental studies of both normal and impaired reading and spelling development are in progress in several of the participating countries. Integration of these procedures would make it possible to determine to what extent the functional description of dyslexia may vary within and between language systems and to identify the implications for remedial practice.

The third objective is to develop a technology for the description of reading and spelling processes at different developmental levels which takes due account of the variations between systems related to language as well as training in school in different European countries.

(d) Neuronal basis

Literacy development depends on the establishment of appropriate neural systems in the brain. A disruption of this development, attributable to genetic, traumatic or other factors, may be the cause of a learning disorder. A number of laboratories in the participating countries are actively engaged in research using non-invasive techniques for investigation of brain activity in learning of disabled and other groups.

The fourth objective is to extend this work to apply neuropsychological knowledge and to establish a technology for the detection of anomalies in the visual or audio-phonic areas which may be related to dyslexia.

3. The general goals of cooperation

The general objective is to combine the knowledge and techniques developed within the participating nations in order to investigate the nature of the learning disabilities (dyslexia) which are encountered in each language, their possible dependency on neurological functioning, linguistic awareness, and the implications for pedagogical practice. The programme will also include research of diagnostic and treatment technologies for supporting the educational work with learning disabilities in the participating countries.

4. Content of the action

In the initial phase the programme will be exclusively based on the ongoing research in the participating countries. This research will be supported by exchange of knowledge, results and assessment technologies.

The next step comprises the development of a comparative, cross-linguistic research programme during which the participants may share and apply techniques based on the expertise deriving from different European research traditions of dyslexia including linguistic, psychological and neuropsychological approaches.

A number of longitudinal studies intended to identify precursors of linguistic awareness and dyslexia as well as to prove the validity and efficiency of different diagnostic and treatment methodologies have been initiated by the participating national research groups before the start of the cooperation. These projects will be interwoven within the work done during this COST supported cooperation and will benefit from and contribute to the results of it.

5. The forms of cooperation

The participating researchers will form a network of information exchanges and proceed in their cooperation with flexible forms of interaction by organizing workshops, forming cross-linguistic and -disciplinary research groups in which the participating national research groups, university departments, research institutes or treatment centres exchange researchers. The activities and results will be reported regularly.

6. Time schedule

The Action will last three years. The continuation depends on the results of the cooperation.

During the first year the cooperation includes 2-3 workshops (the first one at the beginning of 1995) where the ongoing research is followed and plans for the cross-linguistic research will be fixed. The second step will last for two years and comprise research projects, concrete exchange of researchers with an emphasis on cross-linguistic and cross-disciplinary cooperative studies made concomitantly in different participating countries. Some of the projects will be new while some others will be implemented on the basis of ongoing research projects.

7. Organization, management and responsibilities

Organization is based on a coordination committee of the project leaders. It has a secretariat and national coordinators.

The Management Committee will comprise one or two delegates from each signatory and will be nominated after approval of the project.

The delegates of the Management Committee are expected

- to attend, and contribute to meetings of the Management Committee, usually two to four meetings annually;
- to be responsible for the general programme, development of projects and time scale of the Action;
- to be responsible for the research cooperation with other COST Actions;
- to be responsible for setting up multinational task groups and a network of cooperating institutes etc.;
- to be responsible for liaison between the Management Committee and national research groups in the participating countries.

The Management Committee is expected:

- to contact annually the COST secretariat for suitable liaison between the Action and other related COST Actions;
- to create contacts with appropriate international groups as well as national ones. Representatives of other organizations may be given an observer status in the Management Committee;
- to organize annual financial and scientific reporting.

The Management Committee should arrange meetings, workshops, exchange of researchers, visits etc. in order to achieve a rapid exchange of information.

The Management Committee 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 Management Committee may decide to what extent cooperation could be established between national projects, e.g. in the form of joint projects, and whether comparative research projects could be initiated in selected areas.

The Management Committee will stimulate exchange of scholars between the national teams. It will also set the reference term for the exchange of existing and new knowledge, ensuring that the main results are circulated (e.g. through translation of articles and summaries of research monographs). The Management Committee will also take initiatives for publishing books on selected topics, containing contributions from several participating countries.

The Management Committee is responsible for establishing links with related Community and other international networks in the field, in particular the COST Action "Impact of the social environment upon the creation and diffusion of technologies", and at least one seminar should be arranged together with that Action. In the final phase of the Action, the Management Committee will be responsible for producing a final report.

Project Management

The Management Committee will designate the national contributions to the different subprojects.

All projects will have a coordinator with defined responsibilities and duties.

The coordinator is appointed by the Management Committee.

8. Economic dimensions of the Action

The present estimate indicates an investment of 120 person years, and to the costs has to be added funds for seminars, networking, travel, publications etc. The cost of the Action would total ECU 5 million.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
designated as
COST Action A9
"The transformation of European cities and urban governance"

Date of entry into force of the project : 04.05.1995
Duration : 03.05.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	04.05.95	04.05.95
DENMARK	27.04.95	27.04.95
GERMANY	29.06.95	29.06.95
SPAIN	19.12.96	19.12.96
FRANCE	14.06.95	14.06.95
ITALY	11.05.95	11.05.95
NETHERLANDS	27.04.95	27.04.95
NORWAY	06.03.96	06.03.96
SLOVENIA	27.04.95	27.04.95
SWITZERLAND	08.01.97	08.01.97
FINLAND	27.04.95	27.04.95
SWEDEN	08.11.95	08.11.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to develop comparative European research actions on economically efficient and socially effective methods of urban management.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ANNEX

GENERAL DESCRIPTION OF THE ACTION

INTRODUCTION

The cities and urban societies of Europe and the world are in the throes of complex transformations requiring new angles of analysis. The urban question has changed, both in essence and in its priorities. Though cities concentrate economic and social problems, they are also sources of innovation and inventiveness, capable of creating the conditions for efficient economic environment, local employment and the well-being of city-dwellers.

Politicians and administrators must be given the means to understand these transformations: in order for a city to work, there must be interaction between various levels of government, and between governmental and non-governmental agents. New methodologies must be urgently developed in order to understand and interpret new urban challenges for Europe and provide a comprehensive and comparative point of view of urban policies.

SIGNIFICANCE OF THE ACTION

Academics and policy-makers have trouble agreeing on urban questions. This lack of agreement concerns the social and economic significance of cities and urban networks in terms of development, production of wealth and power, as well as their social and geographical nature and is due to the fact that there is no global scientific approach towards understanding European urban systems. Periodic eruptions of social unrest, while revealing the latent faults in social structures, show how difficult it is to find appropriate means of action in urban contexts.

Placing itself in the context of other COST actions and European Science Foundation programmes, the CIVITAS Action is concerned with determining what types of management and government are necessary in order for cities to become economically efficient and socially effective. In this respect, all questions pertaining to the relationships between public and private sectors are crucial, as well as the interaction of various geographical and administrative levels.

Through its choice of themes, of research teams and type of organization, the CIVITAS Action will complement other European research programmes and contribute to solving problems raised through other existing networks (other COST actions, such as CITAIR and Urban Civil Engineering and Environment; European Science Foundation, and in particular RURE, GIS-Data and other future projects in the urban field); it will also be working in coordination with institutional or research networks bringing together politicians and urban administrators (such as Eurocities, CERM, etc.).

Thanks to a global view of European policy-making, it will be possible to elaborate new methodologies enabling researchers to understand the real significance of urban transformations, analyse interactions between various actors, whether traditional or new, and provide food for thought to all those who play a role in developing doctrine and action for cities and city-dwellers.

AIM OF THE ACTION

Encouraging European scale research

The CIVITAS Action also aims at providing the concerned institutions with information enabling them to shed light on complex problems, thanks to comparative research on the precise topics listed below, and with the necessary statistics (new types of information and updating of existing data). Working in close coordination with the programmes of the European Science foundation, the project will formulate needs and recommend methodologies for collecting and organizing data.

The Action must also foster the development and consolidation of scientific cooperation between teams of experts from different countries, in the specific aim of seeing how knowledge can be transferred from one city, country, culture, to another, whether this information concerns the entire European urban system or only one city or type of city. New phenomena must be identified, described and evaluated; and this can only be done in a comparative context, involving long term cooperation between research teams.

The COST CIVITAS Action proposes to compare changes occurring in European cities and analyse how each of them reformulates policies in the face of these transformations. It will provide information in order to guide policy-makers in their work and help them better understand contemporary urban phenomena.

The CIVITAS action will be organized around three main themes, drawn from the central concerns listed below. For each theme, a specially assigned team will be in charge of formulating specific research programmes. CIVITAS will work with the most competent research teams in each country concerned by the Action.

The global issue of urban governance must be addressed according to three fields of enquiry:

(1) Which urban spaces will be organizing our lifestyles and in what kind of city do we want to live?

(2) Which are the most efficient combinations of actors for producing collective goods and services, and under what conditions can economic efficiency be compatible with social cohesion?

(3) How can the principles of collective urban action and cooperation between elected and non-elected representation be redefined so as to deal more effectively with the problems of social cohesion and urban exclusion?

CONTENTS OF THE ACTION

Such are the questions at the root of the three themes developed below, and for which three Working Groups will be set up. The themes will be further defined during the first phase of the programme and will lead to the creation of three coordinated research programmes.

Theme 1: What has and has not changed in urban systems

Since the early 1980s, European cities have undergone spectacular transformations which, from a continental point of view, present many similarities. Cities have spread to such an extent that one may rightly wonder whether areas spared by urbanization still exist. The growth of big cities, after a period of stagnation, has accelerated, whereas that of middle-size and small cities has slowed down. Large urban areas covering several urban centres, such as the Rhine-Ruhr area, the Dutch Randstad or, more recently, the Po valley in Italy, the French Riviera and the Lake Geneva area in Switzerland are developing, and the traditional distinctions between intra-urban and inter-urban relations are disappearing.

Because their influence is usually restricted to predetermined administrative areas, city governments have trouble adapting to networks and rapid dynamics, and are challenged by the question of changing urban limits, gradients and ruptures. More generally speaking, the transformation of spatial structures increasingly concerns a variety of actors: economic and political institutions, land and property buyers, public transport users and city-dwellers.

Three main avenues for research emerge as particularly important:

- Defining what is urban
- Describing and analysing metropolization phenomena
- Urbanness as a potential for development

Theme 2: Making the city: Economic efficiency and social effectiveness

The production of local public goods and services and of urban externalities raises crucial questions: who decides who will produce what? Who participates in production processes and how? How effective are production and management methods? The meaning of "effectiveness" must be defined more precisely so as to take into account all the issues covered when evaluating socio-economic processes. The relationship between efficiency and social cohesion must also be investigated: what type of social cohesion fosters urban efficiency and in what way?

The analysis of the city's production centres on three main themes:

- Cities as generators of externalities, of public goods and services
- Urban society and enterprises
- Competition among cities and competitive advantage

Theme 3: Urban governance and social cohesion: Some new challenges

Urban governments are facing a dilemma. On the one hand, they must encourage economic growth so that their respective cities retain their competitive advantage in the international competition among cities (public aid, tax exemptions, sale at low prices of industrial land and property); to ensure growth, firms must delegate the responsibility of dealing with social and job issues to other bodies. On the other hand, they have to deal with the effects of the streamlining and disinvestment caused by economic growth (industrial wastelands, environmental hazards, social tensions and urban violence, professional requalification, unemployment) while continuing to provide public services to the entire population. Urban governments, which see themselves as "developers" and "protectors", are caught between an increase in social spending and a relative decrease in available revenues; as a result, they are unable to preserve urban social cohesion, since cities are breaking up and their hierarchies are changing according to various regional and global flows. In response to these challenges, new "urban governance systems" are emerging; they are based on the interaction of various protagonists and various administration levels (from the local to the global), themselves still heavily influenced by traditional public action methods and by the fact that public action takes place within administrative territorial denominations.

The first research objective is to take into account the many transformations which have occurred in various countries over the past years and led to institutional reforms. As such, the most significant fact for that period is the emergence of a variety of forms of urban government, each relying on a different system of competency distribution among urban players with different statuses and working at different levels in the regional hierarchy.

The second objective consists in addressing the issue of social cohesion by attempting to explain certain particularly evocative notions belonging to other fields and whose scientific value is uncertain: social exclusion, the new urban poor, the break-up of social ties, two or three-tier urban society, segregation, ghettos, etc.

This research theme may be developed along the following lines:

- The multiple levels of urban management and regulation
- Political representation systems and individualization processes
- Fragmented and compartmentalized administrations versus global urban phenomena
- The social fragmentation of urban areas and the emergency of new regulation.

TIMETABLE

The CIVITAS Action will last four years. It will be divided into three phases:

- the first phase, which will last about twelve months, will be devoted to formulating research projects to be carried out in the framework of the Action. The projects will be based on the state of research in each country and on existing researcher and practitioner networks;

- after the first phase, the Technical Committee Social Sciences will evaluate the action's progress in terms of focus and cooperation. If the outcome is positive, the action may proceed to phases two and three;

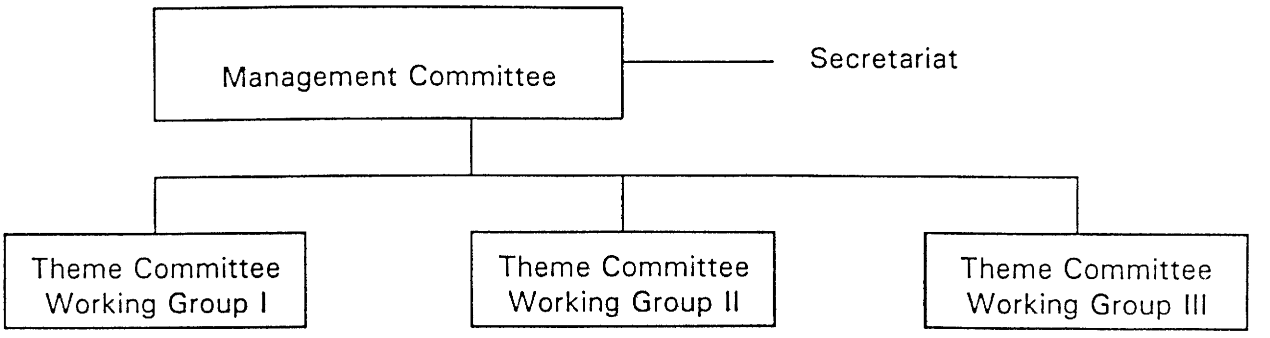
- the second phase will last thirty months and will be devoted to carrying out national research projects and international comparative projects: seminars and exchange programmes will be organized for each of the three themes, as well as global meetings (about once a year), where researchers will be able to compare and exchange findings;

- the third phase, which will last six months, will be devoted to synthesizing research results and formulating recommendations which will be publicized among researchers, practitioners and political representatives.

ORGANIZATION

A Management Committee will be in charge of the organization of the Action, in accordance with the usual structure of COST social sciences actions.

The Management Committee is assisted in its work by three theme committees, one for each theme of the Action:



The theme committees and the Management Committee will meet at least twice a year. A global seminar will bring together, at least once a year, all the researchers participating in the Action.

MEANS

An evaluation of means based on ten participating countries contributing two or three research teams yields the equivalent of 60 man/years for one year, in other words 240 man/years for a period of four years, to which must be added CIVITAS coordination costs and the running costs of the committees.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action A10
"Defence Restructuring and Conversion"

Date of entry into force of the project : 23.07.1996
Duration :

Contracting parties	Date of signing	Date of entry into force
BELGIUM	27.06.96	27.06.96
DENMARK	27.06.96	27.06.96
GERMANY	03.10.96	03.10.96
FRANCE	27.06.96	27.06.96
ITALY	29.05.96	29.05.96
HUNGARY	11.07.96	11.07.96
NORWAY	12.09.96	12.09.96
SLOVENIA	23.07.96	23.07.96
FINLAND	19.12.96	19.12.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which the Signatories are fully aware of.

2. The main objective of the Action is to maximize the social and economic benefits of defence restructuring and conversion by giving added value to ongoing national research on the economic, social, technological and cultural elements shaping this process.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 4 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ACTION A10

DEFENCE RESTRUCTURING AND CONVERSION

A. BACKGROUND

Now that the cold war is over, military expenditures, armed forces, arsenals and the production of armaments have been reduced. Although there are large variations amongst individual countries, Europe as a whole, after being the most heavily militarized for decades, has been the most affected of all the world's regions. Great hopes were placed in some quarters on the process of conversion, the shift in the military/civilian balance of resource use and the employment of freed resources to the best advantage of the civilian sector. These hopes have so far only materialized to a limited degree. It is an issue of major importance in many European countries to intensify the study of opportunities and obstacles of defence restructuring in order to optimize the process of industrial conversion.

Although a good part of the research has been multi-disciplinary and international, there is definite need, especially within Europe, West and East, for increased interaction and cooperation. In the past research on conversion was dominated by North American experts. Now the major efforts are being focused on Europe, with Russia dominating, but this has not yet found adequate expression in social science research on conversion.

The military sectors of the countries concerned are marked by a number of isomorphisms, for instance with respect to almost total central government control, internal organization, secrecy, lack of cost-consciousness and devotion to performance goals. With the demise of socialism in Eastern Europe, civilian sectors are also getting more similar, with political pluralism and market economies established in all countries. The levels of intensity of transformation from military to civilian resource use differ greatly, but forms of transformation show some similarities across the spectrum of countries. The analysis of success and failure in conversion can therefore greatly benefit from conscious comparative approaches.

In addition, a new research agenda is emerging. The traditional agenda on conversion was often based on the simple image of a direct and permanent shift of resources used by the military to the civilian sectors. This was sufficient in the past when this type of analysis was done within the framework of Peace Research. It is much too restrictive now that defence restructuring and conversion is taking place on a large scale. The new agenda is seeking to incorporate relevant social science research and thereby provide a better conceptual and theoretical basis for research in the field. While still driven by the practical issue of conversion it seeks to link the opportunities and difficulties of resource reorientation to the underlying structures and processes in societies, to decisions about the appropriate level of military efforts, about the role of markets and regulation, about trajectories of technologies, etc. Research in the social sciences in a number of fields is recognized as being directly relevant to, why and how military/civilian resource reorientation can succeed.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to maximize the social and economic benefits of defence restructuring and conversion by giving added value to ongoing national research on the economic, social, technological and cultural elements shaping this process.

The action will draw on existing research and enhance its value by comparison and generalization. The action will contribute to the identification of under-researched areas and the stimulation of new research projects both in individual countries and internationally.

It is to be expected that some of the research relevant to the topic will be done within the four Framework Programmes on Science and Technology of the European Union. The COST action will benefit from such activity, as well as from research support on national and subnational levels, by NATO, OECD, the World Bank/IMF and EU programmes such as PHARE and TACIS. It is unique in providing a forum and a network for researchers from Eastern and Western Europe engaged, or planning to be engaged, in research on the topic of defence restructuring and conversion.

Stronger cooperation will enhance the scope of a European level debate on the issues of defence restructuring, conversion, and, in this context, security.

The research topic is of immediate economic and political interest, both to the countries themselves and because of the larger implications of a peaceful development in Europe as a whole. The action invites the application of social science research to a problem of significant practical relevance.

Research on conversion has, in the past, often suffered from a narrow focus, with respect to the geographical area covered and with respect to the extent of state-of-the-art social science employed. Where there has been a distant geographical focus, mostly on Russia and Eastern Europe, considerable duplication of efforts has occurred. Such wastes of time, energy and money can be avoided through better knowledge of past and ongoing research, communication among researchers and coordination of research activities.

With the action, a more comparative and internationalized focus is possible. Also, the action aims at improving the social science content of conversion research in a number of dimensions.

European centred research on the aspects of defence restructuring and conversion provides an opportunity to balance US dominance in the field. The research also provides ample opportunities to improve East-West relations in Europe's academia.

The action will contribute to the improvement of the level of debate on issues of conversion, and in this context, defence and security, in Europe. It raises the awareness of the commonalities, as well as differences, of problems, potentials and policies in the fields of defence restructuring and conversion in Europe.

C. SCIENTIFIC PROGRAMME

In order to improve the integration of state-of-the-art social science research into the research work on conversion social science researchers could be invited to gatherings of conversion experts. Such meetings provide a forum to meet with practitioners from government agencies, industry and international organizations, such as NATO and the EU. The inclusion of actors such as policy-makers and industrialists will come naturally because of the actuality of the topic but will not be an essential as the focus of the action is on the contribution by and to social science research.

Within the research field some dimensions are especially promising for cooperative research. Preferably, specific projects should touch upon more dimensions. The dimensions are:

Economic policy
What are the inter-relations between different economic strategies, at the level of enterprises, regions, national economies and the international level, and conversion?

Technology policy
What are the inter-relations between conversion and choices of technologies, innovations and trajectories of technologies?

Cultures
What are the inter-relations between cultural factors, such as business cultures, national cultures, threat perceptions, etc. and defence restructuring?

Security policy
What are the inter-relations between military planning, military doctrines, arms export policies and defence restructuring?

D. ORGANIZATION AND TIMETABLE

The action will be guided by the usual COST structure with a Management Committee.

In addition, working groups for projects will be established to assist the Management Committee in the organization of the action. These working groups will be responsible for the planning of workshops, publication of results and ongoing communication among researchers participating in a project.

Duration of the Programme is 5 years.

(1) The action will start with:

- synthesis of the state of research in each country as the basis for European level research on defence restructuring and conversion;

- identification of research gaps, discussion of promise for research in the field, and specifically, within this action, stimulation of collaborative research projects on the European level;

- establishment of working groups of interested researchers.

(2) Intense research collaboration will last over a period of 3 years. The timing of activities, including workshops and conferences will take into account the overlap of participation and allow the meeting of various working groups at the same time if appropriate.

In addition, there will be exchange of researchers working on longer term projects adopted within the action.

(3) Finally, the action will be wrapped up. This includes:

- publication of results from the projects;
- meeting of participants in the various working groups to assess the work done;
- publication of a synthesis report.

E. ECONOMIC DIMENSION

Total amount estimated for operation, seminars, networking, travel, publications, exchange of research etc., is ECU 60 000 per annum. A total value of the action is estimated at ECU 4 million.

This estimate is based on preliminary expression of interest in participation by delegates during the 21st and 23rd Technical Committee meeting (1995). Such interest was expressed by Belgium, Denmark, Germany, Hungary, the Netherlands, Norway, Portugal, Slovenia, Sweden and Switzerland.

Agenda for A10

	Year 1	Year 2	Year 3	Year 4	Year 5
Activity	First participants's seminar – review state of research – discuss future topics – establish working groups First seminars of working groups, if appropriate	First seminars of working groups appropriate Additional meetings of working groups	First seminars of working groups from second round of additional topics Additional meetings of working groups Exchange of researchers	Additional meetings of working groups Exchange of researchers	Wrap-up seminar of participants – assessment of work done – discussion of possible future cooperation – discussion of final report First seminars of working groups, if appropriate
Projects	(Convernet) (Bibliography) (Macroeconomics) (Microeconomics) (Additional topics)				
Results		Publication of synthesis of research Publication of Convernet Manual	Publication of Bibliography Publication of research results from topics selected in Year 1	Publication of Research results from topics selected in Year 1 + 2	Publication of research results from topics selected at later state Publication of final report

Memorandum of Understanding
for the implementation of a European Concerted Research Action
designated as
COST Action B8
"Odontogenesis"

Date of entry into force of the project :	13.11.1995
Duration :	12.11.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	08.11.95	08.11.95
CZECH REPUBLIC	08.11.95	08.11.95
DENMARK	25.04.96	25.04.96
GERMANY	25.01.96	25.01.96
GREECE	21.02.96	21.02.96
SPAIN	10.01.96	10.01.96
FRANCE	09.10.96	09.10.96
ITALY	15.01.96	15.01.96
HUNGARY	21.05.96	21.05.96
NETHERLANDS	08.11.95	08.11.95
NORWAY	13.11.95	13.11.95
SLOVENIA	07.10.96	07.10.96
FINLAND	08.11.95	08.11.95
SWEDEN	01.02.96	01.02.96
UNITED KINGDOM	21.02.96	21.02.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to increase our knowledge of cellular and molecular aspects of normal and abnormal tooth formation and to make this information profitable for clinical work including prevention, epidemiology, genetic counselling and therapeutics.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 54 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of six years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION B8

"ODONTOGENESIS"

A. GENERAL BACKGROUND

Teeth occupy a unique position in biology:

1. Teeth represent an important part of fossil records.

2. The embryonic dentition constitutes a powerful tool and a model for developmental biologists and biologists in a broad sense.

3. Teeth have important implications in public health and results from fundamental research should be turned into practical healthcare.

   The European laboratories willing to participate are active in complementary domains including:

   - comparative anatomy and molecular biology;
   - dental cell specification and patterning;
   - tooth histo-morphogenesis and cytodifferentiation;
   - cellular and molecular biology of tooth supporting tissues;
   - extracellular matrix and biomineralization;
   - reparative processes related with caries, dental trauma and periodontitis.

   These laboratories are rather small and there is an unequal distribution of European expertise. The COST system should allow the coordination of complementary research activities, to improve efficacy and to avoid unprofitable redundancies. This COST Action, which does not overlap with other European scientific programmes, should also increase and valorize the European potential in the domain of tooth related molecular genetics.

B. OBJECTIVES OF THE ACTION

The main objective of the Action is to increase our knowledge of cellular and molecular aspects of normal and abnormal tooth formation and to make this information profitable for clinical work including prevention, epidemiology, genetic counselling and therapeutics.

The secondary, derived, objectives range from more general, fundamental aspects to well focused specific problems:

- Positive, constructive interaction of developmental biologists, comparative anatomists and paleontologists. Phylogeny and ontogeny have to be reunited around the centrality of heterochrony: An integrated model of odontogenesis should be developed.

- Unravelling the molecular identity of neural crest derived dental cells.

- Resolving the mechanisms of their patterning in the developing jaws.

- Elucidating the nature of epithelial-mesenchymal signalling leading to tooth specific histo-morphogenesis and eruption.

- Further characterization of the phenotypes of dental papilla cells, odontoblasts, ameloblasts, cementoblasts, and the cells of the periodontium.

- Understanding of the control mechanisms involved in specific phenotypic expressions.

These investigations will improve our understanding of inherited and non-inherited abnormalities and dysplasiae and will generate progress in the development of adequate therapies in the frame of reparative dentinogenesis and periodontal disease.

In order to reach these ambitious goals, implying multidisciplinarity, collaboration is required. The important European potential in the field has to be exploited through coordination, rapid exchange of scientific information, and sharing of laboratory facilities and technical expertise. Such an integration will increase our knowledge and will generate economic and social benefits.

C. THE SCIENTIFIC CONTENT (PROGRAMMING) OF THE ACTION

The participating laboratories will interact in the frame of 4 partially overlapping working groups (WG). According to the topics of each WG the members of the participating laboratories will join one or several WGs.

- WG_1: "Evolution".
- WG_2: "Neural crest cells, patterning, tooth initiation".
- WG_3: "Histo-morphogenesis and cytodifferentiation in development and repair".
- WG_4: "Extracellular matrix-mineralization".

Common tasks: All participants will provide detailed information concerning their laboratory facilities and their technical expertise. The modalities of access to specific equipment and technologies will be defined: common research teams and/or exchange of researchers, technicians, between laboratories. All of this information will be made available through a data bank.

Specific aims:

WG_1: Paleontologists, comparative anatomists and interested developmental biologists will meet and will attempt to understand how homodont dentitions evolved. Cellular and molecular comparisons of odontogenesis in selected fish (including the Zebrafish, an actual model for genetic and molecular investigations), dolphins (available collections exist) rodents, amphibians and humans will be performed.

WG_2: Most of our current knowledge concerning the neural crest derives from experiments performed in amphibian and avian embryos. Most of these data suggest that at least some of the neural crest cells are multipotent prior to their migration, yet virtually no data exists concerning the commitment of connective tissue phenotypes including dental cells. Knowing the putative role of Hox genes, homeobox and other regulatory genes, in conferring molecular indentity; and the rule of retinoic acid and vitamin D pathways, as well as the role of growth factors in cell communication and signalling, the interaction of molecular and cell biologists and bringing into play the available molecular technologies (RT-PCR: antisense strategies, transgenic animals, transfections, etc.) will greatly improve our understanding of the initial events of odontogenesis.

WG$_3$: Homotypic and heterotypic cell interactions implying growth factors, substrate adhesion molecules, cell adhesion molecules, cell junction molecules, etc., regulate tooth histo-morphogenesis and cytodifferentiation. Again, collaboration of morphologists, molecular and developmental biologists is required to try to understand how tooth specific morphogenesis is regulated. Computer assisted 3D reconstructions at all stages, implying morphology, the distribution patterns of mitoses, and apoptoses and of specific transcripts and proteins, will represent a powerful tool. Several European laboratories, familiar with such technology, have to be interconnected.

During recent years some significant strides were made concerning the control of terminal differentiation of dental cells. People involved in such research have now to interact with researchers working in the fields of reparative dentinogenesis and periodontitis. Such collaboration should lead to foreseeable progress in the development of specific therapeutics.

WG$_4$: Today no universal theory explains biomineralization. Teeth, including dentin, enamel, cementum and bone of attachment constitute the most powerful model for analyzing these processes in normal and pathological (inherited or non-inherited) conditions. Structural and compositional (analytical) comparisons in vivo as well as induction of mineralization in reduced in vitro systems have to be further investigated. For obvious reasons the molecular mechanisms of fluoride action have to be investigated. It is also of importance to evaluate the risk of anti-cancer therapy on children's dentition. Specialists in complementary domains (proteoglycans, glycosaminoglycans, non collagenous proteins, collagens, enamel proteins, Ca^{2-} channels, specific enzymes...) will interact.

The participants of each WG will initiate specific collaborations – common research teams, exchange of researchers between laboratories – WG meetings will be organized and the WG coordinators will coordinate interactions between the different WGs. International mid-term and final meetings will be organized. The outcome of our research will be published in well reputed international journals. The mid-term and final evaluations should lead to publication of detailed activity reports.

D. TIMETABLE

E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

The network involved in the Action consists of four interacting working groups. Four different coordinators, members of the Management Committee, will be appointed by the committee. Each WG coordinator, assisted by a co-opted vice-coordinator, will prepare the initial consensus report to initiate the interactions and collaborations of the WGs. All the members of the WGs accept to inform the coordinator on their progress, on their encountered difficulties and also on possible ongoing national programmes and possible interferences. The coordinators will inform the secretariat of the Management Committee every quarter to allow follow-up of the action.

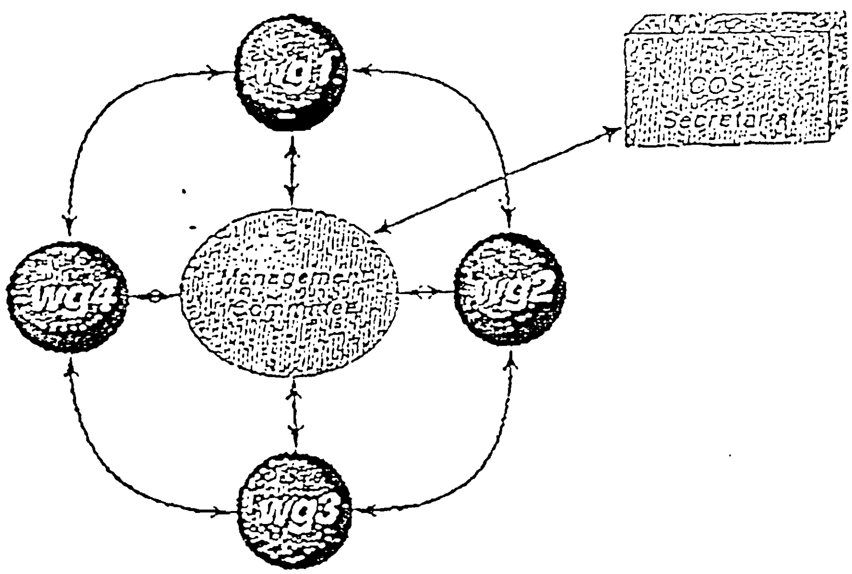
According to the rules of procedure the Management Committee is convened at least twice a year and particularly

- at the starting point (to appoint the WG coordinators, to initiate the data bank, to define place and dates of the first WG meetings)
- immediately after the meeting of WG_4 of phase 2
- in the framework of all the meetings of phases 3 to 6.

Furthermore, each member of the Management Committee (including the WG coordinators) may ask for an extraordinary Management Committee meeting to improve interactions of the WGs, to discuss unexpected problems and to allow countries not participating in the planning to join the Action.

The Management Committee also makes decisions (in the framework of existing general guidelines) concerning the question of intellectual property rights and draws up the annual report.

ORGANIZATIONAL CHART



F. <u>ECONOMIC DIMENSION OF THE ACTION</u>

The overall cost of the activities carried out under the Action has been estimated on the basis of information available during the planning of the Action.

Interested countries

Country	Number of person/year			Personnel cost/year	Operational cost/year	Coordination cost/year
	Cat. A	B	C		(10% of the acquisition costs of instruments and materials)	
Belgium	2	1,5	3	ECU 255 000	ECU 2 550	
Czech Rep.	5	1	1	ECU 365 000	ECU 6 000	
Germany	8	2		ECU 560 000	ECU 18 000	
Greece	3	2	1	ECU 285 000	ECU 1 500	
Finland	6	5	9	ECU 785 000	ECU 20 000	
France	26	15	12	ECU 2 460 000	ECU 32 500	
Hungary	3	2	1	ECU 200 000	ECU 5 000	ECU 60 000
Italy	5	2		ECU 380 000	ECU 5 500	
Netherlands	6	1	1	ECU 425 000	ECU 12 000	
Norway	2	1,5	1	ECU 205 000	ECU 5 100	
Sweden	7	5	8	ECU 620 000	ECU 20 000	
Spain	3	1	2	ECU 270 000	ECU 4 500	
U.K.	20	9	7	ECU 2 300 000	ECU 30 000	
Total/year	96	48	46	ECU 9 110 000	ECU 162 650	ECU 60 000

Estimated overall cost for 6 years: ECU 54 million.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action C5 "Urban Heritage - Building Maintenance"

Date of entry into force of the project :	23.01.1995
Duration :	22.01.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	23.01.96	23.01.96
GERMANY	23.01.96	23.01.96
SPAIN	23.01.96	23.01.96
FRANCE	23.01.96	23.01.96
ITALY	29.04.96	29.04.96
HUNGARY	11.07.96	11.07.96
NETHERLANDS	25.09.96	25.09.96
PORTUGAL	13.06.96	13.06.96
SLOVENIA	29.03.96	29.03.96
SWEDEN	15.02.96	15.02.96
UNITED KINGDOM	24.09.96	24.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is the definition at Community level of evaluation criteria for determining the historical importance of buildings and neighbourhoods in our towns and cities and the effectiveness of methods and techniques used in preservation work.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ACTION C5

ABSTRACT:

European towns and cities preserve the essential features of their history and their cultural heritage in their buildings, in their townscapes and in their urban design.

To preserve this heritage, it is necessary to single out its characteristic features (buildings, streets, neighbourhoods etc.) and to identify the most suitable and cheapest ways of protecting this heritage from decay and destruction.

The definition of these processes at European level is an important instrument for the protection and preservation of this heritage.

1. GENERAL INTRODUCTION

1.1. Urban structural and civil engineering and the maintenance of historical buildings heritage

The urban civil engineering (UCE) has been defined as the intersection between urban management and planning system, urban structured and technical systems and civil engineering. Therefore, policies at local government level on the handling of urban planning and construction problems as building maintenance, preservation and restoration of old buildings and avoiding building decay are included in the field of UCE.

Historic and old buildings and the shape of our towns and cities in Europe are a reality worth preserving, not only as historical documents (or museum pieces) but also as factors determining our present and future quality of life.

The European Community and the individual Member States have, in some cases, spent substantial sums on the protection of historic buildings and ancient monuments. The effects of these measures have not always been positive and the interventions associated with these measures have often been carried out without reference to the relevant urban context.

1.2. Historic monuments and old buildings worth preserving

Apart from some very valuable historic buildings (the so-called monuments), we find in European towns and cities a large number of buildings which are far less important from a historical and architectural point of view. However, these buildings, taken as a whole, represent an important historical heritage. The preservation of important individual buildings is probably much easier than the preservation of individual or groups of less important older buildings.

The preservation of an important "individual monument" is indeed a measure where we usually meet only technical and/or economic problems.

For this kind of building there is usually no economic risk (demolition or damage), since the need to preserve the most important artistic objects is an integral part of the collective consciousness of people in Europe.

With regard to the technologies applied in the preservation of monuments, we can refer to the existing studies and research reports, even if it is necessary to promote further research work in order to protect and preserve the original materials and structures as long as possible. This is why in Germany for example the Federal Ministry for Research and Technology recently decided to continue its building research programme on the protection of historic buildings after ten successful years and to test in practice the insights gained from historic buildings and ancient monuments in repairing and modernizing old and historic residential buildings (COST document CTC/WD/92 – 0 dated 14 May 1993).

The urban context, in which each building is situated, is an important and relevant factor, and the protection of historic buildings must therefore take this urban context into account in its work.

This usually involves buildings which are not of great importance in architectural terms as a result of their specific features, but rather play a role on account of their history, as evidence of earlier ways of life, and due to their building styles and technologies.

In most instances an individual building is not the only essential element of a town or city; it is the buildings taken as a whole which determine the townscape. This is the basis of important towns and cities which are significant for their homogeneity. Destroying a specific building or making significant changes to buildings can greatly impair the general identity and character of a place: a wound to the townscape that cannot be healed.

The preservation of these buildings is meaningful, especially if this is part of a larger safeguarding operation, for which suitable evaluation and safeguard instruments must be defined. These must in particular take social and economic aspects into account but must also be able to anticipate and minimize the changes to the urban context resulting from the intervention.

The demolition and the changes being made to so many individual buildings is a major cause of the chaotic situation we find at present in many European towns and cities.

Many problems in the urban context are caused by distinctive buildings which were devoted at one time to industrial production or social purposes and often characterize whole districts or neighbourhoods. It is also difficult in the case of these buildings to choose between demolishing them and restoring them for a possible new use.

1.3. Neighbourhoods and urban design

The urban form of most towns and cities in Europe is the result of changes over many centuries and, for this reason alone, is an element of historical quality.

New ways of life and new infrastructural facilities must also produce relevant changes. But it is necessary to examine the consequences for the original urban structure and the vitality of individual neighbourhoods.

Many European towns and cities, whether large or small, are still characterized by historic neighbourhoods where buildings reveal a homogeneous use of technology and form and whose significance is based on the preservation of this unity.

It is necessary to assess the value of these urban realities in order to be able to preserve them in a suitable manner. That will be the only prerequisite for an economic use of our elder buildings for housing and working.

1.4. Destruction and decay of buildings

In addition to the usual factors such as neglect of building maintenance or improper use, which cause the decay of buildings in most cases, we must also look at other factors which typify the decay of towns and cities: pollution, traffic, changes in the supporting medium and the many other factors resulting from human activities such as vandalism, wars or economic decline.

We must note that a number of factors common to building damage such as economic or climate-related events as well as earthquakes take on a special significance in the urban context as a result of the proximity of buildings. The protection and rehabilitation measures that can be considered are correspondingly specific.

Urban renewal (urban restructuring) often involves the demolition of individual buildings, whole districts or neighbourhoods. Important economic and social reasons connected with the use and purpose of the buildings and the sites usually provide the basis for this intervention resulting in considerable building damage.

It is necessary to carry out further studies in order to identify the decay factors and possible solution approaches, in particular with regard to the use of traditional and new technologies. It would also be useful, after a certain length of time, to test measures which have been carried out using similar technologies in various European countries. In addition, demolition measures should also be carefully examined in the light of new rehabilitation and utilization techniques.

Nowadays in many European countries construction work in existing buildings is already more than the half of all construction work together.

2. AIM OF THE ACTION

The main object of the action is the definition at European level of evaluation criteria for determining the historical importance of buildings and neighbourhoods in our towns and cities and the effectiveness of methods and techniques used in preservation work. It is therefore very important for all European countries.

It is also relevant to examine as case studies some rehabilitation interventions executed at urban level, evaluating the consequences resulting from them not only in the townscape, but also on the social and economical aspects. Each country has own economic balance. They need to decide what is appropriate for them.

The aims of the proposed COST campaign are therefore as follows:

2.1. Determination of criteria for the valuation of the origins of existing building heritage and the identification of the main factors of preservation and decay (building typology).

Europe preserves the most important part of world-built cultural heritage, but up to now no common criteria for its evaluation have been set up. As a consequence, the national or local laws for its preservation are quite different in the various countries of the Community, and it causes some difference also in decay or degradation factors.

2.2. Determination of common criteria for the evaluation of intervention works.

The study of some urban or building rehabilitation executed in the participating countries and their social and economical aspects, may suggest the parameters to consider establishing common criteria for the evaluation of intervention works.

The general aim of the action is to promote a better knowledge of European historic building heritage, with the definition of common criteria for evaluation in this field. The improvement in knowledge of existing rehabilitation techniques and the anticipated development of new and better suitable ones may have important consequences on the living conditions of the inhabitants of the old buildings in European towns.

Other consequences of the action are the necessary cooperation between researchers of the various countries and of different fields of research, the equally necessary cooperation between them and the managers of companies involved in preservation and rehabilitation works, the probable development of specific communitary research actions and the definition of new research fields and singling out of interesting local situations.

2.3. Determination of effectiveness of the techniques employed in rehabilitation and preservation works.

The necessity to preserve the conspicuous European building heritage has obliged the establishment of specific restoration and strengthening techniques, which today represent a large technological European know-how. But the different techniques, often linked with the different technical prescription of the various countries, have unequal effectiveness, in relation to building and urban preservation. This aspect of the Action aims to make progress in the identification of the most suitable techniques and to set common criteria for evaluation.

