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COST 311

Simulation of maritime traffic

Final report of the action

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COST 311

Simulation of maritime traffic

Edited by:
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Commission of the European Commission

Final report of the action

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COST-TRANSPORT PROJECTS

This is the fifteenth publication in the Transport Research series, which includes final reports and proceedings of seminars on COST projects in the transport field.

Twenty-five European countries[1] are currently involved in COST, the acronm standing for European Cooperation in the field of Scientific and Technical Research. The COST programme as a whole covers pre-competitive research in fifteen areas, one of which is transport.

It operates as follows:

- Each COST project deals with a specific research topic.
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- COST projects in practice take the form of concerted action. The COST structure provides administrative and financial support for the cooperative dimension, but the actual research receives no European funding; work is carried out and funded at the national level but organized at the European level towards a common objective.
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- COST is not part of the European Community but gets substantial Community support for its work.
- COST projects are often complementary to Community research programmes, or may be integrated into such programmes.

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A Technical Committee on Transport sponsors and selects proposals for projects, coordinates the groundwork for those selected, overseas their implementation by the Management Committees and ensures the effective dissemination and follow-up of the results.

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1 Austria, Belgium, Croatia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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<u>COST 311 FINAL REPORT</u>

SUMMARY

This report is the final report of Action COST 311.

It is mainly composed of three parts.

Part I is an executive report. Essentially it intends to provide a general overview of

- the objectives of the project,
- the management and organisation of the project,
- the results obtained by both working groups set up at the outset of the with the following terms of reference :

  Working Group I :
  - to create a library/data base for simulation studies and traffic data, and to update information on existing simulators in Europe;

  Working Group II :
  - to review the current state of the art of simulation techniques in Europe relating to vessel movement studies and
  - to prepare a number of themes for further coordinated researches in the field of simulation applied to maritime traffic.

Part II is the report from Working Group I.

In its part A, it gives detailed information on the structure and on the data bases which were worked out and tested. The software developed at this occasion is available and will be delivered on request to interested users by the COST-Transport Secretariat.

In its part B, the reader will find a number of tables describing simulators currently in use in Europe.

Part III is the report from Working group II. It provides detailed information on various applications of simulation applied to fairway design and training of ship officers and pilots, as well as to VTS functions and training and VTS simulation.

Research Action COST-311 conclusions are reported in the executive report.

A number of major problems relating to safety and efficiency of the maritime traffic, as well as the protection of the environment, depend on the availability of relevant data. Most of them cannot be collected by direct observation.

Thus the executive report puts the emphasis on the necessary developments of simulation as ideal tool for the design and assessment of projects relating to fairways, ship bridge equipments, maritime traffic surveillance and/or control.

The Management Committee of Action 311 strongly pleads for the inclusion of research actions on simulation in any coordinated research programme devoted to maritime transport and to be worked out at European level.

A. FINAL REPORT

PART I.

1. Introduction
2. Review of Cost "311" objectives
3. Management and organisation of the project
4. Report from working group I
5. Report from working group II
6. Further actions
    - 5.1 Generals
    - 5.1 Recommendations
7. Conclusions

PART II.

Working Group I Report

PART III.

Working Group II Report.

PART IV.

Memorandum of Understanding.

PART I

EXECUTIVE REPORT

ACTION COST-311

Final Report

INTRODUCTION

In March 1988, a Memorandum of Undestanding (MOU) for the implentation of a European Research Project on maritime traffic simulation (COST Project 311) was established as the follow up of the work prepared within an ad hoc subcommittee of the Technical Committee on Transport.

Members States adhered to the Memorandum of Understanding, i.e. France, Ireland, Italy, the Netherlands, Portugal, Spain, Finland also participated as a non EEC member State.

The report

- recalls briefly the objectives of COST-311 project
- comments on the management and organisation of the project
- sums up and presents the results of work achieved during the course of the action
- concludes with proposals regarding further actions to be initiated at European level.

I. REVIEW OF COST-311 OBJECTIVES

COST-311 objectives were defined in Section 1, paragraphs 1 and 2 of the Memorandum of Understanding.

1. The Signatories intend to cooperate in a project to promote reseach into maritime traffic simulation

2. The main objective of the Project is to develop cost effective simulation techniques to improve the safety and efficiency of maritime traffic, with particular regard to collision and grounding avoidance.

Specific objectives of the project were defined in Annex II to the MOU.

They were broken down into four topics as follows :

II.2.1 To create a library data base for simulation studies

II.2.2 To develop common method for traffic data analysis

II.2.3 To define a common programme for the development of simulation in Europe

II.2.4 To implement cooperative development of the research.

The programme, directly derived from the preliminary work of an ad hoc Committee set up by the Technical Committee of transport was reasonably ambitious.

Let us mention the following two points which will have to be considered later on :

i) Simulation methods are likely to be extensively applied in the field of maritime traffic. They provide adequate tools for studying the effects of human factors. They should bring answers to those questions which are arising from the use by operators of systems aiming at helping in steering a ship or managing maritime traffic.

ii) Significant improvements of safety and efficiency of human activities at sea may be expected from those of our knowledge on maritime traffic. Simulation is an ideal tool for getting the needed information.

The MOU contains (Section I, paragraph 5) an evaluation of the value of activities in the COST-311 project ; "5. The overall value of the activities of the signatories under the project is estimated at 5 to 6 milliards ECU at 1989 prices".

Let us note, right now, that in reality the signatories were not able to commit themselves at the expected level. Reasons for and consequences of this situation will be commented upon later on in this report conclusions.

According to COST rules, the research ativities of the project 311 did not benefit from special European funds. Nevertheless secretariat, translation, documents distribution facilities were fully provided by the COST Secretariat.

II MANAGEMENT AND ORGANISATION OF THE PROJECT

According to provisos of Annex I to the MOU, a Management Committee wa set up with the responsability for coordinating the project.

The Management Committee regularly held meetings in Brussels at the rate of approximately two meetings a year.

In total eight meetings were held during the four year period 1988-1992 of the project. Minutes of those meetings are gathered in Appendix 1 to this report.

The Management Committee soon recognized that in view of resources available the scope of the work as envisaged in Annex II to the MOU should be somewhat restricted.

It was decided to set up two working groups the terms of reference of which are given in Appendices 2 and 3.

Working Group I was assigned a mission corresponding in broad terms to II.2.1 of the work programme, i.e. "To create a library data base for simulation studies". It was also asked to elaborate on the first part of item II.2.2., i.e. on parameters to be used for the analysis of the traffic data.

On the other hand, Working Group II received the task of preparing a common work plan for further studies on simulation. Thus is partially covered sub item II;2.3. of the work programme, i.e. "To define a common programme for the development of simulation in Europe".

This means, in brief, that the Management Committee regretfully had to admit that within the course of action COST-311, it would not be possible

> neither to produce under item II.2.2 methods associated where the case might be with software packages allowing to assess the validity of parameters characterizing traffic data,
>
> nor to implement, under item II;2.4, cooperative development of the research in the simulation field.

Nevertheless the Management Committee is still convinced that the intentions which had prevailed at the moement of the establisement of the work plan are still valid. It gave therefore consideration to further steps to be taken in the short and mid terms to atain the project objectives.

Two projects were decided as regards the short term.

In the first place the Management Committee tried to liaise with other organizations or fora dealing with simulation apllied to maritime activities, i.e.

- The Permanent International Association of Navigation Congresses (PIANC)
- The US Coast Guard, which has extensively used the CAORF simulator facilities in New York to elaborate standards for channel and associated aids to navigation design
- The Electronic Navigation research Institute of Tokyo.

The Secretary General of PIANC confirmed that the PIANC PTC Working Group 2.0 which, had studied simulation applied to channel design, was about to publish its final report. This report will be available for distribution to the COST 311 partners.

Usable information is still to be obtained from the American and Japanese organizations.

In the second place, the Management Committee, with the help of the European Commisssion considered how and when a seminar could be organized as soon as possible in Spring 1992 to promote at European interactive simulation applied to maritime traffic.

Regarding actions to be undertaken from 1992 onwards, the Management Committee drew its attention

a) to the role to be played by simulation in studies to be undertaken under the maritime part of the EURET I programme.

b) to the advisability to propose to include in the next EURET II programme a specific theme dealing with simulation applied to maritime traffic.

Results of views exchanged with the Management Committee on future actions were gathered up into a set of recommandations. They will be further explained in the fifth part of this report.

III REPORT FROM WORKING GROUP I

Report from Working Group I is attached as Appendix 4 to this report.

Working Group I was chaired by A. Siccardi, IAN CNR, Genoa, Italy.

Mrs Boghaerts, Rijkswaterstaat (The Netherlands) - G. Trant, Cork RTC (Ireland) T. Degré, INRETS (France) and A. Siccardi (Italy) developed a European traffic simulation studies data base with the objectives

- to stimulate further studies in the area concerned with a view to improving the safety and efficiency of maritime traffic,
- to go a long way towards avoiding duplication of efforts and making best use of available resources taking into account that simulation studies and the collection and analysis of maritime traffic data can be very costly,
- to provide the necessary background for major cooperative studies on maritime traffic in Europe.

These actions resulted in a dedicated software which was tested and presented to the Management Committee.

This software was fully documented and the floppy disk together with the documentation which will enable research organizations to use the data base will be kept available, ready for distribtion by the Commisssion. Significant examples of information the data base will provide are contained in Working Group I report.

The Working Group dealt with two other matters of interest :

- elaboration of a list of parameters to be used for the analysis of traffic data,
- updating of the information available on existing simulators in Europe.

Under the first item, Working Group I report contains a list of keywords which is considered as the basis of a common understanding of traffic analysis.

Under the second item, Working Group I endeavoured to complete the information which had been collected during the preparatory phase of COST 301 Action. At that time the ad hoc working group made an enquiry on various types of simulators normally operated in Europe. The results of the enquiry were made available in the technical annex to the ad hoc working group report (COST 213/87 - 16th February 1987). Working group I gathered some new information by means of a new inquiry based on the same questionnaire as in 1986-1987. Results are given in Working group I report. Due to the fact that not all interested European countries answered the new questionnaire, the update information contained in Working Group I report is not complete.

Nevertheless, it demonstrates that a significant number of new facilities have been implemented during the last four years in Europe. This les the Management Committee to state that most likely there is a need for better coordination of the implementation and exploitation of simulators in Europe.

IV REPORT FROM WORKING GROUP II

Report of Working Group II is attached as Appendix 5 to this report.

Working Group II was chaired by J. Suskelainen, VTT, Finland, under the heading "State of the art of simulator techniques in vessel movement studies". Experts of the organizations quoted above took part in the work.

Essentially the report is composed of three parts :

Simulators in fairway design
Simulation of VTS functions
Suggestions for coordinated plans and scenarios for experiments.

Under the first part, the report established distinctions to be made between the two types of simulations currently in use, i.e. fast time simulation and interactive simulation. It compares both types from the point of view of realism, efficiency and costs. Problems arising as regards validation and quality criteria for transit safety are identified. The use of simulators in training ship officers and pilots is underlined. Finally the needs for future researches are presented.

Under part two, methods and equipments currently in use to carry out studies on simulation of VTS functions are described. The need for further studies is recognized. The importance of structured scenarios is emphasized as well as the potential role of simulators for VTS operators training. Special mention is made of the benefit to be expected from AI techniques in the near future.

Working Group II concludes that the following items should be considered as important areas to increase the knowledge by means of simulators :

- Systematized analysis of bridge simulators experiments
- Development of human navigator models for fast time computer simulation
- Correlation of hydraulic and computational simulators
- Displays and procedures for navigation assistance by VTS
- Training of pilots as VTS operators.

V FURTHER ACTIONS

V.1 Generals

As briefly outlined in part II of this report, the Management Committee noted that Governments of countries participating in Action COST-311 gave little financial support to this action.

It noted also with concern, the absence of major European countries such as Germany, Greece and UK, although all of them are deeply involved in simulation applied to maritime traffic.

The Management Committee felt that these facts are in some ways circumstacial. COST-311 was initiated within the period following COST-301 Action when the political will of a coordinated policy in maritime transport was not yet ascertained at European level.

Moreover, researches in safety and protection environment are not likely for the time being to generate interest from the industry. The reasons are :

- that the maritime safety and the protection of environment are being placed in Europe under the direct responsability of governments. Investments and running costs involved in measures aiming at maintaining risks at acceptable levels are deemed to be supported only by public funds ;
- that the market for simulators, even thought not negligible, is rather narrow in the sense that in most cases, simulator facilities are more or less prototypes. No common standards exist so that only one unit of each simulator is built to answer specific needs expressed by one single administration.

Nevertheless, the Management Committee is strongly of the opinion that there is a definite need for establishing a common policy in Europe as regards simulation applied to maritime traffic.

Justifications of this opinion can be found in the above mentioned report presented by the ad hoc working group to the technical Committee, which proposed for the cost 311 action the following objectives :

- to answer functional and operational requirements of authorities (national, European, international) in the field of safety and efficiency of traffic at sea and in harbours. Problems faced by governments in this field may not find answers or may find only limited answers if tackled in isolation ;

- to identify present research tools and methods of simulation used in the studies mentioned above and to develop and improve them as necessary.

In addition, the Management Committee thinks that a new plan of researches on simulation should focus on the following specific problems which are highlighted in Working Group II report and which deserve a coordinated action of all specialized European research institutes or organizations :

I To improve simulation methods and tools used for channel design including that of associated aids to navigation :

II To develop extensively a research programme based on simulation methods to assess the influence of local/regional vessel traffic services on the decision process of the actors of maritime traffic ;

III To provide the European Community with objective elements for the establishment of a harmonized policy on simulaiton facilities to be used for training ship officers and pilots on one hand, and VTS operators on the other hand ;

IV To establish standard specifications for simulators of various kinds, full bridge simulators and mini or micro dedicated simulators.

Actions I to IV inclusively should take into account :

- the influence of human factors,

- the validation of simulators and/or associated softwares.

V.2 Recommendations

The Management Committee feels that the following actions to be undertaken at the EC level would open the way to meeting the above mentioned objectives

a. To hold a seminar in December 1992 with the following programme

- To review results brought forward by COST 311. In particular to present the data base designed by Working Group II,
- To gather comments on current problems encountered by countries which did not nparticipate in COST 311 project.
- To initiate a general discussion on the advisability of further actions and in view of this discussion to specify at least in broad terms these actions with the aim to include them in the EURET programme.

b. Inasmuch as the seminar would have demonstrated that there is in Europe a common willingness to promote cooperation in this field, the results of the seminar would have to be turned into proposals to be submitted to the relevant body in the EC charged with the preparation of EURET II.

As regards recommandation a. the Management Committee discussed the meeting venue and organization.

Recommendation b. appears as the follow-up of the seminar under the assumption that it will bring forward positive conclusions. If such were the case, the information concerning there results should be sent to official representatives of EC countries within the committee responsible for the preparation of EURET II in such a maner that they could easily present proposals relating to simulation applied to maritime traffic.

The Management Committee recommended that the conclusions of the seminar should be drafted, keeping this objective in mind.

It also recommended that specialized European/International organizations be invited as observers in further research action in the field.

CONCLUSION

The Management Committee has the feeling that COST "311" has fully highlighted the need for and the benefit of cooperation at European level in the field of simulation applied to maritime traffic.

Action COST 311 established that simulation raises a number of important problems which are still waiting for coordinated solutions.

The reliability and the representativity of methods and tools are to be refined. The scope of potential applications, expected to grow extensively within the forecoming years is still to be explored. For various reasons, in particular because of their costs, direct experiments and/or trials at sea can only be carried out up to a limited extent. Thus simulation appears as the only means able to enhace our knowledge as desirable.

Due to the lack of ressources COST-311 did not go as far as it could have been expected.

Nevertheless simulation is there. It will be applied as a tool in a number of research programmes such as EURET placed under the European Commission responsability.

The Management Committee proposes that the Commission takes any appropriate steps to review from time to time, the role played by simulation in programmes devoted to maritime traffic and in particular in EURET Information resulting from such reviews would certainly be greatly appreciated.

PART II

WORKING GROUP I REPORT

A. DATABASE ON EUROPEAN TRAFFIC STUDIES

1. **Mandate**
   1.1. Working group composition

2. **Background**

   2.1 Scenario and general objectives
   2.2 General definition of the methodology
   2.3 Summary of activities

   2.3.1. Preparatory
   2.3.2. Questionnaires
   2.3.3. Development of the database on studies
   2.3.4. Development of the database on traffic data

   2.4. Calendar of meetings

3. **The prototype databases**

   3.1 Common structures of the databases
   3.2 Database section on simulation studies
   3.3 Database section on traffic data

4. **Use of the database**

   4.1 Input and editing of a study
   4.2 Searching and reporting

   4.2.1. Keyword list

5. **Conclusions**

Appendix 1 : Test of the questionnaire

Appendix 2 : Questionnaire text

Appendix 3 : Paper presented at VTS conference - Feb.90 - Genoa

Appendix 4 : Prototype database
- Block diagram
- Screen printouts

Appendix 5 : Sample database output

1. Mandate

The mandate for WG1 was defined on April 14th 1988, in a plenary session of COST 311, and was developed in the next sessions of the Management Committee.

The mandate was organized on three points:

1) the development of a common framework (library/directory of data bases) for the recording of traffic simulation methods, scenarios, parameters and results as well as the recording of informations on data and data collection methods concerning marine traffic and its generation.

2) the definition of a convention for the users of such a library/data base of traffic simulation studies and traffic data

3) the definition of such a library/data base

1.1 Working group composition

The Working Group 1 was composed by four members:

Antonio Siccardi, Italy - chairman
Mieke Bogaerts, Holland
Thomas Degré, France
Gerard Trant, Ireland

2. Background

2.1 Scenario and general objectives

A certain number of information about the development of simulation studies and techniques in the field of maritime traffic or, generally, in maritime application have been collected during the development of COST 301 and in the preparatory phase of COST 311.

The scenario defined from these informations allows for the separation of two main different kinds of activity:

the training of the maritime personnel, faced only in some countries, with large investiments in simulation facilities, mainly for ship bridge simulators;

the theoretical study of maritime activities, as well as traffic problems, showing, on the contrary, a general use of simulation techniques

Within these two general frames very large differences can be found in the approaches to the same kind of problems in the different countries and between different research institutions, due to different cultural background and resources.

To be able to develop a common understanding for the simulation of the maritime traffic it will be necessary to identify the existing knowledge about it and to give to the scientific community a kind of key to enable anyone to find who knows what and were.

The main purpose will be to allow the sharing of methodologies and data, to achieve an optimization of resources, particularly in these times were the financial resources dedicated to maritime field for the improuvement of traffic safety and efficency are always shortening.

2.2 General definition of the methodology

A very general definition of the methodology to be used is already included in the mandate, were a library/database is mentioned.

More specifically the WG1 activity was oriented toward the realization af a database about studies on the maritime traffic in Europe, realized with the use of some simulation techniques, and about collection of traffic data suitable for theapplication of simulation procedures.

The development of the database went thorough the classical steps of this kind of activity, wich means:

-sample collection of information by paper forms
-prototyping the database
-testing and final realization

The activity of WG1 terminated with the realization of prototype databases satisfying the mandate requirements, perfectly working over a limited sample set of data, leaving to future actions from the CEC the implementation of an operational product, if any.

2.3 Summary of activities

The development of the work conducted by WG1 is breafly described, according to its time scale.

2.3.1 Preparatory

The WG1 members decided to separate,non only logically but also in the time of their realization, the two parts of the mandate, i.e. it was agreed to develop before the database concerned with studies on the maritime traffic, leaving the part concerned with traffic data collection to a second time.

It was decided to operate the first collection of informations thorough the distribution of a questionnaire to well known cooperative istitutions; an integration to the initial plan of work was made, for the purpose of obtaining a higher credibility and consequently a higher level of cooperation within the scientific community: the mandate coming to WG1 from the COST 311 Management Committee was in principle requiring just indications about how to build the instruments (library or database) to collect the knowledge about simulation; nevertheless it was agreed in the WG1, and later in the Management Committee, to work for the realization of a prototype database.

This prototype database was considered an efficent method to realize a return to the cooperative scientists, with a practical demonstration of the realization and not only with a paper report.

2.3.2 Questionnaires

A questionnaire was realized, for the first collection of information about marine traffic simulation studies.

The questionnaire structure was the skeleton for the future database on studies; to verify its fitness and efficency it was tested over 16 (32) research institutions or commercial organizations in 5 countries; the answers obtained were related to 26 studies; the questionnaires was found satisfactory for the most part. Modifications were made to remove ambiguities and unnecessary redundancies and to include topics specifically suggested by respondents.

Details on the testing of the questionnaires are given in Appendix-1.

The final draft of the questionnaires was agreed by the WG1 at its meeting in Genoa on the 26th of June 1989. The text of the questionnaire is given in Appendix-2.