3. SCIENTIFIC ACTIVITIES PROGRAMME (Research)

The following task-fields for common works in the interested countries can be derived from the above described problems. It will be necessary to get an overview over the already practised methods in the several countries as well as to define the areas for an important and a more deepened research.

Three different directions of research are proposed:

3.1. Evaluation of existing building heritage and singling out of the main factors of preservation and decay.

This aspect involves the preventive evaluation of the situation of urban building heritage (historical and monumental) and of historical characteristics of towns in the different countries involved in the action and the definition of common criteria to evaluate the building heritage and its importance in European culture.

Parallel phases are an inquiry into different preservation laws for historical heritage and the definition of the main decay factors and demolition causes.

3.1.1. Worthy of building maintenance

Developing and compiling criteria for defining the worthy of building maintenance, defining different steps of worthy of maintenance and methods for measuring different criteria.

3.1.2. Level of maintenance

Developing and compiling methods to describe the optical and structural repair; identifying criteria for the definition of urgent steps of maintenance-works.

This subject area includes the constructional methods of building diagnosis: interviewing, inspectioning, examining with and without decay, even, for example, definition of other research subjects, e.g. the simple diagnosis without decay.

3.2. Determination of common criteria for the evaluation of intervention works.

This must be based on the study of urban or building rehabilitation executed in the participating countries, with the evaluation of social and economical aspects. The aim of this part of the Action is the definition of reference criteria for preservation actions for single and groups of buildings in the urban context.

3.2.1. Models of planning, financing and implementation

Compiling strategies and practical examples of repair-works implementation.

3.2.2. Success of repair

Methods and criteria to measure the success of repair; cost comparison; effectiveness of the different constructional methods.

3.3. Comparative study of the techniques employed in rehabilitation works.

The research must start from the study on the employment of traditional and new building technologies in rehabilitation works in the different countries, to arrive at a general evaluation of the effectiveness of restoration and structural strengthening techniques usually carried on.

This aspect involves also the definition of common criteria for the in-site testing of works realized with similar techniques in different countries and the assessment at European level of the existing national building technical regulations.

3.3.1. Objectives of building repair and modernization

Developing and compiling methods and criteria to define the objectives of building repair and modernization. For example: "spending the winter"; basic repairing of the construction; improvement of thermal insulation; optical repair only: saving the suitability of use, basic modernization.

3.3.2. Constructional methods of repair

Developing and compiling typical methods of constructional repair of constructions and structural components being founded very often. To this subject area even belongs the single definition of necessary investigation of detailed areas as:

- repairing natural stones and bricks,
- sealing against humidity from the underground,
- methods to maintain structural components of loam.

4. TIMETABLE

The research will develop during three different phases.

In the first period, approximately six months long, partners will liaise to define better the sub-projects and to plan the exact duration of the latter phases, as well as to set up resources and management of the activities.

In the second period, approximately three years long, the works will be carried on, with regular consultations among the different groups of study to coordinate the research investigation. A preliminary report, devoted to assess the state of the works, will be published two years after the start of this phase.

The third phase, approximately one year long, will be devoted to collecting, writing and publishing the results and conclusions arising from the work.

5. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

The Action organization will be defined coordinately by the representatives of each country who will join the work during the first seminar which will bring together all the participants to the action.

Anyway, the Management Committee of the action will include the leaders of the other UCE Actions, with which is coordinated especially the one on diagnosis on urban infrastructures.

The Management Committee will also ensure the coordination with the Community RTD programmes in the fields of environment and materials and with the EUROCARE project in the EUREKA framework.

6. ECONOMIC DIMENSION OF THE ACTION (DRAFT)

The exact evaluation of Action costs is subject to the definition of the number of countries taking part in the programme, even if up to now delegates of at least four countries (Slovenia, Germany, Italy and Spain) have expressed interest in the Action. The economic dimension of the Action may so be estimated only by default. In any way, the dimension of the problems involved and the interest shown by the participant countries may suggest an expected amount of approximately up to ECU 10 million.

Annexes

1. List of research projects commissioned by the Federal Building Ministry on the state of the existing building stock and the problems posed by building damage in the Federal Republic of Germany, Bonn, February 1994.

2. "Research on the Protection of Historic Buildings and Ancient Monuments", report commissioned by the Federal Ministry for Research and Technology, Bonn, April 1994.

These documents are available in German only.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action C6
"Town and infrastructure planning for safety and urban quality for pedestrians"

Date of entry into force of the project :	29.05.1996
Duration :	28.05.2002

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.05.96	29.05.96
DENMARK	14.11.95	14.11.95
GERMANY	24.07.96	24.07.96
SPAIN	23.05.96	23.05.96
FRANCE	23.05.96	23.05.96
ITALY	29.05.96	29.05.96
FINLAND	23.05.96	23.05.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to promote better safety and urban quality for pedestrians, particularly (but not only) for citizens with special needs – children, the elderly and the handicapped – and to suggest planning and maintenance techniques aimed at improving urban quality.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 24 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST C6

TOWN AND INFRASTRUCTURE PLANNING FOR SAFETY AND URBAN QUALITY FOR PEDESTRIANS

A. GENERAL BACKGROUND

1. General benefit of this COST Action

The Action "Town and Infrastructure Planning for Safety and Urban Quality for Pedestrians" concerns the coordination of national research projects in urban civil engineering. The work of civil engineers, traffic engineers, urbanists, architects, and townscape planners, but also sociologists has to be integrated. The most important benefit of this COST Action will be the synergy between the different national experiences and research projects for better "safety and urban quality in city life".

2. Remarks on the present situation

In all – even in the most advanced – countries it is generally accepted by experts that the low level of safety measures for pedestrians is a serious problem in terms of human lives and economic resources (emergency equipment and health care).

According to the statistics for the year 1991, the index of mortality due to road accidents varies from a minimum of 7,6 fatalities/100 thousand inhabitants for Norway to a maximum of 32 fatalities/100 thousand inhabitants for Portugal. The dry statistical index of 14 declared by Italian statistics concerns a figure of more than 7 000 fatalities.

We realize that it is extremely difficult to compare the data, due to the difficulty of finding homogeneous classifications from one country to another and also due to the different methods of collecting the data. The greatest problem seems to lie in the underestimation, in all countries, of some kinds of accidents, primarily those affecting the most vulnerable road users.

The greatest danger is concentrated in the urban areas (where two thirds of pedestrian fatalities occur). It is undeniable that the pedestrian is the most vulnerable road user, and that the risk of an accident having fatal consequences is seven times higher for pedestrians than for drivers.

Statistical analysis observes the most recent trend, extended to all countries, of a decline in the number of accidents. This trend is related to the decrease in the number of pedestrian trips.

The theme of safety in urban areas concerns all European towns, particularly those characterized by a consolidated historical section. The structure of urban spaces, which has remained basically unchanged in time, has had to adapt to face demands of use that varied as time went by, and were generally intended to satisfy vehicular mobility.

Another specific (and new) problem is caused by the large and fast growing outskirts of the metropolitan areas in Europe, where one can note low population density, large distances, high speed of vehicular traffic and a high motorization rate. These parameters make the promotion and the security of pedestrian traffic difficult.

3. Policies and practices adopted in some European countries

There is a lack of homogeneity as regards the overall policies of individual countries towards the reduction of traffic although countries with a higher pro-capita income are better equipped with state-of-the-art traffic regulations.

After the development of techniques to evaluate the risks in certain traffic situations in Germany (VKT: Verkehrskonflikttechnik) an integrated concept was adopted. In the so-called "Forschungsvorhaben flächenhafte Verkehrsberuhigung" (Research Programme: overall-traffic-calming concept, financed by the Ministries of city, transport and environment) different strategies have been realized on a large scale in 6 different towns and have been observed in a "before/after"-study over the period of 6 years. Results of the experiment have been published in yearly conferences and publications. Based on this experiment, national recommendations for street design have been revised simultaneously.

In Switzerland, planning for pedestrians means planning surface mobility (that is different from vehicular mobility). It is based on the classic hierarchy of the network of roads (main roads, collector roads, secondary roads), where the principal compository elements are identified for each. If all the roads in the residential areas are minor roads and should thus be designed for low speed, an objective will be to make it possible to cross the road safely at any point on collector and neighbourhood streets. In any case, the configuration of any corrective action of traffic planning has to be based on a scrupulous "analysis of conflicts".

The British system operates on two main levels: the urban level (area wide safety management) and the local level aimed at the individual street or section of roadway. At the urban level, by the mid-1980s, the efforts in Great Britain had been concentrated on an important pilot project financed by the government, that gave good results also from a theoretical point of view (operative protocol with diagnosis of phenomena, classification of hierarchies, etc.) but that should be extended and more closely correlated with urban planning. On the local level, however, a number of highly-sophisticated technical elements have been installed (roundabouts, mini roundabouts, protected crossings, islands, various types of bumps, etc.) that are quite effective, though, of course, there is still room for improvement.

The experience of Holland, perhaps the most sophisticated and coherent in time, together with the British experience, shows an equally consolidated scientific and practical treatment of the problem. Aspects of planning roadway infrastructures in an urban environment were broken down into two orders of function largely incompatible with one another: those deriving from residential areas and those deriving from vehicular circulation (flow, distribution, entry). In 1976 about 4 000 *woonerven* (residential areas) were set up in Dutch cities. In these courts, automobiles are allowed to circulate at a walking pace (5-8 km/h) and a radical concept of paving was installed (no pavements, play and rest areas, lawns, etc.). Another arrangement in effect early in the '80s, based on the concept of the "*woonerf*" but less expensive, are the 30-zones, that include residential areas and in which the circulation of motor vehicles is restricted, especially as regards through traffic. Wouters reports on the so-called *wide areas*, which provide a general, integrated approach to road safety extended to an entire city (Maastricht, Groningen) including restructuring residential areas, classification into hierarchies of the road system (main arteries, secondary roads, bicycle routes, home-school routes, consciousness-raising measures, information and controls).

The most significant aspect of the French experience in the field of urban road safety is probably the national pilot programme "Villes plus sures, quartiers sans accidents" that has put into effect about forty operations so far. The locations of the operations (roads through small residential areas, entries to cities, neighbourhoods cut by major traffic arteries) in various parts of France, and the innovative objectives of these operations (improvement of both road safety and urban quality) made it necessary to form interdisciplinary teams. As in the other cases of area-wide management, the programme was a testing ground for the method of study, whereby the specific case opens to the whole urban scale.

In Italy a number of cities adopted traffic restrictions in the seventies and eighties in the city centres, either on a permanent basis or at certain times of the day, installing elements of urban decor. Little or nothing was done in the way of coordinated efforts to moderate traffic in the residential areas. The new motor vehicle code deals very sketchily with the problems of "traffic control" and the protection of pedestrians.

4. Relationship to other COST Actions and to scientific programmes

This COST Action has very close links to the Actions C2 (large infrastructures and quality of urban forms) and C4 (Management and Information in Urbanism). The coordination of overlapping and interference of these Actions are typical for the field of Urban Civil Engineering, and will be managed by the common Technical Committee and in bilateral contacts. Coordination with the Technical Committee on Transport has to be ensured, while the two Technical Committees do have some common features. The main objective of Transport is Transport Systems, and the main objective of Urban Civil Engineering is Infrastructures in town.

Outside the COST area and the national research programmes contacts with the Drive area (e.g. V 1062) and the European Road Safety Federation (ERSF) will be set up.

B. <u>OBJECTIVES OF THE ACTION</u>

1. General objectives

The main objective is to promote better safety and urban quality for pedestrians, particularly (but not only) for citizens with special needs – children, the elderly and the handicapped – and to suggest planning and maintenance techniques aimed at improving urban quality.

2. Secondary objectives

Data gathering campaigns, carried out in different European cities, will provide the opportunity to work out common definitions and standards. Data gathered in different European countries and cities will also allow the measurement and comparison of the success of different strategies.

The improvement of urban life quality is the basic benefit that one expects from the results of the research. This will be made possible by offering techniques and methods of intervention in town planning, based on the value of pedestrian movement. One particular aim is to promote the regaining of the city space for all pedestrians, especially in consideration of the need of the elderly, children and the handicapped, now often forced to stay at home because of the impracticability of the outside spaces.

C. THE SCIENTIFIC CONTENT OF THE ACTION

Research will start with the broadest scope trying to estimate (however roughly) relative importance of all possible risks or safety questions in pedestrian traffic (and light traffic, namely cycling) and then make more accurate studies in any of the more specific fields. Subjects will be analysed in different cases that represent the situation of middle-size European towns.

The following research procedure will be established:

The first and common phase for each research group will concern first of all the development of standardized and easy-to-use methods and definitions to describe the actual situation concerning pedestrian safety, pedestrian mobility and urban quality for pedestrians in relation to the characteristics of infrastructure.

In the second phase empiric research in the different European cities will be initiated based on case studies. Where the "mainstream research" (i.e. the common part of all research groups) will adapt the standardized methods and definitions. The second phase of the action is open for "sidestream research" where the research groups are free to enlarge the programme using specific methods or pointing out specific problems.

The goal of the third phase is to evaluate the influence of the different infrastructure types and acting strategies comparing the results of the empiric research, and to conclude on recommendations for planning of urban infrastructures and strategies to increase safety and urban quality for pedestrians based on the experience of 10 to 20 European cities.

Development of basic knowledge:

- characteristic behaviour for various types of pedestrians including walking habits;
- methods to describe and analyse pedestrian safety and urban quality problems respectively; including the use of video analysis and GIS-based on data organization;
- definition of safety standards based on the experience of different cities (in Northern and Southern Europe);
- methods for analysis and evaluation of measures to improve safety and urban quality but also to increase frequency of walking and increase of walking distance;
- the societal economy of walking.

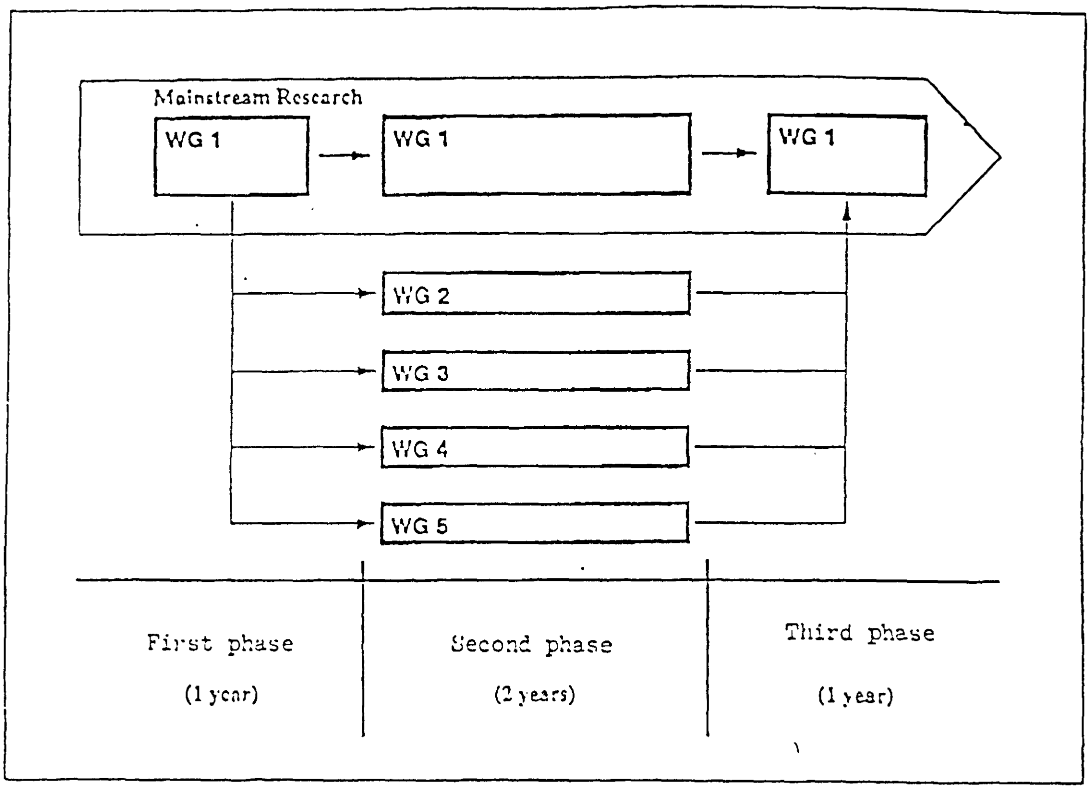
Application of methods for analysis:

- on specific spots or sections (crossings, footpaths);
- in city centres (pedestrian zones);
- in residential areas (traffic calming areas);
- at specific destinations (schools, bus and tram stops);
- for the whole city, pedestrian network all over city areas.

Dissemination of results and experiences:

- reports;
- guidelines for planning and improvements;
- videos;
- seminars.

D. TIMETABLE

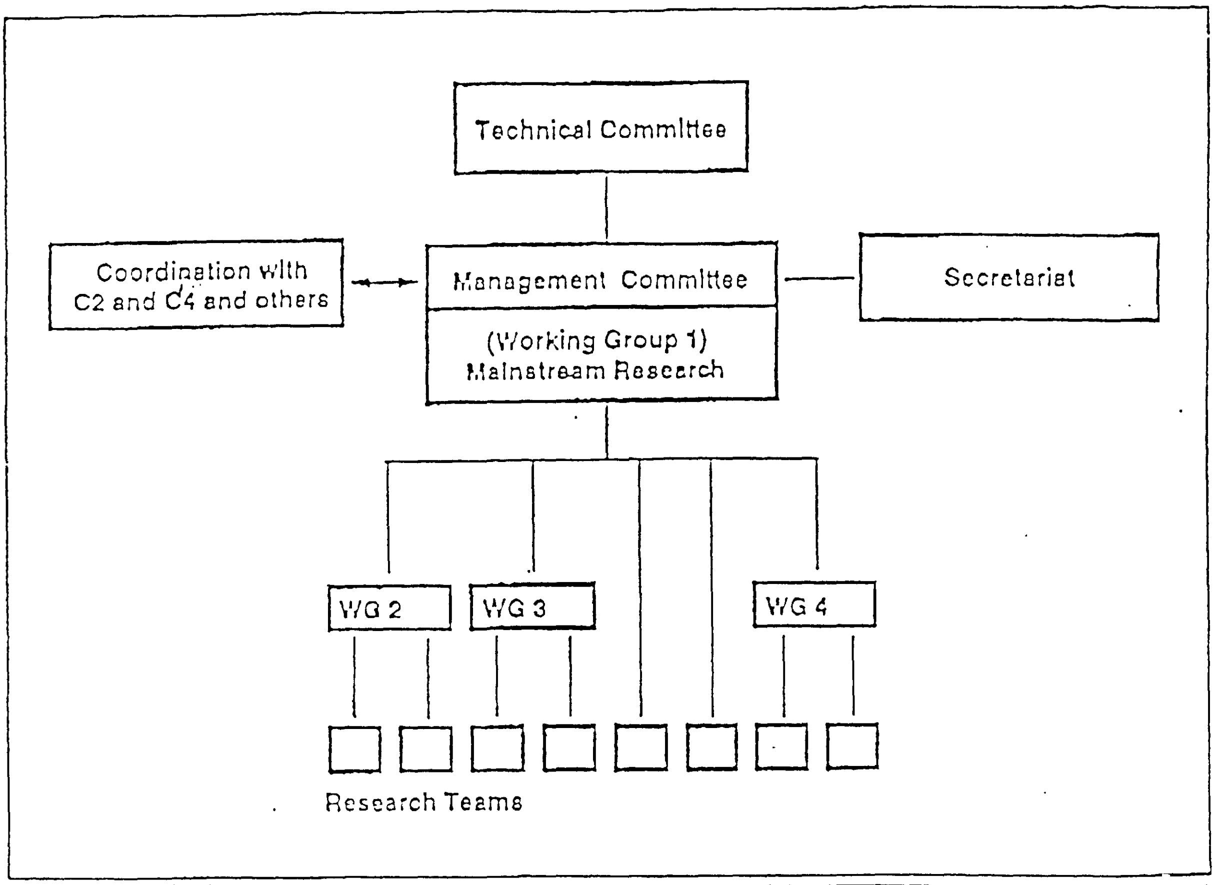


E. ORGANIZATION, MANAGEMENT AND RESPONSIBILITIES

The Action is directed by the Management Committee which is responsible for the contacts with the Technical Committee, the coordination to the parallel Actions C2 and C4 (and others).

All the research teams are directed by a responsible person, and each working group by a coordinator who is responsible for the contacts with (the mainstream group and) the Management Committee (generally as a permanent delegate).

The secretariat of the Management Committee will guarantee the interchange of information between the COST structures and between the working groups and the Management Committee. All the research teams should at least be represented in the mainstream group (minimum part), but are invited to extend their activities on specific research themes in working groups (1, 2, 3 ...).



Organization of the Action

F. ECONOMIC DIMENSION OF THE ACTION

At the present time the list of research institutes and of interested specialists is not complete, for this reason it is difficult to set a definite budget for the Action right now. We estimate that as a minimum approximately 1 to 3 research groups (2 persons each) of 6 different countries will participate for 4 years and 2 research groups will need another year for preparation and conclusion. 100 person-years per ECU 60 000 per person and year amount to about ECU 6 million per annum.

Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action C7 "Soil-structure Interaction in Urban Civil Engineering"

Date of entry into force of the project : 29.05.1996
Duration : 28.05.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	29.05.96	29.05.96
GERMANY	25.04.96	25.04.96
GREECE	18.09.96	18.09.96
SPAIN	25.04.96	25.04.96
FRANCE	25.04.96	25.04.96
IRELAND	17.10.96	17.10.96
ITALY	29.05.96	29.05.96
AUSTRIA	17.10.96	17.10.96
PORTUGAL	13.06.96	13.06.96
SLOVENIA	23.07.96	23.07.96
FINLAND	19.06.96	19.06.96
UNITED KINGDOM	25.04.96	25.04.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is the drawing up of recommendations to take into account soil-structure interaction in urban areas.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 5 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

Action C7

A. General Background of the Action

In the construction or conversion of buildings, especially in urban areas, the soil-structure interaction has to be considered in many ways. In so doing, damage to existing structures that may arise due to changes in the surrounding area should naturally be prevented. The prevention of such damage requires heavy expenditure. This involves not only security measures on the site and at the buildings that are being constructed, but also insurance premiums against consequential costs. Nevertheless, damage to structures quite often occurs because of failure to take into account the soil-structure interaction which, in extreme cases, can lead to a loss of use of the structure.

Figure 1 shows a variety of different examples of specific problems caused by soil-structure interaction in urban areas. One example is the interaction between two foundations where a new construction causes additional settlement and displacement to a neighbouring building. Other examples are sites and excavations in urban areas, where high costs occur due to the construction and testing of retaining walls, since the rigidity of these walls determines the settlement and displacement behaviour of the neighbouring building. This also holds true for the building of tunnels in urban local traffic systems.

Thus the planning and construction of new structures have to be carried out in the knowledge of the soil-structure interaction. Normally, this problem is taken into account by calculating the structure with high safety factors which generally means the estimate of a larger loading in the calculation of a structure. The consequences of such a calculation are higher expenditure on material, and even may entail special construction techniques so that the costs of the construction project rise. Although high security standards are required, damage often does occur to existing structures that can arise both during and after the construction. It is only natural that the amount of money to be spent on insurance premiums increases when damage occurs. In contrast to these developments, the amount of money available for investment in urban sites is decreasing more and more. In addition to that, the conservation of the natural environment and ancient monuments has to be taken into account because possible damage to the environment or to monuments is often irreversible.

Most research on the topic of soil-structure interaction deals with special cases which occur during the construction of projecting structures. Examples are the research done during the construction of skyscrapers (Messe tower Frankfurt) in the Frankfurt area or the leaning tower of Pisa. Other investigations deal with the load-bearing behaviour of special types of foundations (e.g. horizontal loaded piles and pile groups). The crucial point in this research work is the description of the load-bearing behaviour. Other studies, that are more general, advocate the numerical formulation of the soil-structure interaction with the help of the development of complex material models. Some factors influencing the question can be integrated into variable rigidity matrices. The values which describe the influence of the soil-structure interaction in the rigidity matrix also depend on many other different influence parameters, such as geometrical boundary conditions (depth of embedment, kind of foundation, neighbouring structures), the soil parameters, the expected load or the load history and the expected deformation values.

Special problems of single countries are generally investigated at home, and the results of this research work are mostly published there. In the context of European collaboration e.g. SCIENCE cooperation, questions of the comparability and usefulness of different testing methods are investigated (centrifuge model tests, triaxial tests). Different problems of the soil-structure interaction due to the lowering of groundwater or the construction of tunnels, are treated by working parties of the International Society of Soil Mechanics and Foundation Engineering. Another subject of the current investigation in Europe and also overseas (Japan, USA) is the question of earthquakes (protection against damage caused by them). Most of this research work is done with model tests and calculations.

A more detailed description of the previous research into and the current state of the art technology of soil-structure interaction can be found in the technical annex which was presented to the Technical Committee of Urban Civil Engineering (TC-UCE).

The plan to describe soil-structure interaction in urban areas in a comprehensive and internationally valid way calls for the participation of specialists from many different countries. In addition to differing rules and regulations and with respect to the above questions, the many different experiences with different soils and/or different methods of calculations made at national level have to be collected and disseminated. The participation of experts from as many countries as possible leads to the international exchange of knowledge in both directions so that this knowledge can be disseminated at a national level. Within the limits of the COST-Action it is intended to publish the results of the research work in articles in the relevant national languages in the national journals. The main objective, apart from collecting knowledge which at European level should be very extensive, is the creation of a unified state of the art at the upper level of the national knowledge.

In order to have a proper grasp of soil-structure interaction, a description of the state of the art should help to present, describe and summarize the most simple and homogenous methods. This concerns e.g. the appreciation of the settlement of a structure and the extension of the resulting settlement depression. The use of different calculation methods and also the effects of the different material models must be tested. (It is essential to verify the abovementioned knowledge with the help of experiments or measurement of existing structures.) In addition to this, the economic dimension resulting from the security measures has to be estimated. In the estimation of the cost of these security measures, in particular the amount spent on insurance and costs arising from damage must be ascertained. The damage is to be compared with the knowledge which results from international collaboration. Using this method and taking into account the latest developments in technology, this damage should be almost excluded.

The standardization of the latest developments in technology leads to a simplified treatment of international tasks in the field of urban development and also a unified appearance and unified European guidelines for the international market. At the same time, recommendations comprehensible to non-experts concerning soil-structure interaction can be drawn up. Planners (town planners and architects) and also structural engineers should employ them in the estimation of costs and loading stress cases that may occur.

The results of other European programmes such as the abovementioned SCIENCE programs are also included under the first preparatory phase in the collection of knowledge by the COST Action. The relevant COST Actions in the sector of the Technical Committee "Urban Civil Engineering" are involved in the final stage of the preparation. This approach will be described in greater detail in chapters C and E.

B. Objectives of the Cost Action

The main purpose of the COST Action is the formulation of recommendations to take into account soil-structure interaction in urban areas.

These recommendations are to take into account the problems of soil-structure interaction as comprehensively as possible. Moreover, they must correspond to the state of art in technology and be so formulated that not only specialists, but also all people involved in the planning and design of the structures can read them and take them into account. This is especially directed at planning engineers and architects in the sector of town planning and urban development, and to structural engineers, who have to estimate and take appropriate account of the loading stress resulting from the soil-structure interaction.

In the execution of this COST Action, different phases emerge and their results will be formulated as secondary objectives.

In the first phase, the participating institutes should summarize the state of knowledge of the different countries referring to different aspects of soil-structure interaction which will be more precisely specified in the course of the COST Action. Apart from the compilation of the current state of knowledge concerning this topic, the differing consideration of the soil-structure interaction in the laws of the countries involved and the calculation methods actually used should be recorded. The damage that arises from misunderstanding the soil-structure interaction and the resulting costs and also those that may result from insurance payments or security measures on individual construction sites and the buildings to be erected should be shown in summary form in this phase. This compilation of knowledge that is described in detail in part C provides the possibility of indicating gaps in the latest developments in technology which can be filled if necessary within the framework of the COST Action.

It is the objective of the second phase to consolidate the compiled knowledge. On the one hand, this means that the differing knowledge from the particular working fields is balanced against each other (e.g. checking the estimations on existing buildings and experiments in order to test the suitability of various models for describing the soil-structure interaction). In the second phase it should try to fill the gaps discovered in phase I with the help of research projects at a national level. The data on damage to the existing buildings gathered and depicted in phase I must be summarized in damage categories and be developed together with the compiled knowledge of that period. It should be established how far different and new methods of estimation for the soil-structure interaction could have prevented damage that occurred in urban areas. A similar action is required within the work on cost analysis. The reasons for the resulting costs are to be examined.

In the third phase (recommendations) the knowledge that was acquired during the work on the first two phases should be transferred into recommendations for the consideration of soil-structure interaction in the development of towns. With regard to its requirements and formulations, this handbook must be written in a language that can be understood even by non-experts. The target group of these recommendations are town planners and developers who prior to any building project have to carry out the measures necessary for the securing of the new and existing buildings and to estimate the costs. A second target group are the structural engineers who need soil-structure interaction information as a load case that is often decisive in order to calculate the construction of the future building. The formulation of the results should, consequently, be carried out in cooperation with these groups, so that the comprehensibility and the manageability for the addressees of the recommendation are guaranteed.

Using these methods and taking into account the formulated final result it is possible to estimate, in advance, certain costs that can arise as a consequence of soil-structure interaction in urban regions when building a new structure or project. Furthermore, the latest developments in technology in the participating European countries will be brought into focus so that they are available for every nation. This also simplifies international cooperation between planners, engineers and building firms.

Soil-structure interaction in urban areas	
Phase I "Gathering of knowledge"	Compilation of latest developments
	Checking of the knowledge with extra tests
Phase II "Balancing of knowledge"	Balancing the results of the working groups
	Explanation of damages that occurred on the buildings
Phase III "Recommendations"	Formulation of recommendations for the consideration of the topic
	Checking of the comprehensibility of the recommendations through close cooperation with the TC-UCE

C. Scientific Background and Content of the Action

Soil-structure interaction is a very complex question. The complexity can be seen in Figure 2 which shows the interaction of estimation, existing problems, experiments, laboratory results and the final calculation of the building. In order to break down this problem into component parts, Working Groups will be set up in Phase I which will work on the particular aspects of the overall question. These Working Groups will deal with the compilation of developments and results concerning a particular field. On the one hand, these will be taken from literature on the subject and, on the other hand, from complementary investigations carried out (e.g. experiments, field tests or estimations). These results will be summarized for every aspect at the end of Phase I. Planned working groups will be set up on the topics

- methods of estimation and materials
- field tests and in-situ calculations
- modelling experiments
- evaluation of damage
- fixing of costs

A more detailed assignment of topics to the individual groups will be made during the first meeting of the Managment Committee. The standard of knowledge concerning these particular topics varies a great deal. For example, there only exists a slight basis for a precise examination of the costs. But on the other hand there are many results available which can be referred to in cases that require perfect soil or in special situations (e.g. earthquakes). For other extreme conditions, investigations and compilations like this do not exist to this extent.

First of all, the latest developments of all five topic areas have to be summarized. Points that have been neglected or insufficiently clarified that arise from this comprehensive compilation should be formulated and, if necessary, they must be clarified by extra research. This method guarantees that a compilation of knowledge, which is reliably comprehensive in particular cases, is drawn up and made available to a wider public. By doing so, gaps in knowledge could be shown up and further research could fill them. An example of this is the advanced settling within low frequency cyclic loading which is caused in many cases by settlement that goes beyond the usable condition. When estimating such a burdened building, the fixing of the settlement is based upon equivalent static loadings. Thus the settlements which can be estimated in the field cannot be registered through standardization or rules. Further simple methods of the estimation of the settling exist, but are not yet internationally acknowledged. Other gaps are possible in many fields.

Something similar will be seen on a closer examination of buildings where structural damage occurs owing to soil-structure interaction not being taken into account and on examination of the combination of the costs that arise from an inaccurate comprehension of the possible soil reaction.

In Phase II these results will be balanced against each other so that a transfer of specific results to the whole system, subject to research, becomes possible. This is the consequence of the cooperation of the Working Groups I - III and two further groups that must then be formed. The new groups will work on the explanation of the damages using the results gained from the first phase and on detailing the costs that arise through taking into account the soil-structure interaction. It is hoped by means of the comprehensive representation that it is possible to avoid damage by correctly assuming the soil-structure interaction on the one hand and on the other to reduce the costs by taking better account of the interaction. The investigations that were carried out to check the compilation of knowledge concerning existing results and to derive new results are to be continued in Phase II.

At the end of Phase II an assessment of the results will be done in order to decide on the envisaged prolongation of the Action in Phase III.

In Phase III then the results summarized in Phase I and checked in Phase II will be formulated into recommendations which will be published at the end of the COST Action after consultations with participants from other COST Actions such as e.g. COST Actions C1 and C5 as part of the TC-UCE.

The progress of the Action is illustrated in Figures 3.1 and 3.2. There are clearly defined sections between the particular working steps since at the end of each phase a small technical conference has to be conducted during which the results of the particular working groups have to be made available to a broader public. It is not possible to draw an exact dividing line between Phase I and II. In particular the consideration of various influencing factors in the specific fields should be described in the technical symposia at the end of Phase I. This means that the main emphasis will lie on lectures or meetings on subjects such as experiments, laboratory experimental methods, calculation methods as well as on cases of damage and costs. At the end of Phase II there will be another technical conference to demonstrate in particular the interaction between these single components. The following questions should be aired in this context:

- Which models of material are absolutely necessary to be taken into consideration with regard to which questions?
- Which influencing factors do further building measures have on the building?
- To what extent is damage caused by false methods of estimation?

At the end of Phase III a conference concerning the consideration of the soil-structure interaction in urban areas is planned to take place. During this conference lasting several days the recommendations and other results from the Action are to be introduced to and discussed by the public.

D. Organization, Management and Responsibilities

Figure 4 shows the organizational structure of the Action. The Management Committee is to meet every six months in order to receive and arrange the working groups' reports and to delegate extra tasks to the groups, if necessary. During the first phase all five working groups are expected to work relatively independently in order to gather the latest developments in the specific fields. As soon as the working groups have shown their interim results, these are to be published at both national and international level. Arising from work in the groups new questions and research limits appear, which must be examined in detail. These are to be formulated by the groups so that it can be decided within the Management Committee how far they require new research. This first phase should not last longer than two and a half years.

A compilation of the latest developments will be drawn up according to the separate tasks of the five working groups. Within a technical conference the results of these five groups are to be made available to all participants of the COST project and everybody interested in the subject. Each working group is guided by a group leader who is responsible for the efficiency of the group and that it is focused on summarizing the latest developments. Working on the particular tasks within the groups should be improved by a possible exchange of researchers for a period of two up to four weeks. Thus a small circle of researchers could prepare meetings of the working groups and effectively arrange a compilation of the latest developments.

During Phase II, which begins two or two and a half years after the start of the COST Action, subject-specific results will be summarized in a working group that is to be set up at that time. This group will be in charge of balancing the results in a soil-mechanical context. A further two more groups will deal with the interpretation of damage and costs, which were mentioned in chapter C. At the end of this phase there are recommendation outlines or results to what extent it is necessary to take the soil-structure interaction into account for the various questions (e.g. which models, calculation methods or other considerations). In particular, questions about rising costs as a consequence of the consideration of the soil-structure interaction should be discussed at that time. At the end of Phase II there will be another technical conference which will present the summarized results. It will be part of the new Working Groups VI, VII and VIII tasks to build on work carried over from the first phase such as to fill gaps of knowledge or to deal with extra research. These new results must be made available to all participants of the COST project and to the public.

Within Phase III the recommendations formulated by the Working Groups VI, VII and VIII with regard to the knowledge acquired in the first phase will be summarized into recommendations for the consideration of the soil-structure interaction in urban areas. These draft recommendations will be checked and discussed by all groups and an extra external group, which will be composed of members of other COST actions (e.g. Actions C1 and C5 of the Technical Committee for Urban Civil Engineering). Thus, recommendations concerning the soil-structure interaction in urban areas will be available at the end of Phase III. Figure 5 illustrates the Action by means of a flow chart. It is planned to organize a conference lasting several days at the end of Phase III in order to introduce the recommendations concerning soil-structure interaction to the public.

The coordination of the content of the COST Action will be carried out by the scientific secretariat. The Secretariat is responsible for the organization of the meetings of the Management Committee, and, in addition, to encourage the working groups to draw up interim reports and publications. It is to coordinate the draft and final recommendations and the working groups in order to guarantee a unified approach to the general subject. The leaders of the groups are responsible for the work on the subject regarding the content. They are composed of members of the Management Committee.

The organization and carrying out of technical symposia will be done in cooperation with the COST secretariat in Brussels.

At the end of the COST Action, the final draft recommendations are to be shown at a conference on soil-structure interaction in urban areas. Experts not taking part in the COST Action are expected to put questions and describe latest developments in technology in other countries and continents.

E. Timetable

The time schedule of the COST Action is set out in Figure 4. It consists of 3 phases, which are briefly summarized as follows.

The first phase should end after two or two and a half years with a technical conference. Under Phase II, Working Groups I to V stay the same, but the frequency of their meetings is to be reduced. Thus it is possible or advisable to fall back upon them at a later stage in the Action. It is essential in Phase II to fill gaps in knowledge that have arisen and to balance the developments in the specific fields. Furthermore, the results of Working Groups IV and V should be brought into line with those of Working Groups I, II and III during this Phase II. Meanwhile three new groups will be set up during this Phase. The results of the Action in this Phase will be formulated in draft recommendations.

The essential aim of Phase II is basically to check if the draft recommendations can really be used. The formulation of the recommendations will be done after the consultation of and in direct cooperation with the Technical Committee for Urban Civil Engineering.

It is planned to have workshops or conferences at the end of each phase. Every phase will last about two years. As soon as a certain level of knowledge is reached, particular working steps will be published in national and international organs (conferences and/or magazines). Thus an essential aspect of the COST Action, the exchange of knowledge of the latest developments between the participating countries, is guaranteed.

The Action is to last four years, with a possible extension of two more years for Phase III.

F. Economic Dimensions of the Action

Yearly costs of approximately ECU 60 000 will arise for the European Community for this Action. That should cover travelling expenses to the meetings of the Management Committee and the Working Groups. The meetings of the Management Committee and the Working Groups of the COST Action will take place alternately at the participating institutes. Furthermore, there will be costs for the preparation of the Working Group meetings and caused by exchange programmes which are set up to enable independent researchers to stay for a period of two up to four weeks and to work then in a working group in one of the institutes.

The estimated costs resulting from the figures gathered from the six countries that have expressed an interest so far, amount to about ECU 1,15 million.

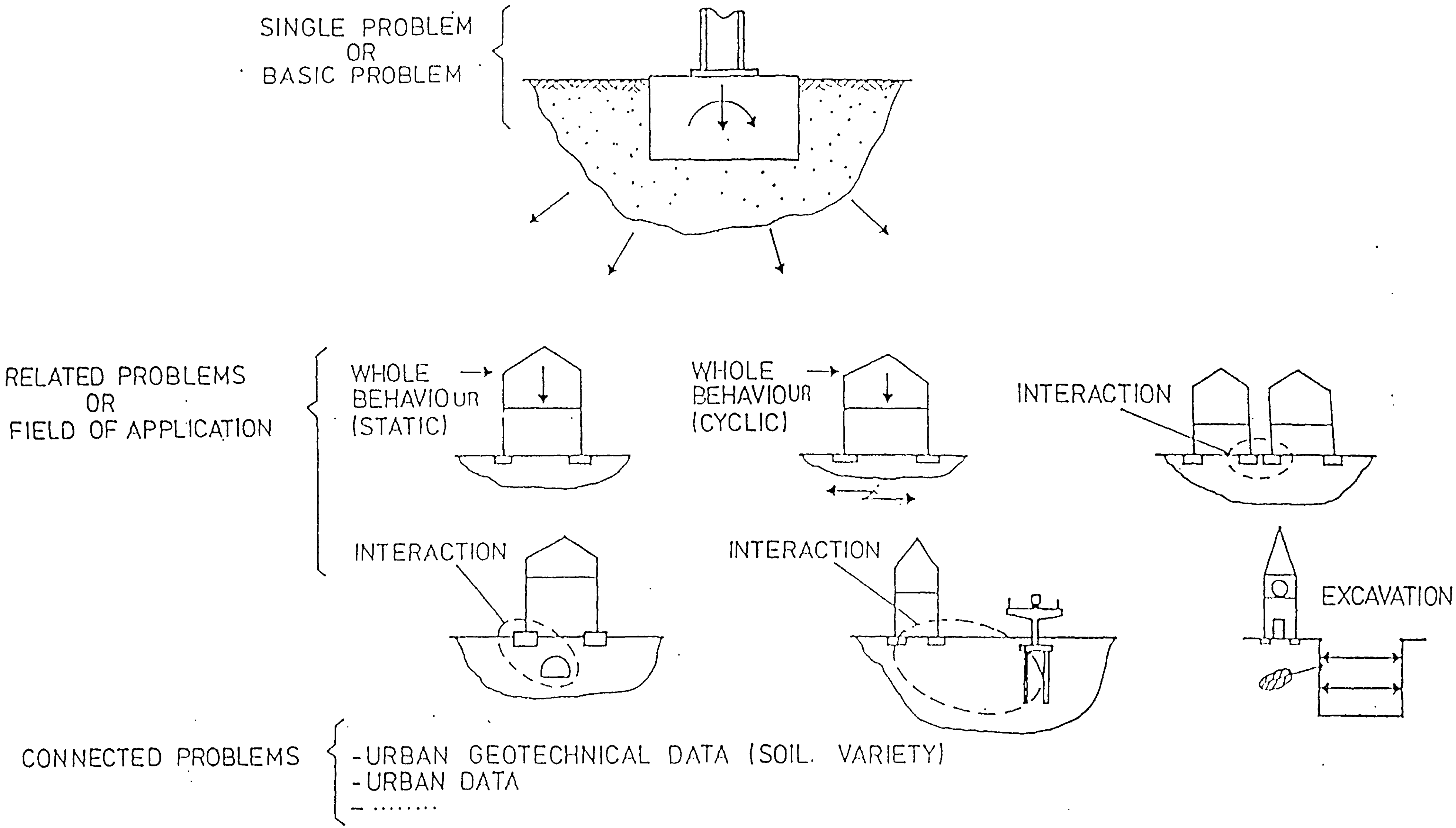

SINGLE PROBLEM
OR
BASIC PROBLEM
RELATED PROBLEMS
OR
FIELD OF APPLICATION
WHOLE
BEHAVIOUR
(STATIC)
WHOLE
BEHAVIOUR
(CYCLIC)
INTERACTION
INTERACTION
INTERACTION
EXCAVATION
CONNECTED PROBLEMS
-URBAN GEOTECHNICAL DATA (SOIL VARIETY)
-URBAN DATA
- ....

Figure 1

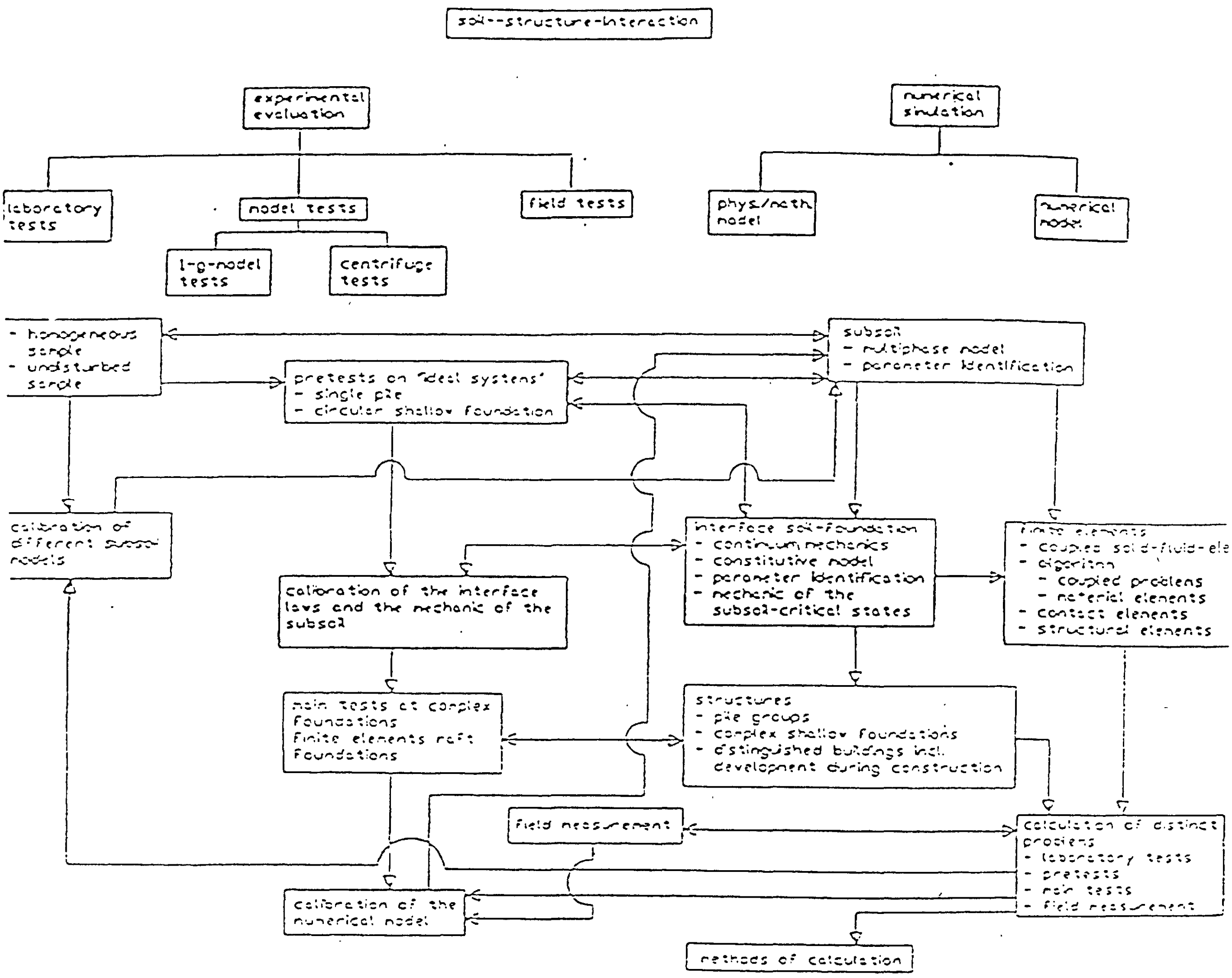

soil-structure-interaction
experimental evaluation
numerical simulation
laboratory tests
model tests
field tests
phys./math. model
numerical model
1-g-model tests
centrifuge tests
- homogeneous sample
- undisturbed sample
subsoil
- multiphase model
- parameter identification
pretests on "ideal systems"
- single pile
- circular shallow foundation
calibration of different subsoil models
interface soil-foundation
- continuum mechanics
- constitutive model
- parameter identification
- mechanic of the subsoil-critical states
finite elements
- coupled solid-fluid-ele
- algorithm
- coupled problems
- material elements
- contact elements
- structural elements
calibration of the interface laws and the mechanic of the subsoil
main tests at complex foundations
finite elements raft foundations
structures
- pile groups
- complex shallow foundations
- distinguished buildings incl. development during construction
field measurement
calculation of distinct problems
- laboratory tests
- pretests
- main tests
- field measurement
calibration of the numerical model
methods of calculation

Figure 2

Phase I and II

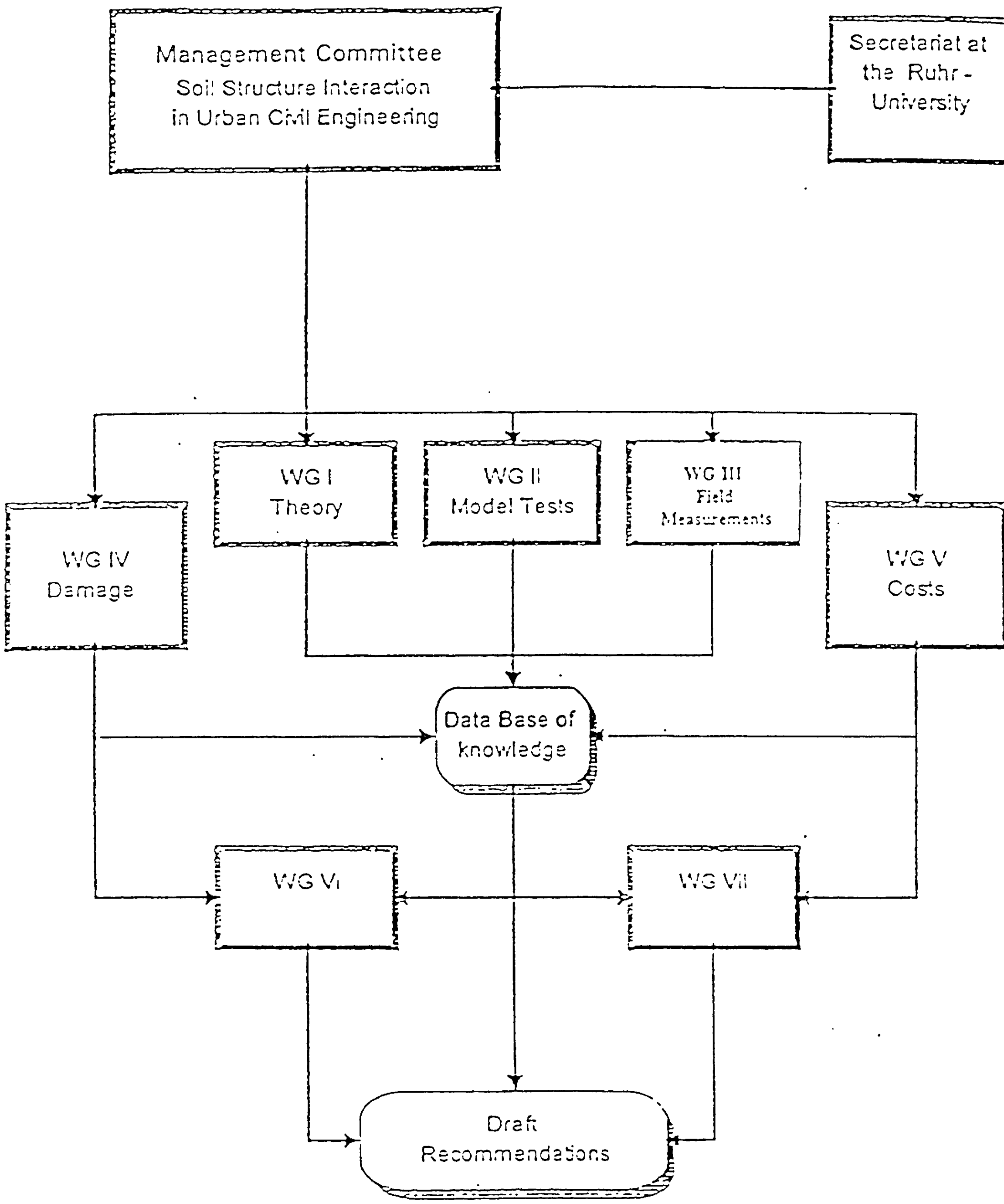


Figure 3.1

Phase III

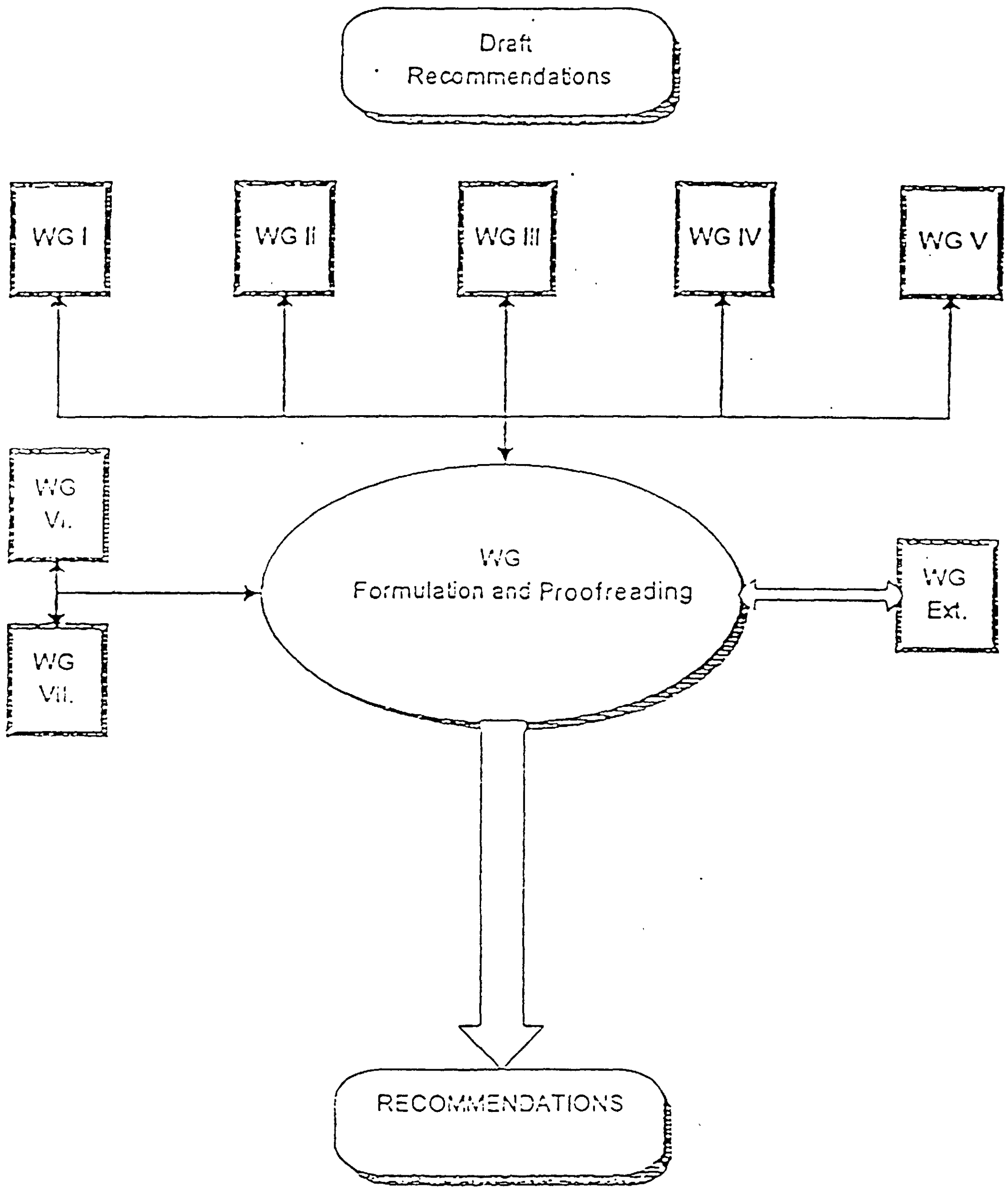
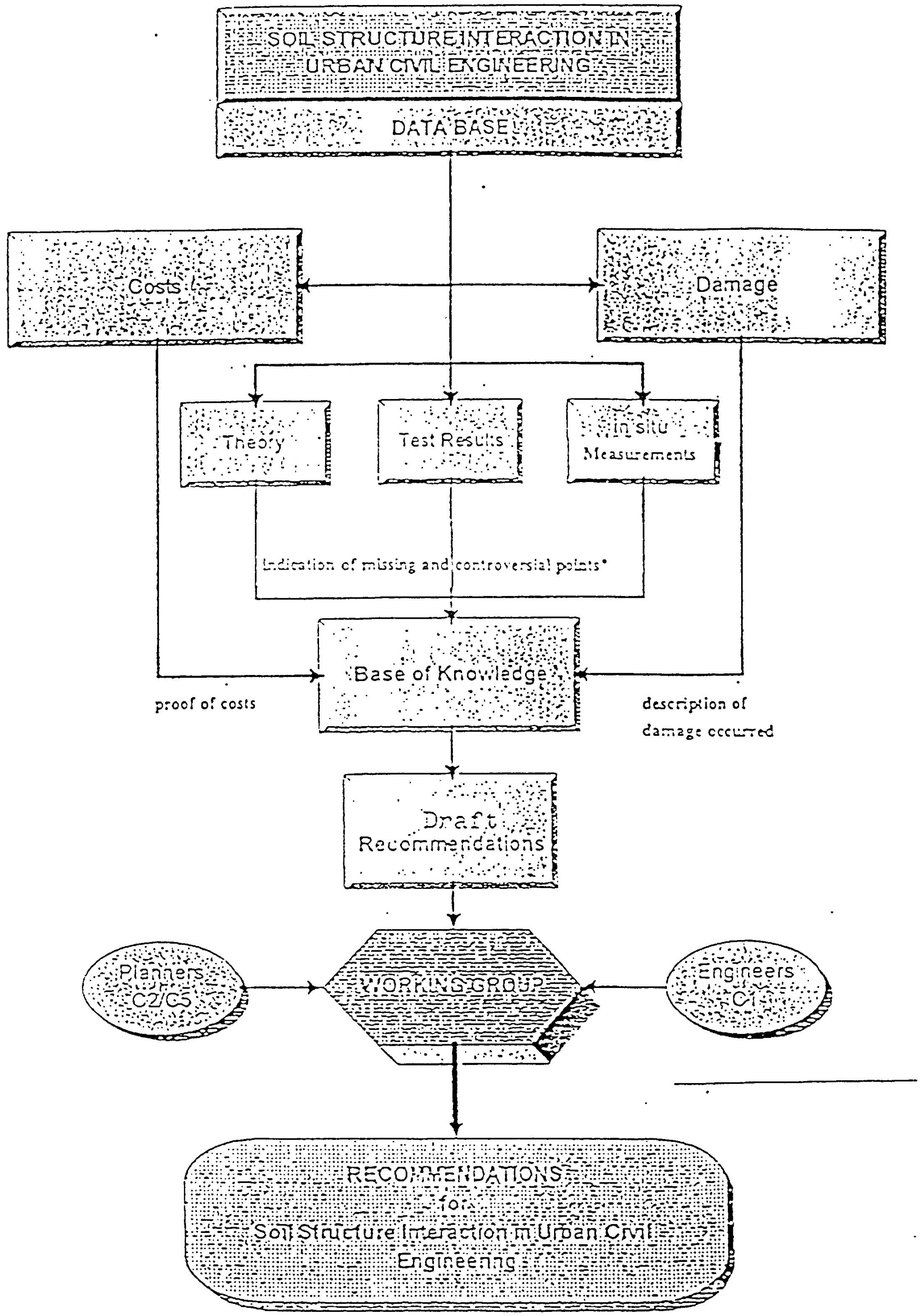


Figure 3.2



*Missing or controversial points have to be filled by national research work under the framework of the COST Action

Figure 4

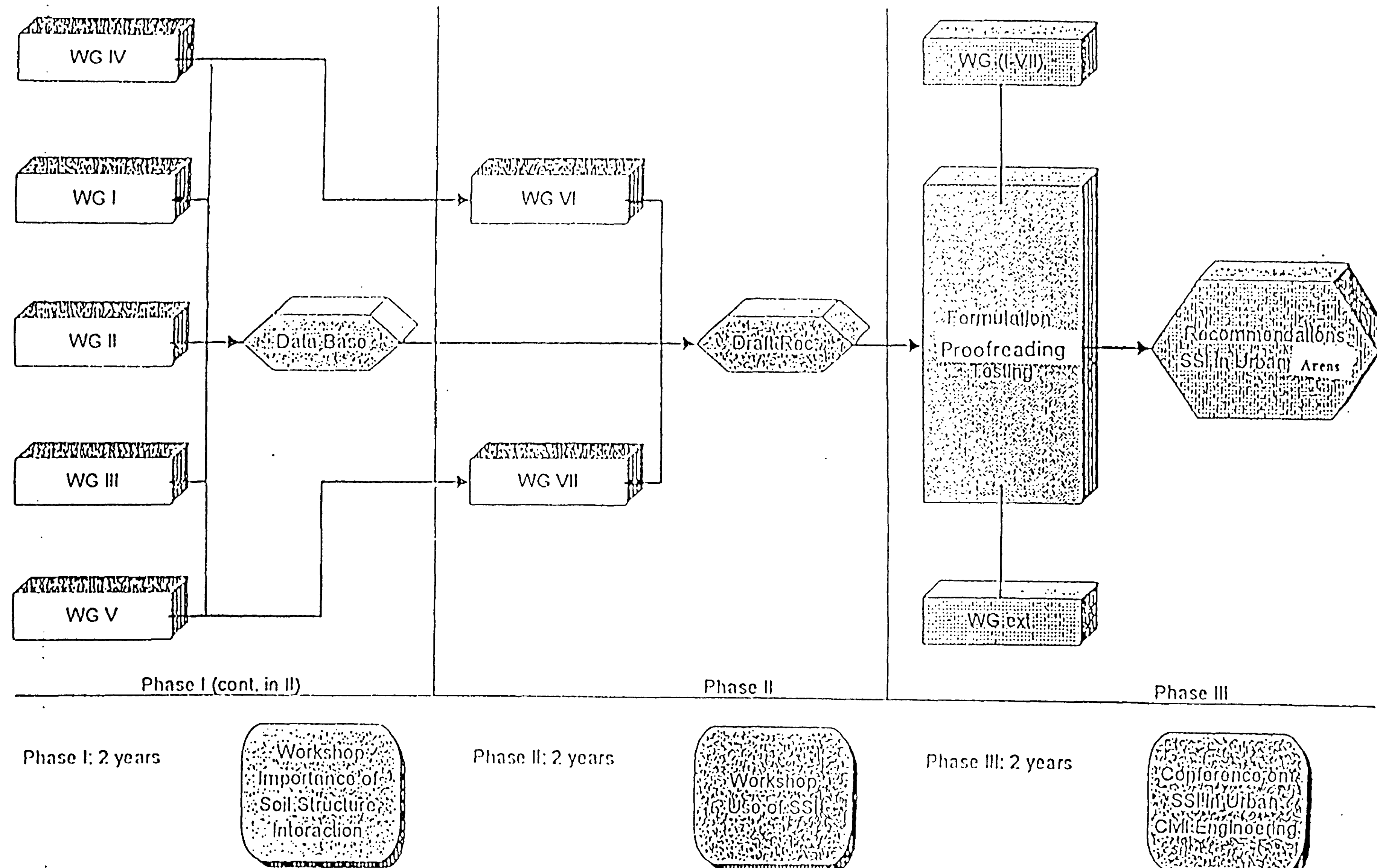

WG IV
WG I
WG II
WG III
WG V
Data Base
WG VI
WG VII
Draft Rec
WG (I-VII)
Formulation
Proofreading
Testing
WG ext
Recommendations SSI in Urban Areas
Phase I (cont. in II)
Phase II
Phase III
Phase I: 2 years
Workshop Importance of Soil Structure Interaction
Phase II: 2 years
Workshop Use of SSI
Phase III: 2 years
Conference on SSI in Urban Civil Engineering

Figure 5

Memorandum of Understanding
for the implementation of a European Concerted Research Action
designated as
COST Action D8
"Chemistry of Metals in Medicine (COMM)"

Date of entry into force of the project : 30.04.1996
Duration : 29.04.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	25.04.96	25.04.96
CZECH REPUBLIC	19.09.96	19.09.96
DENMARK	23.05.96	23.05.96
GERMANY	10.07.96	10.07.96
GREECE	19.06.96	19.06.96
SPAIN	25.04.96	25.04.96
FRANCE	24.07.96	24.07.96
IRELAND	17.10.96	17.10.96
ITALY	24.09.96	24.09.96
HUNGARY	06.09.96	06.09.96
NETHERLANDS	12.09.96	12.09.96
NORWAY	23.04.96	23.04.96
AUSTRIA	17.10.96	17.10.96
PORTUGAL	31.10.96	31.10.96
SWITZERLAND	19.11.96	19.11.96
FINLAND	30.04.96	30.04.96
UNITED KINGDOM	25.04.96	25.04.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to increase knowledge of the chemistry of metals in medicine and to apply this knowledge to the development of novel drugs, novel diagnostic agents, more effective diagnosis and therapy and improvements in health care.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 37 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

ACTION D8

CHEMISTRY OF METALS IN MEDICINE (COMM)

A. GENERAL BACKGROUND

A1. Why a COST Action for this topic

Traditionally medicinal chemistry has been concerned solely with organic chemistry. This situation arose from the belief that living things did not use inorganic chemistry, a subject once thought to be concerned only with inanimate objects (minerals). However in the last 50 or so years it has become apparent that life has an absolute requirement for a wide variety of elements (at last 25). This has led to the emergence of the subject of bioinorganic or inorganic biochemistry as a strong discipline world-wide, and within Europe this has been placed on a firm interdisciplinary footing with the establishment of the COST Action "Coordination Chemistry in the Context of Biological and Environmental Studies" and other developments described below. The success of this programme, which has included, for example, the development of advanced physical techniques for tackling bioinorganic problems and major advances in understanding the active sites of metalloproteins, opens up the way for the exploration of medicinal inorganic chemistry within Europe.

The successful application of bioinorganic chemistry to medical problems requires a concerted effort amongst European scientists in order to allow them to compete with the strong teams in the USA and Japan. There is considerable industrial interest because much of the future emphasis amongst pharmaceutical companies will lie in the discovery of truly novel rather than "me-too" drugs and diagnostic agents. Since much of the inorganic medicinal field, which includes both the essential elements and other elements in the periodic table, is unexplored, the prospects for discovery of such compounds are very high. Success in this area requires wide contacts in a number of fields including pharmacology, microbiology, virology, molecular biology and toxicology. Chemists in a large number of European countries each have a few of such contacts and the establishment of cooperation between them under a carefully-managed COST umbrella will allow them to have a major impact on world science and to pioneer advances in an area which is becoming increasingly important to health care.

A2. Status of Research in the Field

The research field had been emerging strongly over the last few years, with each major bioinorganic conference, workshop and symposium devoting a section to metals in medicine. The field has attracted both main-stream inorganic chemists, organic chemists (who synthesize novel ligands), physical, computational and analytical chemists. The objectives of exploration, understanding, and application are all of importance in this field.

Contributions to the following areas are already evident:

- discovery of anticancer agents (Al, Ga, In, Ti, Ru, Pt, Au, Sn)
- antimicrobial agents (Cu, Zn, Ag, Hg, Bi)
- design of antiviral agents (Li, Pt, Au, W, Cu)
- structures and properties of Bi antiulcer drugs
- antacids (Al, Na, Mg, Ca)

- mechanism of action of antihypertensive agents (Fe, Zn)
- pharmacological use of metalloenzyme mimetics (Mn, Cu, Fe)
- control of iron uptake and metabolism
- relationships between copper uptake, excretion and diseases
- role of metals in gene control (Zn)
- role of mineral deposition and dissolution in disease (Ca, Fe, Sr)
- contrast agents for magnetic resonance imaging (Mn, Gd, Fe)
- Tc and In compounds for diagnostic radio-imaging
- metal compounds in radiotherapy (Re, Y, Pb)
- use of metal compounds in radiosensitization for cancer therapy (Pt, Ru)
- metalloporphyrins and metallochlorins for photodynamic therapy
- discovery of insulin mimetics (Cr, V)

Further targets for research related to health care, discovery and design of diagnostic agents and drugs, the chemical basis of inorganic molecular pharmacology and toxicology, and the interaction of man and the environment, are:

- exploration of physiologically-relevant chemistry of clinically-used drugs
- design and synthesis of novel delivery systems for metal compounds
- kinetic and thermodynamic speciation of metals under physiological conditions
- cellular targeting of metal compounds via ligand design
- use of metalloproteins, metalloenzymes and coenzymes in diagnosis and therapy
- microbial chemistry of metals in relation to medical problems
- exploration of the medicinal chemistry of unusual metals
- metal compounds for genetic regulation
- functional diagnostic agents for magnetic resonance imaging and radio-imaging
- advances in computational chemistry for design and structure-activity relationships
- mineral dissolution and surface chemistry related to diseases and slow-release drugs.

The above list of topics illustrates that many important developments are likely to be stimulated by research in this field. These are of high economic, industrial, social and educational value. Understanding the chemistry of metal ions is central to this programme and is therefore given prominence in this plan for Action.

A3. Relationship with other European Programmes

The significant European interest in this field is exemplified by the success of EUROBIC (e.g. Florence 1994), ICBIC (e.g. Lübeck 1995), EURESCO (San Miniato 1995), and other conferences which have all included significant sections on metals in medicine and have been well attended (up to 1 000 participants). There is also a very high demand for places on research training courses in this area, e.g. MECOM (EUCOR supported by EC COMET), ESF (Louvain-la-Neuve). Existing COST groups within Actions B3 and D1 are complementary to the new Action.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to increase knowledge of the chemistry of metals in medicine and to apply this knowledge to the development of novel drugs, novel diagnostic agents, more effective diagnosis and therapy and improvements in health care.

The objective has some connections with the existing COST Action D1 for which secondary objectives include synthetic analogues of the active centres of metalloproteins, the development of new metal-containing drugs, specific synthesis of organic compounds and molecular recognition of metal ions and ligands. Action D1 has allowed many European workers to make initial contacts in fields related to the new COST Action, which in that respect is a successor to it.

C. SCIENTIFIC PROGRAMME

The Scientific Programme of the Action will be focused on the following five sub-topics:

1. Metallodrugs in clinical use

The objective is to study the physiologically-relevant chemistry of metallodrugs in clinical use within Europe. This will include anticancer (Pt, Ru, Ti), antiarthritic (Au), antimicrobial (Ag, Hg, Zn, Bi), antacids (Mg, Al, Ca), mineral supplements, anti-psychotic agents (Li).

The projects will be concerned with the determination of the structures of the drugs, and chemistry relevant to their formulation and storage, including effects of light and heat. Chemical mechanisms of biological transformations and the role of endogenous biological ligands in pharmacological activity will be investigated. The thermodynamics and kinetics of metal transfer from the drugs onto proteins, DNA, polysaccharides, and lipids (including membranes) will be studied, as well as the chemical implications of combination drug therapy (including combinations of organo- and metallodrugs). The projects will contribute to the optimization of régimes for drug administration, to the minimization of side-effects of therapy, development of rescue agents (reversal or prevention of side-effects), and to understanding the mechanisms of metallodrug action.

2. Radiopharmaceuticals and imaging agents

The research on radiopharmaceuticals and imaging agents will be related to both diagnosis and therapy, especially to the development of functional agents.

The programme will include projects on γ-emitters used in diagnosis (^{99m}Tc, ^{111}Tn) and ß-emitters useful for therapy (e.g. ^{90}Y, ^{212}Bi), as well as contrast agents for magnetic resonance imaging (e.g. Gd, Mn) and X-ray imaging (e.g. Ba). Appropriate design of ligands (including bioconjugates) will allow control of the thermodynamic and kinetic reactivity of the metal ions, targeting to particular organs and tissues, and control of side-effects. It should be possible to design metal compounds which respond to the biological environment and are therefore indicators of biological function, e.g. via the redox state of the metal, protonation of the complex, or enzymatic degradation via suitable linkages in the ligands. The demands of efficient and rapid chemical synthesis of specific complexes of short-lived isotopes, and chemical mechanisms of biotransformations will also be addressed.

3. Metallo-proteins, -enzymes and -prosthetic groups (coenzymes)

The investigation of the medicinal chemistry of metallo-proteins, -enzymes and -prosthetic groups (coenzymes) will be related to the detection and treatment of diseases.

The projects will include studies of the effects on metal binding properties of mutations and chemical modifications of the amino acid residues of metallo-proteins. They will include investigations of the mechanisms of insertion of metal ions and cofactors into apoproteins and consideration of how this chemistry is controlled in vivo. Control of metal binding to metal-activated transcription factors may lead to new drugs for controlling a variety of cellular events. An understanding of how the assembly of metallo-proteins is coded for by DNA, and the development of new methods for the sensitive detection of metallo-proteins and metallo-enzymes may lead to new procedures for use in diagnosis of disease and therapy. The chemical basis for the modification and degradation of metallo-proteins and cofactors in vivo will be investigated. Projects concerned with the design of organic agents targeted on the active sites of metalloenzymes may lead to novel drugs. The potential for the use of cofactors and prosthetic groups in therapy will be considered. Low-molecular-mass metal complexes which mimic metalloenzymes may be useful in therapy.

4. Speciation of metal compounds

This sub-topic will deal with the speciation of metal compounds of medicinal importance.

An understanding of the speciation of metal compounds is central to all studies of metallodrugs. This includes studies of the kinetic and thermodynamic stabilities of metal complexes, and determination of the oxidation state of the metal, the types and numbers of coordinated ligands and their coordination geometry. The enlargement of data bases of stability constants and ligand exchange rates is important. Investigations of the speciation of metal compounds in heterogeneous media such as suspensions of lipids in water, and other media relevant to body fluids, tissues and cells are also important and present a wide range of new challenges. Some projects may be concerned with new analytical methods especially those capable of the determination of speciation at low metal concentrations and in intact biological media. Problems relating to the speciation of metal complexes on supramolecular surfaces such as those of membranes and minerals may be addressed, as well as the relationship between speciation and bioavailability.

5. Design and synthesis of metallodrugs

The sub-topic on design and synthesis of metallodrugs will include relevant areas of computational chemistry and molecular modelling.

The programme will involve the design and synthesis of new drugs for areas of pharmacology for which existing drugs are inadequate, together with exploration of the biological activity of novel metal compounds. Areas of interest include metal compounds with antiviral, antimicrobial, antiarthritic, and anticancer activity, and compounds with specific recognition features, e.g. DNA binding. This will involve the incorporation of specific targeting features into the ligands. There is a need to understand how to design metal compounds with high kinetic stabilities and low toxicities, and compounds which can act as slow-release agents, and pro-drugs which can be activated in vivo by e.g. redox reactions. Some projects may explore the effect of ligand- or metal-based chirality on biological activity. Novel metal compounds may include organometallic and multimetal compounds, metal-derivatized polymers, and compounds with metals in high or low oxidation states. For these, new delivery systems may need to be considered. The exploration of compounds of the less common metals (e.g. some elements of the second and third transition series and lanthanide series) and those with reactive ligands may be profitable. Structure-activity relationships will be established. Metal compounds which are natural products may also offer unexplored potential in therapy.

D. ORGANIZATION AND TIMETABLE

D1. Organization

Research projects fitting in the sub-topics described in section C will be submitted by scientists to the Management Committee members. This Committee will establish contacts between scientists. The organizational structure can be illustrated as follows:

Technical Committee for Chemistry				
Management Committee			Secretariat	
Projects 1	Projects 2	Projects 3	Projects 4	Projects 5 etc.

The Management Committee has responsibilities for:

1. Drawing up the inventory during the first year, organization of workshops and start of the activity; existing contacts (see Section A3) will be used which should greatly facilitate this task.

2. The coordination of the joint activities with other COST Actions; joint meetings are likely to result from this activity.

3. Exploration of wider participation and exchange of information with EC-specific programmes, ESF, etc.

4. The planning of the intermediate report, the final report, and the concluding symposium.

   Progress in each of the projects will also be reported by the respective participants in their own countries within the framework of existing programmes.

D2. Reports

The progress of the programme will be monitored by brief annual reports from each of the participating scientists which will describe the results of research obtained through concertation. A mile-stone report will be prepared by the Management Committee after 3 years of joint activities. The report will be presented to the COST Technical Committee for Chemistry for their review.

A final report will be published to inform non-participating scientists and research workers interested in the results about the scientific achievements of the Action. It is expected that some reviews by participants which describe the progress made and state of the field will be published in International Journals. To conclude the COST Action, a symposium will be held after 5 years which will be accessible to other scientists.

D3. Timetable

The Action will have a duration of five years and comprise the following four stages:

Stage 1: After the first meeting of the Management Committee a detailed inventory of on-going research and existing plans of the participating groups to begin joint projects will be made. This will result in a discussion document which will allow further planning to occur.

Stage 2: It will be evident which projects are closely related and would benefit from joint activities. Researchers (and co-workers) will set up (and continue) joint collaborative projects, and exchange their recent research results. It may be appropriate to explore wider collaboration with other European countries during this stage.

Stage 3: An intermediate progress report will be prepared after 3 years for review by the COST Technical Committee for Chemistry and by the COST Senior Officials Committee.

Stage 4: This final phase will begin after 4 years and will involve the evaluation of the results obtained. It may include the organization of a symposium for all the participants and co-workers.

Total timetable

1996	1997	1998	1999	2000	2001
Start					
Formation of projects					
	Workshop of group leaders				
	Overview available; start meetings; continue meetings on sub-topics				
		Start exploration of wider participation			
			Intermediate Progress Report available for Technical Committee and CSO		
				Start evaluation of results	
					Concluding Symposium

E. ECONOMIC DIMENSION OF THE ACTION

The economic dimension of the Action (initial estimate of total costs = personnel + operational + running) is ECU 37 million.

In total, activities in at least 1 of the 5 sub-topics are on-going in most of the COST member countries.

E1. Personnel costs

The total human effort in the Action amounts to 755 man-years, being equivalent to ECU 32 million.

Estimates of personnel costs (research + administration) are as follows:

Sub-topic 1: in about 18 countries a total of 178 man-years, totalling to ECU 7,6 million.

Sub-topic 2: in about 11 countries a total of 125 man-years, totalling to ECU 5,3 million.

Sub-topic 3: in about 11 countries a total of 59 man-years, totalling to ECU 2,4 million.

Sub-topic 4: in about 15 countries a total of 152 man-years, totalling to ECU 6,4 million.

Sub-topic 5: in about 18 countries a total of 241 man-years, totalling to ECU 10,2 million.

E2. Operational and running costs

The estimate of the total operational and running costs including costs of instruments and materials is ECU 5 million.

E3. Coordination costs

The costs for coordination to be covered by the COST budget are estimated to be ECU 60 000 per year.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
designated as
COST Action E4
"Forest Reserves Research Network"

Date of entry into force of the project : 08.11.1995
Duration : 07.11.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	08.11.95	08.11.95
DENMARK	08.11.95	08.11.95
GERMANY	25.01.96	25.01.96
GREECE	19.12.95	19.12.95
SPAIN	29.11.95	29.11.95
FRANCE	17.04.96	17.04.96
IRELAND	25.04.96	25.04.96
ITALY	15.01.96	15.01.96
HUNGARY	07.11.95	07.11.95
NETHERLANDS	08.11.95	08.11.95
NORWAY	19.02.96	19.02.96
AUSTRIA	16.01.96	16.01.96
PORTUGAL	24.09.96	24.09.96
SLOVENIA	07.10.96	07.10.96
FINLAND	08.11.95	08.11.95
SWEDEN	20.03.96	20.03.96
UNITED KINGDOM	24.09.96	24.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to create a European network of strict forest reserves in order to unify research methodologies and have access to a central data bank for the exchange of research results between the signatory states.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 4 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 3 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST ACTION E4

A. General Background

Importance of forest reserves

Natural and semi-natural forests mainly exist as forest reserves in different European countries. The occurrence of original forest structures has decreased very rapidly during the last centuries. The political forum and the public have become aware of the decline of natural forest ecosystems. International activities underline these facts as well, such as The Earth Summit in Rio de Janeiro, 1992 and The Ministerial Conference on the protection of Forests in Europe in Strasbourg, 1990 and Helsinki, 1993. The efforts are expressed in Resolution S6 of the Strasbourg Conference "European network for research into forest ecosystems" and the Helsinki Resolutions H1 "General guidelines for the sustainable management of forests in Europe" and H2 "General guidelines for the conservation of biodiversity in European forests".

The high degree of biological diversity in these forests, the high potential of genetic variability, their naturalness and uniqueness are important both from a nature conservation point of view, forest management planning and practical silviculture. Research in natural forests and forest reserves indicates the importance of natural development processes for silviculture, and these facts have been acknowledged in many European countries. It has resulted in the growing intention to practice silviculture on a more nature-oriented and biodiversity-oriented basis. Many new terms have found their way into forestry and forest policy, such as "nature oriented silviculture" and multiple-use forestry".

In most European countries strict forest reserves have been established for the purpose of conserving their high natural value. Today, they are the main objects of research based on permanent sample plots. In many cases, there are national networks of strict forest reserves for long-term research. The networks, however, differ a lot in the degrees of their detail, presentation of information and accuracy of the results. This is due to the numerous interpretations of the concept "Forest Reserve". The aims, the number, the formal status and the specific research programs in forest reserves are very diverse in the different European countries.

Therefore, it is of high importance to create a network of strict forest reserves in Europe. This effort fits well within the scope of international scientific and political interest in undisturbed forest ecosystems. The tasks of these actions are true network activities focusing on the development of a common research methodology in strict forest reserves. The results of the action will be of high value to forest management and the implementation of new strategies in practical silviculture.

B. Objectives

The overall objective

The main objective of the action it to create a European network of strict forest reserves in order to unify research methodologies and have access to a central data bank for the exchange of research results between the signatory states.

Therefore, it will be the goal of the COST-action and its partners to combine and standardize already existing methodologies and results of research in strict forest reserves.

The great advantage of a central data bank will offer an excellent basis for further research tasks. It will be possible to carry out joint research activities based on the benefits of a common shared data bank and cooperation network between scientists in many different European countries. These could be for example:

1) the elaboration of computerized models for describing forest structure and dynamics;

2) research on the determination of biodiversity indicators in forests;

3) research on the comparison of structure and biodiversity in managed and unmanaged forest.

This kind of research is already partially executed by several of the countries which have shown their interest in participation. The results of the collaboration between the signatory states will show effects at national and international levels, especially concerning technical, economical, social and environmental issues of forest policy. The research network of European forest reserves and the standardized data will be of high value for the partners and will:

- serve as useful tools for the discussion on forest protection and other multiple-use functions of forests;

- serve as a basis for the improvement of current silvicultural practices;

- demonstrate options for the preservation and/or enhancement of biodiversity in forest management;

- allow the integration of findings (e.g. biodiversity parameters) into forest inventory methods;

- underline the importance of natural disturbances and their meaning for silvicultural management techniques;

- deliver information on restoration management of specific forest areas;

- deliver information on the production of environmentally sound wood and the "Eco-labelling" of forests and forest products.

C. The scientific content of the action

The main activities of the COST-action are divided into three sub-items. The duration of the COST-action is estimated to be 3 years. In general, the following activities will take place jointly in all signatory states:

- liaison with appropriate scientists, forming a common research team;

- research conferences and workshops and publications of proceedings;

- publication of general guidelines for permanent plot sampling;

- exchange of research results, resulting in a central data bank;

- exchange of researchers between cooperating institutes.

The work will be divided into three working groups according to the three sub-items. Each will consist of members of the participating countries. In the first working meeting the researchers will discuss various subjects, and the research aspects of special importance will be identified in more detail, including a detailed time schedule (compare Appendix D1 and E1).