2.3.3 Development of the database on studies

For the realization of the database the WG1 decided to charge software professionals. Quotations were obtained for the preparation of a prototype data base from the 4 different countries.

The lowest quotation was from TOC Marine in Ireland, for a total of 3000 ECU's.

To avoid bureaucratic delays and as a measure of the commitment of the WG1 to the satisfactory completion of its brief it was decided to finance the preparation of the prototype data base from the members' own institutes national funds.

The first version of the database was prepared by Robert Wallace, software professional, with the continous assistence of Gerard Trant. It was ready for end 89.

After testing by the members of the WG1, a second release was ready in May 1990.

The work done by the WG1 was presented at the VTS conference in Genoa, in February 1990; the text of the paper is included as Appendix-3.

2.3.4 Development of the database on traffic data

The database on traffic data was developed as an expansion of the first one; its structure was agreed about by the WG1 members, and it was decided to skip the questionnaire testing phase; the experience already acquired with the first one was considered sufficent, and any one of the members of the WG had also its own experience in data collection to give.

The first version of the complete database was circulated by August 1991 and revised in a meeting of the WG1 in Cork, October the 8.

In the same date were defined the criteria for the use of the database, i.e. for the realization of inquiry in the stored data and of report about them.

2.4 Calendar of meetings

The Working Group 1 had 8 Working meetings:

Dec. 2 1988 - Bruxelles
Apr.27 1989 - Bruxelles
Jun.26 1989 - Genoa
Nov.22 1989 - Bruxelles
Feb.20 1990 - Genoa
Jun. 8 1990 - Cork
Jul.13 1991 - Paris
Oct. 8 1991 - Cork

3. The prototype databases

3.1 Common structures of the databases

As can be seen by fig.1, extracted from the paper presented at the VTS conference in Genoa, we made an effort to keep the structure of the databases similar; in this way the user has to work on the basic same scheme, either he introduces study or traffic data informations; and the processing scheme is also easier to follow.

The common structures of the database (the full block diagram of the final version of the database is included at the beginning of Appendix 4) can be better described making reference to the printouts related to the different screens, given in the same Appendix 4.

The printouts sequence is the same screens sequence that can be seen by an operator using the DB or introducing data in it.

Pages 1 is the introductory message, specifying the origin of the DB; page 2 shows the MAIN MENU with the different possible choices; page 3 is the relative HELP page, with short form indications.

It will be described here the database structure, following the regular way to introduce a new study in the database:

choosing option 2 in the MAIN MENU the user is allowed to introduce a new study (generally speaking, either about simulation or traffic data): he will go thorough the following pages of appendix 4: from 4 to 7 there are identification data for the institution, the particular study, reference person, publications, etc.

Page 8 is the end of the first common part, because here the user has to chose wich branch to follow, if a study on marine traffic simulation or a traffic data collection.

The last sections, SCENARIO, DESCRIPTION etc., KEYWRDS are also common.

3.2 Database section on simulation studies

From page 9 to 21 of appendix 4 are the screens related to the introduction in the DB of simulation studies.

The text in the pages is self explaining; it can be noted that the enquires are divided in objectives, simulation methods and type of

GENERAL STRUCTURE OF THE DATA BASE

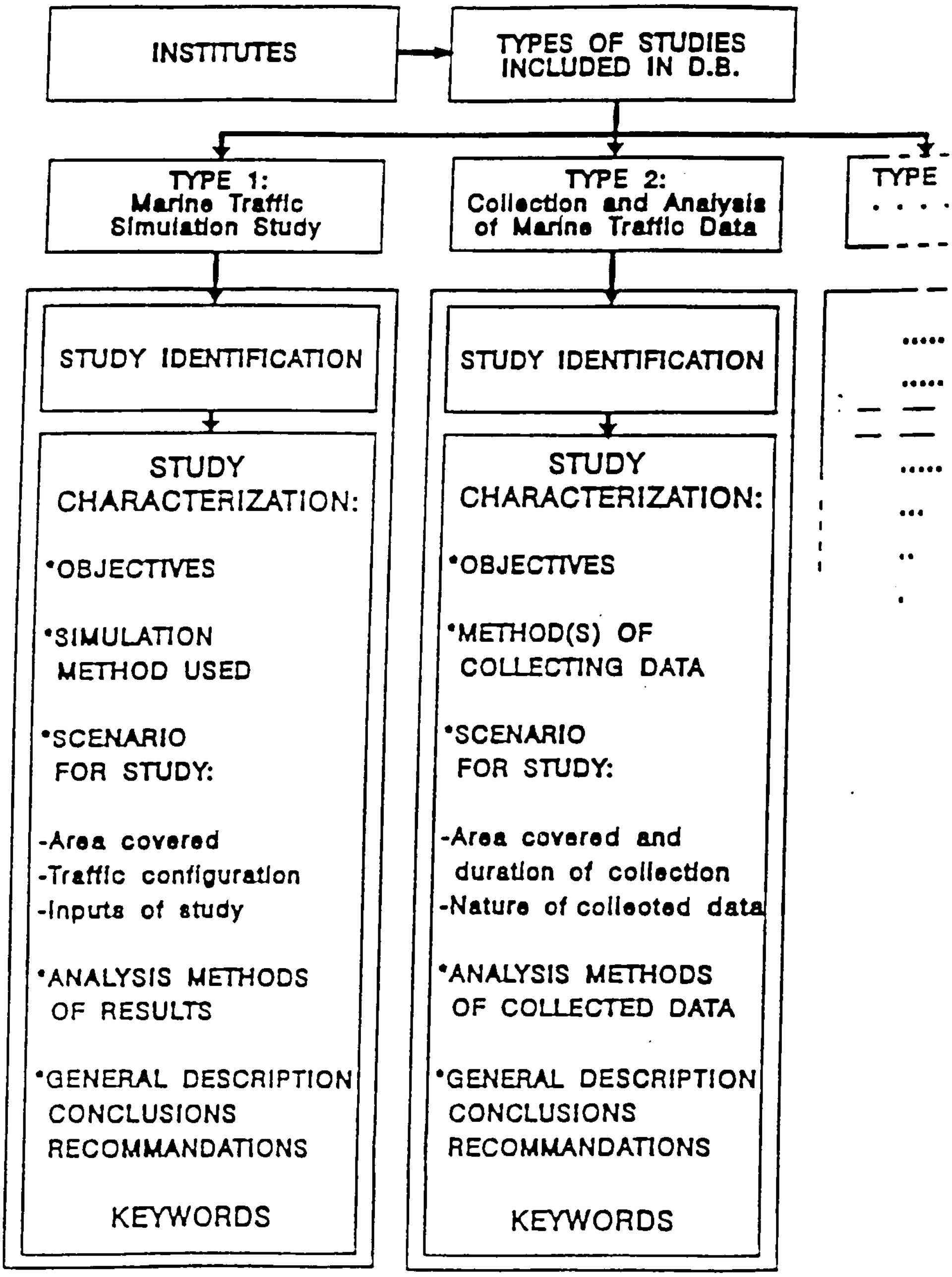


FIG. 1

simulators, traffic configuration and input to the study, scenario, description etc.,keywords.

Every screen of enquires has a help screen, with dedicated explanations: page 15A is, as an example, the help related to page 15, with indications on how to point out if INPUT DATA are constant or variables, or other specifications.

The DESCRIPTION, OBSERVATION, RECOMMANDATION is the only field left uncodified, were the user can write its own text.

The KEYWORDS field will allow for a selection between a limited number of keywords (26). The list of keywords, reported in the next paragraph on the use of DB, has been built taking into account the keywords freely expressed in the test questionnaires, reduced to a significant subset that could be used efficently for selection purposes.

3.3 Database section on traffic data

From page 16 to 19 are the screens related to the traffic data section.

As before, the enquires text is self explaining and a number of help screens can be used as aid to the compilation.

Being the structure essentialy similar (Objectives, methodology, analysis methods, scenario,etc.) the methodology part (being included in this METHODS, DURATION OF OBSERVATIONS, NATURE OF DATA, PARAMETERS) is more relevant here, in comparison with other parts; the methodological aspect is strongly qualifying the data for possible different future use. The OBJECTIVES, page 16, give a good identification of the original purpose of the data collection, with no a priori constraints for a different use; so does the PROCESSING METHOD, strictly related to the original application.

The last part of the enquires, containing SCENARIO, DESCRIPTION ETC., KEYWORDS, is common to the two sections.

4. Use of the database

4.1 Input and editing of a study

The procedure for the introduction of a study has been described already in paragraph 3; in an analogous way the sistem allows the user to edit a study already introduced, selection option 4 in the MAIN MENU.

By giving to the DB the country code and the study identification number (suggestions are given on the screen) it is possible to enter the study, viewing every screen in the same sequence, make corrections o modifications, saving at the end the new version.

Selecting option 3 in the MAIN MENU it is possible to eliminate a study from the list.

Options 1 and 6 give instruments to know briefly the content of the DB: options 1 allow to know all the organizations included, with national identification codes and organization number; option 6 lists the study titles, in full or selected by national code

Option 7 shows a simple report, either on screen or printed, of a selected study, were only the enquires with a positive answer are presented.

4.2 Searching and reporting

Criteria must be defined for the selection of studies in the database, to be able to build significant reports concerning well identified topics or areas

The decision of WG1 was to define a criterium based on the combination of 5 variables:

1) Type of study (simulation or traffic data)

2) Country code

3) Organization code

4) Type of area covered by the study (scenario)

5) KEYWORDS

The criteria of selection will be:

-- If no specification has been given for one variables, that variable is irrelevant for selection

-- For the other variables, if all the specifications match (logical and), the study is included in the report (this is the first, more usual choice, but any other logical combination of results can be also defined as logical yes)

The Keywords are very important in this contest, because are the only parameters left related to the purpose of the study.

The reason to chose just the keywords and not the specific answers given in filling the enquires is very simple: looking for a specific answer gives, with the high number of different questions we have, a very low probability of positive selection.

It would be necessary to examine, with an OR function, many different variables, with a very complicated software structure.

26 keywords have been identified; among them the user has to chose those who better fit to its study, up to a maximum that could be varied, but can reasonably fixed to 6. These will than be used for the searching in the database.

No structured report has been defined for the prototype database: the report will be just the printout of the selected studies.

A sample output has been included, as Appendix 5, about one of the studies.

4.2.1 Keyword list

1) Safe/efficient ship transit

2) Port/waterway design and operations

3) Aids to navigation

4) Marine traffic management

5) Vessel traffic services

6) Allied services to ship

7) Ships' sailing plans

8) Ship manoeuvring characteristics

9) Ship modeling

10) Traffic modeling

11) Ship bridge design

12) Ship bridge procedures

13) Ship casualty(s)

14) Training

15) Numerical/fast time simulation

16) Simulation with operator/interactive

17) Marine simulator(s)

18) Ship types

19) Radar observations

20) Vessel reports

21) Visual observations of ships

22) Environmental data

23) Traffic safety

24) Traffic efficency

25) Vessel encounters

26) Statistical analysis of traffic data

5 Conclusions

As general concluding remarks we can say that the COST311 database is now a prototype completely working for the two envisaged fields. This complies with the mandate reported at the beginning, at least for point 1 and 3. The definition of the convention for the users (point 2) of·such a database has been reach with no problems, within our very restricted univers of users, all friends or cooperative scientists, being this community ready to exchange studies and data; within a real univers restrictive rules have to be defined for the use of the full informations.

The limits of our database are included in the definition of prototype: the transformation from this stage to that of an efficent software product requires various different steps:

-- an accurate phase of testing, to verify the fitness of the database structure and features to a larger community, needing a limited funding

if the testing will be positive the next steps would be:

-- a development phase, with funding, for the realization of the operational database

-- the operational phase, needing a continous financial support.

A second order of remarks can be made, having in mind the public presentation of COST 311 activities:

---- it would be useful to begin the first phase indicated above, circulating the final DB to an enlarged set of selected peoples, to have a larger and more effective collection of studies included in the DB for the presentation

---- an intermediate verification step could be useful, on few reliable friends

---- a promotional action from the CEC could be very useful, with at least a covering letter for the diffusion

---- a small amount of funding could also be necessary, to cover material, mail and personnel expenses for this last data collection.

APPENDIX 1 : TEST OF THE QUESTIONNAIRE.

FINLAND

Contacted thorough national representative in COST 311

GREECE

Contacted thorough national representative in COST 311

SPAIN

Contacted thorough national representative in COST 311

PORTUGAL

Contacted thorough national representative in COST 311

1 - List of Institutes/Companies to whom the questionnaire request was specifically addressed.

FRANCE

OPEFORM
STERIA
SYSECA TEMP REEL
Service Tecnique des Phares et Balises
SOGREAH
Bassin des Carenes
Service Tecnique de la DPMN
Marine Nationale

HOLLAND

MARIN
WL - Delft Hydraulic Laboratory
TNO - IWECO
TNO - IZF
DVK - RWS

ITALY

ILRES
AUTOMA
Porto di Genova SpA
CETENA
SELENIA
TECNOMARE
Stretto di Messina SpA
I.U.N.
I.A.N.

2 - List of Institutes/Companies who answered the questionnaire.

FRANCE	total of	8 questionnaires
OPEFORM		4
S. T. Phares e Balises		1
SOGREAH		3
HOLLAND	total of	10 questionnaires
MARIN		2
WL-Delft Hydraulics		3
TNO-IWECO		2
TNO-IZF		3
ITALY	total of	8 questionnaires
IAN		1
IUN		1
Ist.Osserv.Radar		1
CETENA		4
TECNOMARE		1
FINLAND	total of	3 questionnaires
VTT-Ship Lab.		3
GREECE	total of	1 questionnaire
Mar.Tech.Dev.Comp.		1
SPAIN	total of	1 questionnaire
....		1
PORTUGAL	total of	1 questionnaire
LNEC		1

3 - Table of absolute and percentage number of returns

	Institutions Interrogated	Institutions Answering	Questionn. returned	Q./I.I.	Q./I.A.
FRANCE	8	3	8	100%	266%
ITALY	9	5	8	89%	160%
HOLLAND	5	4	10	200%	250%
FINLAND	1	1	3	300%	300%
Totals	23	13	29	126%	223%

Spain, Portugal and Greece have been left out of this table for the non systematic diffusion of questionnaire.

4 - First control phase over returned questionnaires.

A vary simple analysis was executed over the questionnaires, with the only purpose of verifing:

a - that all the items inserted in the questionnaire are considered of some interest by the "users"
b - that no significant items were missing from the questionnaire
c - that the answering procedures were fully understandable

Question (a) was answered by manually tabulating the answers obtained, and verifing that no question was left without at least one "cross".

Question (b) and (c) were answered by checking the comments inserted in the returned questionnaires:
only 7 questionnaires (24%) contained comments;

-- the very significant ones were concerning the understanding of the INPUTS and TRAFFIC parts in section 2; for these comments the questionnaire was restructured in this part;
-- a suggestion was made to introduce the items "onboard aids" and "the representation of informations on board", but these items are already covered by B.5;
-- space was requested for:

method of analysis - other research techniques - results - conclusions: these items must be considered included in the text information about the study (General description), mainly due to the practical impossibility to structure any answer to these topics;

-- the request to introduce the RISK analysis in the items will be examinated, but it seems also much more likely to be included in the "General description".

APPENDIX 2 : QUESTIONNAIRE TEXT

I. INFORMATION ON YOUR ORGANIZATION

1.1. NAME :

1.2. ADDRESS :

1.3. CITY & POSTAL CODE :

1.4. COUNTRY :

1.5. TELEPHONE(S) :

1.6. TELEX :

1.7. TELEFAX :

1.8. EARN (*) ADDRESS :

1.9. TYPE OF ORGANIZATION :

1.9.1. Public .... (

1.9.2. Private .... (

1.9.3. Other .... (
(please specify) ....
....

- - - - - - - - - - -

(*) European Academic Research Network (EARN)

II. IDENTIFICATION AND CHARACTERIZATION OF A SPECIFIC STUDY RELATING TO SAFETY AND EFFICIENCY OF MARITIME TRAFFIC USING SIMULATION METHODS

1. STUDY IDENTIFICATION

1.1. Name of Reference Person :

1.2. Title of the study :

1.3. Name of Client Organization :

Full address :

1.4. Is this study a part of a National Research Programme (Y/N) :

If Yes,

1.4.1. Name of this National Research Programme :

1.4.2. Period covered by it :

1.5. State of the study :

Completed study	( )
Study being undertaken	( )
Planned study	( )
Proposed study	( )

1.6. (Estimated) starting date of the study :

1.7. (Estimated) completion date of the study :

1.8. Are copies of the report(s) on study available (Y/N) :

If Yes,

1.8.1. Title of report(s) :

1.8.2. Author(s) of report(s) :

1.8.3. Date of report(s) :

1.8.4. Language of report(s) :

1.8.5. Price of report(s) (in national currency) including postage :

1.9. Are there any other publication(s) on the study (Y/N) :

If Yes,

1.9.1. Give the publication(s) reference(s) :
....
....

2. STUDY CHARACTERIZATION

2.1. OBJECTIVES OF THE STUDY

Please indicate the objectives which are relevant to the study.
Code for answers :

- *1 for primary objective*
- *2 for secondary objective*
- *leave blank where not relevant*

A. <u>Objectives related to port and waterway (especially confined waters) design and operations</u>

A.1. Verify/identify the conditions for a safe and efficient transit of specific ship(s) in the considered area................................ (   )
(i.e. physical, hydrological, weather and/or traffic conditions)

A.2. Design/improve physical configuration of the area..... (   )
(i.e. channel or basins dimensions, bridges, piers, berths, definition of specific sub-areas such as anchoring areas, Traffic Separation Scheme in confined waters,...)

A.3. Design/improve aids to navigation external to ship (visual or electronic)....................... (   )

A.4. Design/improve permanent traffic management functions.. (   )
(i.e. permanent navigation rules, procedures...)

A.5. Design/improve real time traffic management functions from VTS, i.e. :

A.5.1. Design/improve services to ship(s)....... (   )

A.5.2. Design/improve internal VTS organization. ( )

A.5.3. Design/improve VTS equipments............ ( )

A.5.4. Identify performances, skills, mental processes of VTS operators............... ( )

A.6. Design/improve allied services to ships.......... ( )
(i.e. pilots, tugs operations...)

A.7. Select navigation strategy to adopt in the area for certain ships' classes................. ( )

A.8. Other objectives................................. ( )
(Please specify)..................................
....
....

B. <u>Objectives related to ships'manoeuvring characteristics, operations and navigation control</u>

B.1. Identification of inherent ship manoeuvring characteristics (for actual or hypothetised ship(s))... ( )

B.2. Identification of maneuvring characteristics and controllability of ship(s) (actual or hypothetised) submitted to external environmental factors........................... ( )

B.3. Development of mathematical model of the behaviour of the complete system : environment/ ship/helsman/navigator .... ( )

B.4. Overall ship bridge design .... ( )

B.5. Design/improvement of ship bridge equipements and human interfaces (including automation aspects)............................ ( )

B.6. Design/improvement of ship bridge procedures.... ( )

B.7. Performances, skills, mental processes of ship bridge operator or team........................ ( )

B.8. Analysis of ship casualties dynamics........... ( )

B.9. Other objectives .... ( )
(Please specify) ....
....
....

C. OBJECTIVES RELATED TO TRAINING

Nota. *The studies having objectives related to training (either of VTS or ship operators) are not directed towards the training itself but the* <u>*preparation*</u> *of training i.e. the definition of training tools, training procedures, criteria to assess the effectinevess of training technics, etc...*

C.1. Defintion of training tools .... ( )
(i.e. criteria for choosing the type of simulator most suitable for a specific training programme, etc...)

C.2. Definition of training procedures .... ( )
(i.e. establishment of gradual courses for skill/knowledge acquisition, methods for skill/knowledge assessment, etc...)

C.3. Validation of training techniques .... ( )
(i.e. criteria for assessing effectiveness of training techniques against real world, etc...)

C.4. Other objectives.................................... ( )
(please specify) ....
....
....

2.2. SIMULATION METHOD USED FOR THE STUDY

Please indicate a x where relevant
Leave blank where not relevant

2.2.1 Type of simulation

2.2.1.A Numerical simulation .... ( )

2.2.1.B Interactive simulation i.e. interaction between an operator and a marine simulator........... ( )

2.2.1.C Other (please specify)............ ( )

2.2.2. Type of simulator (in case of interactive simulator)

2.2.2.A Ship bridge simulator............. ( )

2.2.2.B Ship radar simulator .... ( )

2.2.2.C Ship scale model .... ( )

2.2.2.D VTS simulator .... ( )

2.2.2.E Linkage of simulators mentioned above .... ( )
please specify which ....
....

2.2.2.F Other (please elaborate).......... ( )

2.3. SCENARIO FOR THE STUDY

2.3.1. Specify the location to which the study relates :

2.3.1.A Name of country(s) :

2.3.1.B Name of sea/harbour/river/canal/ :
....

2.3.1.C No specific location .... ( )
(indicate a x if relevant)

2.3.2. Characterization of areas covered by study.

(If more than one area type is involved in the study, please rank them in order of importance : 1 or 2)

2.3.2.A In port .... ( )

2.3.2.B Port approaches .... ( )

2.3.2.C River/canal .... ( )

2.3.2.D Coastal waters .... ( )

2.3.2.E International waters .... ( )

2.3.2.F No specific area .... ( )

2.3.2.G Other (please specify) .... ( )

2.3.3. Traffic Configuration

Please indicate a x where relevant
Leave blank where not relevant

2.3.3.A	Single own ship(*).................	( )
2.3.3.B	2 or more own ships(*)..............	( )
2.3.3.C	Single own ship(*) + programmed traffic	( )
2.3.3.D	2 or more own ships(*).+ programmed traffic	( )
2.3.3.E	Single programmed ship(**).............	( )
2.3.3.F	Two-way programmed traffic(**).....	( )
2.3.3.G	Complex programmed traffic(**).....	( )

- - - - - - - - - - - -

(*) Only for study using Interactive Simulation method (Questions 2.2.1.B)
Own ship is a ship on which a subject has possible command during the experimental runs.

(**) Only for study using Numerical Simulation Method (Question 2.2.1.A)
Programmed ship or traffic may include in addition to the ship model the model of the behaviour of helsman/navigator

2.3.4. Inputs of the study

Please indicate the inputs which are relevant to the study. Code for answers :

- *C for input having constant values during the study*
- *V for input having variable values during study*
- *leave blank if input not relevant*

2.3.4.A	Physical and topographical characteristics of navigational space or sub-spaces...............	( )
2.3.4.B	Meteorological conditions	( )
2.3.4.C	Hydrological conditions (i.e. tides, current, waves,...)...	( )
2.3.4.D	Aids to navigation external to ship(s)	( )
2.3.4.E	Permanent traffic management fonctions (*)......................	( )
2.3.4.F	Real time traffic management fonctions (**).....................	( )
2.3.4.G	VTS operators'equipment............	( )
2.3.4.H	Traffic configuration	( )

- - - - - - - - - - -

(*) Such as general rules, rules for use of specific areas i.e. Traffic Separation Scheme...

(**) Such as services to ship issued from VTS

2.3.4.I	Own ship(s)'manoeuvring caracte- ristics	( )
2.3.4.J	Own ship(s)'type .... Please specify which type :	( ) ( )
2.3.4.K	Own ship(s)'on board aids to navigation	( )
2.3.4.L	Experience of own ship(s)'operator.	( )
2.3.4.M	Other............................... Please specify :	( )

2.4. GENERAL DESCRIPTION

2.4.1. *Please give a brief general description of the study. For a completed study, give also the main conclusions and recommandations of the study.*

2.4.2 In this list, indicate the key words characterizing the study

Indicate a x where relevant
Leave blank where not relevant

Keyword list extracted from the questionnaires, grouped by main topics

Simulation

real time -----

----- experiments

interactive -----

fast time -----

traffic-----

----- modelling

vessel mouvement -----

Control

-----application

-----theory

linear optimal ---

ship ---

Non linear systems

Human

--- information processing

--- factors

--- controllability of ships

--- engeneering research

Man machine model

Performance measurement

Work load measurement

Navigability

--- in confined water

--- in port configuration

--- in shallow water

bank effect on ---

Risk

--- analysis

grounding ---

maneuvring --- indexes

One person watchkeeping

Bridge automation

Ergonomics

Integrated displays

Electronic charts

Electronic mapping

Ship mathematical model

Numerical praediction

Aids

Visual --- to navigation

--- to navigation

Buoys

Validation

Pushtow

Barge

Relational database

Flows

passenger ---

vehicle ---

cargo ---

Transport

--- modelling

--- scenarios

Vessel

--- standardization

--- design

coastal ---

Demand

--- analysis

future ---

Shore based radar

VTS

Coastal VTS

Traffic regulations

Harbour characteristics

Port approach

Port facilities

Tugs

Canal

Venice lagoon

Environmental conditions

Weather conditions

Ship maneuvring

Collision avoidance

Encounters

Ship casualty dynamic

Simulator

Training scenario

Pilots

Pilot training

Visibility conditions

APPENDIX 3 : PAPER PRESENTED AT VTS CONFERENCE - FEB.90 - GENOA.

Gerard TRANT - Cork RTC, Ireland
Mieke BOGAERT - Rijkswaterstaat, The Netherlands
Thomas DEGRE - INRETS, Paris
Antonio SICCARDI - IAN CNR, Genova

DATABASE ON EUROPEAN MARINE TRAFFIC STUDIES

Abstract

The Management Committee of COST 311 (Simulation of maritime traffic), recognized, in its first meeting, the opportunity to develop a knowledge of maritime traffic studies, already completed, in progress or planned, based on simulation techniques. The preparation of a database on this topic was a task undertaken by Working Group 1 of COST 311, whose brief was:

- to develop a common framework (library/database) for the recording of traffic simulation methods, scenarios, parameters and results;

- to propose a convention for the users of such a library/database

- to outline the implementation of such a library/database

An European library/database of traffic simulation methods, results and data should be the outcome of this first WG1-COST 311 action.

The work done, the methodologies developed for the data collection and the first prototype of database are here described and will be operatively shown at the meeting.

G. TRANT is senior lecturer at the Nautical Studies dept. of the CORK Regional Technical College. He is specialist in nautical systems. He is national representative in the COST 311 project. He had a major responsibility in the definition and practical realization of the protoype data base.
M.P. BOGAERTS, naval architect, joined the Navigation and Waterways dept., Ministry of Transport and Public Work. She was senior project engineer, involved in fairway dimensioning, subsequently becoming Head of the Fairway Section and Research Coordinator. She is Dutch representative and member of the WG1 and WG2 in COST 311, and also member of PIANC working group.
T. DEGRE is Research Director in the dept. of Analysis and Traffic Control of INRETS. Since 1970 has been involved in research on maritime traffic and traffic manegement from VTS. He had an active role in COST 301 project and is now acting in the present COST 311 action, being member of WG1 and WG2.
A. SICCARDI, phisicist, joined the C.N.R. in 1970. Since 1981 at the Istituto Automazione Navale, worked mainly in experimental activities at sea and dedicated instrumentation development. He is senior scientist, in charge of the Research Ship Electronic Instrumentation dept. He participated to COST 301 WG8 activities and MEDITRIAL development. He is now italian representative in COST 311 and leader of WG1.

1. INTRODUCTION

The database on marine traffic studies which will be demonstrated with the presentation of this paper was prepared as part of the work programme of Cost 311.

Cost 311 takes up some of the themes that were touched on but not developed in Cost 301; specifically, the application through European co-operation of cost effective simulation techniques to promote the safety and efficiency of marine traffic, with particular regard to collision and grounding avoidance. The objectives of Cost 311 are:

a) To answer functional and operational requirements of authorities (national, European, international) in the field of safety and efficiency of traffic at sea and in harbours. Problems faced by authorities in this field may only find limited answer if tackled in isolation.

b) To identify present research tools and methods of simulation used in marine traffic studies, and develop and improve them as necessary.

The development programme for Cost 311 can be described under four headings:

1.1 The creation of a library (database) on marine traffic studies, including simulation studies, which can be used for recording marine traffic methods, scenarios, parameters and results. The conventions for the use of a database and the organization for its implementation have to be decided on.

1.2 The development of common methods for marine traffic data analysis, bringing together the experience developed in recent years, and using the data available in the Cost 311 database.

1.3 The preparation of a common programme for the development of marine traffic simulation studies in Europe.

1.4 Implementation of co-operative development of marine traffic research.

The Cost 311 programme will run for four years from March 1988.

The preparation of the database for marine traffic studies was a task undertaken by Working Group 1 of Cost 311. The members of the Group are the authors of this paper.

2. CRITERIA FOR PREPARATION OF THE DATA-BASE

It was decided by the members of the Working Group that the database should be prepared according to the following criteria:

2.1 The database should be easy to use, both for inputting data and for acquiring information on studies that are contained in the database.

2.2 The inputting of data on marine traffic study should take as short time as possible.

2.3 A user querying the database should be able to

- consult in a logical order the studies included in the database,
- select studies according to specified rules,
- establish contacts with authors and people responsible for studies, if interested, in order to get more informations on the studies which have been selected.

In order to comply with the criteria, the structure for inputting data (as shown in figure hereafter) was decided on.

3. PREPARATION OF THE DATABASE

Initially a questionnaire was drafted for the collection of information on marine traffic simulation studies. The questionnaires was tested on 17 research institutes/commercial organization in five countries and information on 30 studies was obtained. The response rate was high from the organization that were circulated, although a considerable amount of prompting was necessary from the Group members responsible for distributing the questionnaire. Modification were made to remove ambiguities and repetitions and to insert material that was suggested by the respondents.

The modified questionnaire and the responses formed the basis for the prototype database. The Group members organized the necessary programming and the finance to cover the costs, and also introduced whatever changes that were necessary to adapt the material to the structures and to the potentials of a database .

4. CONCLUSIONS

4.1 The software that has been prepared under the management of Working Group 1 of COST 311 has two primary function:

It will be circulated in disk from to research organization in Europe to collect essential information on marine traffic studies .

It will be used for amalgamating this information to establish the database, so that information can be made available in general and specific forms to interested person.

4.2 It is envisaged that the information contained in the database will be of considerable help to institutes and commercial organizations in Europe that are involved in marine traffic studies, and that it will:

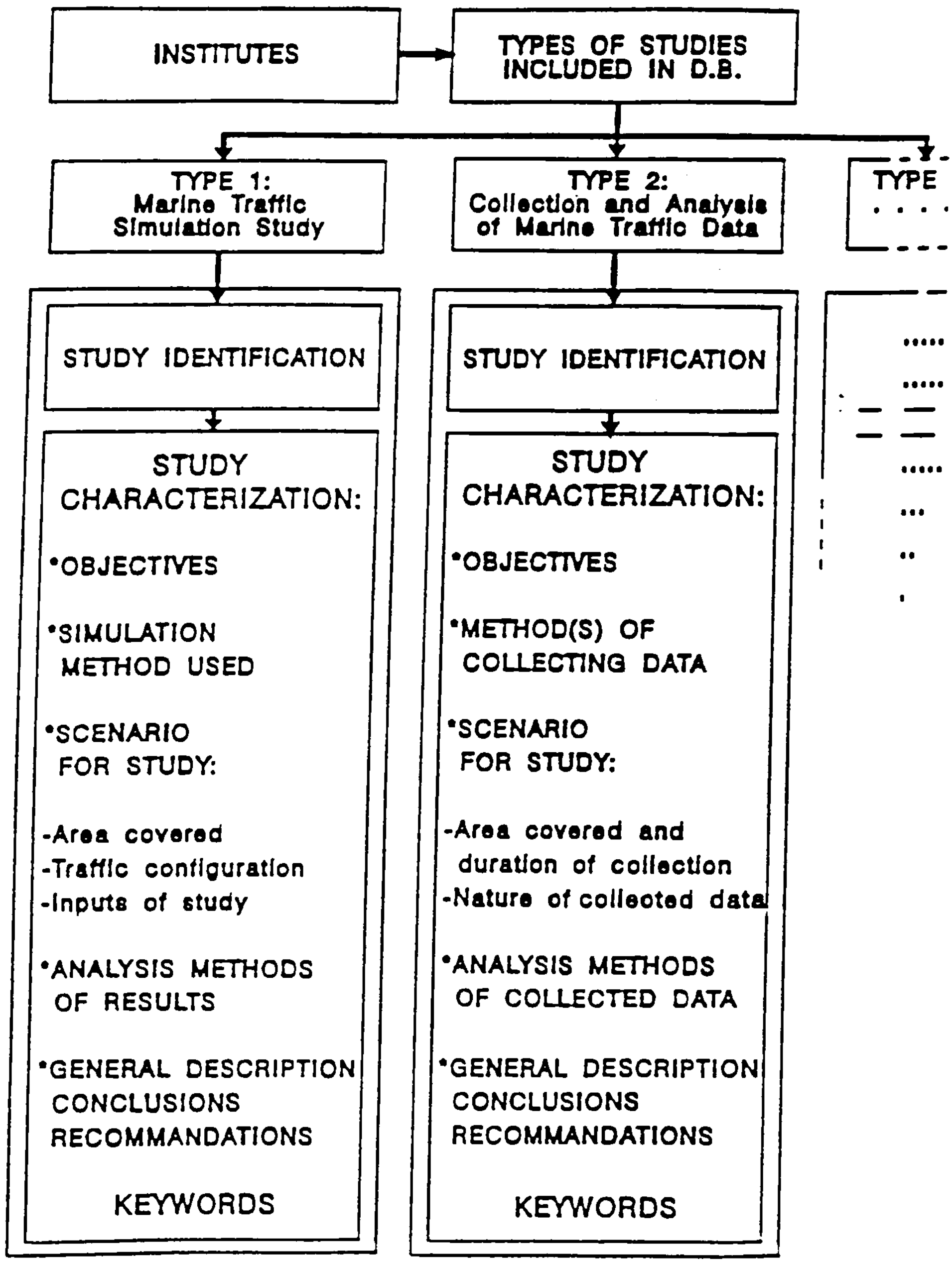
stimulate further studies in this area with a view to improving the safety and efficiency of marine traffic,

go a long way towards avoiding duplication of effort and making best use of available resources, taking into account that simulation studies and the collection and analysis of marine traffic data can be very costly,

provide the necessary background for major co-operative studies on marine traffic in Europe .

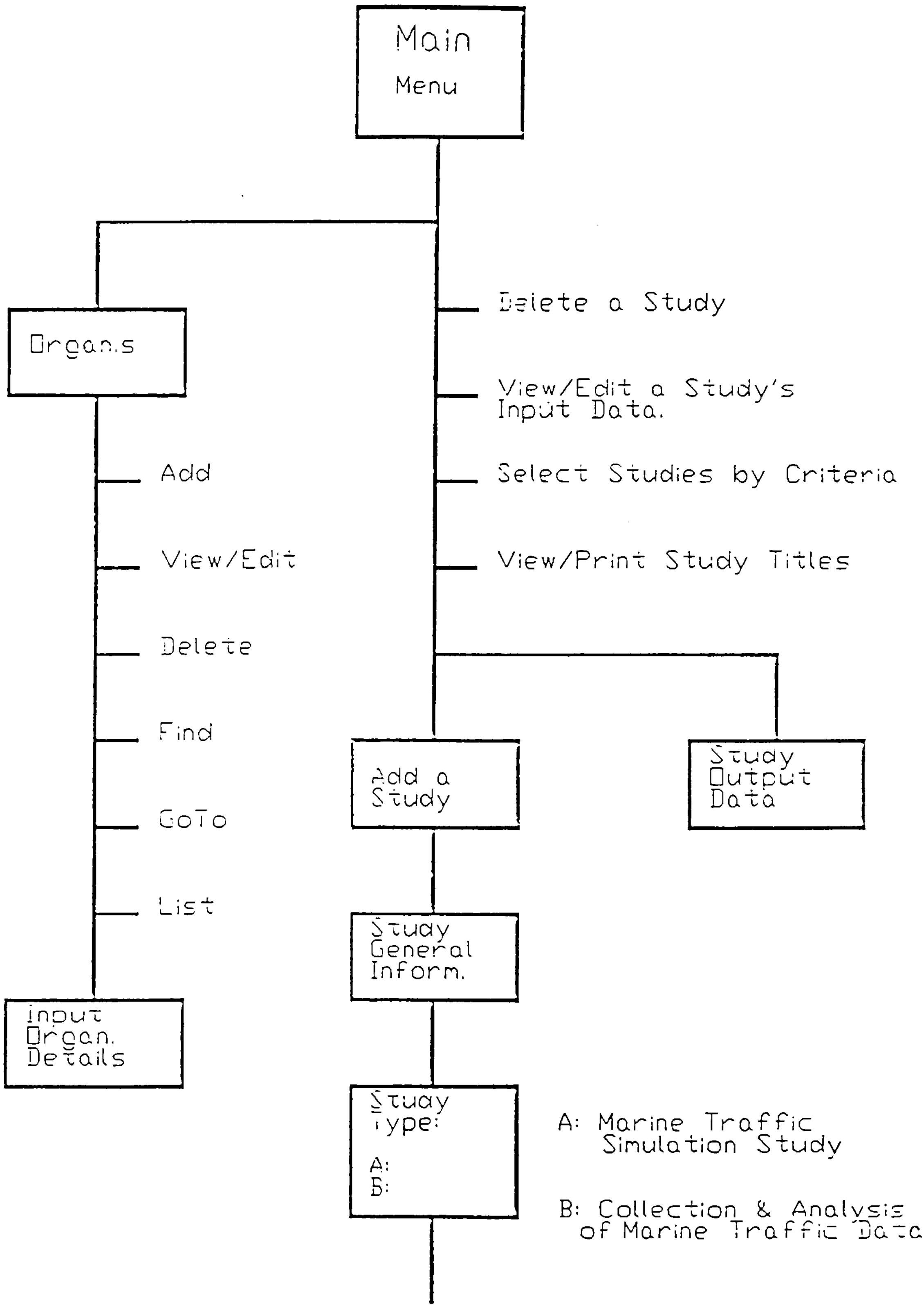
4.3 Eventually, responsibility for promoting the database, providing the necessary administration, circulating queries, and producing output publications and reports should rest with a designated organization. This is a matter for the Management Committee of COST 311 to address. It will also be necessary to secure extra finance for the project to bring it beyond its present experimental stage.

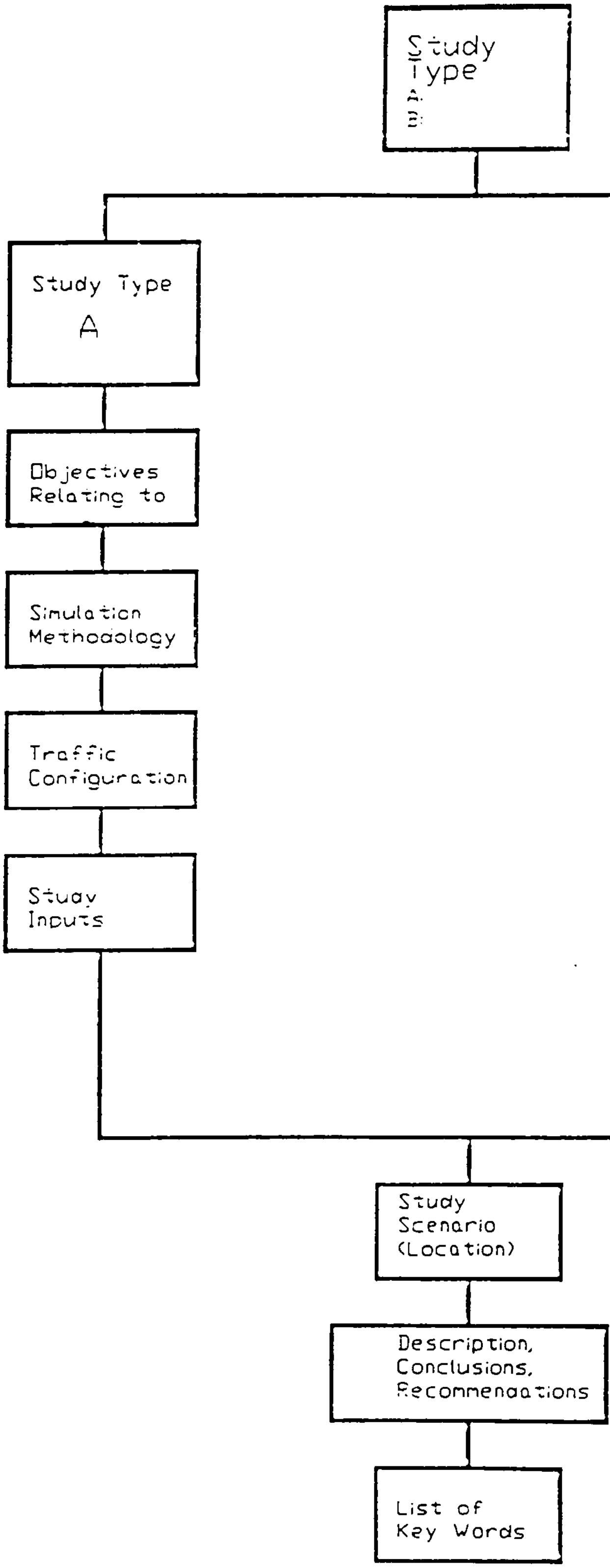
GENERAL STRUCTURE OF THE DATA BASE



PROTOTYPE DATA BASE

BLOCK DIAGRAM


Main
Menu
Organs
Add
View/Edit
Delete
Find
GoTo
List
Input
Organ.
Details
Delete a Study
View/Edit a Study's
Input Data.
Select Studies by Criteria
View/Print Study Titles
Add a
Study
Study
Output
Data
Study
General
Inform.
Study
Type:
A:
B:
A: Marine Traffic
Simulation Study
B: Collection & Analysis
of Marine Traffic Data


Study Type
A:
B:
Study Type A
Study Type B:
Objectives Relating to
Objectives Relating to
Simulation Methodology
Data Collection Methods
Traffic Configuration
Nature of Data Collected
Study Inputs
Duration of Observations
Analysis Method
Study Scenario (Location)
Description, Conclusions, Recommendations
List of Key Words

APPENDIX IV : PROTOTYPE DATA BASE - SCREEN PRINTOUTS

DATABASE OF MARINE TRAFFIC STUDIES

Prepared by

COST 311

MAIN MENU

1. Organisations

2. Add a Study

3. Delete a Study

4. View/Edit a Study's Input Data

5. Select Studies

6. View/Print Study Titles

7. View/Print Study Output Data

8. Safety Check

9. Exit

Main Menu Help Screen

1 - List of organisations in the Database

2 - Input data relating to a new study

3 - Select from a presented list of studies, a study to be deleted

4 - Select from a presented list of studies, a specific study to view/edit the input data

5 - Select studies according to given criteria

6 - View/Print a list of study titles & codes

7 - View/Print the output data of a study selected by its code

8 - Use this function to re-index data files

9 - Exit the system.