Sub-item 1 (Working Group 1): Creation of a network of strict forest reserves used for permanent plot research

Background:
Today, most European countries have established strict forest reserves. The goals, the status and the type of research varies a lot. Most reserves, however, are non-intervention areas and are used for research. In countries with no official forest reserves program there are well protected forest areas where the spontaneous forest development is monitored. They may be included in the actions as well.

Objectives:
A network of strict forest reserves in Europe which are being used for long-term research (or other protected non-managed forest areas used for long-term monitoring) will be set up by the participants. The reserves in the network will be equally divided according to the various vegetation zones and forest types in Europe. Data will be stored in a central data bank giving detailed information on the location, specific characteristics etc. on the selected forest reserves.

Scientific content:
The creation of a network of forest reserves will serve as a permanent and very important basis for future actions. The existence of a complete review on the research plots in the individual reserves will offer scientists numerous possibilities for further research activities.

Sub-item 2 (Working Group 2): Establishment of a common sampling plot technique

Background:
Today most research efforts in forestry are focusing on sites, site-factors and their management possibilities. Only about 5 – 6% of total labour input deal with structure, dynamics and performance of ecosystems, with nature conservation and management of protected areas.

In 1992, a European scale review on ongoing research of forest reserves was carried out by IBN-DLO, the Netherlands. The review was accomplished in the form of a questionnaire on the research concerning forest reserves. In 1994 an EFI Working Paper was published entitled "Forestry research on structure, succession and biodiversity of undisturbed and semi-natural forests and woodlands in Europe". It showed that many European countries have research programs in strict forest reserves using permanent sample plots mostly at national or at the local level. In general the measurements in the plots correspond to internationally used or wide-spread measurement standards (IUFRO-codes, FAO-guidelines etc.). The sizes, types and densities of grids of the permanent sampling plots, however, vary widely according to accuracy, research questions or the capacity of qualified personnel.

Objectives:
It will be the task of working group 2 to create a standardized, European sampling plot technique, based on the various methodologies used in forest reserves research in Europe. This will be supported by the questionnaire accomplished by IBN-DLO and further, additional studies. The sample parameters will be clarified by defining a minimum of common parameter sets in existing monitoring data. This will lead to a set of parameters composed of existing common assessed forest ecosystems indicators which can eventually be supplemented by additional parameters, which are easy to measure and are acceptable for all involved countries.

Scientific content:
Without a common research methodology it will be almost impossible to exchange and compare the results of research in forest reserves. The scientific value of this action will be of main importance for the sub-item 3, the date exchange between countries. At present the lack of an approved uniformity in methodologies prohibits important conclusions on the effects of forest management and conservation at a pan-European level.

Sub-item 3 (Working Group 3): Onset of a central data bank for research results in strict forest reserves

Background:
All countries executing a research program on long term monitoring of strict forest reserves have individual methods for storing and managing data of strict forest reserves. Together with the various sampling plot techniques it prohibits a useful and efficient exchange of data between institutes and countries. The practical significance of such an exchange, however, could be increased progressively at an international level by creating a general forest reserves data-bank.

Objectives:
Working group 3 will establish a central data bank where all research results of the strict forest reserves included in the network will be stored and managed. This includes existing data and future results. The findings will be freely available for all cooperating institutes.

Scientific content:
A central data bank offers opportunities for studying changes in structure and dynamics of undisturbed forests in a broader sense. It allows comparison of the development of various forest types in different vegetation zones, including the effects of natural disturbances. In combination with other research activities e.g. the effects of forest management, or the determination of biodiversity indicators can be studied. This offers possibilities for maintaining the quality and biodiversity of European forests criteria for nature conservation can be formulated including the assessment of improved forest management practices. This will lead to more sustainable timber production taking into consideration the ecological conditions.

D. Timetable

The project is estimated to last three years. Each phase of the project represents one year according to Appendix D1. The tasks are assigned to the individual working groups. It is also indicated in which way the project results will be presented during the lifetime of the project.

E. Organization, management and responsibilities

All participants will have scientists in each individual working group. It is planned to appoint 2 researchers (Senior scientist, junior researcher) for tasks 1 and 2 as they involve a high labour input.

Task 3 will be completed by one junior researcher assisted by a senior scientist.
Each working group will be chaired by a Coordinator. They are elected by the Management Committee. The Coordinators of the working groups would meet twice a year. If the ongoing progress of the project makes it necessary they would have additional meetings.

The three working groups will organize two joint annual meetings. Two annual meetings will be held by each individual working group.

The individual working groups will deliver annual progress reports. It is planned to produce a mid-term review summarizing the present state of the actions. A final report will consist of 3 separate reports presenting the findings of each working group. It will contain results on:

- the actual state of the network of strict forest reserves,

- the general, harmonized sampling plot technique for strict forest reserves,

- the general data bank and the procedures for compiling and managing the incoming data.

The report will give recommendations for further research activities. It will highlight the benefits of a common data bank and application possibilities to forest management.

It is intended to publish the results in international scientific journals and other suitable publications together with the other participants.

F. Economic dimension of the action

The costs of the project are based on the average figures for COST countries from 1993:

–	For one person/year category A:	Senior scientist,	ECU 60 000
–	For one person/year category B:	Technician,	ECU 40 000
–	For one person/year category C:	Junior scientist Secretary	ECU 25 000

The running/operational costs have been estimated to be 12% of the acquisition costs. The coordination costs are to be covered by the COST budget of the Commission.

The estimated costs of the COST-action will amount to approximately ECU 4 million (kECU 4 000). The coordination costs including the expenses for travelling, seminars, translations, publications, workshops etc. are estimated to be approximately ECU 200 000 (kECU 200).

Table 1: cost breakdown for each individual participant and the estimated costs in ecu

Personnel	Man Months/ 1 year (3 years)	Phase 1 (year 1)	Phase 2 (Year 2)	Phase 3 (Year 3)	TOTAL
Working Group 1					
Senior scientist	2 (6)	10 000	10 000	10 000	30 000
Junior scientist	6 (18)	12 500	12 500	12 500	37 500
Secretary	2 (6)	4 200	4 200	4 200	12 600
Working Group 2					
Senior scientist	3 (9)	15 000	15 000	15 000	45 000
Junior scientist	6 (18)	12 500	12 500	12 500	37 500
Secretary	2 (6)	4 200	4 200	4 200	12 600
Working Group 3					
Senior scientist	1 (3)	5 000	5 000	5 000	15 000
Junior scientist	6 (18)	12 500	12 500	12 500	37 500
Secretary	2 (6)	4 200	4 200	4 200	12 600
Running/operational costs		15 000	15 000	15 000	45 000
TOTAL	30 (90)	95 100	95 100	95 100	285 300
Total 12 countries	360 (1080)	1 141 200	1 141 200	1 141 200	3 423 600
Running/operational costs for 12 countries		180 000	180 000	180 000	540 000
Coordination costs		60 000	60 000	60 000	180 000
GRAND TOTAL		1 381 200	1 381 200	1 381 200	4 143 600

Flow chart of the work tasks and possibilities of application

DATA BASE
Strict Forest Reserve

TASK 1
Creation of a network of strict forest reserves used for permanent plot research

TASK 2
The establishment of a common sampling plot technique

TASK 3
Onset of a central data-bank for research results from strict forest reserves

POSSIBLE APPLICATIONS

- Common basis for joint research efforts in strict forest reserves
- Data base for more nature and biodiversity oriented silviculture
- Tools for nature conservation and forest policy issues

Memorandum of Understanding
for the implementation of a European Concerted Research Action
designated as
COST Action E5
"Timber Frame building systems"

Date of entry into force of the project : 08.11.1995
Duration : 07.11.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	01.02.96	01.02.96
DENMARK	08.11.95	08.11.95
GERMANY	06.03.96	06.03.96
GREECE	30.10.96	30.10.96
SPAIN	08.11.95	08.11.95
FRANCE	17.04.96	17.04.96
IRELAND	25.04.96	25.04.96
ITALY	15.01.96	15.01.96
NETHERLANDS	08.11.95	08.11.95
NORWAY	19.02.96	19.02.96
AUSTRIA	31.10.96	31.10.96
PORTUGAL	31.10.96	31.10.96
SLOVENIA	07.11.96	07.11.96
SWITZERLAND	19.11.96	19.11.96
FINLAND	08.11.95	08.11.95
SWEDEN	01.02.96	01.02.96
UNITED KINGDOM	08.11.95	08.11.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to facilitate efficient co-operation in the conduct of research and in the exchange of information between interested parties in the European countries concerning timber building systems.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at 45 MECU at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST E5

TIMBER FRAME BUILDING SYSTEMS

1. General background

There is a great need in many countries to increase productivity and competition in the building sector. One way to achieve this could be to develop and strengthen the position of light-weight timber frame building systems on the market. Experience from North America and some European countries indicate that it is possible to reduce the cost of low to medium rise (2-7 storeys) buildings significantly by using light-weight building systems based on timber and panel products. These systems have the advantage of simple construction techniques at the building site and very short construction times can be achieved. Among other advantages, it should be noted that timber is an environmentally friendly, easily recyclable material, useful in that it stores carbon dioxide, which will be increasingly important for future competitiveness. An increased use of timber in the building sector will also lead to a more efficient use of European forest resources and stimulate the economy in the forest sector, a matter of great importance for rural areas.

Whereas timber frame building systems have a dominating position in North America, the situation in Europe as a whole is quite the opposite. Due to prescriptive fire regulations and strong building traditions, concrete, steel and brick are historically the major structural materials for residential housing in Europe. There is, however, a long experience with timber frame buildings for low rise buildings (mainly single residential houses) in the Scandinavian countries, UK and to some extent in other European countries such as Germany, Austria and Switzerland. New performance based fire regulations are now being introduced in many countries, a development which has been stimulated by the European harmonization of codes and standards. This makes it possible to use timber as a structural material also for multi-residential, medium-rise buildings. There is a clear potential to develop timber frame building systems as a cost-effective alternative to other types of building systems, which would increase competition on the European building markets to the benefit of consumers.

Differences in buildings traditions, market requirements and other boundary conditions makes it impossible to copy technology, construction methods and design from North America into the European markets. As with any new and largely untried form of construction, there are technical issues which need to be resolved. These relate to methods of design, construction and performance, which are currently addressed on a rather ad hoc basis, with no real mechanism in place to ensure consistency of approach. There is widespread concern amongst the industry and regulatory authorities that methods do not exist to demonstrate common rules for safety and performance, which, if left unresolved, will prevent significant growth of this market. Therefore, significant R&D efforts are needed to solve various strategic problems associated with light-weight building technology, especially for medium-rise buildings.

Such R&D activities, dealing with e.g. stability, fire, acoustics, serviceability requirements, heat insulation and construction methods, are undertaken in a number of countries in Europe at the moment, with close collaboration between industry, research institutes and universities. As an example, an internordic research programme, involving six experimental housing projects and a number of research projects in four different countries, has recently been started. In the UK, a feasibility study has been carried out on five-storey buildings already constructed. A proposal has been approved to construct a five-storey building for testing in the Cardington laboratory of Building Research Establishment.

2. Objectives

The purpose of this COST action is to facilitate efficient cooperation in the conduct of research and in the exchange of information between interested parties in the European countries concerning timber building systems. The emphasis is placed on systems, i.e. from the researchers' point of view the activities are to a great extent interdisciplinary. The target group for the activities should be professionals from research institutions as well as from relevant industries, such as building companies, designers and manufacturers of timber components as well as timber suppliers. The expected benefits from the COST Action are:

- More effective sharing of research results
- Transfer of knowledge between European research institutions
- Transfer of knowledge between research and practice
- Initiation of collaborative research programmes on a European basis
- Initiation and support of interdisciplinary research activities
- Development of new market outlets and added value for European timber resources
- Stimulation of joint ventures on a commercial basis between European companies in the building sector and in the timber producing sector.

3. Programme of the Action

Type of activities

Tentatively, the following activities may be considered to achieve the objectives:

- organization of workshops, conferences, seminars, site visits etc.
- exchange of researchers and specialists
- exchange of publications and documentation
- state of art reports, workshop proceedings and practical guidelines may be jointly published under the umbrella of the COST Action
- joint projects in specific areas may be launched by two or more of the participants in the action.

Scientific areas

The scientific field to be covered by the action should be directly related to the development of timber frame housing systems. The relevant research issues are grouped into the following main areas:

- safety and structural stability
- serviceability of elements and systems
- interdisciplinary system aspects.

Safety and structural stability

In general, research aimed at a better control of engineering properties of timber materials, elements and systems. Due to its natural variability, the reliability of structural timber is often questioned and since wood is a combustible material the fire safety of structural timber elements and systems has to be demonstrated in a convincing way.

Specifically, priority is given to research dealing with

- re-evaluation of fire safety principles for whole buildings employing modern methods of risk analysis
- structural fire resistances of building components containing wood
- disproportionate collapse
- stabilization of timber framed buildings against actions of wind and earthquake
- wind shielding factors of masonry cladding.

Serviceability of elements and systems

Research concerning serviceability aspects of light-weight timber frame building systems, such as sound and vibration performance, as well as dimensional stability under action of moisture variations and external loads. For lightweight structures it is difficult to ensure a good sound insulation, particularly in respect of impact sound on "floating floors". Shrinkage and swelling of wood due to variations in moisture have to be mastered to ensure dimensional stability in structural components and in building systems during construction and use.

Specifically, priority is given to research dealing with

- acoustical properties of light-weight timber floor and wall elements
- control of floor vibrations
- behaviour of wood-based components under environmental variations
- shrinkage and compression under concentrated loads perpendicular to grain.

Interdisciplinary system aspects

A significant part of the activities will be devoted to optimization of the integrated performance taking into account all relevant technical requirements on components and systems. In this context the following aspects of the building system will also be addressed:

- efficiency of different construction methods on site involving various degrees of prefabrication

- performance and design of composite structural elements, e.g. concrete and timber in combination

- construction costs and other economic aspects

- design of the building envelope, which should provide thermal insulation, prevent air leakage and damage from internal and external moisture exposure.

Important elements in dealing with system aspects are the experiences gained from a number of construction projects which are under way in various countries in Europe. Activities will be arranged to communicate such experiences among the participants in the programme, as far as competition between companies allows such communication.

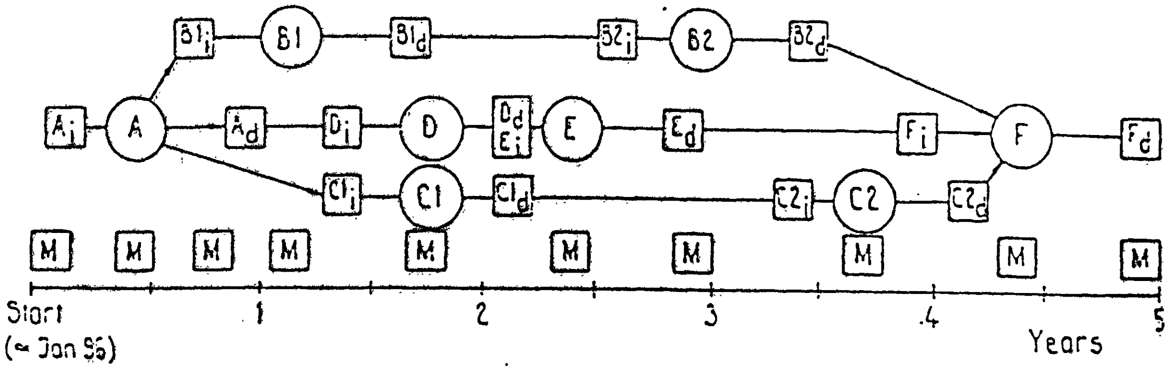
4. Time-table

The duration of the action is 5 years. The time schedule for various activities is displayed in Fig. 1. The contacts among researchers generated by the action is expected to lead to exchange of researchers between laboratories. The total number of exchanges can be estimated to about ten during the five year period. Most of these are expected to be of short duration, i.e. maximum 2 weeks.

5. Organization, management and responsibilities

The Action will be lead by a management committee (MC), which will simultaneously have the role of a technical and research committee. The MC is responsible for all decisions about activities and initiation of them. Responsibility for detailed planning, execution and documentation of each individual activity is delegated by the MC to a task force, which normally may be established within one country for one specific task. The task force is lead by a person appointed by the MC. The responsibility of the task force ceases when the activity is completed.

The activities within the COST action is related to several research programmes and other activities known to be pursued during the time span of the Action. In Scandinavia a cooperative research programme is running from 1995 to 1997 with a possible extension beyond 1997. In the UK a five-storey timber frame building will be built for testing at the BRE full scale test facility in Cardington. Researchers will be invited from other European countries to participate and/or design their own test programmes in this project. A Eureka initiative dealing with related problem areas has recently been initiated by Austria. It is expected that people responsible for these programmes will take active part in the Action.



LEGEND

A:	General starting meeting to establish the current state of technology and state of research in the field. Combined with site visit(s).
B1, B2:	Workshops 1 and 2 related to safety and structural stability.
C1, C2:	Workshops 1 and 2 related to serviceability of elements and systems.
D:	Workshop dealing with interdisciplinary system aspects including presentation of results from a large internordic research programme. Combined with site visits.
E:	Workshop dealing with interdisciplinary system aspects including presentation of results from full scale test programme in UK.
F:	Workshop to establish state of technology and state of research as well as general conclusions achieved through the Action.
M:	Meeting of the management committee.
Indices:	i = distribution of invitations to an activity d = completion of documentation from an activity

Fig. 1: Time table for activities within the Action

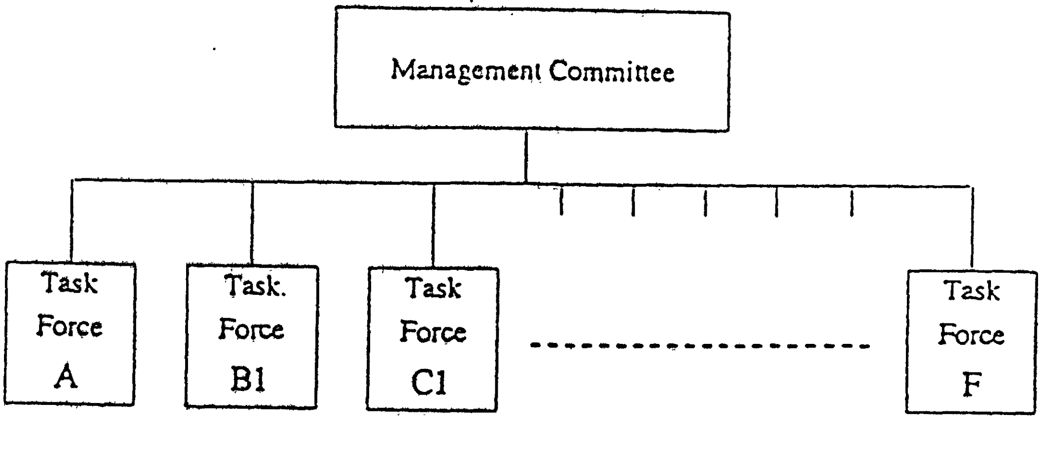


Fig. 2: Organization plan

6. Economic dimension of the Action

The turnover of the research and development subject to coordination and cooperation within the Action is estimated at 9 MECU per year. This figure is based on estimates made of the activities in various European countries according to Table 1.

Table 1: Estimates of the economic dimension of the Action in European countries

Country	Turnover MECU/Year
Austria	0,75
Denmark	0,5
Finland	1,0
France	1,0
Germany	1,0
Ireland	0,25
Italy	0,25
Netherlands	0,25
Norway	0,5
Sweden	1,50
Switzerland	0,5
United Kingdom	1,0
Others	0,5
TOTAL	9,0

Initially, the following countries can be expected to participate in the Action:
United Kingdom, Italy, the Netherlands, Austria, Germany, France, Denmark, Finland, Norway and Sweden.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
designated as
COST Action E6
"Eurosilva : Forest tree physiology research"

Date of entry into force of the project : 27.10.1995
Duration : 26.10.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	25.10.95	25.10.95
DENMARK	25.10.95	25.10.95
GERMANY	25.01.96	25.01.96
GREECE	27.10.95	27.10.95
SPAIN	25.10.95	25.10.95
FRANCE	17.04.96	17.04.96
IRELAND	25.04.96	25.04.96
ITALY	15.01.96	15.01.96
NETHERLANDS	25.10.95	25.10.95
NORWAY	19.02.96	19.02.96
AUSTRIA	20.03.96	20.03.96
PORTUGAL	31.10.96	31.10.96
SLOVAKIA	15.11.96	15.11.96
SLOVENIA	11.11.96	11.11.96
SWITZERLAND	19.11.96	19.11.96
FINLAND	08.11.95	08.11.95
SWEDEN	01.02.96	01.02.96
UNITED KINGDOM	21.02.96	21.02.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to combine and exchange methodologies and results and to share the different approaches of tree physiology in order to better understand and maintain a sustainable production of wood in a way which has to be compatible with a fair management of the forest ecosystems.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 42 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST E6

EUROSILVA: FOREST TREE PHYSIOLOGY RESEARCH

Content:

A. General background

The lack of knowledge of tree physiology is still considered a major bottleneck for mastering sustainable management and conservation of forest ecosystems.

Several reasons may account for this situation, for example:

- the problem of scale and changing of scale, ranging from the molecular and cellular level, to organ, single tree and tree population;
- the particularities of trees versus other plants: longevity, maturation processes, internal transfer of nutriments, long term effects of stress factors, etc.;
- the complexity of forest ecosystems especially in terms of interactions between biotic elements and environmental factors.

In general, knowledge of tree physiology is far behind physiology of annual plants, and especially agricultural crops. Faced with such difficulties and particularities, and because of the limited number of scientists involved in forest tree physiology in the different countries, networking appears very necessary.

In fact, looking back over the last ten years, political or technical conferences dealing with regional or global forestry issues have consistently repeated that more research should be done on tree physiology. One major outcome of the SILVA governmental Conference in Paris (1986) was the launching of a cooperative research project on tree physiology between Germany and France called EUROSILVA. Subsequently (1991), it became part of the programme EUREKA as EUROSILVA-EUREKA No 447; it ended in late 1994. At the Ministerial Conference on Forest Protection in Europe (Strasbourg 1990), 29 signatory countries committed themselves to strengthening tree physiology research on a national and international basis through better coordination: this was the core of Resolution No 5 again called EUROSILVA. This commitment was confirmed at the subsequent conference in Helsinki in 1993.

The efforts to implement Resolution No 5 have been successful in many respects:

- through EUREKA/EUROSILVA, a good network between German and French laboratories involved in tree physiology exists, with some contribution by Swiss and Czech laboratories;

- the results are very attractive to other countries;

- moreover three meetings were held in 1994 (Paris (France)) in January, Birmensdorf (Switzerland) in May and Dourdan (France) in November, in order to prepare and agree on the man lines of a possible COST cooperative research programme.

In other words, a COST project on tree physiology research could be launched very soon since all the preparatory work has been done. Owing to the action of the present EUROSILVA structures everything is ready for that purpose. This COST Action would allow an extension of the activities of the existing European EUROSILVA network and would extend very efficiently the research on tree physiology throughout Europe.

B. Objectives of the Action

The main objectives of this COST Action will be, through the network, to combine and exchange methodologies and results and to share the different approaches of tree physiology in order to better understand and maintain a sustainable production of wood in a way which has to be compatible with a fair management of the forest ecosystems.

The scientific fields to be covered will mainly deal with physiological mechanisms involved at different stages of the life of forest trees. They include:

Mechanisms of tree growth and development
Stress physiology mechanistic bases for critical levels
Tree nutrition processes
Water balance and hydraulic properties of trees
Interaction processes between trees and other organisms (microorganisms, insects...)

The Action will innovate in that, besides classical physiological approaches, it will stimulate the application of molecular biology and other new methods to tree physiology. Special training courses will be offered for this purpose. Multidisciplinary approaches will be particularly favoured.

C. Scientific content of the Action

C.1. Common research teams

Physiology covers a broad range of areas which are very often interacting; therefore it is suggested that the EUROSILVA network be organized under a common frame. After the discussions organized in 1994 between the scientists of 13 different countries, the main areas can be summarized under five major directions that form the nucleus for common research teams:

(a) Growth and development

They are of paramount importance for obvious reasons if one refers to primary production which is still one of the major functions of forest ecosystems. A particular attention will be given to cell wall development, lignification processes and heartwood formation in normal conditions and under stress. These are key points for the elaboration of wood quality. The comprehension of juvenility and maturation processes, very specific to woody perennials, is another crucial point in view of mastering promising reproductive methods such as somatic embryogenesis or micropropagation. They are also determinant for mass propagation through classical vegetative systems. The cellular and molecular bases of plant regeneration would also be investigated. Finally seed dormancy physiology as well as storage physiology requires more attention for improving seed management and developing adequate gene conservation systems.

(b) Tree nutrition

It is also considered a major theme since forest soils are sometimes deficient in some nutriments, and because they are exposed to atmospheric depositions of various elements. In addition, carbon nutrition in the context of the increasing carbon dioxyde rate will also be considered. Mycorhizae as an essential symbiosis involved in nutrition processes will be investigated by looking at the molecular basis of mycorhization and the mycorhizae function in tree nutrition; their regulation by environmental factors and biotic factors (preexisting soil microorganisms as potential antagonists of inoculated strains). Economy of carbon and nitrogen, as major components of tree nutrition, should also be addressed. In this respect, the changes in carbon and nitrogen allocation in trees as a response to an increase in carbon dioxyde atmospheric rate could receive special attention.

(c) Water relations

Water is one of the most limiting factors of forest productivity from the transplantation stage to the mature stage. Therefore a strong emphasis must be put on this part of the physiology in trees. Even if there are still a lot of uncertainties in the rainfall regimes in the context of a possible "global change", we must anticipate by acquiring better knowledge on water relations. Emphasis will be put on water use efficiency in trees by looking at its genetic and environmental determinism. Stomatal regulation in relation with hydraulic architecture in response to environmental constraints would also be covered. In this respect all the aspects related to cavitation or suchlike will be considered.

(d) Physical stress factors

Factors such as drought, high temperature, cold and freezing, atmospheric pollutants, increased UVB require to be more investigated in terms of physiological impact on tree response. This would also include acclimation processes to these factors. Genetic engineering could be explored in model experiments as a way to counteract certain stressors.

(e) Pests and disease

They are potential threats for the sustainability of European forests, especially in a changing environment. It is proposed to look more closely at tree/pest and/or disease interaction and defence mechanisms in trees. Genetic engineering will also be considered as a potential tool to enhance resistance.

For all these topics a good knowledge of the biology of the species should be combined with the most modern methodologies in biochemistry and molecular biology. Some recent breakthroughs in the field of gene expression in relation to lignin synthesis encourage these approaches. On the other side giving access to the partners of the action to some forest experimental plots especially designed by other partners for ecophysiological studies should be another objective of this COST Action.

Finally it is intended that the COST project, even dealing with necessary basic research should be targeted towards practical applications for forest management and/or conservation. It is also quite clear that the topics listed above could be modified after discussion, especially in order to make them even more focused or concentrated.

C.2. Workshops and training courses

The different scientific topics mentioned above are in fact very interactive in the physiological processes in trees. It has been the experience of the four countries involved in the former EUREKA EUROSILVA project that common general workshops for the scientists involved in these different fields are very profitable and have generated unexpected collaboration and beneficial cross-fertilization. Thus, with all the new countries, such a general workshop (at least 60 participants) should be necessary during the first year and repeated at least at the end of the action. Through a preliminary call for identifying the different teams, it would allow the definition and composition of collaborating working groups which might, later on, have some independent activities such as coordination of ongoing research work and specialized workshops (20 to 30 scientists) or seminars. The working groups are likely to fit with the different areas defined in paragraph 3. A workshop for each working group should be planned every other year which means about two such specialized workshops every year (see timetable).

It is also suggested that international training courses for a limited number of participants (10 to 15) from different countries and laboratories could be organized by such working groups, especially to introduce and develop new concepts and new technologies in laboratories where they are not yet used.

C.3. Exchange programme

It is clear that exchanges which allow the scientists, especially the younger ones, to become acquainted with the laboratories, colleagues, and research techniques in other countries are the basis of durable strengthening of the network. They should be encouraged through short term exchanges and prospecting for external funding for long term exchanges.

Under the responsibility of the chairperson, a scientific committee for the Action should be organized with experts for the different areas. It will discuss the proposals made by the working groups for the workshop training courses and training courses and the exchange programme.

C.4. Other aspects

The participating laboratories are, in most cases, likely to be already involved in research in tree physiology and, in this respect, already partially financed for their research. However, a COST Action could help in coordinating this ongoing research work and, through very dynamic working groups, it should stimulate responses to calls for offers from different granting national or international agencies, thus promoting specific common research projects.

Within the COST Action it is also proposed to establish a specific Directory for forest tree physiology research in the participating countries. It would include the name of the laboratories and scientists, research fields, techniques used and facilities available. Besides a stimulation of publications in international scientific journals, COST may also allow financing of proceedings or guidelines for specific fields. The final results of the Action will be published as a book.

D. Timetable

Implementation of the Action would require 5 years. Several preparatory meetings have already taken place and additional ones are not required.

Year 1:

1. First Management Committee meeting and election of the chairperson and a deputy chairperson.
2. General workshop: "State of the art in forest tree physiology" (about 60 participants), final definition of the working groups, election of the working group leaders.
3. Definition of coordinated research-work in each working group.
4. Launching of the exchange and training programme.
5. Call for information for a specific Directory for forest tree physiology research in the participating countries.

Year 2:

1. Second Management Committee.
2. Specialized workshops (20 participants each) for 2 of the working groups.
3. Possibly, training course for one working group.
4. Follow up of the coordinated research work.
5. Exchange programme.
6. Edition of the abovementioned Directory.

Year 3:

1. Third Management Committee, especially devoted to the mid-term evaluation of the action.
2. Specialized workshops (20 participants each) for the other 2 or 3 working groups.
3. Possibly, training course for one other working group.
4. Follow up of the coordinated research work.
5. Exchange programme.

Year 4:

1. Fourth Management Committee.
2. Specialized workshops (20 participants each) for 2 or 3 working groups.
3. Follow up of the coordinated research work.
4. Exchange programme.

Year 5:

1. Fifth Management Committee.
2. Evaluation of results.
3. Preparation of the final report.
4. Second general meeting (about 60 participants).
5. Discussion and adoption of the final report by the participating countries.
6. Book publication.

E. Organization

The participants of the action would have during the first year to establish their organizational rules.

However it is proposed that each participating country organize its own national EUROSILVA network and designate a national coordinator (they are already active in some countries) to run it. The latter ones will be directly in contact with the chairperson of the COST Action and they will be members of the Management Committee. (A provisional list of the present scientists acting as national coordinators in the 13 countries who discussed the project in 1994 is given in Annex 1).

Finally each working group will have to elect a Leader of the Group. The Management Committee should organize internal review procedures to review the quality of all the activities of the working groups. It will evaluate the project at mid term of the Action and focus the priorities for the second half.

F. Economic dimension of the Action

On present information, the total cost can be estimated at about ECU 8,5 million per year.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action E7
"Multi-phrase flows in paper marking"

Date of entry into force of the project :	24.09.1996
Duration :	24.09.1999

Contracting parties	Date of signing	Date of entry into force
GERMANY	24.09.96	24.09.96
SPAIN	19.09.96	19.09.96
FRANCE	19.09.96	19.09.96
ITALY	04.11.96	04.11.96
AUSTRIA	31.10.96	31.10.96
FINLAND	24.09.96	24.09.96
UNITED KINGDOM	19.09.96	19.09.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories. .

2. The main objective of the Action is to create new knowledge for the design of improved paper making processes and paper products.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 3 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 3 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in point 1 above.

ACTION E7

MULTI-PHASE FLOWS IN PAPER MAKING

A. BACKGROUND

The strong competition from other materials for packaging purposes and the increased use of electronic information transfer puts great pressure on the pulp and paper industry to improve their products at a reduced cost and to use renewable and reusable raw materials in an environmentally friendly way. This means that the pulp and paper industry must increase its research efforts and to use cooperative efforts whenever possible. One important task is an improved understanding of the flow behaviour of fibre suspensions and coating colours, which is necessary to improve the different processes involved, in order to obtain new and higher product qualities. To reach this goal, it is necessary to bring together the best experts from many scientific fields in an interdisciplinary action.

Fibre suspensions

Wood fibres constitute the dominant material component in all paper products. Such fibres have a length in the range 1 to 3 mm and a slenderness in the order of 100, which means that they have a considerable flexibility. If a very dilute fibre suspension is left to sediment by gravity, a fibre network will form even at a weight concentration as low as a few tenths of a percent.

The network strength of sediments is extremely low and is sometimes, e.g. in effluent treatment, increased by the addition of chemicals which increase the bonding between the fibres to make it possible to separate the fibres from the liquid.

The network strength increases with the concentration in excess of a minimum concentration according to a power law. Such networks have a mechanical strength due to the restraining of the fibres in bent position through the interaction with surrounding fibres. This behaviour will give fibre suspensions unique rheological properties relative to most other particle suspensions.

During the papermaking process, the fibre suspension has to be diluted with water to a consistency range of 0,11%, to avoid a disturbing fibre flocculation in the final paper products. In order to retain fibrous fines material during the de-watering process in the paper machine, various water soluble retention aid polymers may be added. This will further affect the rheology of a fibre suspension.

Fibre treatment operations such as pumping, refining, screening and mixing are performed in the consistency range of 3 to 5%, and in this range, a fibre suspension exhibits considerable network effects. Pipe flow will be of the plug flow type, in which the suspension moves as a solid plug, and the whole velocity gradient appears at the pipe wall. Means of locally dispersing the suspension to a desired dimensional scale size are important in these processes.

In the high consistency range, 10 to 30%, it is still possible to locally disperse a suspension, but high local energy input is required. Such dispersion is important in high consistency refining and in mixing operations during the pulp manufacturing process.

In summary, fibre suspensions appear in a wide range of consistencies during pulp and paper manufacture, and the rheological behaviour of the suspensions is extremely complex. Improved understanding of the physics of fibre suspensions is needed to allow improvements in process efficiency and product quality.

Coating colours

A coating layer is often added on top of a printing paper surface to improve printability by offering a suitable surface pore structure. Coating colours consist of pigments suspended in water with binder additives as well as viscosity controlling agents. Pigment concentrations are above 50%, and should be as high as possible to minimize drying requirements. For efficient use, the coating pigment should not penetrate into the paper, but remain on the surface.

Coating layers can be applied in different ways. One important way is blade coating, in which the suspension is distributed by a blade pressed against the paper surface. The rheological properties of the suspension are far from Newtonian, which has important effects on the flow behaviour below and after the blade, when the coating colour is consolidated on the paper surface.

The interaction between the suspension and the compressed paper surface is decisive for the result, and is not yet fully understood. Further, in consideration of the steadily increasing coating machine speeds, new application methods such as nozzle application as well as new coating colour recipes have to be developed to improve product quality and uniformity.

De-inking

The flow situation in de-inking cells is another area of multiphase flow within the papermaking processes. Several phases are involved besides water, such as fibres, fillers, ink particles, air bubbles, and de-inking chemicals. Within this area, contrary to the two areas described above, flow shear levels are extremely low.

European dimension

Europe is a net exporter of paper products. A profitable paper industry is of vital importance for the welfare of European forests and for the industrial utilization of this renewable and CO2-neutral resource. It is important that the European paper industry can defend its position, in particular in the competition with other materials and media. Europe also has a world leading industry making equipment and machinery for the paper industry. It is important that also this industry can defend its technical position. This action is going to strengthen the technical basis for the European industries mentioned.

Why a COST action?

This action bridges basic and applied research. Its aim is to bring together a wide range of experts from inside and outside of the paper industry proper. It is based on a bottom-up formulation of the research activities. COST provides the ideal framework for these types of activities.

B. OBJECTIVES AND BENEFITS

The main objective of this COST Action is to create new knowledge for the design of improved paper making processes and paper products. This objective is to be attained through an efficient research cooperation and the exchange of research information between knowledgeable parties in the European countries, concerning the flow properties of fibre suspensions, coating colours and de-inking suspensions. The emphasis is placed on the interaction between mathematical and numerical modelling of flow behaviour and experimental studies of flow phenomena and their effect on process efficiency. In order to carry out such research, competences in fields like soil mechanics, polymer flow etc. are also useful. The target group for the activities should be professionals from research institutions at universities and institutes as well as from relevant industries, such as equipment manufacturers.

The expected benefits from this COST Action are:

- more effective sharing of research results
- transfer of knowledge between European research institutions
- transfer of knowledge between research and practice
- initiation of collaborative research programmes on a European basis
- initiation and support of interdisciplinary research activities.

In this Action, a special emphasis will be placed on introducing the conditions in pulp and paper manufacture to researchers who have not earlier been connected to this industry, but who have relevant expertise, e.g. in fluid dynamics or mathematical modelling.

C. SCIENTIFIC PROGRAMME

Type of activities

The following activities may be considered to achieve the objectives:

- organization of workshops, conferences, seminars, site visits etc.
- exchange of researchers and specialists
- exchange of publications and documentation
- state of the art reports, workshop proceedings etc.
- joint projects in specific areas may be launched by two or more of the participants in the Action.

Scientific areas

The scientific fields to be covered by the Action should be related to the development of improved paper products and paper making processes. The relevant research issues are grouped into the following main areas:

- theoretical modelling of multiphase flows
- experimental studies of multiphase flows.

Theoretical modelling of multiphase flows

At present, there are no reliable, general models for theoretical prediction of the flow of fibre suspensions. The reason is the indeed very complicated micro structure, both with respect to geometry and physics of such suspensions, as outlined in the Background section. Although models for monodisperse suspensions of rigid slender and chemically inert fibres are available, these models are much too complicated to be useful. The models require considerable running times even on powerful computers.

In order to proceed in a meaningful way, considering the difficulty of the task, a strategy has to be laid down. As the construction of a general model based on first principles is at present probably out of reach, certain simplifications have to be imposed on the planned investigations. Firstly, one should aim at different models for different cases, e.g. one model for flow in pipes or paper machine headboxes and another one for build up of and flow through fibre mats on paper machine wires. Secondly, requirements on accuracy will have to be modest, at least to begin with. Thirdly, access to experimental information will be extremely important. Stated somewhat differently, even though results from basic academic research will be used extensively, the target of this Action is industrially useful models rather than academic contributions.

It may be interesting to note that what is aimed at in the present programme is a situation similar to that for the flow of bubbly liquids with finite volume fractions. In that field, very useful models, that are to a large extent based on empirical correlations, are successfully used in e.g. nuclear engineering albeit being insufficient from a strict scientific point of view.

As examples of planned studies, one may try to model fibre mats as either compressible, inhomogeneous anisotropic porous media or to attempt large scale computer simulations of flow through a random two-dimensional compacting network. In pipe flow one may for instance try to generalize the classical Bingham model to account for fibre concentration and fibre properties.

Regarding coating colours, they are easier to model using classical rheological models. On the other hand the flow parameters involved are extreme, with flow velocities up to 25 m/s. The channel boundaries are one smooth blade surface and one compressive, porous and rough paper surface and channel thickness is of the order of 0,1 mm. Particle interaction in the colour as well as with the permeable paper surface has to be considered.

Finally, it should be stated that the construction of a model is one thing but its practical use something else. Thus, the planned studies will involve significant amounts of computational fluid dynamics.

Experimental studies of multiphase flows

Results from experimental studies form a necessary basis for the validation of the different theoretical modelling activities. Through experiments, basic parameters as well as more complex process behaviour can be evaluated.

Experimental studies of fibre suspensions must be performed to quantitatively evaluate important parameters such as fibre properties, floc rheology and floc strength. This could be done by observing fibre shapes in known flow fields and fibre flocs, held in elongational flow in which the fluid forces could be calculated.

Observation of fibre behaviour in well defined flows, like pipe flow, should be performed also with the presence of chemical additives and with the addition of air.

For coating colours, extensive rheological characterization is needed. Further, experimental studies in different, relevant geometries, such as flow in narrow channels and absorption in porous surfaces, are necessary.

To study the different types of particle flow, PIV-(particle image velocimetry)-techniques could be applied. In principle, PIV methods include optical detection of a flow field at two points, closely spaced in time. Local velocities are then obtained using image analysis techniques. This is an area of rapid development, both regarding the generation of light pulses and regarding the video equipment to optically record the phenomena, as well as correlation techniques to analyse the two exposed pictures.

Experiments should also be performed in equipment such as screens, centrifugal cleaners, paper machine headboxes and wire sections, coating applicators etc. In these cases it is generally more difficult to visually observe the flow behaviour. The results should instead be interpreted in the light of the knowledge obtained within the two basic multiphase project areas.

D. ORGANIZATION AND TIMETABLE

A schematic plan for the organization is shown in Figure 1.

The Action will be led by a Management Committee (MC). Responsibility for detailed planning, execution and documentation of each individual activity is delegated by the MC to a task force, led by a professional appointed by the MC.

This COST activity will be carried out in cooperation with existing research programmes within the area, such as those carried out by the main pulp and paper research laboratories in Europe and with organizations like the Centre for Fluid Mechanics within Process Industries, at The Royal Institute of Technology (KTH), Stockholm. Relevant knowledge within the ongoing COST Actions Fluid Dynamics and Paper Recyclability should be utilized.