ORGANIZATIONS

Current Date: 14/10/91 Current Time: 13:05:27

Number of Organizations on File : 6 Last Update : 07/10/91

CODE	NAME
I 01	CETENA S.p.A.
I 02	ENTE GESTIONE ISTUTO OSSERVATORI RADAR
I 03	I.A.N.
IRL01	Nautical Enterprise Centre.
NL 01	TNO-IWECO; Insitute of Mechanical Engineering
NL 02	MARIN

ORGANISATIONS HELP SCREEN

The CODE assigned to an organization is its country's letter(s), and an arbitrary two digit number.

F2-Add. - to include details of another organization.

F3-View/Edit. - Modify as required. PgDn to move rapidly through questions.

F4-Del. - to delete an organization from the list. If there are studies in the Database that relate to an organisation, the organisation cannot be deleted until the studies are first deleted.

F5-Find. - to locate an organization in the list: type in the first few letters of the organization's name, or a name which is not necessarily the exact name of the organization.

F6-Goto. - to select an organization by its code number.

F7-LgLst. - Long list, for print out, of all organizations in the database.

F8-ShLst. - Short list, for print out, of each organization's Code, Name & Telephone Number.

INPUTTING ORGANISATION DETAILS

Name:
Address:

City & Code:
Country:

Telephones:
Telex:
Telefax:

Earn Address:

Name:

Country Code: Number:

Type of Organization:-

Public (Yes/No)..... N
Private (Yes/No)..... N
Other (Yes/No)..... N
Please specify...

ADDING A STUDY

Study General Information

Name of Reference Person: ....

Title of the Study: ....

Code for Performing Organisation: .... {Code Reference}
Name & Address: .... {Called up by Code}
....
....
Name of Client Organisation: ....
Address: ....
....
Study Code: {Org. Code + Study Ref.}

Is this study part of a National research Programme .... N

State of the Study:
Completed: N In progress: N Planned: N Proposed: N

(Estimate) Starting Date: ....
Completion Date: ....
Cost (ECU's): ....
Authors: ....
....
Date of Report/Publication: ....
Language: ....
Is report available: ....N

Are there any other publication(s) on the Study .... N

{If "Y" to above question}
Give the Publication(s) reference(s) ....
....
....

Study Type

A. Marine Traffic Simulation Study

B. Collection & Analysis of Marine Traffic Data

Your Choice .... A/B

OBJECTIVES RELATING TO MARINE TRAFFIC SIMULATION STUDIES

Objectives are in four Sections 1. Relating to Port & Waterway 2. Relating to Ships' Manoeuvring 3. Relating to Training 4. Other C. Continue for more information S. Save & Exit

OBJECTIVES RELATED TO PORT & WATERWAY (ESPECIALLY CONFINED WATER) OPERATIONS

A. Examine the conditions for safe & efficient transit of ship(s) .... N B. Design/Improve physical configuration of the Area .... N C. Design/Improve aids to navigation External to ship (visual or electronic) .... N D. Design/Improve permanent Traffic Management functions .... N

OBJECTIVES RELATED TO PORT & WATERWAY (ESPECIALLY CONFINED WATER) OPERATIONS (CONT.)

E. Design/Improve real time traffic Management functions from VTS.

1. Design/Improve services to ships .... N
2. Design/Improve internal VTS organisation .... N
3. Design/Improved VTS Equipments .... N
4. Identify performances, skills, mental processes of VTS operators .....N

F. Design/Improve Allied Services to Ships .... N

G. Select navigation strategy to adopt in the area for certain ships' classes .... N

H. Others (please specify):

Objectives Related to Ships' Manoeuvring Characteristics, Operations & Navigation Control

I Inherent ship manoeuvring characteristics ....N

J Manoeuvring characteristics of ship(s) subject
to external environmental factors .... N

K Examination of the complete system -
Environment/Ship/Navigator .... N

L Overall ship bridge Design .... N

M Design/Improvement of Ship Bridge Equipment .... N

N Design/Improvement of Ship Bridge Procedure .... N

O Performance, Skills, mental processes of ship
bridge operator or team .... N

P Analysis of Ship Casualty Dynamics ....N

Q Other objective (Please Specify) ....
....
....

Objectives Related to Training.

R Definition of Training Tools .... N

S Definition of Training Procedures .... N

T Validation of Training Techniques .... N

Other objective (Please Specify) ....
....
....

Other Objectives

....
....
....
....

Simulation Method Used in the Study

TYPE OF SIMULATION :

A. Numerical simulation .... N

B. Interactive simulation i.e. interaction
between an operator & a marine simulator .... N

C. Others (please specify): ....
....
....

Type of Simulator

A. Ship bridge simulator .... N

B. Ship Radar simulator .... N

C. Ship scale model .... N

D. VTS simulator .... N

E. Linkage of simulator. mentioned above .... N

F. Others (please specify): ....
....
....

Traffic Configuration

A. Single ship ....N
B. Two or more ships .... N
C. Single ship+ programmed traffic .... N
D. Two or more own ships + programmed traffic .... N
E. Two way programmed traffic .... N
F. Complex programmed Traffic .... N

Input to the Study

A. Physical & Topographical characteristics of navigational space .... N
B. Meteorological conditions .... N
C. Hydrological Conditions(Tides,currents,waves).. N
D. Aids to navigation external to ship(s) ....N
F. Permanent traffic management functions .... N
F. Real time traffic management functions ....N
G. VTS Operators' Equipment .... N

Input to the Study (continued)

H. Traffic Configuration .... N

I. Ship(s)' manoeuvring characteristics .... N

J. Ship(s) type .... N

K. Ship(s)' on board aids to navigation .... N

L. Experience of own ship(s) operator .... N

M. Other (please specify): ....

....

....

Input to the study (continued)

{ Help for Screen 7b }

C for input having values all along the study
V for input having variable values during the study

(*) Such as generals rules, rules for use of
specific areas i.e. Traffic Seperation Scheme..

(**) Such as services to ship issued from VTS

OBJECTIVES RELATING TO COLLECTION & ANALYSIS OF MARINE TRAFFIC DATA.

General Objectives:

i. To obtain general knowledge on marine traffic in an area ....N

ii. To obtain knowledge on the movements of specific types of vessels in an area. .... N

If "Y" to ii, then

Please specify the vessel types for which data was collected ....

....

....

Specific Objectives:

i. The improvement of navigational aids . ... N

ii. Establishment/improvement of vessel traffic services .... N

iii Measurement of Safety of marine traffic against specific criteria .... N

iv Measurement of Efficiency of Marine Traffic flows against specific criteria. .... N

v. Casualty analysis.. N

vi Improvement of traffic regulations.. N

vii. As an input to simulation studies. .... N

viii. Other (please elaborate)...

....

If "Y" to vii, then

Please give the title/brief description of the marine traffic simulation study.

....

....

METHOD(S) USED IN COLLECTING THE MARINE TRAFFIC DATA

A. Radar observations.	N
B. Radar observations supplemented by radio communications ...	N
C. Reports from vessels..........	N
D. Visual sightings	N
E. Analysis of port records..........	N
F. Automatic data collection on board ships	N
G. Other (please elaborate)..........	
....	

NATURE OF RAW DATA COLLECTED - Relating to Vessels

A. Vessel names..........	N
B. Vessel sizes..........	N
C Vessel types..........	N
D Countries of registry of vessels..........	N
E Departure/destination ports..........	N
F Vessels' positions..........	N
G Vessels' courses..........	N
H Vessels' speeds..........	N
I Number of vessels in the area..........	N
J Frequency of vessel encounters..........	N
K Other (please elaborate)..........	
....	

NATURE OF RAW DATA COLLECTED - RELATING TO VARIABLE ENVIRONMENTAL ELEMENTS.

(i) Visibility (ii) Tidal streams (iii) Sea states (iv) Other (please elaborate).. ....

NATURE OF RAW DATA COLLECTED - RELATING TO FIXED ENVIRONMENTAL ELEMENTS.

(i) Channel widths.. N (ii) Depths of water .... N (iii) physical dangers.. N (iv) Other (please elaborate)... ....

DURATION OF OBSERVATIONS

Duration of Observations (days, months, years) .... Observations taken by day ....N by night ....N

ANALYSIS METHOD(S) USED IN PROCESSING THE DATA

A Digitising graphical data.. N

B. Statistical analysis.. N

C. Other (please elaborate)..

....

SCENARIO FOR THE STUDY

Specific location to which the Study relates:

Country(s) ....

Specific Sea/Harbour area ....

....

Characterization of areas covered by Study:

In Port .... N

Port Approaches .... N

River/Lake .... N

Coastal Waters .... N

International Waters .... N

No Specific Area .... N

Other .... N

DESCRIPTION, CONCLUSIONS & RECOMMENDATIONS.

(PLEASE GIVE A CLEAR INDICATION OF THE MAIN OUTPUTS OF THE STUDY)

....

....

....

....

....

....

....

....

....

KEY WORDS RELATING TO THE STUDY

Safe/efficient ship transits....................N	Ships' sailing plans............................ N
Port/waterway design/operations........ N	Ship manoeuvring characteristics....... N
Aids to navigation.............................. N	Ship bridge design.............................. N
Marine traffic management................ N	Ship bridge procedures....................... N
Vessel traffic services......................... N	Ship casualty(s).................................. N
Allied services to ships....................... N	Vessel encounters............................... N
Numerical simulation..........................N	Radar observations............................ N
Simulation with operator.....................N	Vessel reports.................................... N
Marine simulator(s)........................... N	Visual observations of ships.............. N
Training.. N	Traffic data analysis.......................... N
Environmental data............................ N	

APPENDIX 5 : SAMPLE DATABASE OUTPUT

Study Output Data

Print Date 12/01/92 EC MARINE TRAFFIC DATABASE

Study Reference	IRL0101
Title of the Study	Feasibility of Establishing a Helicopter Centre for Ship Surveillance at Cork Airport
Performing Organisation	Nautical Enterprise Centre C/O Cork RTC Bishopstown Cork Ireland
Reference Person	Gerard Trant
Client Organisation	Cork Airport Cork
State of Study	In Progress
Starting Date(Estimate)	January 1992
Completion Date(Estimate)	May 1992
Study Type:	Collection & analysis of Traffic Simulation Data

Objective(s) of Study

Objectives Related to Marine Traffic Data:

To obtain general knowledge on marine traffic in a particular area.

To obtain knowledge on the movements of specific types of vessels in a particular area.

To collect data on marine traffic:
as an input to a database

For the Surveillance of fishing vessels

Brief description of the database:

The database is operated by the Naval Service

Method(s) used in Collecting the Marine Traffic Data:

Visual sightings

Duration of Observation:

On-going

Observations taken:

by day

Nature of the Data Collected:

Information on all traffic movements
Information on movements of particular vessel types

Vessel types on which data was collected:

Fishing vessels.

Parameters used when Collecting the Data:

Countries of registry of vessels
Vessels' names, registration numbers

Meteorological/hydrological conditions of the area:

sea states (relatively rough seas)

Analysis Method used in Processing the Data:

Numerical analysis.
Sorting and disseminating data, using database

Specific Countries to which the Study relates:

Ireland

Specific Sea/Harbour area:

Celtic Sea, and West Coast of Ireland

Coastal Waters
International Waters

Description, Conclusions & Recommendations:

This is a feasibility study, investigating the use of helicopters for a variety of tasks, including collection of information on traffic movements; also for the surveillance of fishing vessels, checking for oil spillages, and the movements of small craft.

Keywords in the Study:

Vessel reports
Visual observations of ships
Traffic data analysis

B. UPDATING OF INFORMATION EXISTING ON SIMULATORS IN EUROPE.

In the mid eighties an inventory was carried out on behalf of COST 301 to get a review of simulator facilities in Europe.

In the preparation phase of COST 311 the same data were used.

The results of this inventory are given as a reference in Appendix A.

Working Group I endeavoured to update the information collected during the preparation of COST 311.

A new questionnaire has therefore been prepared and sent to European Institutes in order to be filled in as regard new facilities.

This questionnaire (in English and in French) is shown in Appendix B.

The answers to this questionnaire are available in COST Secretariat in Brussels.

Due to the fact that only countries having participated to COST 311 action answered the new questionnaire, the updated information on existing simulators are not complete for all Europe.

Nevertheless it demonstrates that in the COST 311, countries significant number of new facilities have been implemented during the last 4 years in Europe as shown below in new tables 4.1 to 4.5 which have to be compared to the identical ones contained for reference in Appendix A.

Table 4.1 : Existing ship simulators

COUNTRY	CODE	TYPE OF SIMULATOR(4)					TOTAL NR
		A	B	C	D	E	
							1?
BELGIUM	B	-	1	-	?	-	1?
DENMARK	D	-	1	?	?	-	13
FINLAND	F	1	1	7	3	1	9
FRANCE	FR	1	-	4	3	1(3)	9?
GERMANY	G	3?	?	?	6?	?	1
IRELAND	IR	-	-	-	1	-	29
ITALY	I	6	-	1	21	1	25
Netherlands	NL	5(2)	-	2	9*	9(1)	2?
NORWAY	NO	1?	?	?	?	1?	1
PORTUGAL	P	-	-	1	-	-	1
SPAIN	SP	-	1	-	-	-	1?
SWEDEN	S	1?	?	?	?	?	

Notes :

(1) 5 Fishing simulators
2 Dredging simulators
1 ??????? simulators
1 VTS simulators

(2) - 2 in operation (MSCN and ILF - TNO)
- 3 planned in 1993 of the same size as MSC

(3) · Fishing simulator

(4) Type of simulator :

A. Full mission bridge simulators are the most comprehensive manoeuvring devices. They consist of a full scale mock-up of a ship's bridge equipped with all instruments required for navigation and manoeuvring and a full scale visual display of the surroundings of the ship as seen through the windows of the wheelhouse.

B. Mini-simulators have the same characteristics as the full mission bridge simulator, but are less sophisticated. The weelhouse is equipped with the necessary instruments only and the outside view is restricted in size.

C. Micro-simulators use a monitor to display the ship and her surroundings. The picture can be a bird's eye view, a synthetic radar view or a panoramic model. The bridge equipment is often limited to an interactive keyboard used for steering and a display which shows the most important instruments-read-outs.

D. Radar simulators can be used as a manoeuvring device for research, e.g. for harbour approaches and inland navigation. Some radar simulators are equipped with a quite realistic bridge mock-up in which all navigational and steering instruments are available.

E. Others e.g. : VTS simulator, engine room simulator, cargo handling simulator, dredging simulator, mooring simulator, submarine simulator etc.

Table 4.2: Characteristics of typical full-mission ship bridge simulators

Characteristics / 1) Simulator	F-VTT	G-Susan	G-AANS	G-Bremen	Ne-MSCN	5) Ne-IZF	6) Ne-Kim	No-SMS	S-SSPA
Image source	CGI	CGI	CGI	light spot	CGI	Model board	CGI	light spot and film	CGI
Manufacturer	marconi	Krupp-Atlas	Krupp-Atlas	VFW-Fokker		TNO		VFW-Fokker	SSPA
display	colour 6 proj.	colour, 10 proj.	colour ?	colour	colour	colour 8 proj.	colour	couluor	black & white, 7TV
Field of view (horz)	240°	250°	260°	315°	240°	>120°	240°	240°	120°
screen distance	3,25 m	6,75 m		3m	10m	4m	10m	10 m.	in bridge windows
Resolution projected	4 arc min. ?	2,9 arc min?		3 arc min.	1,5 arc min.	8-10 arc min.	1 arc min?	1 arc min.	25arc min.
2) max. number of traffic ships	20	20		12 lights	10	about 5	0	12 lights	1(?)
3) nr of interactive traffic ships	?	3 ?		3 ?	30	1	0	?	1(?)
bridge size	5x5,5 m2	8 m diam.		2x1,5 m2	6x8 m2	7x5 m2	6x8m2	36 m2	5x5 m2
radar type	Racal ARPA Selesm.arpa	Krupp-Atlas	Krupp-Atlas	no radar	Racal Decca	Own design	Own design	solartron	Own design
4) nr of own ship types	20	4			10	various	various	7	?

1) A complete list of owners is given in appendix A.4.2
2) Traffic ships : ships sailing in the same gaming area and made visible
3) Interactive traffic ships : traffic ships which interact with the own ship due to steering commands during the run
4) Own ship type : ship with proper dynamics
? Not sure, to be updated in the final version
5) Spherical screen, also used for flight simulation
6) Will be updated very soon

Table 4.2 : Characteristics of full-mission ship bridge simulators (continuation)

Characteristics / 1) Simulator	U.K.-*CMS	U.K. - South Tyneside College	U.K. - CNS Glasgow	U.K. - IMS Plymouth	I - ? ?	Fr-NHS 90 ??? St Malo
Image source	point light source	point light source	point light source	CGI	CGI	BARCO
Manufacturer display	Racal-Decca colour 16 projectors	Racal-Decca colour 16 projectors	Racal-Decca colour 16 projectors	Racal-Decca colour 16 projectors	Sindel colour 9 projectors	Norcontrol/Thomson colour 5 projectors
Field of view (horz)	100°	100°	100°	135°	up to 360°	235°
screen distance	2 m	2 m	2 m	5 m		14 m
resolution projected	0,5 arc min.	0,5 arc min.	0,5 arc min.		≤ 1 arc min	
2) max. number of traffic ships	4	4	4	6	100	59
3) nr of interactive traffic ships	4	4	4	4	12	3
Bridge size	4 m x 4 m	3,8 mx3, 8 m	4 m x 4 m		5 x 10 m2	4 m x 4 m
Radar type	Racal-Decca T/M & R/M	Racal-Decca T/M & R/M	Racal-Decca T/M & R/M	Decca ARPA Decca R/M	ARPA-RM/TM	Norcontrol et HR 2000 K.H.
4) nr of own ship types	15	21	?	12	20	3

1) A complete list of owners is given in appendix A.4.2
2) Traffic ships : ships sailing in the same gaming area and made visible
3) Interactive traffic ships : traffic ships wich interact with the own ship due to steering commands during the run
4) Own ship type: ship with proper dynamics
* The CMS has two identical ship simulators which can be run together in tandem.

Table 4.3 : Characteristics of mini simulators

1) Simulator / Characteristics	B-HLB
Image source	CGI
Manufacturer	Megatek
Display	colour, 1 proj.
Field of view (horz)	60°
Screen distance	2,5 m
Resolution monitor	4 arc min.
2) max. number of traffic ships	1
3) Nr of interactive traffic ships	0
Bridge size	6,5 x 3,5 m2
Radar type	Avimar
4) Number of own ship types	Various

Notes : see table 4.2

5) Hydraulic Laboratory Borgerhout, Belgium

Table 4.4: Characteristics of micro simulators

Owner / Simulatortype / Characteristics	F-Lab. Nat d'Hydraulique Sinav (Tektronix)	F-Serv. Techn. des Phares et Balises Bull mini	F-Lab. de Psychologie de l'Apprentissage HP9825	I-CETENA SIMON (IMB)	Ne-Hydronamic BV HP9000	VTT-Ship Lab DTS	Ne-DVK HP1000
Type of view	perspective view with hidden lines	bird's eye view	perspective view and bird's eye view	bird's eye view	panoramic view and bird's eye view	panoramic view and bird's eye view	bird's eye view
Steering system	commands for propellor & helm(?)	commands for rudder & engine	speed and course commands	bridge console	commands from keyboard	autopilot	bridge console
Max. number of traffic ships	0	0	0	0	0	0	0
Remarks			Elektronic position system available	Coupling with radar possible	Display on screen 2,5 x 2,5 m2	with radar chart	

Table 4.5 : Characteristics of radar simulators (an example)

Simulator / Characteristics	G-Conrad 1)
Radar type	Atlas 8600 ARPA Atlas 6500
Nr of cublicles	3
Nr of own ships	3
Nr of target ships	40
Nr of own ship types	10
Nr of target ship types	9
Steering system	push buttons on control panel

Notes:

1) An interactive link of this radar simulator unit with the Susan full-mission ship bridge simulator is possible

PART III

WORKING GROUP II REPORT

STATE OF THE ART OF SIMULATOR TECHNIQUES IN VESSEL MOVEMENT STUDIES

1. GENERAL

The potential value of simulator studies in resolving marine traffic problems was recognized already in the 60's. Many simulators have been developed since and their usefulness was reconfirmed during the COST 301 project. There are two basic problems inherent, however. For the first: comprehensive simulator installations are still rather expensive and their use is time consuming, secondly: the applicability to simulation study results is usually limited to the example studied. The basic idea behind COST 311 is to improve the situation for the benefit of European governments and shipping operators by collecting material, systematizing its use, and by filling recognized gaps with new experimental data.