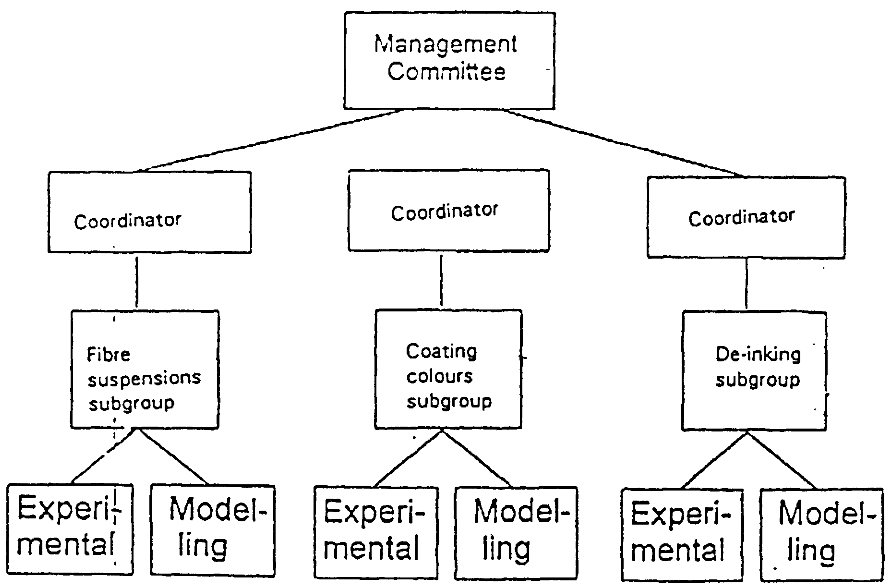
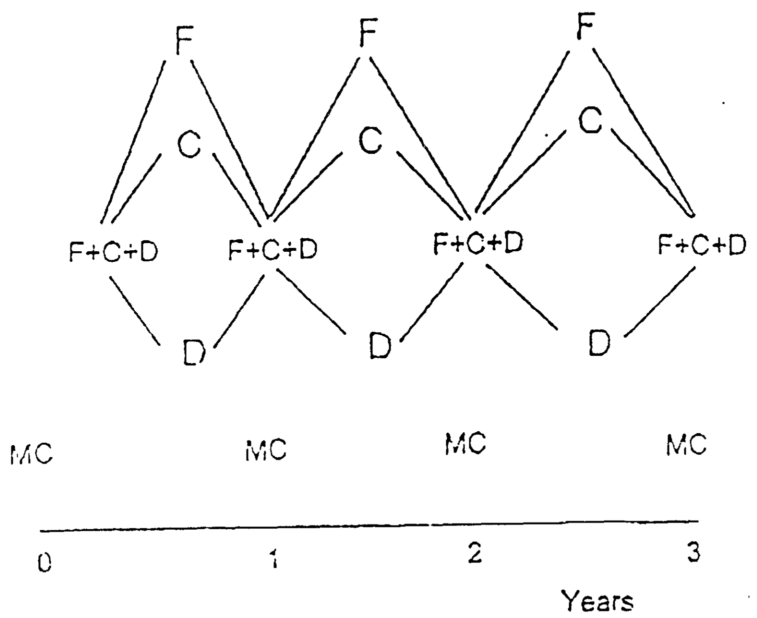


Figure 1: Action structure

The duration of the Action is suggested to be three years. A time schedule for the various activities is displayed in Figure 2. Meetings will be held twice a year in the task groups and once a year in the management committee.

The contacts among the researchers generated by the Action is expected to lead to exchange of researchers between laboratories. Most of these are expected to be of relatively short duration in compliance with the COST rules. For longer exchanges, other financial means will be sought.



MC	=	Management Committee Meeting
F	=	fibre suspensions task group
C	=	coating colours task group
D	=	de-inking task group

Figure 2: Timetable for activities within the action

E. ECONOMIC DIMENSION

The members of the Pulp and Paper Sector Group of the TC Forestry and Forest Products Committee, representing some fifteen countries have participated in developing the proposed action.

The following COST countries have indicated their interest to participate in the action: Finland, France, Germany, the Netherlands, Spain and Sweden. Participation from 2 to 4 more countries is foreseen.

On the basis of national estimates provided by the representatives of the countries mentioned and taking into account the coordination costs to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, in 1995 prices, at roughly ECU 3 million.

This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action E8
"Mechanical Performance of Wood and Wood Products"

Date of entry into force of the project : 27.06.1996
Duration : 26.06.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	19.12.96	19.12.96
DENMARK	27.06.96	27.06.96
GERMANY	24.07.96	24.07.96
SPAIN	27.06.96	27.06.96
FRANCE	27.06.96	27.06.96
ITALY	24.09.96	24.09.96
HUNGARY	26.09.96	26.09.96
NETHERLANDS	19.12.96	19.12.96
NORWAY	12.09 96	12.09.96
AUSTRIA	31.10.96	31.10.96
POLAND	28.08.96	28.08.96
PORTUGAL	24.09.96	24.09.96
SWEDEN	27.06.96	27.06.96
FINLAND	27.06.96	27.06.96
UNITED KINGDOM	27.06.96	27.06.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to produce scientific arguments for demonstrating that wood is a modern material for engineering, that wooden products can be designed with safety, that their mechanical performance can be predicted and wooden structures can be modelled with sound reliability.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 24 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION

ACTION E8

"Mechanical Performance of Wood and Wood Products"

A. Background

Wood research is considered to be important and essential for Europe for three main reasons:

- with the accession of Austria, Finland and Sweden to the European Union, Europe became a considerable forest-power and wood-consumer (280 Mm3/year - round wood equivalent -, self sufficiency: 88%),
- the limitation of the raw materials and energy resources in the world demands an optimized and sustained utilization of the renewable raw material wood,
- in competition with other widely diffused materials more and more basic knowledge is required.

Mechanical performance of wood and wood products is one of the first priorities for wood research: it is necessary to understand the behaviour of wood and wood products in their environment in relation to their internal structure at different levels of investigation:

chemical/ultrastructure/cell wall/particle interface (for panels)/macrostructure (for timber).

Analysis tools which exist in the field of material mechanical sciences (see composite materials, concrete, etc.) have to be adapted and validated on wood and wood products:

physical chemistry/micromechanics/heat and mass transport/fracture analysis/rheology/acoustics/structural analysis.

Observation tools already exist and are more or less usually applied to wood and wood products:

microscopy/ultramicroscopy/NDT/mechanical testing.

Research in the field of wood mechanics (or wood sciences) is essentially financed by public money because the wood industry in principle consists of SMEs which are not able to spend a larger amount of money on research: the institution of a network of laboratories involved in this field generates a considerable benefit for the different European governments.

COST Action 508 (Wood Mechanics) was successful and is considered as a model by Japan, North America, Pacific countries: six years after its creation, the broad field of wood mechanics has been reviewed by delegates of 17 countries through five workshops (keywords: creep - fracture - plasticity/damage - service life - panel products) and will be covered by a general conference in May 1996. Good cooperation between institutions and men, fruitful discussions and visits to laboratories have contributed to a really efficient scientific networking. Since other international networks (RILEM, IUFRO, CIB) allow regular meetings devoted to applications of wood mechanics (timber engineering, drying, non-destructive evaluation, etc.), since a recent COST Action is working on semi-rigid behaviour of timber engineering structural connections - C_1 - and a new COST Action will be launched for timber frame building systems, it is time now to focus the activity of a new Action on basic aspects of wood mechanics.

B. Objectives and benefits

The main objective of the Action is to produce scientific arguments for demonstrating that wood is a modern material for engineering, that wooden products can be designed with safety, that their mechanical performance can be predicted and wooden structures can be modelled with sound reliability.

The following are the expected benefits, for the scientific community, from this COST Action:

- information on national research programmes and possibilities,
- effective and rapid sharing of research results,
- initiation of collaborative European research programmes,
- development of interdisciplinary research activities.

For the economic and technical benefits, the following are expected:

- a good transfer of knowledge from this Action to other Actions in the field of wood industry and timber engineering,
- improvement of processes (such as drying, pulping or manufacture of wood-based materials),
- improvement of design methods (wood-based materials, wooden structures, timber engineering),
- diffusion and improvement of methods for non-destructive evaluation of mechanical performance of wood and wood products,
- opening of new markets for European timber resources, added value through better designs and processes.

C. Scientific programme

Type of activities

To achieve the objectives, the following activities are offered:

- organization of annual workshops, seminars, visits of laboratories,

- the drawing up of state of the art reports and/or studies,
- exchange of research workers and Ph.D. students through short-term scientific missions or other methods,
- exchange of publications and documentation, of activity reports,
- short-term exchange of information via INTERNET networking.

Scientific areas

Much work has been accomplished in developing basic models and understanding of wood behaviour. However, there are specific areas where vital knowledge is deficient and for which European scientific cooperation is specially needed which involves new partnerships compared to Action 508:

1. Fundamentals of physical and mechanical wood-water relations: water absorption, moisture transport, mechanosorptive phenomena (swelling/shrinkage + creep), effects of impregnating products. The main result of COST Action 508 is that mechanical performance of wood and wood products is strongly related to these wood-water relations.

2. Micro-mechanical explanation and prediction of mechanical performance of wood and wood products (deformations: elastic, creep, swelling/shrinkage - fracture - plasticity - damage/fatigue).

3. Improved understanding of interfaces: wood products, as opposed to solid wood, are governed as much by interfaces as by the properties of the wood itself. Thus, the correct description, management and behaviour of the interface are of prime importance:

   panels products (fibre-particule-strand-ply-board) involve wood/glue/wood interfaces,

   joints (all types) involve wood/(metal, wood, polymer)/wood interfaces,

   wood variants involve mature/juvenile/reaction wood "interphases".

4. Damage accumulation: damage sources identification (acoustic emission, microscopy, mechanical testing), damage quantification, accumulation of mechanical and environmental damage, accumulation of different mechanical damage (fatigue + creep).

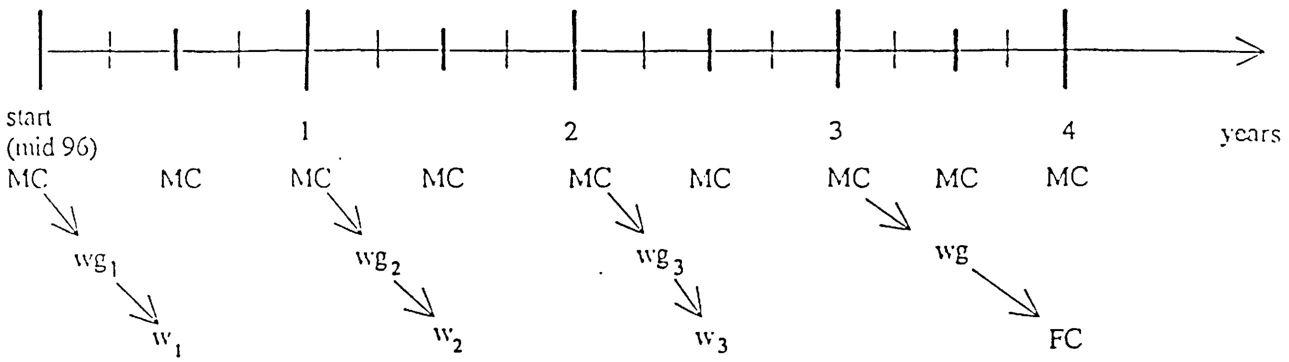
5. Non-standard conditions: hitherto rheological investigation has been particularly limited to a general set of conditions (temperature, humidity, time) corresponding to specific industrial applications (natural drying + timber engineering); investigations have to be extended to green wood, low and high temperatures, high and ultra low deformation rates, special environments, for new applications (mechanics of standing trees, high temperature drying, dynamic actions, etc.).

- Coupled thermo-hygro-mechanical constitutive laws have to be developed (1D to 3D) with a view to improving computational models and progressively complementing mechanical testing by numerical testing. Use of predictive models and explanations are also required for non-standard conditions (5) and damage accumulation (4).

D. Timetable and organization

Timetable

The duration of the Action is four years and the time schedule for various activities is displayed in the following chart:



Legend:

MC	Management Committee meeting
wg_i	Working Group meeting
W_i	Workshop
FC	Final Conference

Comments:

6 months before Workshop W_i, the Management Committee appoints an organization committee, called working group wg_i, for this Workshop.

Organization, Management and Responsibilities

There is no plan to organize separate permanent working groups.

The Management Committee will meet every 6 months to glean information on what is going on in the different countries, in Europe or on the world scale in the scientific field of the Action or in neighbouring fields (other COST Actions), to initiate cooperative programmes through state of the art or studies, to manage consistent short-term scientific missions and to set up an efficient ETERNET network.

The role of the national delegates is to report to the Management Committee what is going on in their national laboratories or institutes and to circulate in them the decisions or proposals of the committee.

The role of the Scientific Secretary is essential: it is necessary to appoint somebody who has enough time to take on this task.

Special attention will be devoted to intermediate (end of the second year) and final reports on activity and evaluations: internal evaluation and external evaluation by a panel of experts.

E. Economic dimension

On the basis of national estimates provided by representatives of different countries, and taking into account the coordination costs to be covered by the COST budget of the European Commission, the annual overall cost of the activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 6 million.

This figure is consistent with an estimate of the activities in the different European countries given in the following table.

Belgium	1
The Czech Republic	5
Denmark	2
Finland	5
France	6
Germany	3
Hungary	1
Ireland	2,5
Italy	2
Netherlands	1,5
Poland	4
Portugal	1
Slovenia	1
Sweden	6,5
Switzerland	4
United Kingdom	4
Total	**49,5**

Table: Foreseeable number of full-time scientists involved in the Action (period 1996-2000)

At the outset, the countries listed in the Table actively contributed in the preparation of the Action, and they are expected to participate in the Action.

Memorandum of Understanding for the implementation of a European Concerted Research Action COST Action G2 "Ancient Landscapes and Rural Structures"

Date of entry into force of the project : 08.03.1995
Duration : 07.03.2001

Contracting parties	Date of signing	Date of entry into force
BELGIUM	08.03.95	08.03.95
DENMARK	07.06.95	07.06.95
GERMANY	08.03.95	08.03.95
GREECE	10.01.96	10.01.96
SPAIN	08.03.95	08.03.95
FRANCE	08.03.95	08.03.95
ITALY	11.05.95	11.05.95
NORWAY	06.03.96	06.03.96
AUSTRIA	16.01.96	16.01.96
PORTUGAL	05.04.95	05.04.95
SLOVENIA	08.03.95	08.03.95
SWITZERLAND	09.01.96	09.01.96
UNITED KINGDOM	24.05.95	24.05.95

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objectives of the Action are:

   - to contribute to a better understanding of the relationships between the natural environment and human activities in ancient geosystems;

   - to establish an inter-disciplinary research programme to study ancient geosystems. By geosystem we mean a system consisting of biotic and abiotic components and the inter-relations between them, including man's strategies for intervention on the ground;

   - to prepare appropriate models in the light of ancient layout systems and data available today, with regional variations;

   - to propose tools to assist in diagnosis or in decision-making regarding exploring and conserving "ground archives". European cooperation will make it possible to harmonize work practices and approaches to conserving and enhancing the rural heritage;

   - to produce research tools suited to landscape investigation and to old land registers;

- to construct European databases and valid frames of reference;

- to refine conceptions and interpretative models on the basis of a critique of methods currently in use.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 27,75 million at 1994 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of six years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in point 1 above.

ANNEX

GENERAL DESCRIPTION OF THE ACTION

A. General context

1.1. Attention is focused at the moment on carrying out an inventory of the European cultural heritage and preserving it. Action on rural heritage and its structures and techniques has fallen far behind.

There is an urgent need to work on understanding that heritage and to carry out an inventory in the face of the destruction attributable to recent agricultural techniques, the rapid growth of urban areas and the threat represented by what might be termed "de-farming" through shrinkage or set-aside. One of the objectives of this project is to contribute to evaluating the rural heritage and its impact on present-day landscapes.

Old forms of land use produced structures (field divisions, roads and paths, water control systems) which can still be observed today. The objective of this project is to work out a typology which could be used at European level. Knowledge of technical sources and coordination of the experiences of our teams in the field should enable us to provide aids to research and interpretation via this project.

In order to achieve the best possible harmonization of inventory and research practices, this project will aim in particular

- to establish parameters for orthonormal systems
- to identify specific period intervals
- to create models and use the GIS (geographical information system).

It is now essential to provide frames of reference and methods of approach for general use. Only a European research programme can stimulate and coordinate efforts which are so far at very different stages of development.

Such research can only be carried out in a multidisciplinary framework with the participation of laboratories working in complementary areas. A COST proposal provides a particularly suitable framework for structuring a network of this kind.

The project programme will develop via coordination of research in the various participating countries in order to avoid duplication.

1.2. Relations with other European programmes

This project was initially structured around a core group of European laboratories already engaged in joint research and has now been extended. The arrival of new teams makes it necessary to rationalize the division of labour and to harmonize work practices in order to make the resources and specialist knowledge brought together available to all.

A number of laboratories have already taken part in a European network (1990) and some (Besançon and CAMS (Centre for Mathematical and Social Analysis) in Paris (France), CSIC (Spain)) are taking part in the third Community programme for Research and Development - DG12 "The Natural and Anthropogenic Causes of Land Degradation and Desertification".

Several (Besançon, Brussels, Evora and Ljubljana) are also involved in bilateral or multilateral accompanying programmes (STRIDE, Human capital, FORCE, PRAXIS 21, INTERREG 2, POPULUS) already in progress or requested in 1994 (TEMPUS, PHARE). Work in these programmes relates to issues which complement those in this project.

Exchanges of researchers and students have already been carried out in association with the TEMPUS, ERASMUS and SCIENCE programmes or via bilateral university exchange arrangements (PICASSO, PLATON etc.).

This project has a direct link with concerns expressed in the fourth Community programme on Research and Development:

1. Programme for Environment/Climate I(2)1: "Reconstruction of climatic and environmental conditions on a global and regional scale over recent climatic cycles".

2. Measurements and Testing. III: "Support for Europe's cultural heritage".

It also ties in with the operation of the European network of "European cities with a very ancient past" which is supported by the European Commission.

Finally, it is in line with the thinking of the International Union for Conservation of Nature and Natural Resources (IUCN).

B. Objectives of the action

The objectives of the action are:

- to contribute to a better understanding of the relationships between the natural environment and human activities in ancient geosystems

- to establish an inter-disciplinary research programme to study ancient geosystems. By geosystem we mean a system consisting of biotic and abiotic components and the inter-relations between them, including man's strategies for intervention on the ground

- to prepare appropriate models in the light of ancient layout systems and data available today, with regional variations

- to propose tools to assist in diagnosis or in decision-making regarding exploring and conserving "ground archives". European cooperation will make it possible to harmonize work practices and approaches to conserving and enhancing the rural heritage

- to produce research tools suited to landscape investigation and to old land registers

- to construct European databases and valid frames of reference

- to refine conceptions and interpretative models on the basis of a critique of methods currently in use.

C. Contents of the project

Coordination under this project will prevent unnecessary duplication. An integrated approach will be put into operation gradually on the basis of the progress made by the working groups in the scientific tasks programmed.

The project will take place in three major stages:

1. Grouping data and perfecting approaches and tools.
2. Implementing correlations and managing data.
3. Validating results and producing a synthesis.

Work will concentrate on four main channels:

1. Ancient technical sources.
2. Creation of computer models and reconstruction of the ancient landscape.
3. Atlas of forms of ground occupation and spatial analysis.
4. Cultural parks: the concept, and tools for assisting in decision-making.

D. Timetable

A programme lasting six years is proposed for this project. It will take the form of gradual production of research tools and regular delivery of partial results, obtained by topic-related working groups.

Working groups were defined at the meeting of the NPG at which national liaison officers and experts were present or represented.

Allocation of researchers will be done at the next plenary meeting.

Wherever possible, work will be carried out in parallel, without duplication, in several laboratories.

First and second years:

The objective is to determine and set in motion a coordinated multidisciplinary approach focusing on man/nature interaction.

First year:

Plenary meeting.

Meetings of working groups.

Selection of cases - examples and inventory of data available.

Discussion of existing models and transposition of methods used in other areas: analysis of convergences and orientations.

Initial presentation of technical sources: texts and archaeology (Germany, Spain, France, United Kingdom, Italy).

Initial proposal for modular analyses (France, United Kingdom, Slovenia).

Initial preparatory work for cultural park projects.

Publication of the working groups' first results.

Second year:

Plenary meeting.

Meetings of working groups.

Critical study of first productions.

Finalization of a common protocol for the preparation of frames of reference and databases.

Analysis of satellite images (Spain, France): work will centre on the revelation of old forms of land use, their conservation and their location in the sample zones. Analysis will be carried out in different laboratories, depending on their specialization (chemical study of soil, plant cover, modular measurements: Belgium, France, United Kingdom, Portugal, Slovenia).

Presentation of atlases developed.

Discussion of spatial analysis models used: suitability and limitations.

Publication of working groups' work.

Third year:

Plenary meetings.

Synthesis of working groups' initial results.

Evaluation of their potential for extrapolation.

Analysis of correlations.

Discussion of data management: GIS

Intermediate reports.

At this stage in the programme, tools of several types will be available and the first models and approaches will be tested.

Fourth year:

Plenary meeting.

Meetings of working groups.

Presentation of the various surveys (Belgium, France, United Kingdom, Greece, Spain, Portugal, Slovenia, Finland).

Further analysis of technical sources.

Publication of working groups' work.

Fifth year:

Plenary meeting.

Meetings of working groups.

Completion of translation of ancient land surveys.

Presentation of atlases completed.

Database of recognizable forms.

Publication of working groups' work.

Sixth year:

Plenary meeting.

Synthesis of working groups' activities.

The methods used in this integrated approach will be evaluated, using statistical calibration wherever possible.

Final report on man/nature interaction in ancient geosystems and its impact in terms of spatio-temporal data.

Dissemination of results: publications and databases.

E. Organization, management and responsibility

Coordination of the project will be conducted by the Management Committee in accordance with the Memorandum of Understanding.

The Management Committee will appoint coordinators for each working group. They will organize cooperation between working groups and within them and be responsible for sessions on each working group's topic when meetings of groups are called. Researchers in each working group will come together on request and not less than four times a year at the plenary meetings organized. Short reports on those meetings will be forwarded to the Management Committee which will circulate them to all participants. The results will be presented at the plenary meetings. Annual reports will be drafted by the researchers, describing the results obtained under this concerted action.

F. Economic dimension of the action

The results, which will be disseminated in various ways, namely publications, databases, a variety of maps and charts, should provide tools to assist in decision-making in cultural and technical areas and also in the economic field.

There is increasing demand, particularly among territorial and administrative bodies, to have the heritage protected and enhanced, particularly heritage under threat.

The project could produce archaeological-risk maps for Europe and lead to participation in the design of cultural parks (Spain, Portugal, Greece, France).

Use of the results of the project should contribute to improving intervention and choices made regarding conservation or intervention.

G. Financial dimension

a) Cost of research covered by the various countries:

On the basis of:

ECU 60 000 per man/year for researchers
ECU 40 000 per man/year for technicians
ECU 25 000 per man/year for administrators.

The current estimate for the cost of research prior to a review of the lists of persons concerned and to receiving your proposals is ECU 4 550 000 per annum.

b) Cost of coordination:

Organization of workshops, publications, short-term scientific missions:
ECU 75 000 per annum.

Total:

a) Cost of research covered by the various countries:

4 550 000 x 6 = ECU 27 300 000

b) Cost of coordination:

75 000 x 6 = ECU 450 000.

Memorandum of Understanding
for the implementation of a European Concerted Research Action
COST Action G3
"Industrial Ventilation"

Date of entry into force of the project : 19.12.1996
Duration : 19.12.2001

Contracting parties	Date of signing	Date of entry into force
DENMARK	19.12.96	19.12.96
GERMANY	09.01.97	09.01.97
SPAIN	19.12.96	19.12.96
FRANCE	19.12.96	19.12.96
ITALY	13.01.97	13.01.97
PORTUGAL	19.12.96	19.12.96
FINLAND	19.12.96	19.12.96
UNITED KINGDOM	19.12.96	19.12.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to produce a basis for a Design Guidebook by a multidisciplinary approach based on gathering the expert knowledge which exists internationally, further developing it and making it available for the designers.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 8 million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least 5 Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION OF THE ACTION

COST ACTION G3

"INDUSTRIAL VENTILATION"

A. BACKGROUND

The available systematic information about industrial ventilation is very scarce. There are some handbooks, made by e.g. Hemeon (USA), Baturin (with its latest edition 1972), Heinsohn (USA), Goodfellow (Canada) and ACGIH (USA), but they do not cover the whole field of industrial air technology. There is actually no internationally accepted handbook available, and the designer has no validated solutions at his disposal. According to the present state-of-the-art, both capturing and ventilating systems are designed to comply with know-how-rules (e.g. air exchange rate) and rarely achieve the targeted heat and contaminant loads. This expertise is not generated by systematic investigations but through experience from various plants under construction and in operation. This is obviously due to a total lack of approved design criteria and lack of European standardization, which make effective ventilation design impossible.

Such a designing procedure leads to overdimensioned systems which cause

- high investment costs;
- high operating cost;
- high energy consumption and CO_2-emissions;
- problems with heat and contaminant loads.

In industrial premises the indoor air quality and the thermal conditions, i.e. working conditions, have a significant influence on productivity, quality of work, health and safety, life cycle of equipment as well as constructions and maintenance costs. In some cases adequate air quality and thermal conditions make production possible and/or improve the quality of the product (e.g. paper industry, food processing industry).

Approved target levels for industrial ventilation design do not exist. Furthermore, the design procedures are completely unhomogenous. Every designer does his own thing in his own way. Only in some cases are there country specific design criteria and design rules, but standardization on a European scale does not exist.

Faced with competition from non-European countries, many enterprises suffer under the high financial burdens arising from high quality levels and increasing environmental requirements. Therefore, it is absolutely essential to create optimized and cost effective solutions for industrial ventilation systems. That means systems optimized for their special purpose, not overdimensioned following conventional design rules.

At the same time the competitiveness and export potentiality of European ventilation industry can be improved.

A general design methodology for industrial ventilation has been developed e.g. in Finland during the technology programme INVENT. The methodology has been commented on and its outline approved internationally. This Action is based on the experiences obtained in the INVENT programme.

Similar research work is carried out in different COST countries and extensive cooperation is needed. This Action gives the research units possibilities to establish connections between different countries, to exchange and to compare their existing know-how, and to develop new knowledge for common use.

There are standards for comfort ventilation under preparation (CEN TC 156) but they cannot be applied to industrial ventilation. The European standards under preparation in TC 114, TC 137, TC 204 and TC 264 cover only a small part of the necessary contents.

Finland has recently made a proposal to CEN to start standardization in the field of industrial ventilation. This Action will provide a good basis for the standardization work.

By means of COST, wider participation can be achieved compared to the EU research programmes.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to produce a basis for a Design Guidebook by a multidisciplinary approach based on gathering the expert knowledge which exists internationally, further developing it and making it available for the designers.

This means:

1. A collection of information on the existing methods and criteria for the design of industrial ventilation methods.
2. Development of the design methodology with respect to different branches and country specific items.
3. Development of valid target levels for industrial facilities.
4. Development of new design criteria and tools to control contaminant sources.
5. Development of new innovative solutions to problems in industrial ventilation.
6. Development of tools for life-cycle assessment of industrial ventilation systems with respect to energy usage, environmental aspects and total lifetime costs.
7. Compilation of information packages on case studies included in the Action.
8. Identification of knowledge gaps.

The produced information will be used as a basis for an Industrial Ventilation Design Guidebook but will also provide a good basis for standardization work.

Benefits

Different practices involved in what is considered to be good design in the field of Industrial Ventilation is one of the factors affecting negatively the economic growth in certain European countries.

The Action will provide a basis for the first reliable design criteria in the world. This will strongly accelerate R&D activities in this field by providing a solid basis for development work. There is also a possibility for extended application of innovations on other areas of air technology as many ideas are applicable also in other areas, for instance in commercial buildings.

The impacts on an end-user of an efficient ventilation system will be the following: decreased energy use for ventilation air; decreased maintenance cost based on better indoor air quality and decreased damage in structures and machinery; in some cases improved product quality; decreased health costs, due to better indoor air quality and decreased absenteeism and increased work satisfaction with better work results.

C. SCIENTIFIC PROGRAMME

The idea of the Action is that all existing, fragmentary parts of design methodology are gathered, documented and structured so as to make it possible to use scientifically based new design criteria and methodology taking into account new theories and new developments.

The work is divided into six work packages. The first work package concentrates on collection, evaluation and adaptation of design guidelines and standards existing in different countries and development of design methodology. In other work packages the main effort will be to develop new design criteria and tools in specified areas. Case studies will be made inside different tasks in order to evaluate new developments.

Work Package 1: Design procedures

Task 1. Collection of the existing fundamentals of planning
To gather standards and design procedures nationally and internationally.

Task 2. Analysis and selection of the procedures to be used by the participants

Task 3. Approval and adaptation of procedures to local conditions
To approve the planning methods to be further developed by countries in different technology areas.

Task 4. Working out the design methodology based on gathered and evaluated material

Work Package 2: Target levels

Task 1. Definition of target levels for indoor and outdoor industrial environments

Work Package 3: Source description and control

Task 1. Developing design methods for selected contaminant sources

Task 2. Developing new methods for local protection
To develop new methods to control contaminant sources.

Work Package 4: Large enclosures

Task 1. Developing new methods to control air-flows in large enclosures

Task 2. Developing new air-distribution methods for large enclosures

Work Package 5: New innovative solutions

To develop and test new techniques for industrial ventilation. New unproven techniques for ventilation processes (such as heating, cooling, filtering etc.) will be developed and tested. (A particularly interesting new technique is the utilization of electrical methods in industrial gas and particle cleaning by using high voltages.)

Work Package 6: Life-cycle assessment

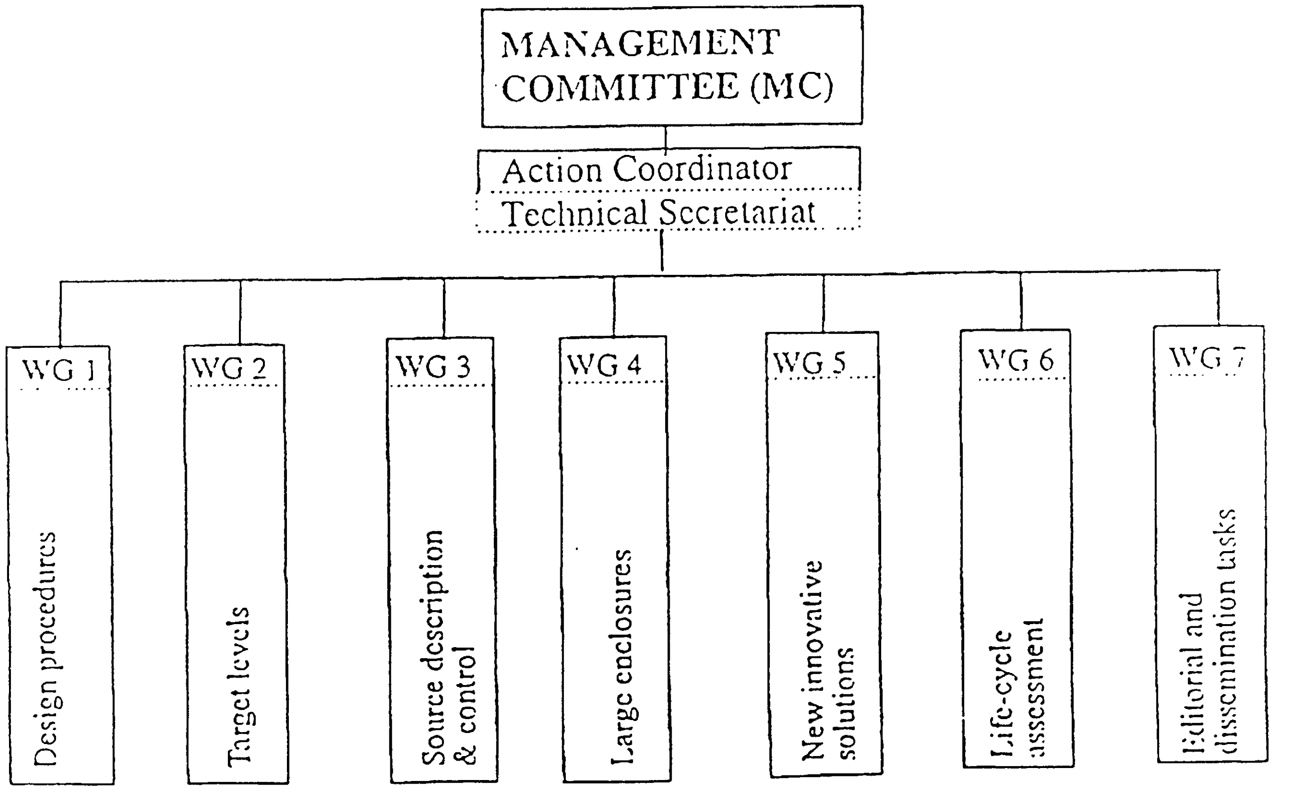
to develop methods for assessment of life-cycle influences.

Work Package 7: Editorial and dissemination tasks

Editorial and dissemination tasks include: meetings, seminars, case-study data, reviewing, knowledge transfer etc.

D. <u>ORGANIZATION AND TIMETABLE</u>

Organization



Management Committee (MC)

The MC will appoint an Action Coordinator as well as Working Group Coordinators. It will meet two or three times a year and have the following responsibilities:

- to assess the progress towards the objectives including the applicability of developed knowledge to practitioners,

- to prepare milestone reviews once a year,

- to promote cooperation and data exchange between Working Groups and different partners when necessary.

Working Groups (WG)

There will be seven WGs, each responsible for one of the work packages described in Section C. Each WG will have the following responsibilities:

- to report on the progress to the Action Coordinator after each workshop,

- to guide and stimulate research within its own field,

- to work out, in its own field, a practical design guide forming an essential part of the Industrial Ventilation Design Guidebook.

Participants

The participants will be invited:

- to attend the workshops,

- to present reports on their research work twice a year.

Timetable (cf. diagram on last page)

The total duration of the Action is five years.

Workshops, Joint research teams, Short term missions, Exchange of scientists

Workshops will be arranged rather frequently in the participating countries; a total number of eight workshops is envisaged. Joint research teams will be formed during the Action between research organizations working on the same topics. Short term missions will be used to collect information (WG 1) also from countries not participating in the Action. Exchange of scientists will be encouraged as a part of the joint research work.

E. ECONOMIC DIMENSION

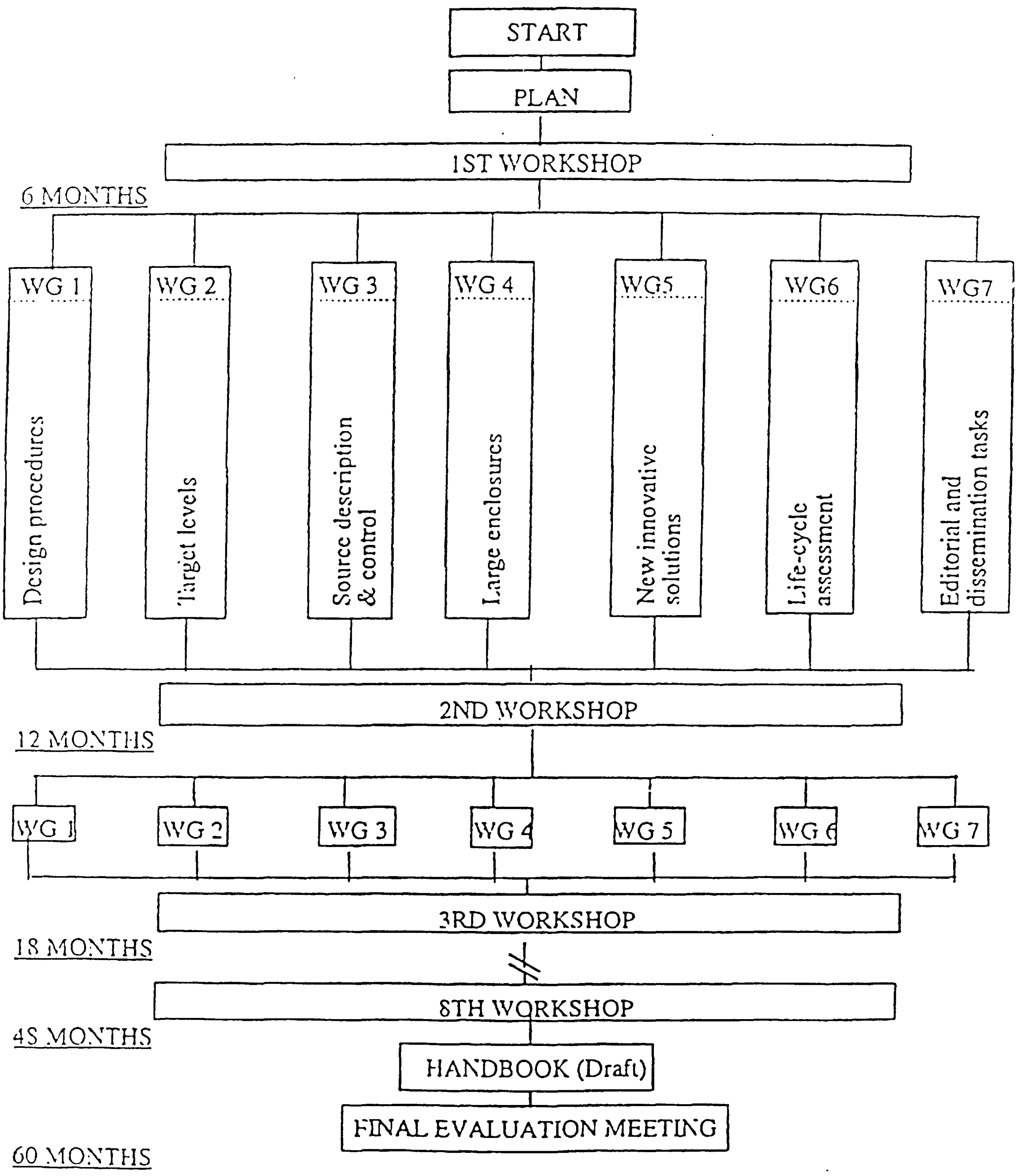
The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Denmark, Finland, France, Germany, Italy, Norway, Poland, Spain, Sweden, Switzerland, the Netherlands, United Kingdom.

On the basis of estimated participation of the abovementioned countries and taking into account the coordination costs to be covered over the COST budget of the European

Commission, the overall cost of the activities to be carried out under the Action is estimated, in 1995 prices, at roughly ECU 8 million.

This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

Timetable



Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action G4 "Multidisciplinary Chestnut Research"

Date of entry into force of the project : 02.05.1996
Duration : 01.05.2001

Contracting parties	Date of signing	Date of entry into force
GERMANY	25.04.96	25.04.96
SPAIN	25.04.96	25.04.96
FRANCE	09.01.97	09.01.97
ITALY	29.05.96	29.05.96
HUNGARY	02.05.96	02.05.96
NETHERLANDS	12.09.96	12.09.96
AUSTRIA	29.05.96	29.05.96
PORTUGAL	19.12.96	19.12.96
SLOVAKIA	30.04.96	30.04.96
SWITZERLAND	19.11.96	19.11.96
UNITED KINGDOM	25.04.96	25.04.96

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to support the revitalization and improvement of chestnut cultivation in Europe.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 10 Million at 1995 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of 5 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

COST G4

MULTIDISCIPLINARY CHESTNUT RESEARCH

A. BACKGROUND

The sweet chestnut (*Castanea sativa*) is an ecologically and economically important tree species with a long cultural tradition in many areas of Europe. In the milder regions north of the alps, southern alpine areas and mainly Mediterranean regions the European chestnut played an important role as a staple food in the history of humans. Selection and grafting of superior trees began at least 3 000 years ago.

Chestnut cultivation offers the advantage of production of both nut and timber. No special agricultural input is required for management of these areas. From the ecological viewpoint chestnut cultivation offers the advantage of covering the soil and acting as erosion protection. Especially in mountain areas at higher elevations steep slopes are extremely difficult to cultivate. From the economic viewpoint it offers advantages as a multiple use crop in the production of high quality fruits and timber. There will be an increasing demand for alternative trees and crops in agricultural areas under study. This tree species seems to be well suited for agroforestry systems, as chestnut tolerates both acidic and saline soils. This advantage makes it very attractive for reforestation programmes on marginal lands. In the near future there will be increasing interest to replace surplus crops by other agroforestry systems.

The primary goal of this proposed Action is to coordinate research and development in Europe aimed at overcoming the various bottlenecks which restrict the further exploitation of chestnut as a multiple use crop. During the last decades a general decline in chestnut cultivation has been observed in many regions. This may have been caused by social, economic and environmental changes, and problems that arose from chestnut stands being old. Beside these aspects limitations to increased planting of chestnuts are also due to the lack of selection of superior plant material, appropriate methods for propagation and problems with diseases. There is a tremendous loss of genetic variation through the extinction of chestnut populations due to diseases and pests. Two major fungal diseases, ink diseases (*Phytophthora ssp.*) and chestnut blight (*Cyphonectria parasitica*), contribute to the decline of this valuable tree species.

For historical reasons, chestnut groves are part of the cultivated land use, and their disappearance would lead to substantial changes in the landscape of many European regions. The future cultivation and conservation of existing chestnut stands is therefore of public and collective interest.

Many European countries have a traditional interest in *Castanea sativa* as a forest and nut tree species. Nowadays countries interested in chestnut cultivation are faced with similar problems. To avoid duplication in research and to increase the level of harmonization between methods for plant production and biological control, cooperation at the international level is needed.