1.1 COST 301 - background

The main goal of the COST 301 Project was to establish common guidelines for the development of future European VTS installations. One approach, which remained rather limited due to time and financial constraints, was the effort to test certain VTS-functions by means of simulations. The feasibility of tactical assistance by VTS in collision and grounding avoidance was tested by means of interactive simulations /1,2,3/. To assist the VTS operators in strategic planning a fast time simulation algorithm was also developed /4/. Many interesting results were gained, however, and to proceed in this field the need for a new project was recognised. This led afterwards to the establishment of the present COST 311 Project.

1.2 Connection to COST 311WG1

Next to training purposes, fairway design has been the most important task for large scale bridge simulators. Very many studies have been made at the U.S. simulators. Data on the European ones will be collected by COST 311 WG1, and consequently they are documented in their report.

2. SIMULATORS IN FAIRWAY DESIGN

2.1 Fast time simulation

Fast time simulation is the generic term for mathematical model simulation on computer, which may be either universal or a dedicated one. The simulation speed is controlled dy the computer capability. All elements included in the process must be icluded in the model, as no interactivity is available.

Two basically different approaches may be chosen for the simulation, either a kind of optimal controller can be included in the model, or a more or less realistic navigator model may be introduced. In the former case the inherent manoeuvring capability of the vessel under given external conditions may be demonstrated. In reality a ship is always controlled les precisely and more manoeuvring space is necessary.The resulting swept path in a fairway transit can be called as piloted lane. These two basic modes of fast time manoeuvring simulation are described in ref. /5/.

2.1.1 Limits and advantages

For preliminary and parametric studies fast time simulations by computer are the most economical method in fairway design. With the power of present day computers many distributed parameters can be handled in reasonable time. Even Monte-Carlo simulations are feasible on a laptop computer. Especially if the inherent manoeuvring lane is produced as result the simulation method is straightforward.

The problem, however, is the modelling of the navigation and ship handling related decisionmaking in the simulation process and to produce realistic results, which take correctly into account the different styles as well as the condition and time related performances of real pilots. Fortunately enough there has been a comprehensive project underway in the Netherlands in this area /6,5/.

An important problem in fast time simulation is the adjustment of the controller or navigator model to take properly in to account all relevant available cues in the visual and radar vievs with realistic vigilance.

Further comparative tests with fast time models and ship handling simulators are required to justify the assumptions made in the design of controller models.

2.1.2 Modelling the navigator

The problem of modelling the navigator's behaviour cannot simply be reduced to defining the reaction of each individual navigator to every possible situation he may find himself in. In that case namely, an infinite amount of decision rules would have to be drawn up. As an alternative, the formalization of the actual task has been proposed as a suitable starting point for a navigator model. This task is assumed to comprise risk and control effort minimizing elements, as well as attaining some goal in terms of a future desired state. The incorporation in the model of control effort and so-called terminal errors is straightforward. Perceived risk is quantified by combining both the situation dependent accuracy with which the navigator expects to be able to estimate his position, and the extent to which being in a certain position is deemed acceptable. The actual supervisory and control behaviour is obtained by applying a mechanism - linear optimal control theory - which minimizes the weighted cost which is related to all three task elements. In this context, the term optimal is somewhat misleading, that is, the resulting behaviour is not to be considered the best control strategy possible. In this application optimal control theory only serves as a tool which translates the combination of a situation and a task description into a unique set of corresponding control actions. Differences in style between individual navigators can be accomplished in a well-interpretable way by adjusting the weighting parameters that define the relative importance which is attached to realizing each subsequent task element /7,8,9/.

2.2 Interactive simulation

Intractive simulation is the most realistic way of modelling the closed loop behaviour of a real ship, provided the interface between the real navigator and the ship model is working realistically. What must be included here is not too easily defined and many different opinions exist as regards the amount of realism required for meaningful results. Everything between PC and full bridge set- up with CGI has been used. It has been generally agreed upon that the experiments must be run in real time. This gives realistic time scale for observation and decision making. In the following lines the basic types are described more in detail.

2.2.1 Simulator types and their properties

In the preparatory phase of COST 311 Project an enquiry was made concerning planned simulation studies in participating countries . It also gives information on available hardware. For the purposes of the final report this effort has to be repeated to bring it up-to-date.

The idea behind the most comprehensive type of ship simulators is to achieve maximum degree of realism possible. This is deemed to require a full size completely equipped bridge assembly with an adequate presentation of night and day visual field surrounding it. Some sacrifices of authentity are inavoidable, but in general the results achieved so far are quite impressive. The most severe drawback for this class of simulators is the high cost involved. In COST 311 area simulators of this type are available only in Wageningen (NL) and Espoo (SF).

For cost reasons interactive simulation applications based on microcomputers are very interesting /12/. For a number of tasks they are obviously quite suitable, but the interface with the operator(s) is rather coarse. Despite the already long tradition of ship manoeuvring simulators no one really knows quantitavely what degree of simulator complexity is required for a given task. At least for preliminary studies they are ideally suited and beeing easily portable, their use is not restricted geographically. The hydrodynamic part of the simulation model does meet completely the degree of accuracy attained by any type of commercial bridge simulator provided that an advanced computational model is used.

2.2.2 Material available about simulators

A data base system to cover public simulation studies made in COST 311-countries has been developed by the WG 1. An European database for microcomputer use will be the final result of this work. Unfortunately the WG 1 was not able to finalize this task due to financial constraints.

The PIANC material contains also a large amount of information on simulation and simulators/22/. The reference/23/ by M.Bogaerts et al contains specific information on inland waterway applications.

2.3 Validation of numerical ship manoeuvring models

The validation of numerical ship manoeuvring models is rather straightforward as regards the hydrodynamic part of it. Relevant material in this area is collected triennially by the ITTC Manoeuvring Committee /10/. This unfortunately covers only the behaviour of vessels in unrestricted waters and in shallow water and dredged channels or canals. The validation of the whole simulation process is a much more complicated affair, however. Thus the PIANC Report/22/ recommends" to carry out more basic research on an international scale to validate simulators and verify results".

In the following the most important areas of modelling are discussed briefly.

2.3.1 Hull forces

In manoeuvres where the transversal velocity is clearly smaller than the longitudinal velocity the hull forces can be approximated by applying the small aspect ratio wing analogy. The viscous flow effects especially in the separated cross flow at the afterbody are not easily taken into account in a computational model. Especially in pronounced transversal movements as typical to harbour manoeuvring, the computational tools are not adequate. For these reasons model testing of the ship hull to be used in the simulation study is indispensable if a high degree of accuracy is required. This unfortunately adds substantially the cost of the total exercise. It is hoped, however, that in the not too distant future the methods of computational fluid dynamics (CFD) are developed to a degree of accuracy necessary. 2.3.2 Control forces

Computational modelling of propeller, rudder, and thruster related forces is today on a level, which is good enough for most simulation purposes. Only more complicated thruster flow-structure interaction effects still require hydraulic model tests to have accurate data in simulations.

2.3.3 Environmental influences

Forces due to wind and waves are today modelled quite accurately for the purposes of ship motion simulation. True time domain simulation of wave action still is too time consuming, but frequenqy domain based models are sufficient at least in moderate wave conditions. The gustines of wind is often ignored, but can be included by a frequency domain approach. The effect of inhomogenous currents especially in confined waters may pose problems, as the the presence of the ship hull can have a remarkable influence on the flow pattern. This kind of situation can only be mastered by means of hydraulic models or complete flow modelling, which is not yet feasible on-line.

Unfortunately not all simulators are capable to use completely up- to-date modelling of the environmental influences, but rely on more or less simplified approaches, which may be adequate for training purposes.

2.3.4 Standard procedures for validation

The basic validation of the physical part of a simulator model is rather easily done, if it exists reference material measured preferably on real ship or at least with a scale model. For open waters well established standard maneuvers like turning circle, zig-zag-maneuver etc. are feasible. In confined waters it is more difficult to have good coverage by full scele measurements and one has to rely upon model data. In worst case one has to try to find representative model measurements available in published literature. Most simulators have a basic library of ship types, which will do for preliminary testing, but for specific ship simulations the determination of actual coefficients in the equations of motion by model testing methods is indispensable. This approach also is a apriori guarantee for the quality of simulatin provided that the basic model is good enough.

The validation of the perception and psyco-physiological part of the total simulation exercise is a much more difficult task. One way is just to try to provide as much realism as one can afford in modelling the bridge, view, and mental load.

2.4 Quality criteria for transit safety

To improve the dissemination of knowledge in fairway design the results of as mamy simulator experiments as possible should be systematized to aid in assessing the safety levels of candidate configuration as easily as possibly. The method developed by the U.S. Coast Guard as described in /13/ could be regarded as a rather promising approach. Further work has been reported by USCG recently in /14/. In specific projects of elevated importance dedicated simulator tests are obviously well founded even in the future. Examples of these are Messina Straits /15/), Helsinki Approach etc.

2.5 Training of ship officers and pilots

Training is probably the most obvious use of interactive ship handling simulators. Here there are many levels of students and ambition levels. Thus it is apparent that simulators of different levels of complexity should be applied. A full bridge simulator is clearly too expensive for teaching basics at nautical schools, but even relatively simple desk top simulators may serve rather well in specific training tasks, if the manoeuvring model involved is good enough. To clarify the terminology one could start calling the more simple simulators "ship handling training device" and leave the word simulator for the more sophisticated ones.

An important type of simulators is the on-board simulator, which is a PC-based desk top unit on board, where it may be used for general training as well as for practising specific manoeuvres under difficult external conditions etc. This type of simulator devepoped at VTT has been tested onboard the ferry "Silja Serenade"(Helsinki-Stockholm).

2.6 Needs for future research

A considerable effort is needed to systematize analysis of bridge simulator experiments to make full use of their potential value and to aid in their application to related scenarios. The interpretation of results obtained with rather limited number of experiments is also problematic and conclusions accordingly vague.

Today an important area in ship control is the increased application of integrated ship control systems, which are changing the ships' bridges to real ship control centres (SCC), which set completely new requirements for simulator techniques as well in their development phase as also for the training purposes.

To increase the reliability and applicability of fast-time simulations the development of reliable human navigator models is of paramount importance and every effort in this area should be encouraged.

Correlation of hydraulic and computational simulations is still very important in case of ship manoeuvring in confined waters. Obviously most part of harbours and their approaches are of that nature. Thus further development of computational models may only be expected with the aid of verification based on model and full scale measurements.

3. SIMULATION OF VTS FUNCTIONS

3.1 Introduction

As already mentioned in 1.1, simulation of VTS functions has been undertaken mainly in the framework of COST 301 European Project. Studies of this typ investigate what operational benefits (or penalties) can result from particular VTS functions. They are less concerned with how VTS works and more with what effects VTS has on the traffic.

The specific VTS functions considered in this research were of two types: Strtegic Planning and Tactical Assistance, which are described in /16/.

3.2 Studies reported

Of the many proposals for simulation studies within COST 301, the following 3 were finally selected: 3.2.1 Feasibility study for a real time algorithm to optimize Strategic Planning for ferries in the Dover Strait. (see/4/ and /16/.

3.2.2 Evaluation of the interaction between a VTS operator giving Tactical Assistance and navigators with regard to collision avoidance manoeuvres around offshore structure. (see /17/ and /16/).

3.2.3 Evaluation of the interaction between a VTS operator giving Tactical Assistance and a navigator with regard to stranding avoidance manoeuvres in a narrow fairway. (see /3/, /2/ and /16/).

3.3 Methods and equipments used

Two types of simulation methods have been used to carry out these studies:

- study mentioned in 3.2.1 by fast time simulation
- studies mentioned in 3.2.2 and 3.2.3 by interactive simulation.

Simulation of these types are feasible with rather simple or sophisticated facilities: a Macintosh Plus micro-computer for study mentioned in 3.2.1; four ARPA simulators, one VTS console simulator and a simulated VHF communication system for study mentioned in 3.2.2; a full-bridge simulator linked to a VTS console simulator and a VHF communication system for study mentioned in 3.2.3.

Similar exercises are feasible for the generic problem. On the other hand it seems obvious that many functions now performed by VTS-operators could be handled by computers. An interesting approach to apply AI-techniques is presented in /18/.

In a more traditional navigation context the USCG has also been experimenting with different types of navigation data presentation /19/. It should also be pointed out that the rapid development of AI-techniques might benefit this area as well /20,21/.

3.4 Assessment of improvements in safety

Most often, the results of an assessment are valid for and only for the scenario within which this assessment has been made. The scenario identifies many of the assumptions made in the assessment process and the experimental factors, these factors being either constant or controlled.

Scenarios are structured descriptions of studies /16/. The role of scenarios, and the activity which lead to their definitons are to:

- Provide means to communicate study description,
- Provide common frames of reference for parallel investigations,
- Assist in defining priorities for studies,
- Enable all the assumptions and data limits to be defined, thus indicating the limits in the validity of the results.

3.5 Training and VTS-simulation

VTS-system simulators are generally recognized as beeing powerful tools for operator training purposes. Therefore it is natural, that also in the present study careful attention to this aspect must be given especially when new methodology is itroduced to the scope of VTS-activities.

4. SUGGESTIONS FOR COORDINATED PLANS AND SCENARIOS FOR EXPERIMENTS

The following items have been identified as important areas to increase the knowledge by means of simulation:

- Validation (IJS 050492)
- System (IJS 040492)
- Navigation (IJS 040492)
- Training (IJS 050492)
- The Development (M. Heikkilä April 6th 1992)

These project ideas are presented more in detail in Annex 1 of this report.

The basic hindrance for generation of suitable research projects of common interest seems to be an acute lack of available funds in the participating countries, however. On the other hand, the preparations of the European transport research program "EURET" , which contains a few subthemes containing relevant matters for COST 311-scope, have attracted considerable interest.

In the present situation the only solution to materialize the recommendations of the COST 311 Project is to suggest their inclusion as relevant themes for the future EURET II Program.

5. REFERENCES

1. Lyon, P. and Nockels, D.: Evaluation of the interaction of a VTS operator and navigators regarding collision avoidance using a radar simulator. COST 301, AN 2126, Aug.86

2. OPEFORM (F) "Evaluation of interaction between VTs operator and a navigator with regard to Stranding avoidance". COST 301- T.1.41-Dec 1986.

3. Heikkilä, M. and Sukselainen, J.: The role of VTS in grounding avoidance - A simulation study. COST 301, AN 1112, Feb.87

4. ORION (F) "Feasibility of an algorithm to assist the VTS operator with regard to Strategic Planning of planning". COST 301-T.2.63-Oct 1986.

5. Perdok,J. et al: The use of real time and fast time simulation in ship control studies. CAMS-89, IFAC Workshop on Expert Systems and Singnal Processing in Marine Automation, Lyngby, August 28- 30 1989.

6. Bogaerts, M.: Brief summary of Dutch programmes. COST 311 Note Oct.1988 See also Papenhuijzen, R.: Modelling the planning and control behaviour of the navigator. 7th European annual conference on human decision making and manual control, Paris 1988

7. " On the modelling of the behaviour of a navigator: background and proposal for a control theoretic approach" by R. Papenhuyzen (TNO-IWECO) 1988, Training, Human Decision Making and Control (J. Patrick and K. D. Duncan editors)

8. "On the modelling of the behaviour of a navigator" by R. Papenhuyzen (TNO-IWECO), H. G. Stassen (Delft University of Technology) 1987, Eight Ship Control Systems Symposium, Volume 2.

9. "Modelling the planning and control behaviour of the navigator" by R. Papenhuyzen (TNO-IWECO) 1988, Conference Annuelle Europeenne; prise de decision ex contorle manuelle.

10. 19th Intern. Towing Tank Conf. 16 - 22 Sep. 1990, Madrid, Proceedings Vol. I.

11. MARSIM-90 Proceedings Tokyo 1990

12. Jia,X.L. et al: Design and application of a compact ship manoeuvring and control simulator. CAMS-89, IFAC Workshop on Expert Systems and Singnal Processing in Marine Automation, Lyngby, August 28-30 1989.

13. Sukselainen, J.: Systematization of bridge simulator use in fairway design tasks. COST 311 Note 24.2.89

14. Brown, W.S. et al: Positioning experiment... Interim report, U.S. Coast Guard Contract DTCG-23-86-C-20030, Oct. 1988

15. Palchetti, S.: Fairway design aspects. COST 311 Note 4.4.89

16. Degré, T. & al: COST 301 Final Report - Annex to main report, volume n° 7. Apr 1987/ AN 0109/.

17. MARITECH (UK) "Evaluation of interaction between VTS operator and navigators with regard to Collision avoidance". COST-T.2.62- Aug 1986.

18.Koyama, T. and Yan, J.: On the design of the marine traffic control system. Journal of SNAJ Vols. 162 & 164 1988/89

19.Smith, M.W.: Preliminary findings for the radio aid experiments. Ship Analytics Note to USCG from Nov.30 1988.

20.Brown, W. et al: Factors to consider in developing a knowledge- based autopilot expert system for ship manoeuvring simulation. SNAME STAR Symp. New Orleans 12-15 April 1989

21.Grabowski, M.: Decision aiding technology and integrated bridge design. ditto

22.PIANC-PTC II, WG20: Capability of ship manoeuvring simulation models for approach channels and fairways in harbours. To be published.

23.M.P.Bogaerts et al: Application of simulation in design and operation of inland waterways. MARSIM&ICSM 90, Tokyo June 4-7, 1990

VALIDATION OF SIMULATOR TEST USING HYDRAULIC MODELS AND FULL SCALE MEASUREMENTS IN REGULAR SERVICE

Background

In most cases the known simulation models are able to produce ship motion dynamics with accuracy good enough for practical purposes. Difficulties may arise, however, in very confined waters with irregular geometry. The reason is that generally the simulator models make use of empirical test data acquired from tests with rather simple and schematic geometrical layout.

Goal

To clarify the requirements of adequate modeling of wery confined passages with irregular geometry on ship simulators.

Means

To collect and reanalyse existing data where computational simulations and hydraulic tests have been conducted for a fairway passage. Additionally it obviously is necessary to complement the scarce data with dedicated hydraulic tests to gain data expecially for short asymmetric banks or shallows, the influence of which is easily over- or underestimated in mathematical models. Besides of improving simulator models the data thus gained could directly provide guidance for favourable geometries for asymmetric dredging of narrow passages of irregular natural geometry.

The other choice for still more accurate verification can be deducted from in service measurements using precision positioning equipment like DGPS available in the Gulf of Finland. Risky experiments are not feasible, but normal passages could easily be recorded and the results compared with those of simulator runs.

SYSTEM FOR ANALYSIS OF BRIDGE SIMULATOR EXPERIMENTS IN FAIRWAY DESIGN

Background

Bridge simulator tests are very expensive and often it is not feasible to conduct so many test runs as strict obeyance of statistical rules for experimental design require. How to make best use of the limited number of available test run records and how to extend their use for more generic purposes to assist the others.

Goals

To develope means of effective experimental design to help the simulator users. To create means of extend the use of existing simulator results to related scenarioos without excessive loss of accuracy.

Means

By reanalysing existing simulator records and by means of dedicated tests try to find ways to develop a modular approach for construction of experiments to facilitate their division into basic fairway elements, the records of which could be rearranged if need should arise. To define semiempirical methods to fairway design with means of existing simulator data to facilitate parametric optimisation. The final design could then be refined by a few dedicated tests.

NAVIGATION ASSISTANCE BY VTS

Background

Under certain conditions the pilotage of vessels can only be accomplished by a VTS system. The traditional way by use of a shore-based radar and a PPI is known to be rather unsatisfactorily for precise ship handling in confined waters. What are the other choices?

Goals

To develope procedures and display systems to facilitate efficient use of VTS-information in conducting a vessel safely through difficult passages.

Means

The main point is to find suitable means to define hardware requirements for suitable equipment to facilitate precise navigation with the aid of a VTS-system in confined waters. There are two basic ways of approach. Either to pilote a ship remotely from a VTS-station or to transmit all required information to the ship to complement its inadequate own equipment.

In the present state-of-the-art both systems should be based on DGPS-positioning to ensure accurate navigation. As the prices of suitable positioning equipment only are very favourable ~~(10000ECU)~~ cost is not a prohibitive factor in further development.

TRAINING OF VTS-OPERATORS

Background

In these days the concept of VTS is changing rapidly. The governements are under hard financial pressure on one side and the requirements to enhance the safety of navigation on the other side. This necessitates the maximal use of existing VTS equipment at hand. The key issue for optimal safety and efficiency of traffic is the quality and capability of the personnel.

Goals

To improve the know-how and abilities of VTS personnel by effective training hardware and procedures to optimize their daily interventions to the traffic they are serving.

Means

First to analyze thorougly the present and future tasks of a given VTS-systems by aid of results to be obtained in EURET 1.3~~TAIE~~-project for optimum use of available hardware. Then one could configure a suitable training system to drill those procedures, which are found to be of primary rank. Most effective training systems are generally those, which can be utilized at anyones working place and not only once annually or so during a dedicated course.

THE DEVELOPMENT OF TECHNOLOGY FOR INTEGRATED SHIP CONTROL DEVELOPMENT AND TRAINING (SOFT/VIRTUAL INSTRUMENTS)

BACKGROUND

The technical developments in operation and control of ships have been rapid during the last years. Several new concepts have evolved and are taken into use onboard, ashore and even in space to improve the safety and effectiveness of maritime transport.

The most notable among these developments are the integrated navigation concepts, which are changing the ship's bridge to a real ship control centre (SCC). From a SCC one officer in watch can not only operate the navigational equipment but also the machinery and cargo handling systems. The automation of functions and the integration of the operation is intended to ease the burdens on the officers in carrying out her/his tasks but it also requires a lot of new skills from her/him.

Because the development of integrated systems for ships has been very fast and has been carried out by several manufacturers, the crew of a newbuilding equipped with this kind of a system is confronted with the formidable task of learning quickly what capabilities it has and how it should be operated. Same kind of a situation occurs in pilotage of new ships when pilots not familiar with the newest equipment are conning the ships in restricted waterways without using the best means available.

It is expected that the present developments to emphasise the role of the ship owners and the subsequent interests of national administrations on the quality of management as well as the classification ship management will increase the need for training also in hich tech ships.

PROJECT IDEA

The aims of the project are:

1) To produce a prototype training simulator for integrated ship bridges which is easily configurable to present the integrated navigation systems (SCC:s) from different manufacturers. Important aspects here are both the data presentation and the different modes of operation including the sequences to switch between them.

2) The same system with easily configurable information presentation capabilities is also a development environment for man-machine-interfaces in ship control equipment.

3) The SCC development would also gain from this project in the form of improved centralized information presentation and possibly in promoting the standardisation of these systems.

An integral and important part of the project is the participation of the users. The users, i.e. experienced active ship officers from shipowners using integrated navigation systems, will be in the project in the initial planning stage and will carry out the evaluation of the prototype system. Particularly beneficial would be if the representatives of operators would be from shipping companies having different equipment in their ships (i.e. different levels of automation) because in that case the training for transfer from one ship to another could be evaluated. Also the training for a ship newbuilding could be a useful test for the prototype developed.

PROJECT TASKS

The project contains the following tasks:

1) The evaluation of present state-of-the-art in graphics information presentation, integrated navigation system development (US ECDIS and EC EURET programs) and human interface in process control applications.

2) The development of the programming methodology for the information presentation and equipment (information) integration.

3) The development of prototype system with the inclusion of the latest ideas from 1). This development includes both the design and simulation systems.

4) The evaluation of the system from the point of view of training.

THE PROJECT GROUP

The participants in the project should represent the different expertise in the field of ship navigation:

1) The manufacturers of integrated navigation system.

2) The manufacturers of shiphandling simulators (navigation training systems)

3) The ship research institutes with knowledge on ship mathematical modelling (hydrodynamics) and the use of shiphandling simulator for both training and research.

4) The end users (shipowners) of the development work both onboard and in training

PART IV

MEMORANDUM OF UNDERSTANDING

FOR THE IMPLEMENTATION OF A EUROPEAN RESEARCH PROJECT

ON MARITIME TRAFFIC SIMULATION

The Signatories to this Memorandum of Understanding, declaring their common intention to take part in a European research project on maritime traffic simulation have reached the following understandings:

SECTION 1

1. The Signatories intend to co-operate in a project to promote research into maritime traffic simulation (hereinafter referred to as the "Project").

2. The main objective of the Projectis to develop cost effective simulation techniques to improve the safety and efficiency of maritime traffic, with particular regard to collision and grounding avoidance.

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

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

5. The overall value of the activities of the Signatories under the Project is estimated at 5 to 6 million ECU at 1986 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 Project in one or several of the following ways:

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

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

(c) by contributing to the provision of a Secretariat and/or other co-ordinating services or activities necessary for the aims of the Project to be achieved;

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

(e) by arranging for inter-laboratory visits and 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 upon signature by at least three Signatories.

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 Project will notify the Secretary-General of the Council of the European Communities of its intention as soon as possible, preferably not later than three months beforehand.

4. If at any time the number of Signatories falls below three, 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 remain open for Signature, by the Governments which took part in the Ministerial Conference held in Brussels on 22 and 23 November 1971 and by the European Communities, for a period of six months from the date of the first signature.

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

2. After this period of six months has elapsed, 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 Project.

SECTION 5

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

SECTION 6

1. The Secretary-General of the Council of the European Communities will inform all Signatories of the dates of the signatures to this Memorandum of Understanding and of the date of its entry into effect, 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.

CO-ORDINATION OF THE PROJECT

CHAPTER I

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

The Governments which took part in the Ministerial Conference held in Brussels on 22 and 23 November 1971 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.

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

(a) the choice of research topics on the basis of those provided for in Annex II including any modifications submitted to Signatories by the competent public authorities or bodies; any proposed changes to the Project framework will be referred for an opinion to the 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 Project;

(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 Project, 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 signature.

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 projects 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. The final reports 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 Project assigned to them under Annex II (hereinafter referred to as "the research results") will be under an obligation, if so requested by another Signatory (hereinafter referred to as the "applicant Signatory"), to supply the research results and to grant to the applicant Signatory or to a third party nominated by the applicant Signatory a licence to use the research results and such technical know-how incorporated therein as is necessary for such use if the applicant Signatory requires the granting of a licence for the execution of work in respect of the Project.

Such licences will be granted on fair and reasdnable 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 Signaotry terminates its participation in the Project, any rights of use which is 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.

ANNEX II

GENERAL DESCRIPTION OF THE PROJECT

I. Scope and objectives of the project

I.1. The scope of the research will be the application through European co-operation of cost effective simulation techniques to improve the safety and efficiency of maritime traffic, with particular regard to collision and grounding avoidance. The research will investigate the various factors influencing the safety and efficiency of traffic including the human factor.

I.2. The orientation of the work content of the programme should meet the following two objectives:

a) to answer functional and operational requirements of authorities (national, European, international) in the field of safety and efficiency of traffic at sea and in harbours.

Problems faced by governments in this field may not find answers or may only find limited answers if tackled in isolation. This apply also to some problems examined in international bodies.

In respect of IMO it is underlined that the type of work to be undertaken by COST 311 may be able to throw light on a number of issues currently considered in IMO sub-committees (e.g. management of space around off-shore structures).

COST 311 should focus as a priority on those issues which provide answers of common interest thus avoiding duplication of efforts.

b) to identify present research tools and methods of simulation used in studies mentioned above and to develop and improve them as necessary.

This objective is secondary to the first one but may prove necessary in the execution of a).

II. Programme

II.1 Elements for a programme

Three main sources are to be used:

- the results of the inventory;
- the ideas for projects of TNO-IWECO;
- the reports of COST 301 simulation studies.

All these documents will be assembled and made available to the COST 311 Management Committee at its first meeting. (COST 311-Compendium).

II.1.1 Requirements identified by the inventory

The results of the inventory show clearly that:

a) a large number of studies are planned to satisfy either private, national or international needs (IMO, IALA);

b) part of these studies are requested by national administrations;

c) generic and specific studies are required;

d) most studies do not appear to fit in with long term national programmes;

e) the target dates of the projects described are very tight;

f) there is little evidence of national planning to follow up the further simulation work identified during the COST 301.

II.1.2 TNO-IWECO proposal and simulation research for VIS

The proposal of TNO-IWECO presents a large list of studies which cover a wide range of topics. The main subject are described both as research objectives and in relation to the fields of application.

II.1.3 COST 301 simulation studies reports show the need to develop new studies to assess VTS operational benefits and to investigate the technical feasibility.

VTS operational benefits can be described as a relation between management functions and traffic functional problems. Feasibility is the relation between a certain management function and its implementation.

A number of these projects was also listed during the presentation of Marine VTS simulator.

II.2 COST 311 programme development

To assist on the consideration of national and co-operative plans, against the background of the intended specific studies and their target dates it seems reasonable to consider four types of action in the development of the COST 31A programme.

II.2.1 To create a library/data base for simulation studies

Data on parameters of traffic and traffic safety is of great value considering the costs of simulation techniques, the number of parameters to be considered and the statistical confidence levels of the results which should be attained. The first action would be:

- to develop a common framework (library/directory of data bases) for the recording of traffic simulation methods, scenarios, parameters and results;

- to define a convention for the users of such a library/data base of traffic simulation results;

- to implement such a library/data base.

A European library/data base of traffic simulation results/data should be the result of this first action.

II.2.2 To develop common method for traffic data analysis

Parameters and associated criteria have to be defined for the analysis of traffic data.

The experience developed in recent years could be brought together and using the data available in the COST 311 library/data base sensitivity study could be developed to decide on such criteria.

A software package for traffic data analysis should be the result of this second action.

II.2.3 To define a common programme for the development of simulation in Europe

Bearing in mind the results of the first two actions and taking into account some general issues as described in II.2.2 it will be of primary interest to translate these items within the structure research.

Examples of areas of application are:

a) Optimum use of port resources;

b) Integrated Bridge Control Systems (including Watchkeeping);

c) VTS-operational procedures;

d) Platform protection;

e) Casualty investigation using simulation methods and simulators;

f) Syllabus of Training in Maritime Safety.

Such programme will provide the basis for the selection of the proposals to be co-ordinated.

It is hoped that a consistent approach will result in a comprehensive overview of the traffic management problems and that a better balance between the amount of work to be developed and the resources to be made available by the co-operation could be attained.

A co-ordinated policy for planning simulation studies within European countries should be the result of this third action of co-operation in the programme.

II.2.4 To implement co-operative development of the research

The development of simulation studies along the programme approved by the management committee will be dependent on the resources made available and the organization of those resources.

Many solutions can be developed, varying from national implementation to a centralized management of the resources made available by the steering committee's executive (which may be a project leader supported by a project management official).

Constraints such as technical resources availability (e.g. funds, facilities, ...) local or national interest will have to be considered.

However the planning and the management of the resources necessary for the implementation of the programme will have to be carefully defined.

An organization for the co-ordination of the programme and consequently for the planning of the use and/or development of simulation facilities in Europe will be necessary for the implementation of the fourth co-operation action. co-operation.

III. Duration and estimated costs

It is anticipated that four years should be allowed for the undertaking of the four actions of the co-operation programme.

Estimated costs: 5 to 6 million ECU.

B. SEMINAR

SEMINAR COST-311

Thursday 3 December

MORNING :	08.30 a.m. -	Registration
	09.00 a.m. -	Opening address by **Mr K. Van Miert** (Member of the Commission)
	09.10 a.m. -	General presentation of the seminar on COST-311 by **Mr. Pruniéras**, Chairman of the Management Committee of COST-311.

1st SESSION **SIMULATION WITHIN COST-311**

Chairman : **Mr Pruniéras**
Rapporteur : **Mrs Bogaerts** (Rijkswaterstaat Dienst verkeerskunde, Rotterdam - The Netherlands)

09.30 a.m. -	Results of Working Group 1 (Database on European marine traffic studies / Updating of information on existing simulators in Europe) **Mr Siccardi** (Istituto Automazione Navale, Genova - Italy)
09.50 a.m. -	Discussion
10.00 a.m. -	Results of Working Group 2 (State of the art of simulators techniques in Vessel movement studies) **Prof. Sukselainen** (VTT Ship Laboratory, Espoo - Finland)
10.20 a.m. -	Discussion
10.30 a.m. -	Coffee-break

2nd SESSION **SIMULATION WITHIN EURET**

Chairman : **Mr. H.J. Crooks** (IMSF Chairman)
Rapporteur : **Mrs Bogaerts**

10.45 a.m. -	Presentation of EURET projects **Mr Anselmo** (European Commission - DG VII)
10.50 a.m. -	Simulation in ATOMOS Project (EURET) **Mr Stig E. Sand** (Danish State railways - Denmark)
11.10 a.m. -	Discussion
11.20 a.m. -	Simulation in R.T.I.S. project (EURET) **Mr C. Deutsch** (OPEFORM, Malakoff - France)

11.40 a.m. -	Discussion
11.50 a.m. -	Simulation in TAIE Project (EURET) **Mr C. Glansdorp** (Marine Analitics - The Netherlands)
12.20 a.m. -	Discussion
12.30 a.m. -	Lunch

AFTERNOON

3rd SESSION **SIMULATION WORLDWIDE**

Chairman : **Capt. Hofstee** (President of European Maritime Pilots Association - EMPA)

Rapporteur : **Prof. Sukselainen**

2.15 p.m. -	Situation in Germany **Capt. Froese** (Fachhochschule Hamburg - Germany)
2.35 p.m. -	Situation in U.K. **Capt. Weeks** (University of Plymouth, Plymouth - United Kingdm)
2.55 p.m. -	Opinion of Permanent International Association at Navigation Congresses (PIANC) **Mr H. Blaauw** (Maritime Research Institute - The Netherlands)
3.15 p.m. -	Discussion
3.25 p.m. -	Coffee-break
3.50 p.m. -	Situation in Scandinavia **Mr B. Högbom** (University of KALMAR - Sweden)
4.10 p.m. -	Discussion
4.20 p.m. -	Situation in USA **Mr H.J. Crooks** (Chairman of International Maritime Simulation Forum (IMSF), Toledo - U.S.A.)
4.40 p.m. -	Discussion
4.50 p.m. -	Situation in Japan **Mr Sinya Nakamura** (Yusen marine Science Inc., Tokyo - Japan)
5.10 p.m. -	Discussion
5.20 p.m. -	General discussion
5.30 p.m. -	End of the 3rd session

Friday 4 December

MORNING

4th SESSION **FUTURE DEVELOPMENTS**

Chairman : **Mr Erdmenger** (Director at European Commission - DG VII)
Mr T. Degre (INRETS F-Arcueil)

09.00 a.m. - New research projects in Europe.
Mr Anselmo (European Commission - DG VII)
09.20 a.m. - Discussion
09.30 a.m. - Future utilization
Mr Salvarani (European Commission - DG VII)
09.50 a.m. - Discussion
10.00 a.m. - Panel (PIANC - IAPH - IALA - Pilots - Users)
11.00 a.m. - Coffee-break

CLOSING SESSION

11.20 a.m. - Conclusions in a panel

The Chairmen

The Rapporteurs

The CEC Speakers

The Users

11.50 a.m. - General discussion
12.00 a.m. - Closing address
12.10 a.m. - End of the seminar

1st SESSION

SIMULATION WITHIN COST-311

First Session - Simulation within COST-311.

Summary of the session by Mrs Bogaerts -Rapporteur.

Opening address by Mr. Van Miert (member of the European Commission).
Van Miert underlines the international interest in maritime traffic by pointing at the participation of non EC-members in this seminar (e.g. Japan, US). For the EC safety of navigation is a very important subject, as described in the White Paper on transport. Objectives are application of approved rules, admission of sub-standard ships and improvement of aids of navigation. VTS belongs to the last category, in which simulation plays an important role. Simulation should also be applied to casualty analyses, in which human errors constitute an important factor.
Cost 311 was a step which revealed the state of the art of simulation in Europe, but suffered of the absence of some major countries in this particular field. The subject simulation will be included in the next EC framework-program as it is in the ongoing EURET-program.

Introduction by Mr. Prunieras (chairman of the Management Committee of Cost 311, France).
The program of Cost 311 was created after the successful termination of Cost 301. The objective of Cost 311 was the application of cost effective simulation techniques to improve the safety and efficiency of maritime traffic. The details and results of Cost 311 are described in the preliminary final report which is disseminated today.
The objective of this seminar is twofold:

- to inform the maritime world about the results of Cost 311, the simulation aspects in the EURET-program and the state of art in other maritime countries;
- to discuss with authorities, users and experts the conditions and subjects of future research.

This is the right moment, because the European Committee has adopted a common maritime transport policy and the outlines of the fourth framework-program are being drawn up.

Cost 311 working group 1 by Mr. Siccardi (Instituto Automazione Navale, Italy).
Under supervision of workinggroup 1, a prototype database has been developed to record general information on simulation studies and on maritime traffic data. The main purpose is to give the scientific community a tool which enables them to find where knowledge is available and to share methodologies. The database has been tested by an inquiry amongst 13 institutes in 4 countries. However, funding is needed to exploit the database in a professional manner.
Working group 1 also updated the information on simulators in Europe. Therefore Thomas Degré (Inrets, France) adapted the inquiry of Cost 301. All countries participating in Cost 311 gave the latest state of the art in their country. The survey shows an enormous increase of micro and radar simulators (e.g. at nautical schools) and also new full mission bridge simulators based on CGI visual display techniques in Italy, the Netherlands, France and Finland.

Cost 311 working group II by Mr. Sukselainen (VTT Ship laboratory, Finland). Working group II has given a review of modern simulation techniques, their advantages and shortcomings and their applicability. With some examples mr. Sukselainen showed that today simulators are a standard tool in shiphandling and fairway design studies. They are even used on board ships for track prediction, with quite good results. Despite the general usefulness and application of simulation some problems have not yet been resolved. The performance, even on a high sophisticated simulator, is not as good as in reality. The accident risk is higher on simulators. This fact has prevented that simulation results are used as absolute risk figures.

General discussion

Mr. Deutsch (Opéform, France) points out that the question: "Which level of detail in simulators is necessary for simulations", is still not solved. Can simulator manufacturers give us the answer?

Mr. Degré (Inrets, France) replies that users ask this question to simulator owners who sell their facility.

Mr. Simon (VBD, Germany) has experience with radar simulators in the field of inland and coastal shipping. However, this tool is not always adequate. A full mission bridge seems necessary as many handlings have to be carried out in difficult situations.

Mr. Froese (Susan, Germany) assents. In ship navigation no standard procedures are applied in contrast with air-navigation.

The EURET-program by Mr. Anselmo (European Commission - DG VII).

The EURET-program is a part of the second framework. The program runs from '90 to '93, comprises a budget of 25 MECU and covers 11 topics. The main themes of this program are:

1. Optimum transport network exploitation
   theme 13 Design and assesment of vessel traffic management systems.
2. Logistics
   theme 24 Optimization of manpower in maritime transport and taking human factors into consideration in human/ship systems.
3. Reducing harmfull external effects.

Simulation in Atomos project by Mr. Sand (Danish State Railways, Denmark). Atomos deals with the optimization of man power in maritime transport through implementing advanced technology. The sole simulation element in the Atomos project is the development of a software tool for generation of sensor data (GENTS), which imitate real machinery sub-systems.

Under the jurisdiction of DG XIII operates the so called SIG group. This is a group of experts from science and industry which examines the use, needs and experiences of simulation in industries in the EC member countries as well as in the Esprit projects, dissiminates this knowledge and links the scientific and industrial world. The maritime sector is represented in SIG.

Recently the Danish Maritime Institute carried out a qualification test for masters of a new ferry type. This test consisted of a simulation-training program which was validated by field recordings of ferry crossings and finished with a performance test. This seems to be a challenging example of licensing.

Simulation in RTIS project by Mr. Deutsch (Opéform, France).
RTIS (Regional Traffic Information System) aims to design and assess a regional traffic management system. The Mediterrenean area is used as pilot. The main objective of this project is to reduce maritime traffic costs. Traffic simulation plays an important role in the RTIS project as no real world data are used but artificially generated traffic data. The transit voyage of a ship between two points is the elementary unit in this simulation process. Such a transit generates vessel traffic services of different kinds (port actions, piloting services, custom activities, ship provision etc.) leading to information streams and costs. A model is developed which takes into account all these services. After validation this model can be used to calculate VTS costs and can be applied in different maritime areas. To generate traffic data fast simulation is used. For VTS procedures and training bridge simulation is necessary.