Many scientists involved in chestnut research in Europe are gathered in the "European Chestnut Network", which is a forum for collaboration, discussion and exchange of current research results and ideas. In the course of discussion it became obvious that there is a need for a common research initiative like a COST Action on a multidisciplinary level, because there exist gaps in our knowledge, which require specific attention.

B. OBJECTIVES AND BENEFITS

The main objective of the proposed Action is to support the revitalization and improvement of chestnut cultivation in Europe.

The general objectives of the proposed Action can be described as follows:

- to increase the basic understanding in the area of tree physiology,
- to gain more knowledge on the genetic resources of chestnut in Europe,
- to develop strategies for collection and conservation of germplasm (ex situ and in situ),
- to compare and harmonize general protocols for biological control against chestnut diseases,
- to integrate biological control methods into common silvicultural management,
- to assess other biocontrol methods for their range of application and utilization in the field.

Extended knowledge in the area of chestnut preservation offers the advantage for an inventory of possible economically important genotypes for nut and timber production. Furthermore it can provide ecologically adapted genotypes in different countries and their potential use in reforestation programmes.

More knowledge about the effect of certain silvicultural practice and management on pests and diseases in context with ecological studies will improve the production system as well as the socio-economical situation.

Removal of the bottlenecks in the cultivation of this tree species will be a valuable contribution to European agriculture and forestry so as to achieve a sustainable low-input system with reduced used of pesticides and fertilizers.

C. SCIENTIFIC PROGRAMME

The research topics, which have been identified to require most attention are grouped in work packages and will be focusing on:

Work package 1: Tree Physiology
Work package 2: Genetic resources (Conservation and genetic variation)
Work package 3: Pathology
Work package 4: Silviculture

Work package 1: Tree Physiology

Traditionally the propagation of plant material is achieved by grafting selected genotypes using softwood or hardwood cuttings, by layering, or by stoolbed propagation. For several years, micropropagation of selected elite trees with increased resistance to *Phytophthora ssp.* has been gaining in importance in several countries, especially France and Spain.

Knowledge of the complex systems involved in tree defence mechanisms in general is rather poor. Little is known about the plant parasite interactions in chestnut. Basic efforts in this field can contribute to develop appropriate strategies against tree disease and pests in general.

Proposed investigations:

- comparison of propagation techniques and their usefulness
- comparison of grafting techniques
- detailed studies of graft incompatibilities between scion and rootstock
- improvement of micropropagation techniques
- basic studies on plant pathogen interactions
- determination of pathogenicity and resistance factors

Work package 2: Genetic resources (Conservation and genetic variation)

European chestnuts exhibit a considerable amount of genetic variability because of their long history of cultivation. In the last few years there has been increased activity in breeding and selection of orchard-adapted cultivars, including American and Euro-Japanese hybrids with superior nut quality and improved resistance to chestnut blight and ink disease.

Chestnut conservation studies would provide an inventory for future selection of potentially important genotypes for nut and timber production. Furthermore they may provide an inventory of ecotypes in different countries and their potential for use in reforestation programmes.

Proposed investigations:

- to monitor the genetic variability of chestnuts in Europe
- to optimize biochemical and molecular techniques for the evaluation of regional chestnut cultivars
- to develop strategies for collection and conservation of germplasm (ex situ and in situ)
- to elaborate and evaluate strategies for in situ and ex situ conservation according to general guidelines for widespread species
- to determine cultivar suitability for certain geographical areas
- to integrate selected genotypes into future breeding programmes

Work package 3: Pathology

Ink disease, a disease of the fine roots of chestnut, is present in most of the chestnut growing areas from Portugal to the Black Sea. Primarily *Phytophthora cambivora* was considered as causal agent of ink disease, but recently also, *P. cinnamomi* and *P. citricola* were found. Due to the production of chlamydospores, *Phytophthora* species can survive droughts. Fine roots damaged during dry seasons are especially susceptible to attack by *Phytophthora sp.*

When chestnut blight was introduced, the severity of ink disease was camouflaged by the heavy blight attacks. In recent years, however, it is recurring – mainly in Portugal, France and Spain leading to decline and mortality, foremost in nurseries and orchards. Disease development depends on tree resistance, soil type, fertilization, and climatic conditions. Drought periods promote the disease and there is concern that *P. cinnamomi* may become more damaging under conditions of general climatic warming.

Chemical treatment is debated. However, in orchards it is not economical and in forests it is prohibited by most European countries because of environmental hazard. Selection and breeding for resistant rootstocks, biological control with mycorrhiza and soil treatments to improve natural suppressiveness must be developed with a view to controlling ink disease.

Chestnut blight, caused by the fungus *Cryphonectria parasitica* was introduced into Europe in 1938 from Asia via America. Once established in a wound, the fungus invades and destroys the surrounding bark and cambial tissue, forming a visible sunken canker. Death of the cambium of this ringporus tree prevents formation of the new xylem vessels needed for liquid transport, and this causes wilting of the leaves above (beyond) the canker. The detection of transmissible hypovirulence in 1957 offered the potential for biological control of the disease. Hypovirulence is caused by dsRNA virus in the genus of Hypovirus, and it is transmitted by hyphal anastomosis between vegetative compatible (v-c) strains. In several European countries and the United States hypovirulence has been used as a biocontrol agent in the field.

Proposed investigations:

- to evaluate other chestnut pests and diseases to estimate their potential threat
- to conduct ecological investigations into the dispersal and population structure, and the population dynamics of the two main pathogens of chestnut, *Cryphonectria parasitica* and *Phytophthora ssp.*
- to compare and coordinate general protocols for biological control of chestnut blight (*Cryphonectria parasitica*)
- to compare and evaluate ecologically based field experiments for feasibility studies of biological control systems – this shall include a survey of field methods for the application of hypovirulent *C. parasitica* strains
- to assess other biocontrol methods for their range of application and utilization in the field
- determination of factors that effect the dispersal and establishment of hypovirulent strains: vc group diversity, sexual reproduction, transmission of dsRNA, vectors for hypovirulent strains
- development and optimization of techniques to apply hypovirulent strains as biocontrol agents
- to select appropriate hv strains
- to evaluate genetically engineered hypovirulent strains for their use as biocontrol method
- analysis of population structures and population dynamics of *C. parasitica* and the associated hypovirulence with classical and molecular markers
- studies on the effects of dsRNA on virulence and sporulation
- assessment of other control methods: antagonistic fungi, antagonistic bacteria

Work package 4: Silviculture

Castanea sativa is grown in coppices for the production of stakes and construction wood. This forest-production system is characterized by a short (10-20 years) rotation cycle. Economic studies estimated that the production of chestnut requires no additional costs and other input for 15 to 20 years. As well as the big advantage of durability, chestnut wood has very good mechanical properties. One main problem which limits the exploitation of chestnut as a timber source is caused by ringshake (rolure) which is the tendency of wood to form tangential fractures along the annual growth ring.

The influence of silvicultural management practices on fungal epidemiology is still unclear.

Proposed investigations:

- to study the population dynamics and epidemiology of major pathogens under special silvicultural strategies
- to integrate biological control methods into common silvicultural management practices

These objectives require the cooperation of scientists from universities, research organizations, and private industry, working in areas such as plant physiology, genetics, molecular biology, population biology, agronomy, silviculture and pathology.

Relation to other international scientific programmes

The Community programmes "Improvement of coppice forests in the Mediterranean region" (MEDCOP) and "New silvicultural methods and innovative industrial processing methods to improve the utilization of chestnut wood" are covering silvicultural aspects and new management systems, as well as improved processing techniques for chestnut wood.

In the Community programme "CAMAR", France, Spain and Portugal have produced interspecific hybrids (*C. sativa x C. crenata*) which have resistance to *Phytophthora*. Studies on the performance of some of these resistant hybrids revealed that they have only partial resistance to ink disease.

D. ORGANIZATION AND TIMETABLE

A Management Committee will be set up and will be responsible for coordinating the Action. The Management Committee will meet as soon as possible to initiate the Action and establish Working Groups. The organization of Working Groups related to the topics of the work packages outlined in "The scientific programme" (Section C) is intended.

Proposed Working Groups:

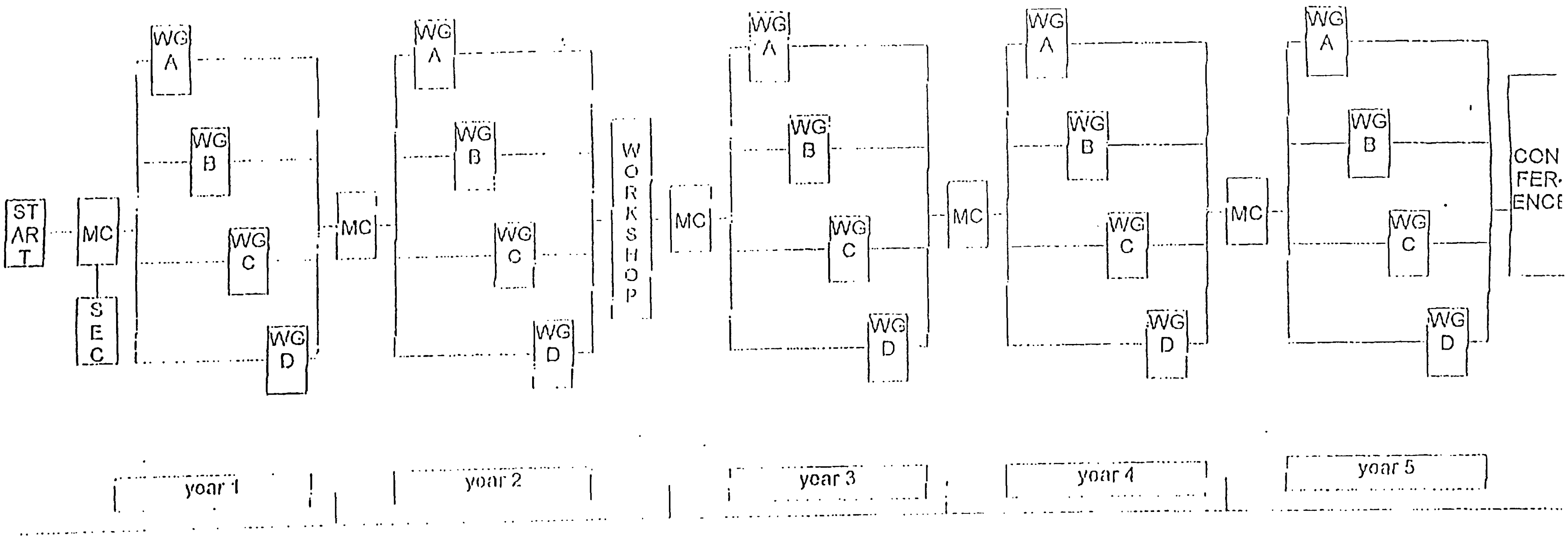
A. Tree Physiology
B. Genetic resources
C. Pathology
D. Silviculture

Each Working Group will be organized with two Joint-Coordinators who will organize meetings of their Working Group and be responsible for coordinating the research programme. Meeting of the working groups shall be organized in yearly intervals. An annual report of the Working Group activities will be submitted to the COST Senior Officials. It is intended that each Working Group will meet once a year.

It is anticipated that the Action will extend over five years, with each Working Group proceeding in parallel. Close liaison will be maintained between the different Working Groups with Workshops every second year to review overall progress. The Management Committee will oversee the general direction and progress of the interaction between Working Groups and their relationships with other COST Actions. A conference will be held when the Action is completed.

The organizational structure and the timetable envisaged of the proposed Action is illustrated in Figure 1.

Fig.1: Organization and timetable of the Action



MC: Management Commitee Meeting
SEC: Secretariat
WG A: Working group „Tree Physiology"
WG B: Working group „Genetic Resources"
WG C: Working group „Plant Pathology"
WG D: Working group „Silviculture"

E. ECONOMIC DIMENSION

Many COST countries such as Spain, United Kingdom, France, The Netherlands, Germany, Switzerland, Italy, Slowakia and Hungary have actively participated in the preparation of the Action. Interest in this Action has been indicated in addition from Greece and Turkey.

The overall cost of the research activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 10 million over 5 years, equivalent to around 40 man/yrs with ECU 70 000 per year coordination costs. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

Synoptic tables for other COST projects in force at 1 January 1995

The texts of the projects signed prior to 1 January 1995 are contained in Volumes 1 to 8 of the Collected Agreements covering the period from 1971 to 1994.

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 : 10.10.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.10.91	02.10.91
GERMANY	11.10.90	11.10.90
GREECE	15.06.93	15.06.93
SPAIN	07.02.93	07.02.93
FRANCE	06.02.93	06.02.93
IRELAND	11.10.90	11.10.90
ITALY	19.05.92	19.05.92
NETHERLANDS	11.10.90	11.10.90
NORWAY	23.01.91	23.01.91
PORTUGAL	04.07.91	04.07.91
SWITZERLAND	17.05.91	17.05.91
FINLAND	10.04.91	10.04.91
SWEDEN	09.11.90	09.11.90
TURKEY	07.03.91	07.03.91
UNITED KINGDOM	11.10.90	11.10.90

(1) "COST projects", Vol. 6, p. 25.

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 : 26.04.1991
Duration : 25.04.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.10.91	02.10.91
GERMANY	27.02.91	27.02.91
GREECE	09.12.92	09.12.92
SPAIN	05.04.95	05.04.95
FRANCE	27.02.91	27.02.91
ITALY	26.04.91	26.04.91
PORTUGAL	27.02.91	27.02.91
UNITED KINGDOM	27.02.91	27.02.91

(1) "COST projects", Vol. 7, p. 27.

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 : 13.02.1992
Duration : 12.02.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	13.02.92	13.02.92
DENMARK	13.02.92	13.02.92
GERMANY	13.02.92	13.02.92
GREECE	14.01.93	14.01.93
SPAIN	14.03.96	14.03.96
FRANCE	13.02.92	13.02.92
IRELAND	30.06.94	30.06.94
ITALY	21.02.94	21.02.94
HUNGARY	28.09.93	28.09.93
AUSTRIA	21.02.96	21.02.96
PORTUGAL	06.12.95	06.12.95
SLOVAKIA	12.09.95	12.09.95
SWITZERLAND	29.03.96	29.03.96
UNITED KINGDOM	24.03.93	24.03.93

(1) "COST projects", Vol. 7. p. 37.

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 : 12.06.1991
Duration : 11.06.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	09.12.92	09.12.92
CROATIA	18.05.92	18.05.92
CZECH REPUBLIC	02.04.92	02.04.92
DENMARK	24.07.91	24.07.91
GERMANY	07.03.91	07.03.91
GREECE	09.12.92	09.12.92
SPAIN	12.06.91	12.06.91
FRANCE	06.02.92	06.02.92
IRELAND	18.09.91	18.09.91
ITALY	03.03.92	03.03.92
NETHERLANDS	12.06.91	12.06.91
NORWAY	18.09.91	18.09.91
PORTUGAL	15.07.92	15.07.92
SLOVAKIA	02.04.92	02.04.92
SWITZERLAND	29.04.92	29.04.92
FINLAND	12.09.96	12.09.96
SWEDEN	12.06.91	12.06.91
TURKEY	23.06.94	23.06.94
UNITED KINGDOM	12.06.91	12.06.91

(1) "COST projects", Vol. 7, p. 51.

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 : 25.04.1991
Duration : 24.04.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.10.91	02.10.91
CZECH REPUBLIC	02.04.92	02.04.92
DENMARK	23.01.92	23.01.92
GERMANY	25.04.91	25.04.91
GREECE	25.04.91	25.04.91
FRANCE	05.03.92	05.03.92
IRELAND	04.07.91	04.07.91
ITALY	07.04.92	07.04.92
HUNGARY	10.03.93	10.03.93
NETHERLANDS	05.06.91	05.06.91
NORWAY	18.09.91	18.09.91
POLAND	06.04.94	06.04.94
PORTUGAL	23.07.92	23.07.92
SWITZERLAND	17.05.92	17.05.92
SWEDEN	24.04.91	25.04.91
UNITED KINGDOM	25.04.91	25.04.91

(1) "COST projects", Vol. 7, p 55.

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 : 16.01.1992
Duration : 15.07.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.01.92	16.01.92
CZECH REPUBLIC	02.04.92	02.04.92
DENMARK	06.02.92	06.02.92
GERMANY	16.01.92	16.01.92
SPAIN	24.06.92	24.06.92
FRANCE	13.02.92	13.02.92
ITALY	14.04.92	14.04.92
HUNGARY	28.09.93	28.09.93
NETHERLANDS	16.01.92	16.01.92
PORTUGAL	02.07.92	02.07.92
SLOVAKIA	02 04.92	02.04.92
SWITZERLAND	11.11.92	11.11.92
FINLAND	12.01.93	12.01.93
SWEDEN	09.04.92	09.04.92
UNITED KINGDOM	16.01.92	16.01.92

(1) "COST projects", Vol. 7, p. 57.

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 : 08.12.1992
Duration : 07.12.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	24.02.94	24.02.94
GERMANY	21.10.92	21.10.92
GREECE	21.10.92	21.10.92
SPAIN	21.10.92	21.10.92
FRANCE	09.12.92	09.12.92
ITALY	08.12.92	08.12.92
HUNGARY	05.05 94	05.05.94
NORWAY	18.05.94	18.05.94
POLAND	09.01.95	09.01.95
SWITZERLAND	20 04.94	20.04.94
SWEDEN	20.07.94	20 07.94
UNITED KINGDOM	09.12.92	09.12 92
ESA	13 05.93	13.05.93

(1) "COST projects", Vol 7, p. 67.

Memorandum of Understanding for the implementation of a European research project on active phased arrays and array fed antennae COST Project 245 (1)

Date of entry into force of the project : 29.04.1993
Duration : 28.04.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.06.93	15.06.93
CROATIA	18.05.93	18.05.93
DENMARK	29.04.93	29.04.93
GERMANY	29.04.93	29.04.93
GREECE	01.06.93	01.06.93
SPAIN	10.06.93	10.06.93
FRANCE	17.11.93	17.11.93
ITALY	17.09.95	17.09.95
NETHERLANDS	29.04.93	29.04.93
NORWAY	23.06.93	23.06.93
POLAND	29.04.93	29.04.93
PORTUGAL	10.06.93	10.06.93
SWITZERLAND	20.04.94	20.04.94
FINLAND	14.12.93	14.12.93
SWEDEN	04.05.93	04.05.93
TURKEY	29.04.93	29.04.93
UNITED KINGDOM	29.04.93	29.04.93
ESA	13.05.93	13.05.93

(1) "COST projects", Vol. 8, p. 19.

Memorandum of Understanding
for the implementation of a European
research action on verification and validation methods
for formal descriptions
COST Project 247

Date of entry into force of the action : 16.12.1993
Duration : 20.05.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
CROATIA	16.03.95	16 03.95
CZECH REPUBLIC	14.02.94	14.02.94
DENMARK	16.12.93	16.12.93
GERMANY	16.12.93	16.12.93
GREECE	18.11.94	18.11.94
SPAIN	02.06.94	02.06.94
FRANCE	27.01.94	27.01.94
ITALY	18.03.94	18.03.94
HUNGARY	24.05.94	24.05.94
NETHERLANDS	16.12.93	16.12.93
POLAND	16.12.93	16.12.93
SLOVENIA	28.01.94	28.01.94
SWITZERLAND	18.05.95	18.05.95
FINLAND	06.04.94	06.04.94
SWEDEN	01.07.94	01.07.94
TURKEY	16.12.93	16.12.93
UNITED KINGDOM	10.02.94	10.02.94

Memorandum of Understanding for the implementation of a European research project on materials and reliability of passive optical components and optical fibre amplifiers in telecommunication networks COST Project 246 (1)

Date of entry into force of the project :	25.03.1993
Duration :	24.03.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	08.03.95	08.03.95
DENMARK	25.03.93	25.03.93
GERMANY	25.03.93	25.03.93
FRANCE	17.11.93	17.11.93
ITALY	16.03.94	16.03.94
NETHERLANDS	25.03.93	25.03.93
SWITZERLAND	25 03.93	25 03.93
FINLAND	25.03.93	25 03 93
SWEDEN	12.05.93	12 05.93
UNITED KINGDOM	08.03.95	08 03.95

(1) "COST projects", Vol. 8, p. 25.

Memorandum of Understanding for the implementation of a European research action on the future European telecommunications user COST Action 248 (1)

Date of entry into force of the action :	20.10.1993
Duration :	19.10.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.05.95	17.05.95
CROATIA	07.03.95	07.03.95
DENMARK	20.10.93	20.10.93
GERMANY	20.10.93	20.10.93
GREECE	24.02.94	24.02.94
SPAIN	13.09.95	13.09.95
FRANCE	27.01.94	27.01.94
IRELAND	04.11.93	04.11.93
ITALY	11.11.96	11.11.96
HUNGARY	05.05.94	05.05.94
NETHERLANDS	20.10.93	20.10.93
NORWAY	20.10.93	20.10.93
SLOVENIA	28.01.94	28.01.94
SWITZERLAND	28.01.94	28.01.94
SWEDEN	20.10.93	20.10.93
UNITED KINGDOM	03.03.94	03.03.94

(1) "COST Actions", Vol. 8, p. 33.

Memorandum of Understanding for the implementation of a European research action on continuous speech recognition over the telephone COST Action 249 (1)

Date of entry into force of the action : 24.05.1994
Duration : 23.05.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
CZECH REPUBLIC	23.02.95	23.02.95
DENMARK	24.05.94	24.05.94
GERMANY	13.10.94	13.10.94
GREECE	21.09.94	21.09.94
SPAIN	07.07.94	07.07.94
FRANCE	23.02.95	23.02.95
ITALY	26.07.94	26.07.94
HUNGARY	24.05.94	24.05.94
NETHERLANDS	08.09.94	08.09.94
NORWAY	23.02.95	23.02.95
PORTUGAL	12.07.95	12.07.95
SLOVAKIA	24.05.94	24.05.94
SLOVENIA	24.05.94	24.05.94
SWITZERLAND	24.05.94	24.05.94
FINLAND	05.09.96	05.09.96
SWEDEN	01.07.94	01.07.94
TURKEY	26.01.96	26.01.96
UNITED KINGDOM	29.09.94	29.09.94

(1) "COST Actions", Vol. 8, p. 39.

Memorandum of Understanding for the implementation of a European research action on speaker recognition in telephony COST Action 250 (1)

Date of entry into force of the action : 29.09.1994
Duration : 28.09.1998

Contracting parties	Date of signing	Date of entry into force
DENMARK	29.09.94	29.09.94
GREECE	27.09.94	27.09.94
SPAIN	06.10.94	06.10.94
FRANCE	29.09.94	29.09.94
IRELAND	13.10.94	13.10.94
ITALY	04.11.94	04.11.94
NETHERLANDS	12.01.95	12.01.95
PORTUGAL	15.03.95	15.03.95
SLOVENIA	13.01.95	13.01.95
SWITZERLAND	06.04.95	06.04.95
TURKEY	17.11.95	17.11.95
UNITED KINGDOM	29.09.94	29.09.94

(1) "COST Actions", Vol. 8, p. 45.

Memorandum of Understanding for the implementation of a European research project in the field of interactions between high-speed rail and air passenger transport COST Project 318 (1)

Date of entry into force of the project : 03.03.1994
Duration : 02.03.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	05.07.95	05.07.95
GERMANY	11.05.94	11.05.94
SPAIN	03.03.94	03.03.94
FRANCE	12.04.95	12.04.95
IRELAND	03.03.94	03.03.94
ITALY	20.04.94	20.04.94
PORTUGAL	23.01.96	23.01.96
SLOVENIA	03.03.94	03.03.94
SWITZERLAND	03.03.94	03 03.94
SWEDEN	03.03.94	03.03.94

(1) "COST projects", Vol. 8, p. 51.

Memorandum of Understanding for the implementation of a European research project in the field of estimation of pollutant emissions from transport COST Project 319 (1)

Date of entry into force of the project : 29.04.1993
Duration : 28.04.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.06.93	15.06.93
CZECH REPUBLIC	23.09.94	23.09.94
DENMARK	17.11.93	17.11.93
GERMANY	30.06.93	30.06.93
GREECE	29.04.93	29.04.93
SPAIN	27.10.93	27.10.93
FRANCE	19.05.93	19.05.93
IRELAND	16.12.93	16.12.93
ITALY	02.02.94	02.02.94
HUNGARY	28.09.93	28.09.93
NETHERLANDS	07.10.93	07.10.93
AUSTRIA	17.10.96	17.10.96
SLOVAKIA	29.04.93	29.04.93
SWITZERLAND	29.04.93	29.04.93
FINLAND	29.04.93	29.04.93
SWEDEN	03.05.95	03.05.95
UNITED KINGDOM	29.04.93	29.04.93

(1) "COST Projects", Vol. 8, p. 57.

Memorandum of Understanding for the implementation of a European research action in the field of urban goods transport COST Action 321 (1)

Date of entry into force of the action : 27.01.1994
Duration : 26.01.1998

Contracting parties	Date of signing	Date of entry into force
DENMARK	24.05.94	24.05.94
GERMANY	27.01.94	27.01.94
GREECE	17.01.96	17.01.96
SPAIN	07.07.94	07.07.94
FRANCE	27.01.94	27.01.94
ITALY	20.06.96	20.06.96
NETHERLANDS	27.01.94	27.01.94
SLOVENIA	27.01.94	27.01.94
SWITZERLAND	27.01.94	27.01.94
FINLAND	05.04.95	05.04.95
SWEDEN	27.01.94	27.01.94
UNITED KINGDOM	12.04.95	12.04.95

(1) "COST Actions", Vol. 8, p. 63.

Memorandum of Understanding for the implementation of a European research action on the weighing-in-motion of road vehicles COST Action 323 (1)

Date of entry into force of the action : 24.05.1994
Duration : 23.11.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	13.06.96	13.06.96
GERMANY	06.10.94	06.10.94
SPAIN	23.01.96	23.01.96
FRANCE	24.05.94	24.05.94
IRELAND	27.04.95	27.04.95
HUNGARY	22.01.96	22.01.96
NETHERLANDS	24.05.94	24.05.94
AUSTRIA	26.10.94	26.10.94
PORTUGAL	12.04.95	12.04.95
SLOVAKIA	30.11.94	30.11.94
SLOVENIA	24.05.94	24.05.94
SWITZERLAND	13.10.94	13.10.94
FINLAND	24.05.94	24.05.94
SWEDEN	01.07.94	01.07.94
UNITED KINGDOM	24.05.94	24.05.94

(1) "COST Actions", Vol. 8, p. 81.

Memorandum of Understanding for the implementation of a European research action in the field of long-term performance of road pavements COST Action 324 (1)

Date of entry into force of the action : 02.02.1994
Duration : 01.02.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GREECE	17.01.96	17.01.96
SPAIN	16.02.94	16.02.94
FRANCE	16.02.94	16 02 94
IRELAND	17.10.96	17.10.96
HUNGARY	02.02.94	02.02.94
NETHERLANDS	30.03.94	30.03 94
AUSTRIA	02.02.94	02 02.94
PORTUGAL	14.12.94	14 12.94
SLOVENIA	02.02.94	02 02.94
SWITZERLAND	02.02.94	02.02 94
FINLAND	02.02.94	02.02.94
SWEDEN	01.07.94	01.07.94
UNITED KINGDOM	02.02.94	02.02 94

(1) "COST Actions", Vol. 8, p. 89.

Memorandum of Understanding for the implementation of a European research action in the field of electronic charts for navigation COST Action 326 (1)

Date of entry into force of the action : 16.02.1994
Duration : 15.02.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	27.04.95	27.04.95
DENMARK	08.08.94	08.08.94
GERMANY	16.02.94	16.02.94
GREECE	03.05.95	03.05.95
SPAIN	16.02.94	16.02.94
FRANCE	03.03.94	03.03.94
IRELAND	03.03.94	03.03.94
ITALY	14.04.94	14.04.94
NETHERLANDS	07.12.94	07.12.94
NORWAY	16.02.94	16.02.94
PORTUGAL	07.07.94	07.07.94
SLOVENIA	16.09.94	16.09.94
FINLAND	15.02.94	15.02.94
SWEDEN	29.09.94	29.09.94
UNITED KINGDOM	16.02.94	16.02.94

(1) "COST Actions", Vol. 8, p. 97.

Memorandum of Understanding for the implementation of a European research action in the field of the integrated strategic infrastructure networks in Europe COST Action 328 (1)

Date of entry into force of the action : 14.09.1994
Duration : 13.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
CZECH REPUBLIC	23.02.95	23.02.95
DENMARK	14.09.94	14.09.94
GERMANY	14.09.94	14.09.94
GREECE	17.01.96	17.01.96
SPAIN	01.02.95	01.02.95
FRANCE	22.12.94	22.12.94
IRELAND	08.03.95	08.03.95
ITALY	14.09.94	14.09.94
NETHERLANDS	14.09.94	14.09.94
AUSTRIA	15.03.95	15.03.95
PORTUGAL	14.06.95	14.06.95
SLOVENIA	13.01.95	13.01.95
SWITZERLAND	13.10.94	13.10.94
FINLAND	26.01.95	26.01.95
SWEDEN	14.09.94	14.09.94
UNITED KINGDOM	02.12.94	02.12.94

(1) "COST Actions", Vol. 8, p 103.

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 : 31.12.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	07.10.82	07.10.82
CZECH REPUBLIC	18.06.92	18.06.92
DENMARK	23.11.81	23.11.81
GERMANY	23.11.81	23.11.81
FRANCE	23.11.81	23.11.81
IRELAND	23.11.81	23.11.81
ICELAND	04.12.92	04.12.92
ITALY	23.11.81	23.11.81
HUNGARY	11.12.92	11.12.92
NETHERLANDS	23.11.81	23.11.81
NORWAY	23.11.81	23.11.81
AUSTRIA	23.11.81	23.11.81
SWITZERLAND	23.11.81	23.11.81
FINLAND	23.11.81	23.11.81
SWEDEN	23.11.81	23.11.81
UNITED KINGDOM	23.11.81	23.11.81
EC	23.11.81	23.11.81

(1) "COST projects", Vol. 2, p. 61.

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 : 08.12.1988
Duration : 07.06.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	12.01.89	12.01.89
GERMANY	08.12.88	08.12.88
GREECE	08.12.88	08.12.88
SPAIN	25.10.90	25.10.90
FRANCE	08.12.88	08.12 88
ITALY	18.09.90	18.09.90
NETHERLANDS	05.07.90	05.07.90
NORWAY	08.12 88	08.12.88
AUSTRIA	05.10.89	05.10.89
PORTUGAL	07.09.89	07.09.89
SWITZERLAND	23.06.89	23.06.89
FINLAND	30.03.90	30.03 90
SWEDEN	21.02.89	21.02.89
UNITED KINGDOM	08.12.88	08 12 88

(1) "COST projects", Vol. 5, p. 107.

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 : 23.06.1992
Duration : 30.06.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	18.06.92	18.06.92
GERMANY	18.06.92	18.06.92
SPAIN	25.03.93	25.03.93
ITALY	23.06.92	23.06.92
NORWAY	15.03.93	15.03.93
AUSTRIA	15.03.95	15.03.95
SLOVAKIA	03.09.93	03.09.93
SWITZERLAND	29.04.93	29.04.93
UNITED KINGDOM	18.06.92	18.06.92

(1) "COST projects", Vol. 7, p. 109.

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 :	22.05.1992
Duration :	21.05.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	30.04.92	30.04.92
GERMANY	24.06.92	24.06.92
SPAIN	07.10.92	07.10.92
FRANCE	09.12.92	09.12.92
ITALY	24.06.92	24.06.92
HUNGARY	10.03.93	10.03.93
SWITZERLAND	22.05.92	22.05.92
FINLAND	30.04.92	30 04.92
SWEDEN	08.12.92	08.12.92
UNITED KINGDOM	30.04.92	30 04.92

(1) "COST projects", Vol. 7, p. 115.

Memorandum of Understanding for the implementation of a European research project on modelling in materials science and processing (MMSP) COST Project 512 (1)

Date of entry into force of the project :	17.02.1993
Duration :	16.02.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.06.93	15.06.93
CZECH REPUBLIC	07.09.93	07.09.93
GERMANY	10.06.93	10.06.93
SPAIN	12.04.95	12.04.95
FRANCE	24.05.93	24.05.93
IRELAND	05.05.93	05.05.93
ITALY	13.05.93	13.05.93
HUNGARY	20.04.95	20.04.95
NORWAY	17.02.93	17.02.93
AUSTRIA	27.04.95	27.04.95
POLAND	31.05.95	31.05.95
SLOVENIA	17.02.93	17.02.93
SWITZERLAND	17.02.93	17.02.93
FINLAND	17.02.93	17.02.93
SWEDEN	04.05.93	04.05.93
UNITED KINGDOM	17.02.93	17.02.93

(1) "COST projects", Vol. 8, p. 107.

Memorandum of Understanding for the implementation of a European research project on improvements in availability and quality of intermetallicbased materials COST Project 513 (1)

Date of entry into force of the project : 09.06.1993
Duration : 08.06.1997

Contracting parties	Date of signing	Date of entry into force
CZECH REPUBLIC	23.09.94	23.09.94
GERMANY	09.06.93	09.06.93
FRANCE	09.06.93	09.06.93
ITALY	06.09.93	06.09.93
AUSTRIA	27.04.95	27.04.95
SWITZERLAND	09.06.93	09.06.93
FINLAND	09.06.93	09 06.93
UNITED KINGDOM	09.06.93	09 06.93

(1) "COST projects", Vol. 8, p. 115.

Memorandum of Understanding for the implementation of a European research project on ferroelectric ceramic thin films COST Project 514 (1)

Date of entry into force of the project : 12.05.1993
Duration : 11.05.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.06.93	15.06.93
DENMARK	08.12.93	08.12.93
GERMANY	07.10.93	07.10.93
SPAIN	10.06.93	10.06.93
FRANCE	12.01.95	12.01.95
IRELAND	12.05.93	12.05.93
ITALY	19.07.95	19.07.95
PORTUGAL	24.05.94	24.05.94
SLOVENIA	12.05.93	12.05.93
SWITZERLAND	12.05.93	12.05.93
FINLAND	12.05.93	12.05.93
SWEDEN	12.05.93	12.05.93
TURKEY	23.11.93	23.11.93
UNITED KINGDOM	12.05.93	12.05.93

(1) "COST projects", Vol. 8, p. 127.

Memorandum of Understanding for the implementation of a European research action on tribology COST Action 516 (1)

Date of entry into force of the action : 30.06.1994
Duration : 29.06.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
CROATIA	12.07.94	12.07.94
CZECH REPUBLIC	23.09.94	23.09.94
DENMARK	22.12.94	22.12.94
GREECE	28.06.95	28.06.95
SPAIN	24.05.95	24.05.95
FRANCE	30.06.94	30.06.94
ITALY	27.07.94	27.07.94
HUNGARY	22.01.96	22.01.96
NETHERLANDS	14.06.95	14.06.95
NORWAY	10.12.96	10.12.96
POLAND	07.12.95	07.12.95
PORTUGAL	22.12.94	22.12.94
SLOVAKIA	11.01.95	11.01.95
SLOVENIA	16.09.94	16.09.94
SWITZERLAND	03.12.96	03.12.96
FINLAND	30.06.94	30.06.94
SWEDEN	30.06.94	30.06.94
UNITED KINGDOM	30.06.94	30.06.94

(1) "COST Actions", Vol. 8, p. 143.

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 : 07.10.1992
Duration : 07.10.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CROATIA	18.05.93	18.05.93
CZECH REPUBLIC	07.10.92	07.10.92
GERMANY	17.12.92	17.12.92
GREECE	20.10.93	20.10.93
SPAIN	15.09.93	15.09.93
FRANCE	14.10.92	14.10.92
ITALY	27.01.93	27.01.93
HUNGARY	24.02.94	24.02.94
NETHERLANDS	14.01.93	14.01.93
NORWAY	07.10.92	07.10.92
AUSTRIA	09.02.94	09.02.94
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	07.10.92	07.10.92
FINLAND	08.12.92	08.12.92
SWEDEN	16.11.92	16.11.92
UNITED KINGDOM	07.10.92	07.10.92

(1) "COST Projects", Vol. 7, p. 119.

Memoramndum of Understanding
for the implementation of a European
research project on chemodynamics and water quality
protection in natural porous media
COST Project 67 (1)

Date of entry into force of the project : 20.10 1993
Duration : 19.10.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	20.10.93	20.10.93
GERMANY	20.10.93	20.10.93
SPAIN	16.02.94	16.02.94
FRANCE	20.10.93	20.10.93
ITALY	19.04.94	19.04.94
HUNGARY	10.02.94	10.02.94
NETHERLANDS	20.04.94	20.04.94
NORWAY	20.10.93	20.10.93
PORTUGAL	13.04.94	13.04.94
SWITZERLAND	28.01.94	28 01.94
FINLAND	20.10 93	20.10.93
SWEDEN	20.10.93	20.10 93
UNITED KINGDOM	23.03.95	23.03 95

(1) "COST Projects", Vol. 8, p. 149.

Action 1 (COST 615) (1)
Database, monitoring and
modelling of urbain air pollution

Date of entry into force of the action : 19.05.1993
Duration : 18.05.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.06.93	15.06.93
CROATIE	13.05.96	13.05.96
CZECH REPUBLIC	04.08.94	04.08.94
DENMARK	19.05.93	19.05.93
GERMANY	17.11.93	17.11.93
GREECE	19.05.93	19.05.93
SPAIN	28.07.93	28.07.93
FRANCE	19.05.93	19.05.93
ITALY	20.04.94	20.04.94
HUNGARY	28.09.93	28.09.93
NORWAY	22.06.94	22.06.94
SLOVAKIA	22.03.95	22.03.95
SWITZERLAND	19.05.93	19.05.93
FINLAND	10.06.93	10.06.93
SWEDEN	10.02.94	10.02.94
UNITED KINGDOM	19.05.93	19.05.93

(1) "COST Actions", Vol. 8, p. 157.

Action 2 (COST 616) (1)
Mobile sources of air pollution in urban areas

Date of entry into force of the action : 19.05.1993
Duration : 18 05.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	04.08.94	04.08.94
CZECH REPUBLIC	04.08.94	04.08.94
DENMARK	19.05.93	19.05.93
GERMANY	17.11.93	17.11.93
GREECE	19.05.93	19.05.93
SPAIN	28.07.93	28.07.93
FRANCE	19.05.93	19.05.93
IRELAND	08.03.95	08.03.95
ITALY	20.04.94	20.04.94
HUNGARY	10.02.94	10.02.94
NORWAY	13.11.95	13.11.95
SWITZERLAND	19.05.93	19.05.93
SWEDEN	10.02.94	10.02.94
UNITED KINGDOM	19.05.93	19.05.93

(1) "COST Actions", Vol. 8, p. 157.

Action 3 (COST 617) (1)
Stationary sources of air pollution in urban areas

Date of entry into force of the action : 19.05.1993
Duration : 18.05.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	15.02.96	15.02.96
CZECH REPUBLIC	04.08.94	04.08.94
DENMARK	19.05.93	19.05.93
GERMANY	17.11.93	17.11.93
GREECE	19.05.93	19.05.93
SPAIN	28.07.93	28.07.93
FRANCE	19.05.93	19.05.93
ITALY	20.04.94	20.04.94
HUNGARY	28.09.93	28.09.93
SLOVAKIA	23.09.94	23.09.94
SWITZERLAND	19.05.93	19.05.93
UNITED KINGDOM	19.05.93	19.05.93

(1) "COST Actions", Vol. 8, p. 158.

Action 4 (COST 618) (1)
Insitution building and information policy

Date of entry into force of the action : 19.05.1993
Duration : 18.05.1997

Contracting parties	Date of signing	Date of entry into force
DENMARK	19.05.93	19.05.93
GREECE	19.05.93	19.05.93
SPAIN	24.05.94	24.05.94
FRANCE	19.05.93	19.05.93
ITALY	20.04.94	20.04.94
HUNGARY	10.02.94	10.02.94
SWITZERLAND	19.05.93	19.05.93
UNITED KINGDOM	19.05.93	19.05.93

(1) "COST Actions", Vol. 8, p. 158.

Memorandum of Understanding for the implementation of a European research action on the effects of atmospheric CO2 increase on carbon fluxes in grassland ecosystems COST Action 619 (1)

Date of entry into force of the action : 30.06.1994
Duration : 29.06.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
DENMARK	29.09.94	29.09.94
GERMANY	17.11.94	17.11.94
SPAIN	07.07.94	07.07.94
FRANCE	30.06.94	30.06.94
IRELAND	30.06.94	30.06.94
ITALY	04.07.94	04.07.94
HUNGARY	30.06.94	30.06.94
NETHERLANDS	26.07.94	26.07.94
NORWAY	21.03.95	21.03.95
AUSTRIA	12.10.95	12.10.95
SWITZERLAND	04.07.94	04.07.94
FINLAND	05.07.94	05.07.94
SWEDEN	08.11.95	08.11.95
UNITED KINGDOM	14.09.94	14.09.94

(1) "COST Actions", Vol. 8, p. 183.

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 :	06.02.1992
Duration :	05.02.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	06.02.92	06.02.92
CZECH REPUBLIC	24.05.94	24.05.94
DENMARK	07.10.92	07.10.92
GERMANY	07.10.93	07.10.93
SPAIN	06.02.92	06.02.92
FRANCE	06.02.92	06.02.92
ITALY	04.11.92	04.11.92
HUNGARY	28.09.93	28.09.93
NETHERLANDS	12.07.95	12.07.95
NORWAY	25.09.92	25.09.92
SLOVENIA	09.01.96	09.01.96
SWITZERLAND	13.03.92	13.03.92
FINLAND	06.02.92	06.02.92
SWEDEN	06.02.92	06.02.92

(1) "COST Projects", Vol. 7, p. 129.