Simulation in TAIE project by Mr. Glansdorp (Marine Analytics, the Netherlands).
Unfortunately, no simulation is applied in the TAIE project. The objectives of the project are to increase the safety and efficiency of traffic flows in NW-Europe by:
- improvement of assesment tools;
- improvement of VTS operations;
- "add-ons" on existing VTS systems as shore based pilotage, contingency planning and resource management;
- harminozing VTS training;
- improvement of VTS-architecture.

Traffic images for the entire North Sea are used as input. The generation of these data is one of the many tasks of this project which just started.
Simulation of VTS procedures has been erased from this program and postponed to the following EURET-program, because the availability of adequate simulation facilities was very uncertain.

General Discussion
Mr. Simon (VBD, Germany): Are port authorities and shipowners involved in the RTIS program?
Mr. Deutsch (Opéform, France): In RTIS simulation is used to generate the input instead of real world operational data. Nevertheless, shipowners are also using simulation to predict their operational tasks.
Mr. Spaans (KIM, the Netherlands): is very pleased that traffic and casualty data are collected. Traffic data can be used in traffic simulation models. Are accident rates from simulation in conformity with real world accident rates?
Mr. Glansdorp (Marine Analytics, the Netherlands): Although traffic models are quite precise risk contours can not be compared with accidents from black spot analyses. Risk contours and the nautical mile are valuable measures, but are not identical with casualties.
Mr. Spaans concludes that we still have to study real accidents.
Mr. Kop (IALA, the Netherlands): likes to mention that very recently certificates have been issued to VTS personal in the Netherlands. This is the first step of harmonising VTS procedures which will undoubtedly led to an European approach for VTS.
Mr. Anselmo (EC, DG VII): emphasizes that EC programs are meant for researchers, industry and users. Concerning casualty analysis no agreed method is available for this type of analysis which makes a comparison very difficult.

OPENING ADDRESS BY MR K. VAN MIERT

(Member of the European Commission.)

Ladies and Gentlemen,

In welcoming you on behalf of the Commission to this seminar, I would like to emphasize that it is not only European but international in nature.

Europe's interest in the matter is self-evident, and not only the Community's, but that of all Europe, since it is the results of a COST research project that are under examination.

What is more, the ramifications of the research, i.e. the prospects for the use of its results, tie in with the Community's concerns about maritime safety.

However, while there may be specifically Community or European aspects to research or maritime safety, it is clear that these aspects cannot be separated from the wider context when it comes to maritime problems. This is why I would like to draw particular attention to the presence among us of two speakers from Japan and the United States, who have consented to take part in this seminar. They will tell us about what is happening in their countries and, no doubt, how we can draw on each other's experience. They should be thanked for coming specially to take part in your work.

Their presence underlines that maritime transport is a world issue, and in particular when it comes to safety.

This is perhaps the time to point out that, though the International Maritime Organization is and should remain the general forum for safety standards, the European Community too is playing a fundamental role in the matter. 159

In terms of policy, the main areas of concern, the objectives and the steps that the Community should take in the field of maritime safety are summarized in the white paper on transport policy that the Commission (has recently adopted) (will shortly be adopting). Maritime safety should then be the subject of a specific Commission communication.

One of the chief objectives of the Community policy on maritime safety will be the elimination of vessels that fail to meet international standards. More generally, vessel safety will be enhanced by:

- the efficient application by the Community of general standards adopted at international level;
- stricter supervision of vessels of all flags entering the Community, with particular attention to flags whose ships do not satisfy international rules on construction and maintenance;
- the improvement of the infrastructure of maritime navigation aids, and in particular VTS and radio-navigation systems;
- better coordination of Community Member States' initiatives within the International Maritime Organization.

The last two points are directly related to the development of simulation. Simulation can and must play a fundamental role in the VTS field.

It can help:
- develop the design of systems;
- evaluate their performance;
- train operators and, more generally, seamen.

Simulation can also be a first class analytical and training instrument in the study of human error. This is a key point when one considers that over 60% of shipping accidents on which insurance companies pay out are the result of human error.

A great many tools have been developed with the aim of reproducing at will and at an acceptable cost real-life situations that threaten human life or the environment.

In the field of shipping and, more generally, human activities at sea, simulation is a particularly effective way of gathering research data in the requisite quantities or reproducing sets of circumstances typically confronting people with operational responsibilities.

The work of COST 311 has now shed vital light on the matter:
- It permits the nature and scope of different European countries' simulation systems to be determined, showing their similarities, differences and, in some cases, their failings.
- It shows the broad lines of a common approach.

However, two things cannot be overlooked:
- Several European countries did not take part in COST 311.
- The survey of European simulation systems and equipment is therefore incomplete.

The fact that the main European countries which chose not to take part in the research project are here today should enable the results to be supplemented. Furthermore, the Community's EURET research programme includes traffic simulation methods among contracts dealing with various aspects of VTS.

I hope therefore that you will be able, in the course of these two days, to make decisive progress towards the more effective use of simulation systems, not only in the Community but throughout Europe.

Last but not least, our American and Japanese friends will enable you to make useful comparisons on a worldwide basis of the advantages and extent of the use of vessel traffic simulation, since they will no doubt be illustrating the convergence on international standards.

All these reasons highlight the importance of your work at this seminar.

In declaring this event open, I wish you all possible success so that the results you achieve enable maritime safety to make new and substantial progress.

RESULTS OF WORKING GROUP 1

By Mr Antonio SICCARDI
(Istituto Automazione Navale)

Mandate

The mandate for WG1 was defined on April 14th 1988, in a plenary session of COST 311, and was developed in the next sessions of the Management Committee.

The mandate was organized on three points:

1) the development of a common framework (library/directory of data bases) for the recording of traffic simulation methods, scenarios, parameters and results as well as the recording of informations on data and data collection methods concerning marine traffic and its generation.

2) the definition of a convention for the users of such a library/data base of traffic simulation studies and traffic data

3) the definition of such a library/data base

To be able to develop a common understanding for the simulation of the maritime traffic it will be necessary to identify the existing knowledge about it and to give to the scientific community a kind of key to enable anyone to find who knows what and were.

The main purpose will be to allow the sharing of methodologies and data, to achieve an optimization of resources, particularly in these times were the financial resources dedicated to maritime field for the improuvement of traffic safety and efficency are always shortening.

Working group composition

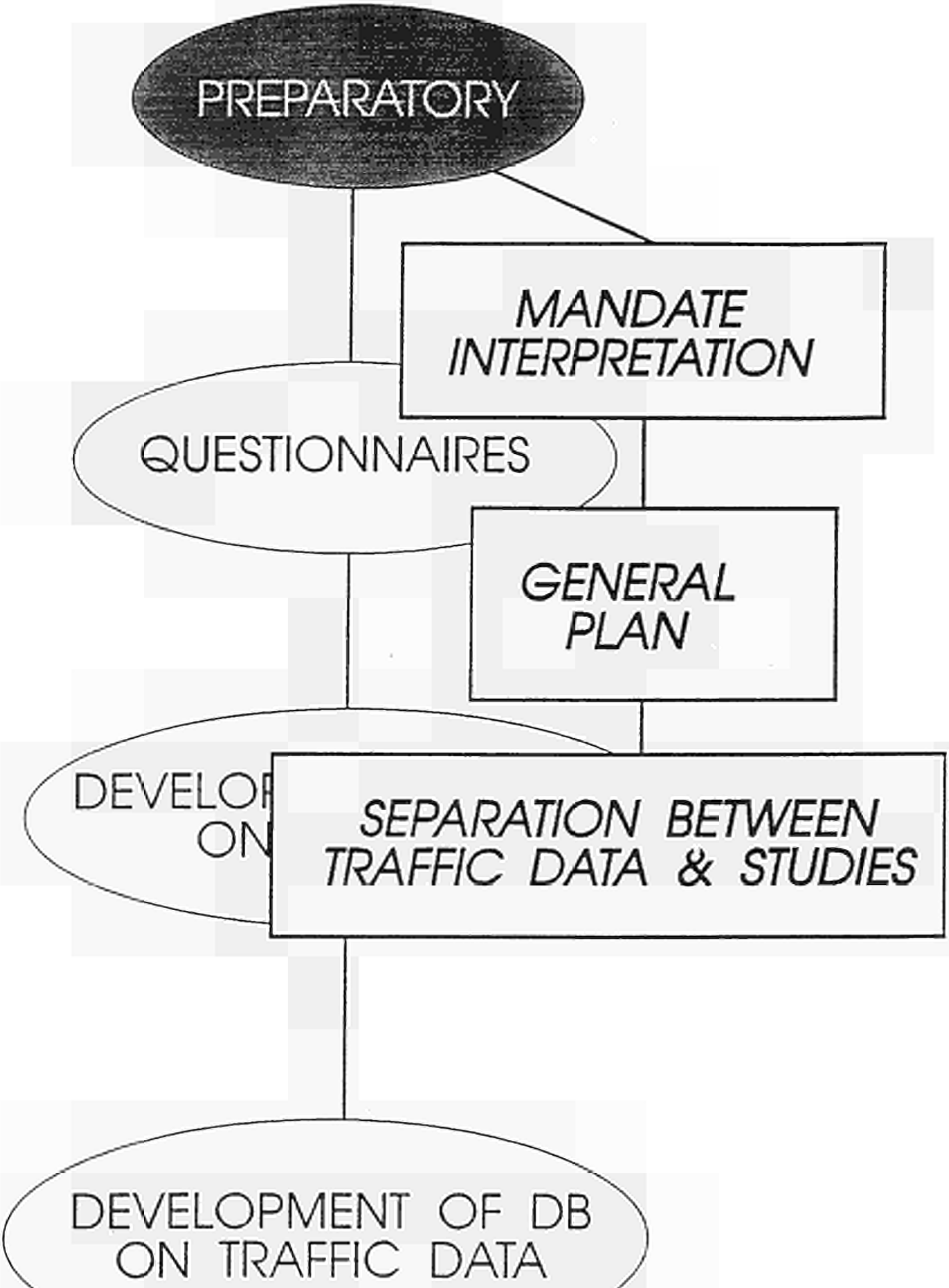
Antonio Siccardi, Italy - chairman
Mieke Bogaerts, Holland
Thomas Degré, France
Gerard Trant, Ireland

The scenario defined allows for the separation of two main different kinds of activity:

the training of the maritime personnel, faced only in some countries, with large investiments in simulation facilities, mainly for ship bridge simulators;

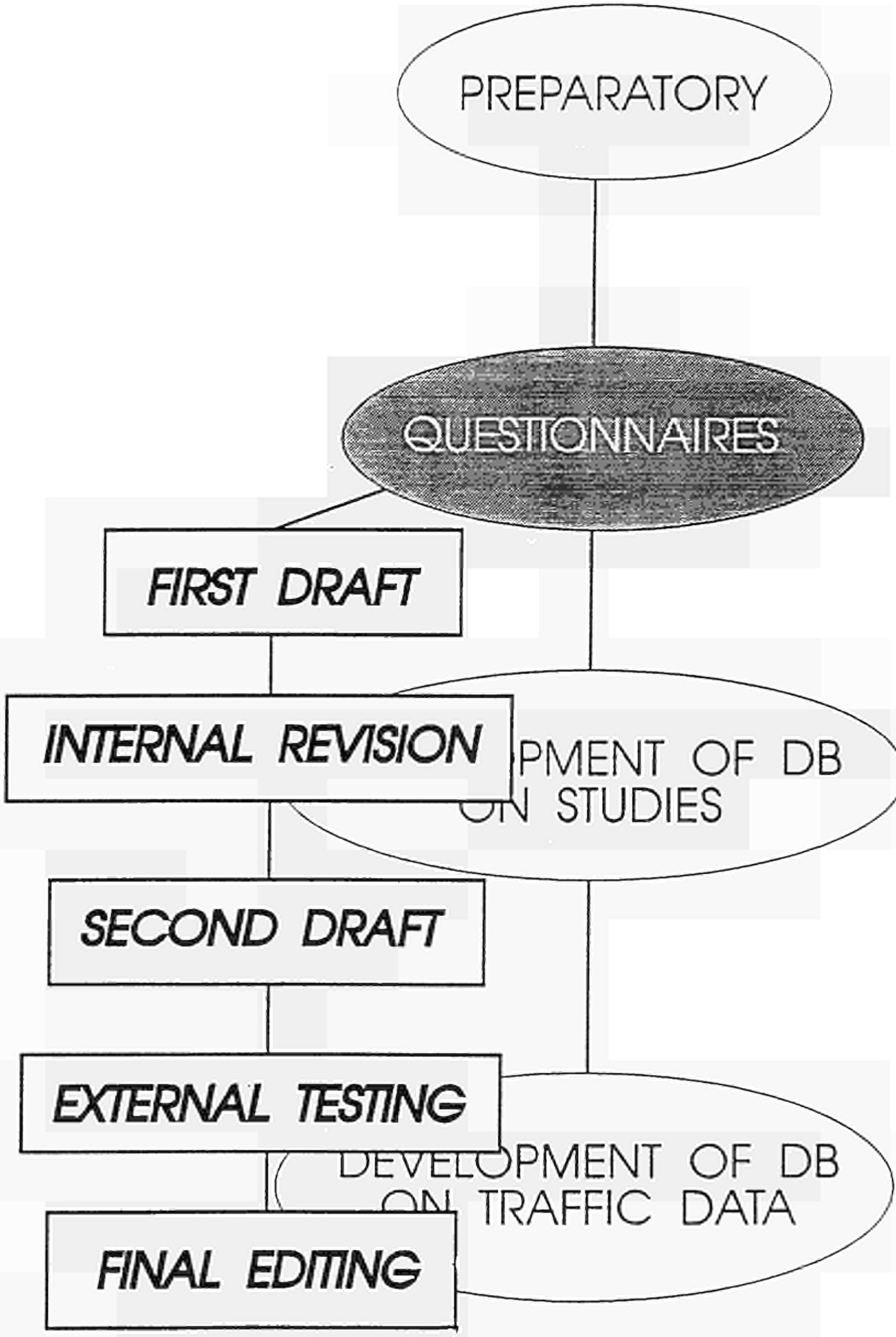
the theoretical study of maritime activities, as well as traffic problems, showing, on the contrary, a general use of simulation techniques

Within these two general frames very large differences can be found in the approaches to the same kind of problems in the different countries and between different research institutions, due to different cultural background and resources.


PREPARATORY
MANDATE INTERPRETATION
QUESTIONNAIRES
GENERAL PLAN
DEVELOP
ON
SEPARATION BETWEEN TRAFFIC DATA & STUDIES
DEVELOPMENT OF DB ON TRAFFIC DATA

It was decided to operate the first collection of informations thorough the distribution of a questionnaire to well known cooperative istitutions; an integration to the initial plan of work was made, for the purpose of obtaining a higher credibility and consequently a higher level of cooperation within the scientific community: the mandate coming to WG1 from the COST 311 Management Committee was in principle requiring just indications about how to build the instruments (library or database) to collect the knowledge about simulation; nevertheless it was agreed in the WG1, and later in the Management Committee, to work for the realization of a prototype database.

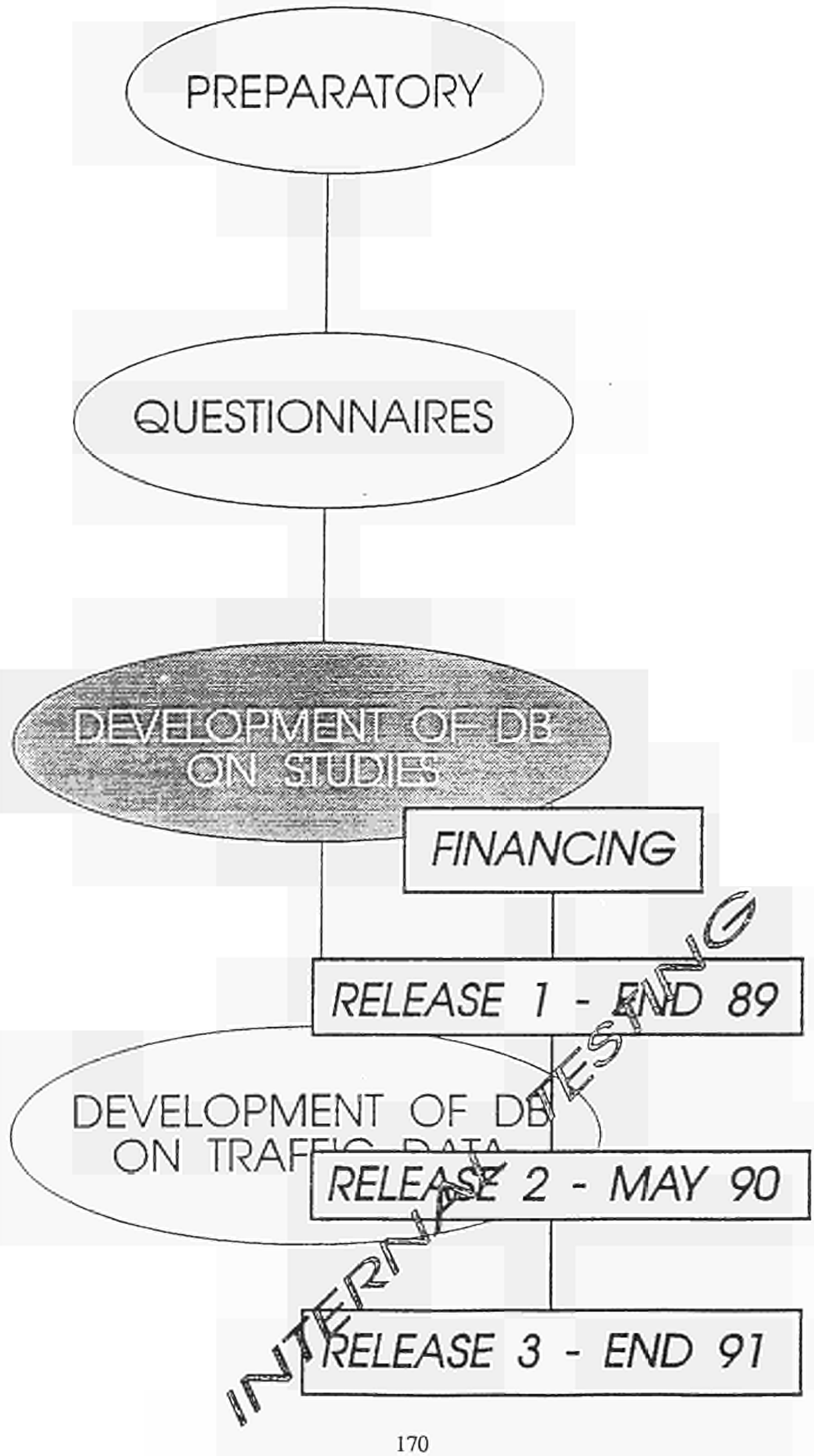
This prototype database was considered an efficent method to realize a return to the cooperative scientists, with a practical demonstration of the realization and not only with a paper report.