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
BELGIUM	29.05.96	29.05.96
CROATIA	20.07.95	20.07.95
CZECH REPUBLIC	11.12.92	11.12.92
GERMANY	07.10.92	07.10.92
GREECE	28.06.95	28.06.95
SPAIN	29.10.92	29.10.92
FRANCE	19.05.93	19.05.93
ITALY	14.06.93	14.06.93
HUNGARY	11.12.92	11.12 92
NETHERLANDS	24 02.93	24.02.93
AUSTRIA	17.10.96	17 10.96
POLAND	18.04.94	18.04 94
PORTUGAL	22.09.94	22 09 94
SLOVAKIA	12.10.94	12.10.94
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	07.10.92	07.10 92
FINLAND	30.10.92	30.10.92
SWEDEN	04.05.93	04.05.93
UNITED KINGDOM	07.10.92	07.10.92

(1) "COST Projects", Vol. 7, p. 133.

Memorandum of Understanding for the implementation of a European research action on the development of VHF/UHF wind-profilers and vertical sounders for use in European observing systems COST Action 76 (1)

Date of entry into force of the action :	24.03.1994
Duration :	23.03.1999

Contracting parties	Date of signing	Date of entry into force
DENMARK	24.05.94	24.05.94
GERMANY	04.08.94	04.08.94
GREECE	15.03.96	15.03.96
SPAIN	24.03.94	24.03.94
FRANCE	24.03.94	24.03.94
ITALY	03.06.94	03.06.94
HUNGARY	24.03.94	24.03.94
NETHERLANDS	30.03.94	30.03.94
AUSTRIA	22.12.94	22.12.94
PORTUGAL	22.09.94	22.09.94
SWITZERLAND	04.07.94	04.07.94
FINLAND	24.03.94	24.03.94
UNITED KINGDOM	24.03.94	24.03.94

(1) "COST Actions", Vol. 8, p. 191.

Memorandum of Understanding for the implementation of a European research action on the application of remote sensing in agrometeorologie COST Action 77 (1)

Date of entry into force of the action : 24.03.1994
Duration : 23.03.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GERMANY	04.08.94	04.08.94
GREECE	20.04.94	20.04.94
SPAIN	24.03.94	24.03.94
FRANCE	07.07.94	07.07.94
ITALY	25.03.94	25.03.94
HUNGARY	24.03.94	24.03.94
NETHERLANDS	12.09.96	12.09.96
PORTUGAL	22.09.94	22.09.94
SWITZERLAND	24.03.94	24.03.94
FINLAND	24.03.94	24.03.94
SWEDEN	24.03.94	24.03.94
UNITED KINGDOM	24.03.94	24.03.94

(1) "COST Actions", Vol. 8. p. 199.

Memorandum of Understanding for the implementation of a European research action on the development of 'nowcasting' techniques COST Action 78 (1)

Date of entry into force of the action : 24.03.1994
Duration : 23.03.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GERMANY	04.08.94	04.08.94
GREECE	07.02.96	07.02.96
SPAIN	24.03.94	24.03.94
FRANCE	24.05.94	24.05.94
ITALY	24.05.94	24.05.94
HUNGARY	24.03.94	24.03.94
NETHERLANDS	30.03.94	30.03.94
NORWAY	06.10.94	06.10.94
AUSTRIA	22.12.94	22.12.94
PORTUGAL	22.09.94	22.09.94
SLOVAKIA	11.01.96	11.01.96
SLOVENIA	24.03.94	24.03.94
SWITZERLAND	04.07.94	04.07.94
FINLAND	24.03.94	24.03.94
SWEDEN	24.03.94	24.03.94
UNITED KINGDOM	24.03.94	24.03.94

(1) "COST Actions", Vol. 8, p. 203.

Memorandum of Understanding for the implementation of a European research action on the integration of data and methods in agroclimatology COST Action 79 (1)

Date of entry into force of the action :	24.03.1994
Duration :	23.03.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GERMANY	02.06.94	02.06.94
GREECE	20.04.94	20.04.94
SPAIN	24.03.94	24.03.94
FRANCE	07.07.94	07.07.94
ITALY	24.03.94	24.03.94
HUNGARY	24.03.94	24.03.94
NETHERLANDS	30.06.94	30.06.94
AUSTRIA	22.12.94	22.12.94
PORTUGAL	22.09.94	22.09.94
SLOVAKIA	16.02.96	16 02.96
FINLAND	24.03.94	24.03.94
SWEDEN	24.03.94	24.03.94
UNITED KINGDOM	24.03.94	24.03.94

(1) "COST Actions", Vol. 8, p. 211.

Memorandum of Understanding for the implementation of a European research action on harmonization in the preprocessing of meteorological data for atmospheric dispersion models COST Action 710 (1)

Date of entry into force of the action :	03.03.1994
Duration :	02.03.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GERMANY	22.09.94	22.09.94
GREECE	03.03.94	03.03.94
SPAIN	29.05.96	29.05.96
FRANCE	24.05.94	24.05.94
ITALY	29.04.94	29.04.94
HUNGARY	10.02.94	10.02.94
NETHERLANDS	11.05.94	11.05.94
AUSTRIA	22.12.94	22.12.94
PORTUGAL	22.09.94	22.09.94
SLOVENIA	10.02.94	10.02.94
SWITZERLAND	04.07.94	04.07.94
FINLAND	10.02.94	10.02.94
SWEDEN	24.03.94	24.03.94
UNITED KINGDOM	10.02.94	10.02.94

(1) "COST Actions", Vol. 8, p. 217.

Memorandum of Understanding for the implementation of a European research action on the operational applications of meteorology to agriculture, including horticulture COST Action 711 (1)

Date of entry into force of the action :	24.03.1994
Duration :	23.03.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GERMANY	02.06.94	02.06.94
GREECE	20.04.94	20.04.94
SPAIN	24.05.94	24.05.94
FRANCE	07.07.94	07.07.94
ITALY	25.03.94	25.03 94
HUNGARY	24.03.94	24 03.94
NETHERLANDS	30.06.94	30.06 94
NORWAY	06.10.94	06 10.94
AUSTRIA	22.12.94	22 12 94
POLAND	26.10.94	26 10.94
PORTUGAL	06.09.95	06.09 95
SLOVAKIA	12.10.94	12 10 94
SLOVENIA	24.03.94	24.03.94
FINLAND	24.03.94	24.03.94
SWEDEN	24.03.94	24.03.94
UNITED KINGDOM	24.03.94	24.03.94

(1) "COST Actions", Vol. 8, p. 221.

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 :	14.03.1991
Duration :	13.03.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.01.92	16.01.92
CZECH REPUBLIC	24.09.92	24.09.92
GREECE	17.11.93	17.11.93
SPAIN	30.05.90	30.05.90
FRANCE	30.05.90	30.05.90
IRELAND	20.01.93	20.01.93
ITALY	14.03.91	14.03.91
SWITZERLAND	13.03.92	13.03.92
UNITED KINGDOM	30.05.90	30.05.90

(1) "COST Projects", Vol. 7, p. 139.

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 : 21.02.1991
Duration : 20.02.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.10.91	02.10.91
CROATIA	17.02.93	17.02.93
DENMARK	13.05.92	13.05.92
GERMANY	18.06.92	18.06.92
GREECE	21.12.94	21.12.94
SPAIN	21.02.91	21.02.91
FRANCE	16.10.91	16.10.91
IRELAND	04.07.91	04.07.91
ICELAND	14.10.94	14.10.94
ITALY	29.03.95	29.03.95
HUNGARY	10.03.94	10.03.94
NETHERLANDS	07.03.91	07.03.91
NORWAY	21.02.91	21.02.91
POLAND	03.02.93	03.02.93
SLOVAKIA	03.09.93	03.09.93
SWITZERLAND	17.05.91	17.05.91
FINLAND	21.02.91	21.02.91
SWEDEN	13.04.94	13.04.94
UNITED KINGDOM	21.02.91	21.02.91

(1) "COST Projects", Vol. 7, p. 143.

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 : 10.04.1991
Duration : 09.04.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.10.91	16.10.91
GERMANY	10.04.91	10.04.91
SPAIN	10.04.91	10.04.91
FRANCE	10.04.91	10.04.91
ITALY	12.01.96	12.01.96
HUNGARY	11.12.92	11.12.92
POLAND	06.03.95	06.03.95
SWITZERLAND	17.05.91	17.05.91
SWEDEN	15.05.96	15.05.96
UNITED KINGDOM	10.04.91	10.04.91

(1) "COST Projects", Vol. 7, p. 147.

Memorandum of Understanding for the implementation of a European research action on the biological control of weeds in Europe COST Action 816 (1)

Date of entry into force of the action :	02.02.1994
Duration :	01.02.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.02.94	02.02.94
CROATIA	12.07.94	12.07.94
DENMARK	02.02.94	02.02.94
GERMANY	02.02.94	02.02.94
SPAIN	16.02.94	16.02.94
FRANCE	05.09.96	05.09.96
ITALY	15.04.94	15.04.94
HUNGARY	02.02.94	02.02.94
NETHERLANDS	02.02.94	02.02.94
NORWAY	22.11.95	22.11.95
SLOVAKIA	24.05.94	24.05.94
SWITZERLAND	02.02.94	02.02.94
UNITED KINGDOM	02.02.94	02.02.94

(1) "COST Actions", Vol. 8, p. 227.

Memorandum of Understanding for the implementation of a European research action on population studies of airborne pathogens on cereals as a means of improving strategies for disease control COST Action 817 (1)

Date of entry into force of the action :	16.12.1993
Duration :	15.12.1998

Contracting parties	Date of signing	Date of entry into force
CZECH REPUBLIC	16.12.93	16.12.93
DENMARK	16.12.93	16.12.93
GERMANY	16.12.93	16.12.93
FRANCE	16.02.94	16.02.94
ITALY	09.10.95	09.10.95
HUNGARY	16.12.93	16.12.93
NETHERLANDS	27.01.94	27.01.94
NORWAY	27.09.96	27.09.96
POLAND	06.04.94	06.04.94
SLOVAKIA	23.03.94	23.03.94
SWITZERLAND	16.05.94	16.05.94
FINLAND	16.12.93	16.12.93
SWEDEN	17.05.95	17.05.95
UNITED KINGDOM	16.12.93	16.12.93

(1) "COST Actions", Vol. 8, p. 233.

Memorandum of Understanding for the implementation of a European research action on hydrogenases and environmental biotechnology COST Action 818 (1)

Date of entry into force of the action : 16.02.1994
Duration : 15.02.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
GERMANY	16.02.94	16.02.94
SPAIN	16.02.94	16.02.94
FRANCE	22.02.94	22.02.94
ITALY	22.08.94	22.08.94
HUNGARY	10.03.94	10.03.94
NETHERLANDS	16.02.94	16.02.94
PORTUGAL	14.12.94	14.12.94
SWITZERLAND	19.09.95	19.09.95
SWEDEN	16.02.94	16.02.94
UNITED KINGDOM	16.02.94	16.02.94

(1) "COST Actions", Vol. 8, p. 237.

Memorandum of Understanding for the implementation of a European research action on entomopathogenic nematodes COST Action 819 (1)

Date of entry into force of the action : 24.05.1994
Duration : 23.05.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
CZECH REPUBLIC	23.09.94	23.09.94
GERMANY	24.05.94	24.05.94
SPAIN	02.06.94	02.06.94
FRANCE	05.09.96	05.09.96
IRELAND	24.05.94	24.05.94
ITALY	07.07.94	07.07.94
HUNGARY	08.06.94	08.06.94
NETHERLANDS	24.05.94	24.05.94
NORWAY	22.11.95	22.11.95
AUSTRIA	30.11.95	30.11.95
POLAND	22.09.94	22.09.94
PORTUGAL	20.07.94	20.07.94
SWITZERLAND	19.09.95	19.09.95
FINLAND	24.05.94	24.05.94
SWEDEN	06.09.95	06.09.95
UNITED KINGDOM	14.09.94	14.09.94

(1) "COST Actions", Vol. 8, p. 245.

Memorandum of Understanding for the implementation of a European research action on vaccines against animal coccidioses COST Action 820 (1)

Date of entry into force of the action : 07.07.1994
Duration : 06 07.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	07.07.94	07.07 94
CZECH REPUBLIC	14.10.94	14.10.94
DENMARK	07.07.94	07.07.94
GERMANY	22.09.94	22.09.94
SPAIN	06.12.95	06.12.95
FRANCE	05.09.96	05.09.96
IRELAND	23.03.95	23.03.95
ITALY	26.07.94	26.07.94
HUNGARY	07.07.94	07.07.94
NETHERLANDS	08.09.94	08.09.94
NORWAY	22.11.95	22.11.95
POLAND	07.07.94	07.07.94
SWITZERLAND	19.09.95	19.09 95
SWEDEN	06.10.94	06.10.94
UNITED KINGDOM	29.09.94	29.09 94

(1) "COST Actions", Vol. 8, p. 251.

Memorandum of Understanding for the implementation of a European research action on arbuscular mycorrhizas in sustainable soil-plant systems COST Action 821 (1)

Date of entry into force of the action : 27.04.1994
Duration : 26.04.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06 94
CROATIA	24.05.94	24 05.94
CZECH REPUBLIC	24.05.94	24.05.94
DENMARK	27.04.94	27.04.94
GERMANY	24.05.94	24.05.94
SPAIN	07.07.94	07.07.94
IRELAND	27.04.94	27.04.94
ICELAND	28.07.94	28.07.94
ITALY	27.04.94	27.04.94
HUNGARY	05.05.94	05.05.94
NORWAY	22.11.95	22.11.95
AUSTRIA	23.03.95	23.03.95
POLAND	27.04.94	27.04.94
PORTUGAL	08.06.94	08.06.94
SLOVENIA	16.09.94	16.09.94
SWITZERLAND	16.05.94	16.05.94
FINLAND	11.05.94	11.05.94
SWEDEN	30.05.94	30.05.94
UNITED KINGDOM	27.04.94	27.04.94

(1) "COST Actions", Vol. 8, p. 259.

Memorandum of Understanding for the implementation of a European research action on the development of integrated systems for large-scale propagation of elite plants using in vitro techniques COST Action 822 (1)

Date of entry into force of the action : 24.04 1994
Duration : 23.05.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
CROATIA	24.05.94	24.05.94
CZECH REPUBLIC	24.05.94	24 05.94
DENMARK	30.06.94	30.06.94
GERMANY	02.12.94	02.12.94
GREECE	24.01.96	24.01.96
SPAIN	20.07.94	20 07.94
FRANCE	05.09.96	05.09.96
IRELAND	03.11.94	03 11.94
ITALY	26.07.94	26 07.94
HUNGARY	08 06.94	08.06.94
NORWAY	22 11.95	22.11.95
AUSTRIA	28.06 95	28 06.95
POLAND	29.09.95	29 09.95
PORTUGAL	22.09.94	22 09.94
SLOVAKIA	24.05.94	24.05.94
FINLAND	24.05.94	24 05.94
SWEDEN	24.05.94	24 05.94
UNITED KINGDOM	29.09.94	29.09.94

(1) "COST Actions", Vol. 8, p. 265.

Memorandum of Understanding for the implementation of a European research action on new technologies to improve phytodiagnosis COST Action 823 (1)

Date of entry into force of the action : 06.10.1994
Duration : 05.10.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
CZECH REPUBLIC	30.03.95	30.03.95
DENMARK	23.02.95	23.02.95
GERMANY	10.07.96	10.07.96
GREECE	24.01.96	24.01.96
SPAIN	06.10.94	06.10.94
FRANCE	22.09.94	22.09.94
IRELAND	13.10.94	13.10.94
ITALY	04.11.94	04.11.94
HUNGARY	30.09.94	30.09.94
NETHERLANDS	22.09.94	22.09.94
NORWAY	22.11.95	22.11.95
AUSTRIA	30.11.95	30.11.95
PORTUGAL	14.12.94	14.12.94
SWITZERLAND	11.09.96	11.09.96
FINLAND	22.09.94	22.09.94
SWEDEN	15.02.96	15.02.96
UNITED KINGDOM	23.02.95	23.02.95

(1) "COST Actions", Vol. 8, p. 271.

Memorandum of Understanding for the implementation of a European research action on the interactions of food matrix with small ligands influencing flavour and texture COST Action 96 (1)

Date of entry into dorce of the action :	14.12.1994
Duration :	13.12.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	23.11.94	23.11.94
CZECH REPUBLIC	13.01.95	13.01.95
GERMANY	17.05.95	17.05.95
GREECE	13.03.96	13.03.96
SPAIN	08.03.95	08.03.95
FRANCE	22.12.94	22.12.94
IRELAND	04.05.95	04.05.95
ITALY	06.01.95	06.01.95
HUNGARY	14.12.94	14.12.94
NETHERLANDS	23.11.94	23.11.94
NORWAY	15.02.95	15.02.95
SWITZERLAND	09.01.96	09 01.96
FINLAND	23.11.94	23.11.94
SWEDEN	23.11.94	23.11.94
UNITED KINGDOM	23.11.94	23.11.94

(1) "COST Actions", Vol. 8, p. 277.

Memorandum of Understanding for the implementation of a European research action on pathogenic micro organisms in poultry and eggs COST Action 97 (1)

Date of entry into force of the action :	14.12.1994
Duration :	13.12.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	23.11.94	23.11.94
CZECH REPUBLIC	23.04.96	23.04.96
DENMARK	23.11.94	23.11.94
GERMANY	08.03.95	08.03.95
GREECE	28.06.95	28.06.95
SPAIN	01.02.95	01.02.95
FRANCE	14.06.95	14.06.95
IRELAND	22.06.95	22.06.95
ITALY	05.01.95	05.01.95
HUNGARY	14.12.94	14.12.94
NETHERLANDS	30.03.95	30.03.95
NORWAY	15.02.95	15.02.95
SWITZERLAND	21.11.95	21.11.95
FINLAND	23.11.94	23.11.94
SWEDEN	12.10.95	12.10.95
UNITED KINGDOM	23.11.94	23.11.94

(1) "COST Actions", Vol. 8, p. 285.

Memorandum of Understanding for the implementation of a European research action on the effects of antinutrients on the nutritional value of legume diet COST Action 98 (1)

Date of entry into force of the action : 19.10.1994
Duration : 18.10.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
DENMARK	12.01.95	12.01.95
GERMANY	22.12.94	22.12.94
SPAIN	01.02.95	01.02.95
FRANCE	08.03.95	08.03.95
IRELAND	19.10.94	19.10.94
ITALY	19.10.94	19.10.94
HUNGARY	19.10.94	19.10.94
NETHERLANDS	19.10.94	19.10.94
NORWAY	15.02.95	15 02 95
POLAND	14.03.96	14 03 96
SLOVENIA	19.10.94	19.10.94
UNITED KINGDOM	22.12 94	22.12 94

(1) "COST Actions", Vol 8, p. 291.

Memorandum of Understanding for the implementation of a European research action on food consumption and composition data action COST 99

Date of entry into force of the action : 19.10.1994
Duration : 18 10.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
CROATIA	06.12.94	06.12.94
CZECH REPUBLIC	19.10.94	19.10.94
DENMARK	19.10.94	19.10.94
GERMANY	08.03.95	08.03.95
GREECE	19.10.94	19.10.94
SPAIN	01.02.95	01.02.95
FRANCE	08.03.95	08.03.95
IRELAND	08.03.95	08.03.95
ICELAND	27.10.95	27.10.95
ITALY	04.11.94	04.11.94
LUXEMBURG	24.07.96	24.07.96
HUNGARY	19.10.94	19.10.94
NETHERLANDS	12.01.95	12.01.95
NORWAY	15.02.95	15.02.95
AUSTRIA	19.09.96	19.09.96
POLAND	09.01.95	09.01.95
PORTUGAL	23.02.95	23.02.95
SLOVAKIA	22.03.95	22.03.95
SLOVENIA	19.10.94	19.10.94
SWITZERLAND	21.11.95	21.11.95
FINLAND	19.10.94	19.10.94
SWEDEN	17.11.94	17.11.94
TURKEY	27.03.95	27.03.95
UNITED KINGDOM	22.12.94	22.12.94

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 foce of the project :	18.09.1991
Duration :	17.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	16.01.92	16.01.92
DENMARK	23.01.92	23.01.92
GERMANY	18.09.91	18.09.91
SPAIN	30.04.96	30.04.96
FRANCE	06.02.92	06.02.92
ITALY	09.10.95	09.10.95
NETHERLANDS	18.09.91	18.09.91
NORWAY	18.09.91	18.09.91
AUSTRIA	16.09.94	16.09.94
SLOVENIA	25.03.93	25.03.93
SWITZERLAND	29.04.92	29.04.92
FINLAND	18.09.91	18.09 91
SWEDEN	12.10.95	12.10.95
UNITED KINGDOM	18.12.91	18.12.91

(1) "COST Projects", Vol. 7, p. 161.

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 :	16.12.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CROATIA	18.05.93	18.05.93
DENMARK	02.03.93	02.03.93
GERMANY	13.07.94	13.07.94
GREECE	12.10.94	12.10.94
FRANCE	22.12.94	22.12.94
ITALY	23.03.94	23.03.94
NETHERLANDS	17.12.92	17.12.92
NORWAY	17.12.92	17.12.92
AUSTRIA	30.11.95	30.11.95
POLAND	12.10.94	12.10.94
PORTUGAL	10.05.95	10.05.95
SWITZERLAND	17.12.92	17.12.92
FINLAND	12.01.93	12.01.93
SWEDEN	26.10.93	26.10.93

(1) "COST Projects", Vol. 7, p. 171.

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 :	13.10.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CZECH REPUBLIC	21.10.92	21.10.92
DENMARK	02.03.93	02.03.93
GERMANY	17.07.94	17.07.94
FRANCE	14.10.92	14.10.92
IRELAND	09.12.92	09.12.92
ITALY	26.07.94	26.07.94
HUNGARY	10.03.93	10.03.93
NETHERLANDS	11.11.92	11.11.92
NORWAY	14.10.92	14.10.92
AUSTRIA	22.12.94	22 12.94
SLOVAKIA	11.07.96	11.07.96
SWITZERLAND	17.12.92	17.12.92
FINLAND	14.10.92	14.10.92
SWEDEN	16.11.92	16.11.92
UNITED KINGDOM	14.10.92	14 10.92

(1) "COST Projects", Vol. 7, p. 175.

Memorandum of Understanding for the implementation of a European research project on criteria for the choice and definition of healthy volunteers und/or patients for Phases I and II studies in drug development COST Project B1 (1)

Date of entry into force of the project :	24.02.1986
Duration :	23.02.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	07.03.91	07.03.91
CZECH REPUBLIC	09.07.93	09.07.93
DENMARK	24.02.86	24.02.86
GERMANY	10.04.86	10.04.86
SPAIN	16.11.89	16.11.89
FRANCE	24.02.86	24.02.86
IRELAND	18.01.89	18.01.89
ITALY	25.09.90	25.09.90
NETHERLANDS	09.07.87	09.07.87
NORWAY	24.02.86	24.02.86
SWITZERLAND	28.04.86	28.04.86
FINLAND	24.02.86	24.02.86
SWEDEN	24.03.86	24.03.86
TURKEY	17.02.92	17.02.92
UNITED KINGDOM	11.02.87	11.02.87

(1) "COST Projects", Vol. 4, p. 107.

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
BELGIUM	15.06.93	15.06.93
DENMARK	03.04.96	03.04.96
GERMANY	16.06.93	16.06.93
GREECE	27.07.94	27.07.94
SPAIN	10.06.93	10.06.93
FRANCE	08.10.92	08.10.92
ITALY	16.04.93	16.04.93
HUNGARY	11.12.92	11.12.92
NETHERLANDS	03.04.96	03.04.96
NORWAY	26.03.93	26.03.93
AUSTRIA	04.02.93	04.02 93
SLOVENIA	15.09.93	15.09.93
SWITZERLAND	08.10.92	08.10.92
FINLAND	12.01.93	12.01.93
SWEDEN	08.10.92	08.10.92
UNITED KINGDOM	14.09.94	14.09.94

(1) "COST Projects", Vol. 7, p. 181.

Memorandum of Understanding for the implementation of a European research project on unconventional medicine COST Project B4

Date of entry into force of the project : 09.06.1993
Duration : 08.06.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	27.04.95	27.04.95
DENMARK	27.01.94	27.01.94
GERMANY	27.01.94	27.01.94
SPAIN	30.06.93	30.06.93
ITALY	26.10.93	26.10.93
HUNGARY	26.10.93	26.10.93
NETHERLANDS	29.09.94	29.09.94
NORWAY	09.06.93	09.06.93
SLOVENIA	15.09.93	15.09.93
SWITZERLAND	09.06.93	09.06.93
FINLAND	09.06.93	09.06.93
SWEDEN	12.10.95	12.10.95
UNITED KINGDOM	09.06.93	09.06.93

Memorandum of Understanding for the implementation of a European research action on the molecular mechanisms in the etiology of non-insulin dependent diabetes mellitus (NIDDM) COST Action B5 (1)

Date of entry into force of the action : 24.05.1994
Duration : 23.05.1999

Contracting parties	Date of signing	Date of entry into force
CZECH REPUBLIC	24.05.94	24.05.94
DENMARK	13.10.94	13.10.94
GERMANY	24.05.94	24.05.94
SPAIN	07.07.94	07.07.94
FRANCE	24.05.94	24.05.94
IRELAND	27.09.95	27.09.95
ITALY	26.07.94	26.07.94
HUNGARY	24.05.94	24.05.94
NETHERLANDS	26.07.95	26.07.95
SLOVAKIA	24.05.94	24.05.94
SLOVENIA	12.09.95	12.09.95
SWEDEN	23.02.95	23.02.95
UNITED KINGDOM	16.06.94	16 06.94

(1) "COST Actions", Vol. 8, p. 297.

Memorandum of Understanding for the implementation of a European research action on the psychotherapeutic treatment of eating disorders COST Action B6 (1)

Date of entry into force of the action : 30.06.1994
Duration : 29.06.2000

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
CZECH REPUBLIC	14.10.94	14.10.94
DENMARK	26.10.94	26.10.94
GERMANY	30.06.94	30.06.94
SPAIN	07.07.94	07.07.94
FRANCE	30.06.94	30.06.94
ICELAND	17.01.96	17.01.96
ITALY	27.07.94	27.07.94
HUNGARY	19.07.94	19.07.94
NETHERLANDS	24.05.95	24.05.95
POLAND	31.05.95	31.05.95
SWITZERLAND	14.09.95	14.09.95
FINLAND	30.06.94	30.06.94
SWEDEN	17.11.94	17.11.94
UNITED KINGDOM	30.06.94	30.06.94

(1) "COST Actions", Vol. 8, p. 303.

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 :	07.03.1991
Duration :	06.03.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.10.91	02.10.91
CZECH REPUBLIC	31.07.91	31.07.91
DENMARK	24.07.96	24.07.96
GERMANY	10.04.91	10.04.91
GREECE	06.07.94	06.07.94
SPAIN	08.05.91	08.05.91
FRANCE	07.03.91	07.03.91
IRELAND	17.05.91	17.05.91
ITALY	25.05.91	25.05.91
HUNGARY	30.03.93	30.03.93
NETHERLANDS	07.03.91	07.03.91
NORWAY	27.09.96	27.09.96
AUSTRIA	10.03.92	10.03.92
POLAND	30.03.93	30.03.93
PORTUGAL	13.03.94	13.03.94
SLOVENIA	17.11.92	17.11.92
SWITZERLAND	04.07.91	04.07.91
FINLAND	07.03.91	07.03.91
SWEDEN	07.03.91	07.03.91
TURKEY	07.03.91	07.03.91
UNITED KINGDOM	07.03.91	07.03.91
EC	22.06.91	22.06.91

(1) "COST Projects", Vol. 7, p. 187.

Memorandum of Understanding for the implementation of a European research action on large-scale infrastructures and quality of urban scape COST Action C2 (1)

Date of entry into force of the action :	13.07.1994
Duration :	12.07.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
GERMANY	10.06.96	10.06.96
GREECE	11.09.96	11.09.96
SPAIN	13.07.94	13.07.94
FRANCE	13.07.94	13.07.94
ITALY	13.07.94	13.07.94
NETHERLANDS	13.07.94	13.07.94
PORTUGAL	12.09.96	12.09.96
SLOVENIA	13.01.95	13.01.95
SWITZERLAND	29.03.96	29.03.96
FINLAND	01.03.95	01.03.95
UNITED KINGDOM	13.07.94	13.07.94

(1) "COST Actions", Vol. 8, p. 311.

Memorandum of Understanding for the implementation of a European research action on diagnosis of urban infrastructure COST Action C3 (1)

Date of entry into force of the action : 17.11.1994
Duration : 16.11.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
GERMANY	10.07.96	10.07.96
FRANCE	17.11.94	17.11.94
ITALY	17.11.94	17.11.94
PORTUGAL	31.10.96	31.10 96
SWITZERLAND	05.04.95	05 04.95
FINLAND	17.11.94	17.11.94
SWEDEN	23.02.95	23.02.95
UNITED KINGDOM	17.11.94	17.11.94

(1) "COST Actions", Vol. 8, p. 319.

Memorandum of Understanding for the implementation of a European research action on management and information application development in urban civil engineering COST Action C4 (1)

Date of entry into force of the action : 30.09.1994
Duration : 29.09.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
GERMANY	10.06.96	10.06.96
SPAIN	01.02.95	01.02.95
FRANCE	29.09.94	29.09.94
ITALY	04.11.94	04.11.94
HUNGARY	29.09.94	29.09.94
SWITZERLAND	05.04.95	05.04.95
FINLAND	29.09.94	29.09.94
SWEDEN	15.02.96	15.02.96
UNITED KINGDOM	29.09.94	29.09.94

(1) "COST Actions", Vol. 8, p. 329.

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 : 14.09.1992
Duration : 13.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CZECH REPUBLIC	14.02.94	14.02.94
DENMARK	08.10.92	08.10.92
GERMANY	10.09.92	10.09.92
GREECE	24.02.93	24.02.93
SPAIN	12.05.93	12.05 93
FRANCE	09.12.92	09.12.92
IRELAND	24 03.93	24 03.93
ITALY	20.11.92	20.11.92
HUNGARY	10.03.93	10 03.93
NETHERLANDS	08.10.92	08 10.92
NORWAY	16 12.92	16.12.92
POLAND	30.03.93	30.03.93
PORTUGAL	15.10.93	15 10.93
SLOVENIA	29.01.93	29 01 93
SWITZERLAND	10.09.92	10 09 92
FINLAND	10.09.92	10 09.92
SWEDEN	14.09.92	14.09.92
UNITED KINGDOM	24.03.93	24.03.93

(1) "COST Projects", Vol. 7, p. 193.

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 : 10.09.1992
Duration : 09.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CROATIA	27.07.95	27.07.95
CZECH REPUBLIC	23.02.95	23.02.95
DENMARK	08.10.92	08.10.92
GERMANY	10.09.92	10.09.92
SPAIN	12.05.93	12.05.93
FRANCE	09.12.92	09.12.92
IRELAND	24.03.93	24.03.93
ITALY	20.11.92	20.11.92
HUNGARY	10.03.93	10.03.93
NETHERLANDS	08.10.92	08.10.92
NORWAY	16.12.92	16.12.92
POLAND	10.09.92	10.09.92
PORTUGAL	15.10.93	15.10.93
SLOVENIA	21.01.93	21.01.93
SWITZERLAND	10.09.92	10.09.92
FINLAND	10.09.92	10.09.92
SWEDEN	14.09.92	14.09.92
UNITED KINGDOM	24.03.93	24.03.93

(1) "COST Projects", Vol. 7, p. 201.

Memorandum of Understanding for the implementation of a research project on the theory and modelling of chemical systems and processes COST Project D3 (1)

Date of entry into force of the project : 10.09.1992
Duration : 09.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CROATIA	27.07.95	27.07.95
CZECH REPUBLIC	10.09.92	10.09.92
DENMARK	08.10.92	08.10.92
GERMANY	10.09.92	10.09.92
SPAIN	12.05.93	12.05.93
FRANCE	09.12.92	09.12.92
IRELAND	24.03.93	24.03.93
ITALY	20.11.92	20.11.92
HUNGARY	10.03.93	10.03.93
NETHERLANDS	08.10.92	08.10.92
NORWAY	16.12.92	16 12.92
POLAND	10.03.93	10.03 93
SLOVAKIA	28.07.95	28.07.95
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	10.09.92	10.09.92
FINLAND	10.09.92	10.09.92
SWEDEN	14 09.92	14.09.92
UNITED KINGDOM	24.03.93	24.03.93

(1) "COST Projects", Vol. 7, p 209.

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 : 14.09.1992
Duration : 13.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CZECH REPUBLIC	04.08.94	04.08.94
DENMARK	08.10.92	08.10.92
GERMANY	10.09.92	10.09.92
GREECE	15.09.93	15.09.93
SPAIN	12.05.93	12.05.93
FRANCE	09.12.92	09.12.92
IRELAND	24.03.93	24.03.93
ITALY	20.11.92	20.11.92
HUNGARY	08.06.94	08.06.94
NETHERLANDS	08.10.92	08.10.92
NORWAY	16.12.92	16.12.92
POLAND	03.02.93	03.02.93
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	10.09.92	10.09.92
FINLAND	10.09.92	10.09.92
SWEDEN	14.09.92	14.09.92
UNITED KINGDOM	24.03.93	24.03.93

(1) "COST Projects", Vol. 7, p. 215.

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 : 24.09.1992
Duration : 23.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CZECH REPUBLIC	24.09.92	24.09.92
DENMARK	08.10.92	08.10.92
GERMANY	17.12.92	17.12.92
SPAIN	01.06.93	01.06.93
FRANCE	09.12.92	09.12.92
IRELAND	24.03.93	24.03.93
ITALY	02.07.93	02.07.93
HUNGARY	16.03.93	16.03.93
NETHERLANDS	08.10.92	08.10.92
NORWAY	16.12.92	16.12.92
POLAND	03.03.93	03.03.93
PORTUGAL	19.11.96	19.11.96
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	24.09.92	24.09.92
FINLAND	24.09.92	24.09.92
SWEDEN	24.09.92	24.09.92
UNITED KINGDOM	24.03.93	24.03.93

(1) "COST Projects", Vol. 7, p. 221.

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 : 10.09.1992
Duration : 09.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CZECH REPUBLIC	07.10.92	07.10.92
DENMARK	08.10.92	08.10.92
GERMANY	10.09.92	10.09.92
GREECE	03.04.96	03.04.96
SPAIN	01.06.93	01.06.93
FRANCE	09.12.92	09.12.92
ITALY	20.11.92	20.11.92
HUNGARY	10.03.93	10.03.93
NETHERLANDS	08.10.92	08.10.92
POLAND	10.09.92	10.09.92
PORTUGAL	15.10.93	15.10.93
SLOVAKIA	07.10.92	07.10.92
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	10.09.92	10.09.92
FINLAND	10.09.92	10.09.92
SWEDEN	14.09.92	14.09.92

(1) "COST Projects", Vol. 7, p. 231.

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 : 14.09.1992
Duration : 13.09.1997

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.12.92	17.12.92
CZECH REPUBLIC	21.10.92	21.10.92
DENMARK	08.10.92	08.10.92
GERMANY	10.09.92	10.09.92
SPAIN	10.06.93	10.06.93
FRANCE	09.12.92	09.12.92
IRELAND	21.03.93	21.03.93
ITALY	20.11.92	20.11.92
HUNGARY	10.03.93	10.03.93
NETHERLANDS	08.10.92	08.10.92
NORWAY	16.12.92	16.12.92
PORTUGAL	15.10.93	15.10.93
SLOVENIA	29.01.93	29.01.93
SWITZERLAND	10.09.92	10.09.92
FINLAND	10.09.92	10.09.92
SWEDEN	14.09.92	14.09.92
UNITED KINGDOM	23.03.93	23.03.93

(1) "COST Projects", Vol. 7, p. 241.

Memorandum of Understanding
for the implementation of a European
research action on paper recyclability
COST Action E1 (1)

Date of entry into force of the action : 10.02.1994
Duration : 09.02.1998

Contracting parties	Date of signing	Date of entry into force
GERMANY	11.05.94	11.05.94
SPAIN	16.02.94	16.02.94
FRANCE	10.02.94	10.02.94
IRELAND	17.10.96	17.10.96
ITALY	18.05.94	18.05.94
HUNGARY	10.02.94	10.02.94
NETHERLANDS	24.02.94	24.02.94
NORWAY	18.05.94	18.05.94
AUSTRIA	24.07.96	24.07.96
POLAND	09.12.96	09.12.96
PORTUGAL	22.09.94	22.09.94
SLOVENIA	10.02.94	10.02.94
SWITZERLAND	16.05.94	16.05.94
FINLAND	10.02.94	10.02.94
SWEDEN	10.02.94	10.02.94
UNITED KINGDOM	10.02.94	10.02.94

(1) "COST Actions", Vol. 8, p. 351.

Memorandum of Understanding
for the implementation of a European
research action on wood durability
COST Action E2 (1)

Date of entry into force of the action : 02.02.1994
Duration : 01.02.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.06.94	02.06.94
DENMARK	24.05.94	24.05.94
GERMANY	02.02.94	02 02.94
GREECE	17.04.96	17.04.96
SPAIN	02.02.94	02.02.94
FRANCE	02.02.94	02.02.94
IRELAND	02.06.94	02.06.94
ITALY	24.06.94	24.06.94
NETHERLANDS	30.03.94	30.03.94
NORWAY	18.05.94	18.05.94
AUSTRIA	24.07.96	24.07.96
PORTUGAL	22.09.94	22 09.94
SLOVAKIA	24.05.94	24.05.94
SLOVENIA	02.02 94	02 02.94
SWITZERLAND	16.05.94	16.05.94
FINLAND	02.02.94	02.02.94
SWEDEN	18.02.94	18 02 94
UNITED KINGDOM	10.02.94	10 02.94

(1) "COST Actions", Vol. 8, p. 361.

Memorandum of Understanding
for the implementation of a European
research action on forestry in the context of rural development
COST Action E3 (1)

Date of entry into force of the action : 02.02.1994
Duration : 01.02.1998

Contracting parties	Date of signing	Date of entry into force
BELGIUM	02.02.94	02.02.94
DENMARK	02.02.94	02.02.94
GERMANY	02.02.94	02.02.94
GREECE	15.11.96	15.11.96
SPAIN	07.07.94	07.07.94
FRANCE	02.02.94	02.02.94
IRELAND	03.03.94	03.03.94
ITALY	13.06.94	13.06.94
HUNGARY	30.09.94	30.09.94
NETHERLANDS	26.10.94	26.10.94
NORWAY	18.05.94	18.05.94
AUSTRIA	17.06.94	17.06.94
PORTUGAL	22.09.94	22.09.94
SLOVAKIA	24.05.94	24.05.94
SLOVENIA	02.02.94	02.02.94
SWITZERLAND	16.05.94	16.05.94
FINLAND	02.02.94	02.02.94
SWEDEN	02.02.95	02.02.95
UNITED KINGDOM	10.02.94	10.02.94

(1) "COST Actions", Vol. 8, p. 367.

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 :	10.09.1992
Duration :	09.09.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	06.09.95	06.09.95
CZECH REPUBLIC	07.10.92	07.10.92
DENMARK	01.02.96	01.02.96
GERMANY	11.11.92	11.11.92
SPAIN	11.11.92	11.11.92
FRANCE	09.12.92	09.12.92
ITALY	03.11.92	03.11.92
NETHERLANDS	23.07.92	23.07.92
NORWAY	26.03.93	26.03.93
SWITZERLAND	23.07.92	23.07.92
FINLAND	23.07.92	23.07.92
SWEDEN	14.09.92	14.09.92
UNITED KINGDOM	10.09.92	10.09.92

(1) "COST Projects", Vol. 7, p. 247.

Memorandum of Understanding for the implementation of a European research action on the application of ion beam analysis to art or archaeological objects COST Action G1 (1)

Date of entry into force of the action :	13.07.1994
Duration :	12.07.1999

Contracting parties	Date of signing	Date of entry into force
BELGIUM	17.11.94	17.11.94
GERMANY	13.07.94	13.07.94
SPAIN	13.07.94	13.07.94
FRANCE	13.07.94	13.07.94
ITALY	26.07.94	26.07.94
HUNGARY	30.09.94	30.09.94
AUSTRIA	28.06.95	28.06.95
SLOVENIA	13.01.95	13.01.95
FINLAND	13.07.94	13.07.94
UNITED KINGDOM	22.12.94	22.12.94

(1) "COST Actions", Vol. 8, p. 381.

Recapitulatory tables

These tables contain the projects signed in 1995 and 1996 (indicated in shaded areas) as well as the projects signed previously which were still in force on 1 January 1995.

Projects	15	211ter	215bis	230	237	239	240	241
Signature Signatories	14	15	7	8	15	19	16	15
BELGIUM	05.04.95	02.10.91	19.12.96	02.10.91	13.02.92	09.12.92	02.10.91	16.01.92
CROATIA						18.05.93		
CZECH REPUBLIC	19.01.96					02.04.92	02.04.92	02.04.92
DENMARK			04.12.95		13.02.92	24.07.91	13.01.92	06.02.92
GERMANY	29.05.95	11.10.90		27.02.91	13.02.92	12.06.91	25.04.91	16.01.92
GREECE	27.09.95	15.06.93		09.12.92	14.01.93	09.12.92	25.04.91	
SPAIN	05.04.95	07.02.91		05.04.95	14.03.96	12.06.91		24.06.92
FRANCE	17.05.95	06.02.92	04.12.96	27.02.91	13.02.92	06.02.92	05.03.92	13.02.92
IRELAND		11.10.90			30.06.94	18.09.91	04.07.91	
ICELAND								
ITALY	11.05.95	19.05.92	15.12.96	26.04.91	21.02.94	03.03.92	07.04.92	14.04.92
LUXEMBOURG								
HUNGARY					28.09.93		10.03.93	28.09.93
NETHERLANDS		11.10.90				12.06.92	05.06.91	16.01.92
NORWAY		23.01.91				18.09.91	18.09.91	
AUSTRIA	21.12.95		10.12.96		21.02.96		06.04.94	
POLAND	18.10.95			02.10.91			23.07.92	
PORTUGAL	12.09.95	04.07.91			06.12.95	15.07.92		02.07.92
SLOVAKIA	11.07.95				12.09.95	02.04.92		
SLOVENIA					12.09.95			02.04.92
SWITZERLAND		17.05.91			29.03.96	29.04.92	17.05.91	11.11.92
FINLAND	05.04.95	10.04.91	04.12.96			12.09.96		12.01.93
SWEDEN		09.11.90				12.06.91	25.04.91	09.04.92
TURKEY	02.05.95	07.03.91				23.06.94		
UNITED KINGDOM	05.04.95	11.10.90	04.12.96	27.02.91	24.03.93	12.06.91	25.04.91	16.01.92
ESA								
EC								
Entry into force	11.05.95	11.10.90	18.12.96	26.04.91	13.02.92	12.06.91	25.04.91	16.01.92
End of project	10.05.99	10.10.97	18.12.01	25.04.98	12.02.97	11.06.98	24.04.98	15.07.98

Projects	243	244bis	245	246	247	248	249	250
Signature Signatories	13	11	18	10	18	16	19	12
BELGIUM	24.02.94	19.12.96	16.03.93	08.03.95	02.06.94	17.05.95	02.06.94	
CROATIA		19.11.96	18.05.93		16.03.95	07.03.95		
CZECH REPUBLIC		10.12.95			14.02.94		23.02.95	
DENMARK		04.12.96	29.04.93	25.03.93	16.12.93	02.10.93	24.05.94	29.09.94
GERMANY	20.10.92	09.01.97	29.04.93	25.03.93	16.12.93	20.10.93	13.10.94	
GREECE	20.10.92		01.06.93		18.11.94	24.02.94	21.09.94	27.09.94
SPAIN	20.10.92	14.11.95	10.06.93		02.06.94	13.09.95	07.07.94	06.10.94
FRANCE	09.12.92	04.12.95	17.11.93	17.11.93	27.01.94	27.01.94	23.02.95	29.09.94
IRELAND						04.11.93		13.10.94
ICELAND								
ITALY	08.12.92	18.11.95	17.09.95	16.03.94	18.03.94	11.11.96	26.07.94	04.11.94
LUXEMBOURG								
HUNGARY	05.04.94	04.12.95			16.12.93	05.04.94	24.05.94	
NETHERLANDS			29.04.93	23.03.93	24.05.94	20.10.93	08.09.94	12.01.95
NORWAY	18.04.94		23.06.94			20.10.93	23.02.95	
AUSTRIA								
POLAND	09.02.95	13.01.97	29.04.93		16.12.93			
PORTUGAL			10.06.93				12.07.95	15.03.95
SLOVAKIA							24.05.94	13.01.95
SLOVENIA					28.01.94	28.01.94	24.05.94	
SWITZERLAND	20.04.94		20.04.94	25.03.93	18.05.95	28.01.94	24.05.94	06.04.95
FINLAND	20.06.94		14.12.93	25.03.93	06.04.94		05.09.96	
SWEDEN			04.05.93	12.05.93	01.07.94	20.10.93	01.07.94	
TURKEY			29.04.93		16.12.93		26.01.96	17.11.95
UNITED KINGDOM	09.12.92	14.11.95	08.03.95	08.03.95	10.02.94	03.03.94	21.01.94	29.09.94
ESA	13.05.93		13.05.93					
EC								
Entry into force	08.12.92	20.11.95	29.04.93	25.03.93	16.12.93	20.10.93	25.05.94	29.09.94
End of project	07.12.98	20.11.00	28.04.97	24.03.97	20.05.99	19.10.97	23.05.98	28.09.98

Projects	251	252	253	254	255	256	257	258
Signature Signatories	12	10	9	10	15	5	13	9
BELGIUM	27.04.95		15.02.96	29.05.95	15.02.96		19.12.95	19.12.96
CROATIA							22.11.96	
CZECH REPUBLIC	03.05.95				23.04.96			10.12.96
DENMARK							14.11.95	10.12.96
GERMANY	07.05.95	25.04.96	25.04.96		25.04.96		·12.09.96	09.01.97
GREECE	03.05.95	02.05.96		19.06.96	21.02.96			
SPAIN	05.04.95		15.02.96		21.02.96	19.12.96	19.09.96	10.12.96
FRANCE		25.04.96	15.02.96	17.11.93	15.02.96	19.12.96	04.12.96	10.12.96
IRELAND			15.02.96		15.02.96	19.12.96		
ICELAND								
ITALY	11.05.95	29.05.96	07.03.96	16.03.94	07.03.96		24.09.96	
LUXEMBOURG								
HUNGARY					15.04.96		05.09.96	
NETHERLANDS				23.03.93			12.09.96	19.12.96
NORWAY		23.04.96	23.04.96		23.04.96			
AUSTRIA	30.11.95				10.12.96			
POLAND	09.12.96	25.09.96					13.01.97	
PORTUGAL		15.05.96			15.05.96			
SLOVAKIA					15.02.96		15.11.96	
SLOVENIA	05.04.95		23.07.96					
SWITZERLAND				25.03.93				
FINLAND				25.03.93	14.03.96		05.09.96	19.12.96
SWEDEN	05.04.95			12.05.93				
TURKEY	07.04.95					18.12.96		
UNITED KINGDOM	05.04.95	25.04.96	14.03.96	08.03.95	14.03.96	19.12.96	05.09.96	10.12.96
ESA								
EC								
Entry into force	07.04.95	02.05.96	07.03.96	25.03.93	15.02.96	19.12.96	24.05.94	02.02.94
End of project	06.04.99	01.05.00	06.03.00	24.03.97	14.02.00	19.12.00	23.11.98	01.02.97

Projects	289	318	319	321	323	324	326	327
Signature Signatories	7	10	17	11	16	15	14	6
BELGIUM	04.12.95	05.07.95	15.06.93		02.06.94	02.06.94	27.04.95	
CROATIA								
CZECH REPUBLIC			23.09.94					
DENMARK	27.11.96		17.11.93	24.05.94	13.06.96	24.05.94	08.08.94	
GERMANY		11.05.94	30.06.93	27.01.94	06.10.94		16.02.94	17.05.95
GREECE	29.11.95		29.04.93	17.01.96		17.01.96		
SPAIN		03.03.94	27.10.93	07.07.94	23.01.96	16.02.94	16.02.94	
FRANCE	10.12.95	12.04.95	19.05.93	27.01.94	24.05.94	16.02.94	03.03.94	17.05.95
IRELAND		03.03.94	16.12.93		27.04.93	17.10.96	03.03.94	
ICELAND								
ITALY		20.04.94	02.02.94	19.01.96			14.04.94	20.05.95
LUXEMBOURG								
HUNGARY			28.09.93		22.01.96	02.02.94		17.05.95
NETHERLANDS			07.10.93	27.01.94	24.05.94	30.03.94	07.12.94	
NORWAY							16.02.94	
AUSTRIA	10.12.95		17.10.96		26.10.94	02.02.94		
POLAND								
PORTUGAL		23.01.96			12.04.95	14.12.94	07.07.94	
SLOVAKIA			29.04.93		30.11.94			
SLOVENIA		03.03.94		27.01.94	24.05.94	02.02.94	16.09.94	
SWITZERLAND		03.03.94	29.04.93	27.01.94	13.10.94	02.02.94	16.02.94	17.05.95
FINLAND	09.01.97		29.04.93	05.04.95	24.05.94	02.02.94	16.02.94	
SWEDEN		03.03.94	17.05.95	27.01.94	01.07.94	01.07.94	21.09.94	17.05.95
TURKEY								
UNITED KINGDOM	27.11.95		29.04.93	12.04.95	25.05.94			
ESA								
EC								
Entry into force	10.12.95	03.03.94	29.04.93	27.01.94	24.05.94	02.02.94	16.02.94	17.05.95
End of project	10.12.99	02.03.97	28.04.97	26.01.98	23.11.98	01.02.97	15.02.97	16.11.99

Projects	328	329	330	331	332	333	334	335
Signature Signatories	17	13	13	13	9	15	9	8
BELGIUM	17.11.94	14.06.95	25.10.95	21.07.95	05.04.95	06.03.96	19.12.96	
CROATIA						21.01.96		
CZECH REPUBLIC	23.02.95	13.09.95						
DENMARK	20.09.94	07.06.95	23.05.96	26.07.95	27.06.96	15.05.96	05.09.96	03.10.96
GERMANY	20.09.94	07.06.96	12.09.96	26.07.95		12.09.96		03.10.96
GREECE	17.01.96	06.03.95	27.10.95					
SPAIN	01.02.95	14.06.95	25.10.95	26.07.95	05.04.95	06.03.96		14.10.96
FRANCE	22.12.94	07.06.95	17.04.96	25.04.96	17.05.95	25.04.96	05.09.96	03.10.96
IRELAND	08.03.95		17.10.96					
ICELAND				17.01.96		06.03.96	13.09.96	
ITALY	20.09.94	20.06.96	13.01.96	19.04.96	11.05.95			14.10.96
LUXEMBOURG								
HUNGARY			24.10.95			06.03.96	08.11.96	
NETHERLANDS	20.09.94	29.06.95				12.09.96	12.09.96	
NORWAY		06.03.96						
AUSTRIA	15.03.95				21.02.96	29.05.96	17.10.96	
POLAND								
PORTUGAL	14.06.95	07.06.95	12.09.96	15.02.96		13.06.96		
SLOVAKIA			16.04.96	26.07.95				
SLOVENIA	13.01.95			29.03.96		23.07.96		
SWITZERLAND	13.10.94			21.11.95		03.12.96		19.11.96
FINLAND	26.01.95	14.06.95	03.11.95	27.03.96	05.04.95	10.07.96	05.09.96	31.10.96
SWEDEN	20.09.94							
TURKEY								
UNITED KINGDOM	02.12.94	12.10.95	25.10.95	12.10.95	05.04.95	05.03.96	05.09.96	03.10.96
ESA								
EC								
Entry into force	14.09.94	14.05.95	27.10.95	29.03.95	27.06.96	06.03.96	12.09.96	14.10.96
End of project	13.09.97	13.05.98	26.04.98	28.09.98	26.06.00	05.03.99	12.09.99	

Projects	335	337	40	49	501	507	510	511
Signature Signatories	13	9	7	12	17	14	9	10
BELGIUM	19.12.95	19.12.95	12.09.95		07.10.82	12.01.89	18.06.92	30.04.92
CROATIA	23.05.95							
CZECH REPUBLIC					18.06.92			
DENMARK	27.06.95		08.09.95	07.06.95	23.11.81	08.12.88	18.06.92	
GERMANY			12.09.95	08.03.95	23.11.81			24.06.92
GREECE				03.05.95		08.12.88		
SPAIN	12.09.95	12.09.95		23.02.95		25.10.90	25.03.93	07.10.92
FRANCE	27.06.95	12.09.95	08.09.95	05.09.95	23.11.81	08.12.88		09.12.92
IRELAND	17.10.95	04.12.95		23.02.95	07.11.83			
ICELAND	13.09.95	13.09.95			04.12.92			
ITALY	14.10.95		24.09.95	10.04.95	23.11.81	18.09.90	29.06.92	24.06.92
LUXEMBOURG								
HUNGARY	11.07.95				11.12.92			10.03.93
NETHERLANDS	27.06.95	12.09.95	12.09.95	29.05.95	23.11.81	05.07.90		
NORWAY				23.02.95	23.11.81	08.12.88	15.03.93	
AUSTRIA					23.11.81	05.10.89	15.03.95	
POLAND								
PORTUGAL	19.12.95	19.12.95	30.10.95	06.09.95		07.09.89		
SLOVAKIA							03.09.93	
SLOVENIA								
SWITZERLAND					23.11.81	23.06.89	29.04.93	22.05.92
FINLAND	10.07.95	12.09.95			23.11.81	30.03.90		30.04.92
SWEDEN				23.02.95	23.11.81	21.02.89		08.12.92
TURKEY								
UNITED KINGDOM	05.09.95	12.09.95		17.05.95	23.11.81	08.12.88	18.06.92	30.04.92
ESA								
EC					23.11.81			
Entry into force	10.07.95	13.09.95	12.09.95	08.03.95	23.11.81	08.12.88	23.06.92	22.05.92
End of project	09.07.99	13.09.00	12.09.00	07.03.99	31.12.97	07.06.97	30.06.97	21.05.97

Projects	512	513	514	516	517	518	66	67
Signature Signatories	16	8	14	19	6	5	17	13
BELGIUM	15.06.93		15.06.93	17.11.94	19.05.95	19.05.95	17.12.92	20.10.93
CROATIA				12.07.94			18.05.93	
CZECH REPUBLIC	07.09.93	23.09.94		23.09.94			07.10.92	
DENMARK			08.12.93	22.12.94				
GERMANY	10.06.93	09.06.93	07.10.93				17.12.92	20.10.93
GREECE				28.06.95			20.10.93	
SPAIN	12.04.95		10.06.93	24.05.95	12.03.95	19.05.95	15.09.93	16.02.94
FRANCE	24.05.94	09.06.93	12.01.95	30.06.94			14.10.92	20.10.93
IRELAND	05.05.93		12.05.93					
ICELAND								
ITALY	13.05.93	06.09.93	19.07.95	30.06.94			27.01.93	19.04.94
LUXEMBOURG								
HUNGARY	20.04.95			22.01.96			24.02.94	10.02.94
NETHERLANDS				14.06.95	05.05.95		14.01.93	20.04.94
NORWAY	17.02.93			10.12.96			07.10.92	20.10.93
AUSTRIA	27.04.95	27.04.95					09.02.94	
POLAND	31.05.95			07.12.95				
PORTUGAL			24.05.94	22.12.94				13.04.94
SLOVAKIA				11.01.95		19.05.95		
SLOVENIA	17.02.93		12.05.93	16.09.94	05.05.95	20.05.95	29.01.93	
SWITZERLAND	17.02.93	09.06.93	12.05.93	03.12.96			07.10.92	28.01.94
FINLAND	17.02.93	09.06.93	12.05.93	30.06.94	19.12.95		08.12.92	20.10.93
SWEDEN	04.05.93		12.05.93	30.06.94			16.11.92	20.10.93
TURKEY			23.11.93			21.05.95		
UNITED KINGDOM	17.02.93	09.06.93	12.05.93	30.06.94	05.05.95		07.10.92	23.03.95
ESA								
EC								
Entry into force	17.02.93	09.06.93	12.05.93	30.06.94	19.05.95	21.05.95	07.10.92	20.10.93
End of project	16.02.97	08.06.97	11.05.99	29.06.98	18.05.00	20.05.00	06.10.97	19.10.98

Projects	615	616	617	618	619	682	75	76
Signature Signatories	16	14	12	8	15	14	19	13
BELGIUM	15.06.93	04.08.94	15.02.96		17.11.94	06.02.92	29.05.96	
CROATIA	13.03.96						20.07.95	
CZECH REPUBLIC	04.08.94		04.08.94			24.05.94	09.12.92	
DENMARK	19.05.93	19.05.93	19.05.93	19.05.93	29.09.94	07.10.92	07.10.92	24.05.94
GERMANY	17.11.93	17.11.93	17.11.93		17.11.94	07.10.93	07.10.92	04.08.94
GREECE	19.05.93	19.05.93	19.05.93	19.05.93			28.06.95	15.03.96
SPAIN	28.07.93	28.07.93	28.07.93	24.05.93	07.07.94	06.02.92	29.10.92	24.03.94
FRANCE	19.05.93	19.05.93	19.05.93		30.06.94	06.02.92	19.05.93	24.03.94
IRELAND		08.03.95			30.06.94			
ICELAND								
ITALY	20.04.94	20.04.94	20.04.94	20.04.94	04.07.94	04.11.92	14.06.93	03.06.94
LUXEMBOURG								
HUNGARY	28.09.93	10.02.94	28.09.93	10.02.94	30.06.94	28.09.93	11.12.92	24.03.94
NETHERLANDS					26.07.94	12.07.95	24.02.93	30.03.94
NORWAY	22.06.94	13.11.95			21.03.95	25.09.92		
AUSTRIA					12.10.95		17.10.96	22.12.94
POLAND							18.04.94	
PORTUGAL							22.09.94	22.09.94
SLOVAKIA	22.03.95	22.03.95	23.09.94				12.10.94	
SLOVENIA						09.01.96	29.01.93	
SWITZERLAND	15.05.93	19.05.93	19.05.93	19.05.93	04.07.94	13.03.92	07.10.92	04.07.94
FINLAND	10.06.93				05.07.94	06.02.92	30.10.92	24.03.94
SWEDEN	10.02.94	10.02.94			08.11.95	06.02.92	04.05.93	
TURKEY								
UNITED KINGDOM	19.05.93	19.05.93	19.05.93	19.05.93	14.09.94			24.03.94
ESA								
EC								
Entry into force	19.05.93	19.05.93	19.05.93	19.05.93	30.06.94	06.02.92	29.10.92	23.03.94
End of project	18.05.97	18.05.97	18.05.97	18.05.97	29.06.99	05.02.98	28.10.97	23.03.99

Projects	77	78	79	710	711	712	713	714
Signature Signatories	12	18	14	16	18	6	10	7
BELGIUM	02.06.94	02.06.94	02.06.94	02.06.94	02.06.94		15.02.95	19.12.95
CROATIA								
CZECH REPUBLIC							23.04.95	
DENMARK	24.05.94	24.05.94	24.05.94	24.05.94	24.05.94		15.02.95	
GERMANY	04.08.94	04.08.94	02.06.94	22.09.94	02.06.94	25.04.95	25.04.96	
GREECE	20.04.94	07.02.96	20.04.94	03.03.94	20.04.94		19.04.95	
SPAIN	24.03.94	28.03.94	24.03.94	13.09.95	24.05.94		15.12.95	12.09.95
FRANCE	07.07.94	24.05.94	07.07.94	24.05.94	07.07.94	24.07.95		12.09.95
IRELAND								
ICELAND								
ITALY	25.03.94	24.05.94	24.03.94	29.04.94	25.03.94	29.05.95	07.03.95	
LUXEMBOURG								
HUNGARY	24.03.94	24.03.94	24.03.94	10.02.94	24.03.94			
NETHERLANDS	12.09.96	30.03.94	30.06.94	11.05.94	30.06.94	25.04.95		12.09.95
NORWAY		06.10.94			06.10.94			12.09.95
AUSTRIA		22.12.94	22.12.94	22.12.94	22.12.94		10.07.95	
POLAND					26.10.94		23.03.95	
PORTUGAL	22.09.94	22.09.94	22.09.94	22.09.94	06.09.95			
SLOVAKIA		11.01.96	16.02.96		12.10.94			
SLOVENIA		24.03.94		10.02.94	24.03.94			
SWITZERLAND		04.07.94		04.07.94				
FINLAND	24.03.94	24.03.94	24.03.94	10.02.94	24.03.94	30.04.95	15.02.95	19.12.95
SWEDEN	24.03.94	24.03.94	24.03.94	24.03.94	24.03.94			
TURKEY								
UNITED KINGDOM	24.03.94	24.03.94	24.03.94	24.03.94	24.03.94	25.04.96		12.09.95
ESA								
EC								
Entry into force	24.03.94	24.03.94	24.03.94	03.03.94	24.03.94	29.05.96	07.03.95	12.09.95
End of project	23.03.98	23.03.98	23.03.98	02.03.97	23.03.99	28.05.00	06.03.00	12.09.00

Projects	811	814	815	816	817	818	819	820
Signature Signatories	9	19	10	13	14	11	17	15
BELGIUM	16.01.92	02.10.96	16.10.91	02.02.96		02.06.94	02.06.94	07.07.94
CROATIA		17.02.93		12.07.94				
CZECH REPUBLIC	24.09.92				16.12.93		23.09.94	14.10.94
DENMARK		13.05.92		02.02.94	16.12.93			07.07.94
GERMANY		18.06.92	10.04.91	02.02.94	16.12.93	16.02.94	24.05.94	22.09.94
GREECE	17.11.93	21.12.92						
SPAIN	30.05.90	21.02.91	10.04.91	16.02.94		16.02.94	02.06.94	06.12.95
FRANCE	30.05.90	16.10.91	10.04.91	05.09.96	16.02.94	22.12.94	05.09.96	05.09.96
IRELAND	20.01.93	04.07.91					24.05.94	23.03.95
ICELAND		14.10.94						
ITALY	14.03.91	29.03.95	12.01.96	15.04.94	09.10.95	22.08.94	07.07.94	07.07.94
LUXEMBOURG								
HUNGARY		10.03.93	11.12.92	02.02.94	16.12.93	10.03.94	08.06.94	07.07.94
NETHERLANDS		07.03.91		02.02.94	27.01.94	16.02.94	24.05.94	08.09.94
NORWAY		21.02.91		22.11.95	27.09.96		22.11.95	22.11.95
AUSTRIA							30.11.95	
POLAND		03.02.93	06.03.95		06.04.94		22.09.94	07.07.94
PORTUGAL						14.12.94	20.07.94	
SLOVAKIA		03.09.93		24.05.94	23.03.94			
SLOVENIA								
SWITZERLAND	13.03.92	17.05.91	17.05.91	02.02.94	16.05.94	19.09.95	19.09.95	19.09.95
FINLAND		21.02.91			16.12.93		24.05.94	
SWEDEN		13.04.94	15.05.96		17.05.95	16.02.94	06.09.95	06.10.94
TURKEY								
UNITED KINGDOM	30.05.90	21.02.91	10.04.91	02.02.94	16.12.93	16.02.94	14.09.94	29.09.94
ESA								
EC								
Entry into force	14.03.91	21.02.91	10.04.91	02.02.94	16.12.93	16.02.94	24.05.94	07.07.94
End of project	13.03.97	20.02.00	09.04.97	01.02.99	15.12.98	15.02.99	23.05.99	06.07.99

Projects	821	822	823	824	825	826	827	828
Signature Signatories	19	19	18	21	15	16	10	13
BELGIUM	02.06.94	02.06.94	17.11.94	23.02.95	05.07.95	05.07.95	16.01.96	29.05.96
CROATIA						12.10.95		
CZECH REPUBLIC	24.05.94	24.05.94	30.03.95	30.03.95		23.04.96		13.09.96
DENMARK	27.04.94	30.06.94	23.02.95	23.02.95	29.06.95			23.05.96
GERMANY	24.05.94	02.12.94	10.07.96	08.03.95	29.06.95	29.06.95		
GREECE		24.01.96	24.01.96	15.03.95	27.11.96	23.06.95	17.04.96	
SPAIN	07.07.94	20.07.94	06.10.94	08.03.95	29.06.95	29.06.95	17.01.96	23.05.96
FRANCE	07.07.94	05.09.96	22.09.94	08.03.95	29.06.95	05.09.96	19.06.96	
IRELAND	27.04.94	03.11.94	13.10.94	25.04.96	13.02.95	25.04.96	17.01.96	17.10.96
ICELAND	28.07.94							
ITALY	27.04.94	24.05.94	22.09.94	07.04.95	19.07.95	19.07.95		20.06.96
LUXEMBOURG								
HUNGARY	05.05.94	08.06.94	30.09.94	08.03.95	13.07.95	13.07.95		23.05.96
NETHERLANDS			22.09.94	12.04.95	29.06.95	25.10.95		12.09.96
NORWAY	22.11.95	22.11.95	22.09.94	23.05.95	27.03.96		19.02.96	12.09.96
AUSTRIA	23.03.95	28.06.95	30.11.95	30.11.95	30.11.95	31.10.96		31.10.96
POLAND	27.04.94	29.09.95		11.06.96				28.08.96
PORTUGAL	08.06.94	22.09.94	14.12.94	07.06.95		06.09.95	15.02.96	
SLOVAKIA		24.05.94		22.03.95				
SLOVENIA	16.09.94			01.03.95	29.03.96			
SWITZERLAND	16.05.94	19.09.95	11.09.96	21.11.95	21.11.95	21.11.95		23.12.96
FINLAND	11.05.94	24.05.94	22.09.94	05.04.95			16.01.96	
SWEDEN	30.05.94		15.02.96	17.05.95	29.06.95	12.10.95	16.01.96	
TURKEY								
UNITED KINGDOM	27.04.94	29.09.94	23.02.95	17.05.95	06.09.95	29.06.95	20.03.96	23.05.96
ESA								
EC								
Entry into force	27.04.94	24.04.94	06.10.94	08.03.95	29.06.95	05.07.95	17.01.96	29.05.96
End of project	26.04.98	23.05.99	05.10.98	07.03.00	28.06.00	04.07.00	16.01.00	28.05.01

Projects	93	95	96	97	98	99	914	915
Signature Signatories	17	12	15	16	13	25	15	13
BELGIUM	02.10.91		23.11.94	23.11.94	17.11.94	17.11.94	04.05.95	03.03.95
CROATIA						06.12.94		
CZECH REPUBLIC			13.01.95	23.04.96		19.10.94		23.04.95
DENMARK	13.05.92	05.05.95		23.11.94	12.01.95	19.10.94	12.01.95	27.01.95
GERMANY	28.06.90		17.05.95	08.03.95	22.12.94	08.03.95	08.03.95	08.03.95
GREECE		12.01.95	13.03.96	28.06.95		19.10.94	07.02.96	03.04.95
SPAIN	07.02.91	12.01.95	08.03.95	01.02.95	01.02.95	01.02.95	01.02.95	01.02.95
FRANCE	17.02.93	12.01.95	22.12.94	14.06.95	08.03.95	08.03.95	14.05.95	08.03.95
IRELAND	18.09.91	08.03.95	04.05.95	22.06.95	19.10.94	08.03.95	13.09.95	08.03.95
ICELAND	11.02.94					27.10.95	17.01.95	
ITALY	20.12.91	21.03.95	06.01.95	05.01.95	19.07.95	04.11.94	12.01.95	12.01.95
LUXEMBOURG						24.07.96		
HUNGARY	08.06.94		14.12.94	14.12.94	19.10.94	19.10.94	12.01.95	12.01.95
NETHERLANDS	28.06.90		23.11.94	30.03.95	19.10.94	12.01.95	05.04.95	12.01.95
NORWAY	28.06.90	15.02.95	15.02.95	15.02.95	15.02.95	15.02.95	19.02.95	15.02.95
AUSTRIA		17.04.95				19.09.96		21.02.95
POLAND	30.03.93				14.03.96	01.09.95		
PORTUGAL		01.02.95				23.02.95		12.01.95
SLOVAKIA						22.03.95		
SLOVENIA					19.10.94	19.10.94		27.01.95
SWITZERLAND	28.01.91	14.09.95	09.01.96	21.11.95		21.11.95		21.11.95
FINLAND	28.06.90		23.11.94			19.10.94		27.01.95
SWEDEN	30.07.90	12.01.95	23.11.94	23.11.94		17.11.94	12.01.95	
TURKEY	22.04.91			12.10.95		27.03.95	14.07.95	27.03.95
UNITED KINGDOM	27.01.94	27.03.96	23.11.94	23.11.94	22.12.94	22.12.94	12.01.95	27.01.95
ESA								
EC								
Entry into force	28.06.90	01.02.95	14.12.94	14.12.94	19.10.94	19.10.94	12.01.95	12.01.95
End of project	27.06.97	31.01.99	13.12.98	13.12.98	18.10.98	18.10.99	11.01.99	11.01.00

Projects	S16	S17	A4	A6	A7	A8	A9	A10
Signature Signatories	12	8	14	15	15	16	12	9
BELGIUM	29.05.96	12.09.96	16.01.92	17.12.92	17.12.92	08.03.95	04.05.95	27.06.96
CROATIA				18.05.93				
CZECH REPUBLIC		19.09.96			21.10.92			
DENMARK	03.04.96		23.01.92	02.03.93	02.03.93	24.05.95	27.04.95	27.06.96
GERMANY	23.05.96	12.09.96	18.09.91	13.07.94	13.07.94	12.01.95	29.06.95	03.10.96
GREECE				12.10.94		12.01.95		
SPAIN	03.04.96	12.09.96	30.04.96		14.10.92	04.05.95	19.12.96	
FRANCE	25.04.96		06.02.92	22.12.94	09.12.92	31.05.95	14.06.95	27.06.96
IRELAND								
ICELAND						22.05.95		
ITALY		14.10.96	09.10.95	23.03.94	26.07.94	12.01.95	11.05.95	24.09.96
LUXEMBOURG								
HUNGARY	15.04.96	13.09.96			10.03.93	12.01.95		11.07.96
NETHERLANDS	12.09.96	23.10.96	18.09.91	17.12.92	11.11.92	12.01.95	27.04.95	
NORWAY	12.09.96		18.09.91	17.12.92	14.10.92	06.03.96	06.03.96	12.09.96
AUSTRIA	19.09.96		16.09.94	30.11.95	22.12.94	20.03.96		
POLAND				12.10.94				
PORTUGAL				10.05.95		12.07.95		
SLOVAKIA								
SLOVENIA			25.03.93				27.04.95	23.07.96
SWITZERLAND	19.11.96		29.04.92	17.12.92	17.12.92		08.01.97	
FINLAND	03.04.96		18.09.91	12.01.93	14.10.92	12.01.95	27.04.95	19.12.96
SWEDEN	03.04.96		12.10.95	26.10.93	16.11.92	30.03.95	08.11.95	
TURKEY								
UNITED KINGDOM		12.09.96	18.12.91		14.10.92	08.11.95		
ESA								
EC								
Entry into force	03.04.96	13.09.96	18.09.91	17.12.92	14.10.92	12.01.95	04.05.95	23.07.96
End of project	02.04.01	13.09.01	17.09.97	16.12.97	13.10.97	11.01.98	03.05.99	

Projects	B1	B3	B4	B5	B6	B8	C1	C2
Signature Signatories	16	16	13	13	15	14	21	13
BELGIUM	07.03.91	16.06.93	27.04.95		17.11.94	08.11.95	02.10.91	17.11.94
CROATIA								
CZECH REPUBLIC	09.07.93			24.05.94	14.10.94	08.11.95	31.07.92	
DENMARK	24.02.86	03.04.96	27.01.94	13.10.94	26.10.94	24.04.95	24.07.96	
GERMANY	10.04.86	15.06.93	27.01.94	24.05.94	30.06.94	25.01.96	10.04.91	10.06.96
GREECE		27.07.94				21.02.95	06.07.94	11.09.96
SPAIN	16.11.89	10.06.93	30.06.93	07.07.94	07.07.94	10.01.95	08.05.91	13.07.94
FRANCE	24.02.86	08.10.92		24.05.94	30.06.94		07.03.91	13.07.94
IRELAND	18.01.89			27.09.95	17.01.96		17.05.91	
ICELAND								
ITALY	25.09.90	16.04.93	26.10.93	24.05.94	30.06.94	15.01.95	23.05.91	13.07.94
LUXEMBOURG								
HUNGARY		11.12.92	26.10.93	24.05.94	19.07.94	21.05.96	30.03.93	
NETHERLANDS	09.07.87	03.04.96	29.09.94	26.07.95	24.05.95	08.11.95	07.03.91	13.07.94
NORWAY	24.02.86	26.03.93	09.06.93			13.11.95	27.09.96	
AUSTRIA		04.02.93					10.03.92	
POLAND					31.05.95		30.03.93	
PORTUGAL								12.09.96
SLOVAKIA	11.07.96			24.05.94				
SLOVENIA		15.09.93	15.09.93	12.09.95		07.10.95	17.11.92	13.01.95
SWITZERLAND	28.04.86	08.10.92	09.06.93		14.09.95		04.07.91	29.03.96
FINLAND	21.02.86	12.01.93	09.06.93		30.06.94	08.11.95	07.03.91	01.03.95
SWEDEN	24.03.86	08.10.92	12.10.95	23.02.95	17.11.94	01.02.96	07.03.91	01.03.95
TURKEY	17.02.92						07.03.91	
UNITED KINGDOM	11.02.87	14.09.94	09.06.93	16.06.94	30.06.94	21.02.96	07.03.91	13.07.94
ESA								
EC							22.06.91	
Entry into force	24.02.86	11.12.92	09.06.93	24.05.94	30.06.94	13.11.95	07.03.91	13.07.94
End of project	23.02.98	10.12.97	08.06.98	23.05.99	29.06.00	12.11.01	06.03.98	12.07.98

Projects	C3	C4	C5	C6	C7	D1	D2	D3
Signature Signatories	9	10	10	7	12	19	19	19
BELGIUM	17.11.94	17.11.94	23.01.95	23.05.96	23.05.96	17.12.92	17.12.92	17.12.92
CROATIA							27.07.95	27.07.95
CZECH REPUBLIC						14.02.94	23.02.95	10.09.92
DENMARK				14.11.95		08.10.92	08.10.92	08.10.92
GERMANY	10.07.96	10.06.96	23.01.95	24.07.75	25.04.95	10.09.92	10.09.92	10.09.92
GREECE					13.09.96	24.02.93		
SPAIN		01.02.95	23.01.95	23.05.96	25.04.95	12.05.93	12.05.93	12.05.93
FRANCE	17.11.94	29.09.94	23.01.95	23.05.96	25.04.95	09.12.92	09.12.92	09.12.92
IRELAND					17.10.96	24.03.93	24.03.93	24.03.93
ICELAND								
ITALY	17.11.94	04.11.94	23.04.95	29.05.96	23.05.96	20.11.92	20.11.92	20.11.92
LUXEMBOURG								
HUNGARY		30.09.94				10.03.93	10.03.93	10.03.93
NETHERLANDS			25.09.95			08.10.92		08.10.92
NORWAY			11.07.95			16.12.92		16.12.92
AUSTRIA					17.10.96			
POLAND			13.05.95			30.03.93	10.09.92	10.03.93
PORTUGAL	31.10.96		13.05.95		13.06.96	15.10.93	15.10.93	
SLOVAKIA								28.07.95
SLOVENIA			29.03.95		23.07.96		29.01.93	29.01.93
SWITZERLAND	05.04.94	05.04.95				10.09.92	10.09.92	10.09.92
FINLAND	17.11.94	29.09.94		23.05.96	19.06.96	10.09.92	10.09.92	10.09.92
SWEDEN	23.02.95	15.02.96	15.02.96			11.09.92	14.09.92	14.09.92
TURKEY								
UNITED KINGDOM	17.11.94	29.09.94			25.04.95	24.03.93	24.03.93	24.03.93
ESA								
EC								
Entry into force	17.11.94	30.09.94	30.09.94	29.05.96	29.05.96	14.09.92	10.09.92	10.09.92
End of project	16.11.98	29.09.98	29.09.98	28.05.02	28.05.01	13.09.97	09.09.97	09.09.97

Projects	D4	D5	D6	D7	D8	E1	E2	E3
Signature Signatories	18	16	17	17	17	16	18	19
BELGIUM	17.12.92	17.12.92	17.12.92	17.12.92	25.04.95		02.06.94	02.02.94
CROATIA								
CZECH REPUBLIC	04.08.94	24.09.92	07.10.92	21.10.92	19.09.95			
DENMARK	08.10.92	08.10.92	08.10.92	08.10.92	23.05.96		24.05.94	02.02.94
GERMANY	10.09.92	17.12.92	10.09.92	10.09.92	10.07.95	11.05.94	02.02.94	02.02.94
GREECE	15.09.93		03.04.96		19.06.95		17.04.96	15.11.96
SPAIN	12.05.93	01.06.93	01.06.93	10.06.93	25.04.95	16.02.94	02.02.94	07.07.94
FRANCE	09.12.92	09.12.92	09.12.92	09.12.92	24.07.95	10.02.94	02.02.94	02.02.94
IRELAND	24.03.93	24.03.93		24.03.93	17.10.96	17.10.96	02.06.94	03.03.94
ICELAND								
ITALY	20.11.92	02.07.93	20.11.92	20.11.92	24.09.95	18.05.94	24.06.94	13.06.94
LUXEMBOURG								
HUNGARY	08.06.94	10.03.93	10.03.93	10.03.93	06.09.96	10.02.94		30.09.94
NETHERLANDS	08.10.92	08.10.92	08.10.92	08.10.92	12.09.96	24.02.94	30.03.94	26.10.94
NORWAY	16.12.92	16.12.92		16.12.92	23.04.95	18.05.94	18.05.94	18.05.94
AUSTRIA					17.10.95	24.07.96	24.07.96	17.06.94
POLAND	03.02.93	30.03.93	10.09.92			09.12.96		
PORTUGAL		19.11.96	15.10.93	15.10.93	31.10.95	22.09.94	22.09.94	22.09.94
SLOVAKIA			07.10.92				24.05.94	24.05.94
SLOVENIA	29.01.93		29.01.93	29.01.93		10.02.94	02.02.94	02.02.94
SWITZERLAND	10.09.92	24.09.92	10.09.92	10.09.92	19.11.95	16.05.94	16.05.94	16.05.94
FINLAND	10.09.92	24.09.92	10.09.92	10.09.92	30.04.95	10.02.94	02.02.94	02.02.94
SWEDEN	14.09.92		14.09.92	14.09.92		10.02.94	18.02.94	12.07.95
TURKEY								
UNITED KINGDOM	24.03.93	24.03.93		24.03.93	25.04.95	10.02.94	10.02.94	10.02.94
ESA								
EC								
Entry into force	14.09.92	24.09.92	10.09.92	14.09.92	30.04.95	10.02.94	02.02.94	02.02.94
End of project	13.09.97	23.09.97	09.09.97	13.09.97	29.04.01	09.02.98	01.02.98	01.02.98

Projects	E4	E5	E6	E7	E8	F1	G1	G2
Signature Signatories	17	17	18	7	15	13	10	13
BELGIUM	03.11.95	01.02.96	25.10.95		19.12.95	06.09.95	17.11.94	08.03.95
CROATIA								
CZECH REPUBLIC						07.10.92		
DENMARK	03.11.95	03.11.95	25.10.95		27.06.95	01.02.96		07.06.95
GERMANY	25.01.95	06.03.96	25.01.96	24.09.96	24.07.96	11.11.92	13.07.94	08.03.95
GREECE	19.12.95	30.10.96	27.10.95					10.01.96
SPAIN	29.11.95	03.11.95	25.10.95	19.09.96	27.06.95	11.11.92	13.07.94	08.03.95
FRANCE	17.04.96	17.04.96	17.04.96	19.09.96	27.06.96	09.12.92	13.07.94	08.03.95
IRELAND	25.04.96	25.04.96	25.04.96					
ICELAND								
ITALY	15.01.96	15.01.96	15.01.96	04.11.96	24.09.96	03.11.92	13.07.94	11.05.95
LUXEMBOURG								
HUNGARY	07.11.95				26.09.96		30.09.94	
NETHERLANDS	03.11.95	03.11.95	25.10.95		19.12.95	23.07.92		
NORWAY	19.02.96	19.02.96	19.02.96		12.09.96	26.03.93		06.03.96
AUSTRIA	16.01.96	31.10.96	20.03.96	31.10.96	31.10.96		28.06.95	15.01.96
POLAND					28.08.96			
PORTUGAL	24.09.96	31.10.96	31.10.96		24.09.96			05.04.95
SLOVAKIA			15.11.96					
SLOVENIA	07.10.96	07.05.96	11.11.96				13.01.95	08.03.95
SWITZERLAND		19.11.96	19.11.96			23.07.92		09.01.96
FINLAND	03.11.95	03.11.95	03.11.95	24.09.96	27.06.96	23.07.92	13.07.94	
SWEDEN	20.03.96	01.02.96	01.02.96		27.06.95	11.09.92		
TURKEY								
UNITED KINGDOM	24.09.96	03.11.95	21.02.96	19.09.96	27.06.96	10.09.92	22.12.94	24.05.95
ESA								
EC								
Entry into force	03.11.95	03.11.95	27.10.95	24.09.96	27.06.96	10.09.92	13.07.94	08.03.95
End of project	07.11.00	07.11.00	25.10.00	24.09.99	25.06.00	09.09.99	12.07.99	07.03.01

Projects	G3	G4							
Signature Signatories	8	11							
BELGIUM									
CROATIA									
CZECH REPUBLIC									
DENMARK	19.12.96								
GERMANY	09.01.97	25.04.96							
GREECE									
SPAIN	19.12.95	25.04.95							
FRANCE	19.12.96	09.01.97							
IRELAND									
ICELAND									
ITALY	13.01.97	29.05.96							
LUXEMBOURG									
HUNGARY		02.05.95							
NETHERLANDS		12.09.95							
NORWAY									
AUSTRIA		29.05.95							
POLAND									
PORTUGAL	19.12.95	19.12.96							
SLOVAKIA		30.04.95							
SLOVENIA									
SWITZERLAND		19.11.95							
FINLAND	19.12.96								
SWEDEN									
TURKEY									
UNITED KINGDOM	19.12.95	25.04.96							
ESA									
EC									
Entry into force	19.12.95	02.05.96							
End of project	19.12.01	01.05.01							

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(1) This alphabetical index classifies and cross-refers the subject-matter of the project.

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