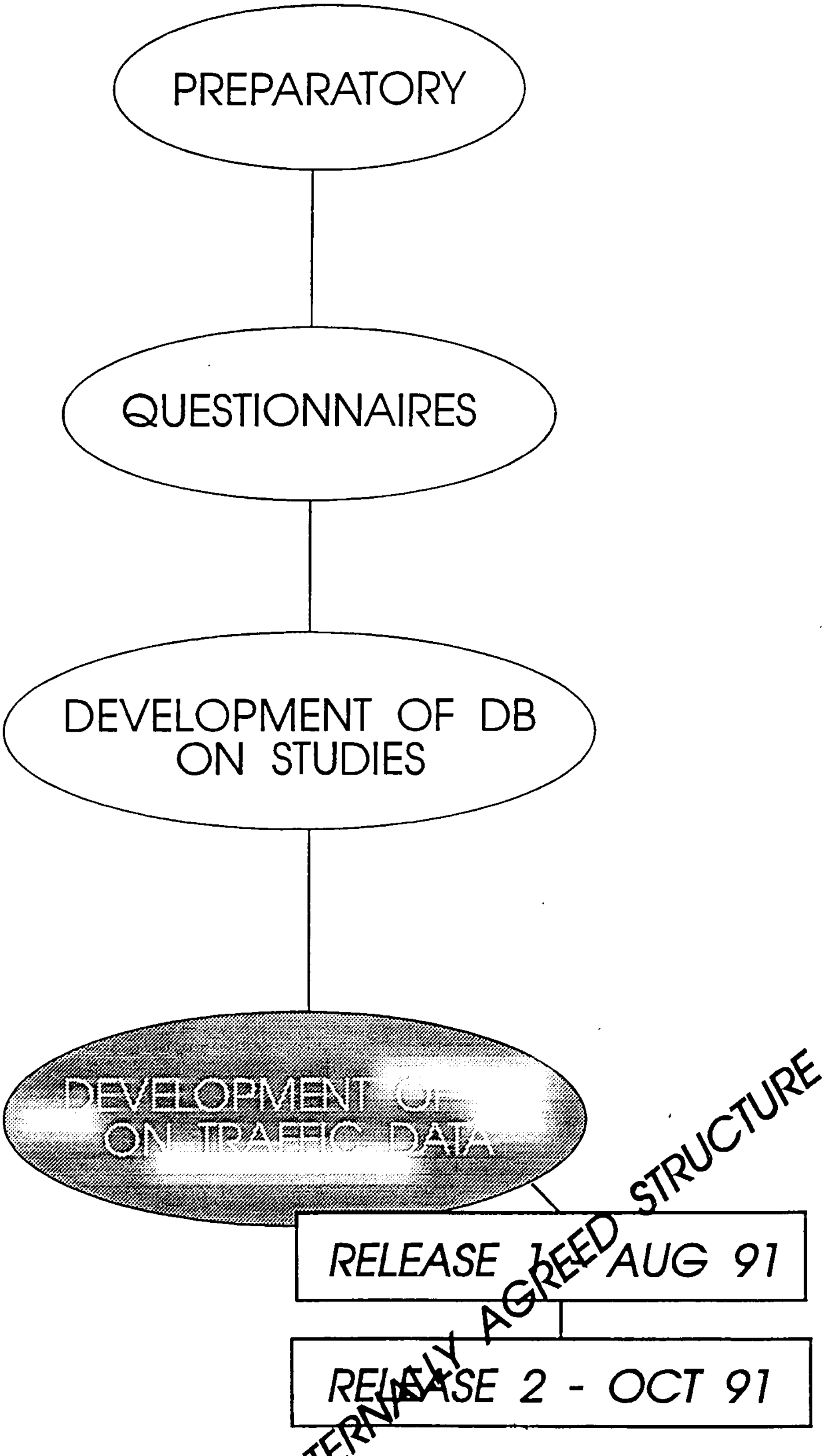

PREPARATORY
QUESTIONNAIRES
FIRST DRAFT
INTERNAL REVISION
SECOND DRAFT
EXTERNAL TESTING
FINAL EDITING
...PMENT OF DB
ON STUDIES
DEVELOPMENT OF DB
ON TRAFFIC DATA

3 - Table of absolute and percentage number of returns

	Institutions Interrogated	Institutions Answering	Questionn. returned	Q./I.I.	Q./I.A.
FRANCE	8	3	8	100%	266%
ITALY	9	5	8	89%	160%
HOLLAND	5	4	10	200%	250%
FINLAND	1	1	3	300%	300%
Totals	23	13	29	126%	223%

Spain, Portugal and Greece have been left out of this table for the non systematic diffusion of questionnaire.


PREPARATORY
QUESTIONNAIRES
DEVELOPMENT OF DB ON STUDIES
FINANCING
RELEASE 1 - END 89
DEVELOPMENT OF DB ON TRAFFIC DATA
RELEASE 2 - MAY 90
RELEASE 3 - END 91
INTERNAL TESTING


PREPARATORY
QUESTIONNAIRES
DEVELOPMENT OF DB ON STUDIES
DEVELOPMENT OF
ON TRAFFIC DATA
RELEASE 1 - AUG 91
RELEASE 2 - OCT 91
INTERNALLY AGREED STRUCTURE

MAIN MENU

1. Organisations

2. Add a Study

3. Delete a Study

4. View/Edit a Study's Input Data

5. Select Studies

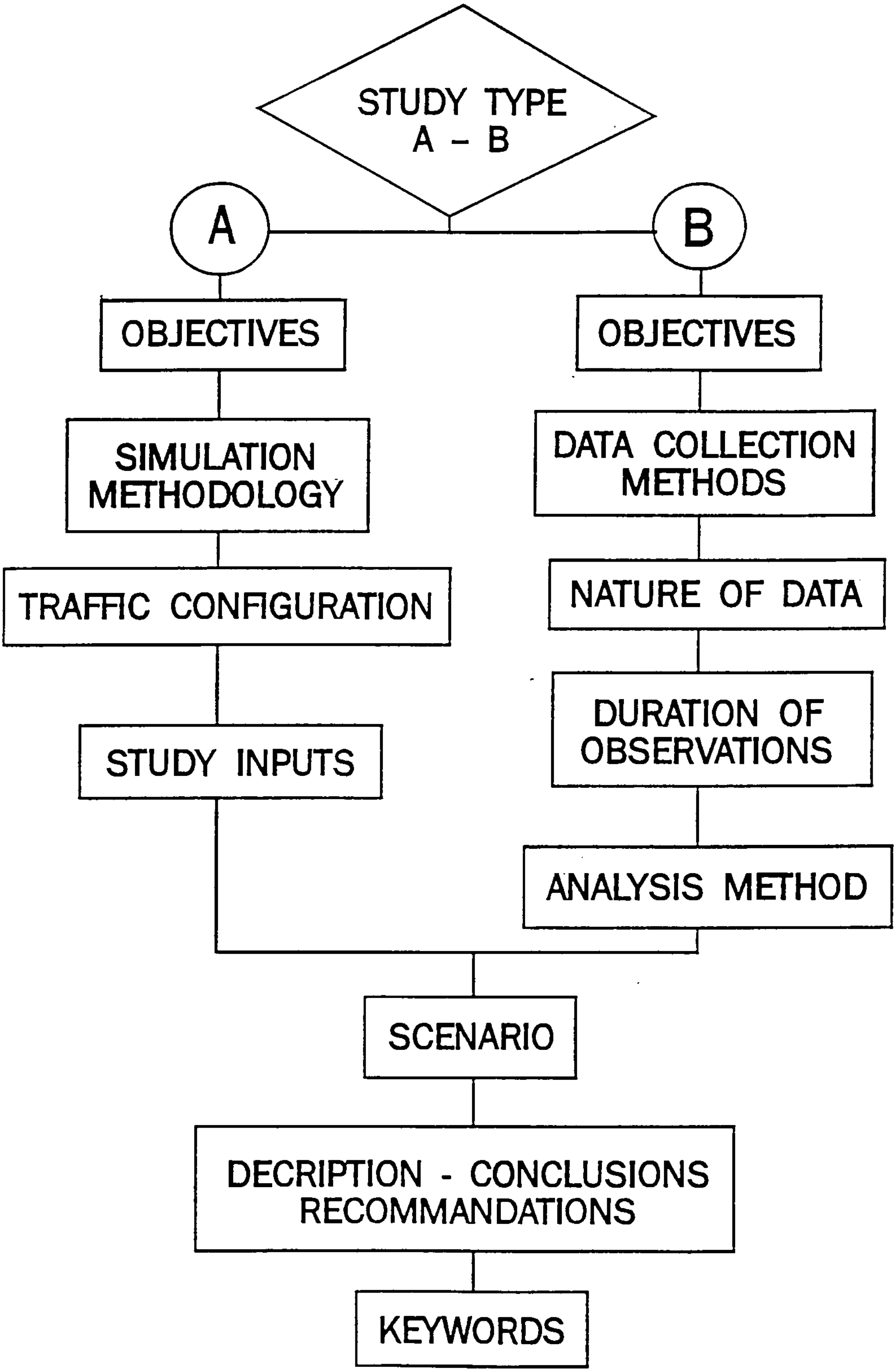
6. View/Print Study Titles

7. View/Print Study Output Data

8. Safety Check

9. Exit

F1 for Help Screen


STUDY TYPE
A - B
A
B
OBJECTIVES
OBJECTIVES
SIMULATION METHODOLOGY
DATA COLLECTION METHODS
TRAFFIC CONFIGURATION
NATURE OF DATA
DURATION OF OBSERVATIONS
STUDY INPUTS
ANALYSIS METHOD
SCENARIO
DECRIPTION - CONCLUSIONS RECOMMANDATIONS
KEYWORDS

OBJECTIVES RELATING TO MARINE TRAFFIC SIMULATION STUDIES

Objectives are in four Sections
1. Relating to Port & Waterway
2. Relating to Ships' Manoeuvring
3. Relating to Training
4. Other
C. Continue for more information
S. Save & Exit

Your Choice ....

OBJECTIVES RELATED TO PORT & WATERWAY (ESPECIALLY CONFINED WATER) OPERATIONS

{Screen: Obj 1.1 }

A. Examine the conditions for safe & efficient transit of ship(s) .... N
B. Design/Improve physical configuration of the Area .... N
C. Design/Improve aids to navigation External to ship (visual or electronic) .... N
D. Design/Improve permanent Traffic Management functions .... N

Objectives Related to Ships' Manoeuvring Characteristics, Operations & Navigation Control

{ Screen: Obi 1.4 }

I Inherent ship manoeuvring characteristics ....N

J Manoeuvring characteristics of ship(s) subject
to external environmental factors .... N

K Examination of the complete system -
Environment/Ship/Navigator .... N

L Overall ship bridge Design .... N

{ Screen: Obi 1.5 }

M Design/Improvement of Ship Bridge Equipment .... N

N Design/Improvement of Ship Bridge Procedure .... N

O Performance, Skills, mental processes of ship
bridge operator or team .... N

P Analysis of Ship Casualty Dynamics ....N

Q Other objective (Please Specify) ....
....
....

Objectives Related to Training.

{ Screen: Obi 1.6 }

R Definition of Training Tools .... N

S Definition of Training Procedures .... N

T Validation of Training Techniques .... N

Other objective (Please Specify) ....

....

....

Other Objectives

{ Screen: Obi 1.7 }

....

....

....

....

Simulation Method Used in the Study

{ Screen: Sim 1 }

TYPE OF SIMULATION :

A. Numerical simulation .... N

B. Interactive simulation i.e. interaction
between an operator & a marine simulator .... N

C. Others (please specify): ....
....
....

Type of Simulator

{ Screen Sim. 2 }

A. Ship bridge simulator .... N

B. Ship Radar simulator .... N

C. Ship scale model .... N

D. VTS simulator .... N

E. Linkage of simulator. mentioned above .... N

F. Others (please specify): ....
....
....

Traffic Configuration

{ Screen: Sim 3 }

A. Single ship ....N
B. Two or more ships .... N
C. Single ship+ programmed traffic .... N
D. Two or more own ships + programmed traffic .... N
E. Two way programmed traffic .... N
F. Complex programmed Traffic .... N

Input to the Study

{ Screen: Sim. 4 }

A. Physical & Topographical characteristics of navigational space .... N
B. Meteorological conditions .... N
C. Hydrological Conditions(Tides,currents,waves).. N
D. Aids to navigation external to ship(s) ....N
F. Permanent traffic management functions .... N
F. Real time traffic management functions ....N
G. VTS Operators' Equipment .... N

OBJECTIVES RELATING TO COLLECTION & ANALYSIS OF MARINE TRAFFIC DATA.

{ Screen: Obj 2.1 }

General Objectives:

i. To obtain general knowledge on marine traffic in an area ....N

ii. To obtain knowledge on the movements of specific types of vessels in an area. .... N

If "Y" to ii, then

Please specify the vessel types for which data was collected ....

....

....

Specific Objectives:

i. The improvement of navigational aids . ... N

ii. Establishment/improvement of vessel traffic services .... N

iii Measurement of Safety of marine traffic against specific criteria .... N

iv Measurement of Efficiency of Marine Traffic flows against specific criteria. .... N

v. Casualty analysis... N

vi Improvement of traffic regulations.. N

vii. As an input to simulation studies. .... N

viii. Other (please elaborate)...

....

If "Y" to vii. then

Please give the title/brief description of the marine traffic simulation study.

....

....

NATURE OF RAW DATA COLLECTED - RELATING TO VARIABLE ENVIRONMENTAL ELEMENTS.

{ Screen: Data 2.3 }

(i) Visibility
(ii) Tidal streams
(iii) Sea states
(iv) Other (please elaborate) ....
....

NATURE OF RAW DATA COLLECTED - RELATING TO FIXED ENVIRONMENTAL ELEMENTS.

{ Screen: Data 2.4 }

(i) Channel widths .... N
(ii) Depths of water .... N
(iii) physical dangers .... N
(iv) Other (please elaborate) ....
....

DURATION OF OBSERVATIONS

{Screen: Data 2.5 }

Duration of Observations (days, months, years)
....

Observations taken by day ....N
by night ....N

METHOD(S) USED IN COLLECTING THE MARINE TRAFFIC DATA

{ Screen: Data 2.1 }

A. Radar observations.	N
B. Radar observations supplemented by radio communications ...	N
C. Reports from vessels	N
D. Visual sightings	N
E. Analysis of port records	N
F. Automatic data collection on board ships	N
G. Other (please elaborate)	

NATURE OF RAW DATA COLLECTED - Relating to Vessels

{ Screen: Data 2.2 }

A. Vessel names	N
B. Vessel sizes	N
C Vessel types	N
D Countries of registry of vessels	N
E Departure/destination ports	N
F Vessels' positions	N
G Vessels' courses	N
H Vessels' speeds	N
I Number of vessels in the area	N
J Frequency of vessel encounters	N
K Other (please elaborate)	

SCENARIO FOR THE STUDY

{ Screen: Scen. 1 }

Specific location to which the Study relates:

Country(s) ....

Specific Sea/Harbour area ....

....

Characterization of areas covered by Study:

In Port .... N

Port Approaches .... N

River/Lake .... N

Coastal Waters .... N

International Waters .... N

No Specific Area .... N

Other .... N

KEYWORDS RELATING TO THE STUDY

{SCREEN KEY 1 }

Safe/efficent ship transits..........	N	Ships' sailing plans..................	N
Port/waterway design/operations	N	Ship manoeuvring characteristics	N
Aids to navigation....................	N	Ship bridge design	N
Marine traffic management	N	Ship bridge procedures.............	N
Vessel traffic services..............	N	Ship casualty(s)	N
Allied services to ships	N	Vessel encounters	N
Numerical simulation	N	Radar observations...................	N
Marine simulator(s)..................	N	Visual observations of ships.......	N
Training..................................	N	Traffic data analysis	N
Environmental data	N		

Searching and reporting

Criteria must be defined for the selection of studies in the database, to be able to build significant reports concerning well identified topics or areas

The decision of WG1 was to define a criterium based on the combination of 5 variables:

1) Type of study (simulation or traffic data)

2) Country code

3) Organization code

4) Type of area covered by the study (scenario)

5) KEYWORDS

Conclusions

As general concluding remarks we can say that the COST311 database is now a prototype completely working for the two envisaged fields. This complies with the mandate reported at the beginning, at least for point 1 and 3. The definition of the convention for the users (point 2) of such a database has been reach with no problems, within our very restricted univers of users, all friends or cooperative scientists, being this community ready to exchange studies and data; within a real univers restrictive rules have to be defined for the use of the full informations.

The limits of our database are included in the definition of prototype.

Keywords list extracted from the questionnaires, grouped by main topics.

Simulation

real time ...
... experiments
interactive ...
fast time ...
traffic ...
... modeling
vessel mouvement ...

Control

... application
... theory
linear optimal ...
ship ...

Non linear systems

Human

... information processing
... factors
... controllability of ships
... engineering research

Man machine model

Performance measurement

Work load measurement

Navigability

... in confined water
... in port configuration
... in shallow water
bank effect on ...

Risk

... analysis
grounding ...
maneuvring ... indexes

One person watchkeeping

Bridge automation

Ergonomics

Integrated displays

Electronic charts

Electronic mapping

Ship mathematical model

Numerical prediction

Aids

visual ... to navigation

Buoys

Shore based radar
VTS

Coastal VTS

Traffic regulations

Harbour characteristics

Port approach

Port facilities

Tugs

Canal

Venice lagoon

Environmental conditions

Weather conditions

Ship maneuvring

Collision avoidance

Encounters

Ship casualty dynamic

Simulator

Training scenario

Pilots

Pilot training

Visibility conditions

Validation

Pushtow

Barge

Relational database

Flows

passenger ...
vehicle ...
cargo ...

Transport

... modelling
... scenarios

Vessel

... standardization
... design

coastal...

Demand

... analysis
future ...

RESULTS OF WORKING GROUP 2

SIMULATOR TECHNIQUES IN VESSEL MOVEMENT STUDIES

By Prof. Juhani SUKSELAINEN
(VTT Ship Laboratory)

Juhani Sukselainen

SIMULATOR TECHNIQUES IN VESSEL MOVEMENT STUDIES

1. GENERAL

Simulators are today a standard tool in ship handling and fairway design studies. They offer the possibility to visualize clearly and understandably the problem at hand. Especially for the purposes of waterway design two comprehensive treatments have been published recently [1,2]. The general usefulness of simulator techniques is widely recognized, although some problems involved have not yet been solved. One of them is the generally rather high cost of simulators and their use. Additionally there are some further problem areas, that remain and will these be discussed in this paper to some extent.

There are two basic approaches to ship movement simulation. The first one simulates the total process on a computer and is called fast time simulation as only the computer speed limits the solution time. The other possibility is to simulate only the ship and environment on a computer and to retain the original human controller on the simulator bridge. In this case the simulator has to run in real time.

The basics for mathematical ship manoeuvring models used in simulators will not be discussed here, the field having been extensively covered elsewhere.

2. SIMULATORS IN FAIRWAY DESIGN

2.1 Fast time simulation

Fast time simulation is the generic term for mathematical model simulation on a computer, which may be either universal or a dedicated one. The simulation speed is controlled by the computer capability. All elements included in the process must be included in the model, as no interactivity is available.

Two basically different approaches may be chosen for the simulation: either a kind of optimal controller can be included in the model, or a more or less realistic navigator model may be introduced. In the former case the inherent manoeuvring capability of the vessel under given external conditions may be demonstrated. In reality a ship is always controlled less precisely and more manoeuvring space is necessary.The resulting swept path in a fairway transit can be called as piloted lane. These two basic modes of fast time manoeuvring simulation are described in ref. [3].

2.1.1 Limits and advantages

For preliminary and parametric studies fast time simulations by computer are the most economical method in fairway design. With the power of present-day computers many distributed parameters can be handled in reasonable time. Even Monte-Carlo simulations are feasible on a laptop computer. Especially if the inherent manoeuvring lane is produced as a result, the simulation method is straightforward.

There has been a lot of discussion about the validity of mathematical models to describe ship behaviour for simulation purposes. For most purposes those available today are adequate for deep-water conditions with stationary environmental conditions. In most cases one has to apply ship model data with suitable corrections for scale effects, as reliable data identified from full-scale dedicated trials is extremely scarce. Moreover, as even dedicated model tests to determine the necessary coefficients in the equations of motion for a specific ship are rather costly, simple regression models for the most important factors might be used as first aid in preliminary studies.

For simulations in confined waters, changing currents and gusty winds the situation is more complex and no adequate solution is readily available. In some cases direct hydraulic model tests are justified to test those assumptions one has to make to force the available mathematical models to these conditions.

As the simulated ship-handling task on a simulator is essentially a closed control loop, and as it is generally accepted, then in this case the requirements for the ship model are far lower than in the case of an open-loop phenomen like a turning circle. To test this assumption one should actually conduct a type of sensitivity analysis to a given simulator model undergoing tests. This could clarify the situation and set clear limits on acceptable ship model tolerances that do not influence the simulator experiments significantly. It is suggested in ref.[1] to experiment with this sensitivity analysis using fast time simulation techniques with autopilot function.

The problem, however, is the modelling of the decision-making related to the navigation and ship handling in the simulation process and to produce realistic results, which take correct account of the different styles as well as the condition and time-related performances of real pilots. Fortunately there has been a comprehensive project underway in the Netherlands in this area [4].

An important problem in fast time simulation is the adjustment of the controller or navigator model to take proper account of all the relevant available cues in the visual and radar views with realistic vigilance.

Further comparative tests with fast time models and ship-handling simulators are required to justify the assumptions made in the design of controller models.

2.1.2 Modelling the navigator

The problem of modelling the navigator's behaviour cannot simply be reduced to defining the reaction of each individual navigator to every possible situation he may find himself in. In such a case, an infinite amount of decision rules would have to be drawn up. As an alternative, the formalization of the actual task has been proposed as a suitable starting-point for a navigator model. This task is assumed to comprise risk- and control-effort-minimizing elements, as well to attain some goal in terms of a future desired state. The incorporation in the model of control effort and so-called terminal errors is straightforward. Perceived risk is quantified by combining both the situation-dependent accuracy with which the navigator expects to be able to estimate his position, and the extent to which being in a certain position is deemed acceptable. The actual supervisory and control behaviour is obtained by applying a mechanism - linear optimal control theory - which minimizes the weighted cost, which is related to all three task elements. In this context, the term optimal is somewhat misleading, that is, the resulting behaviour is not to be considered the best control strategy possible. In this application optimal control theory only serves as a tool which translates the combination of a situation and a task description into a unique set of corresponding control actions. Differences in style between individual navigators can be achieved in a well-interpretable way by adjusting the weighting parameters that define the relative importance attached to realizing each subsequent task element [5,6,7].

2.2 Interactive simulation

Interactive simulation is the most realistic way of modelling the closed-loop behaviour of a real ship, provided the interface between the real navigator and the ship model is working realistically. What must be included here is not easily defined and many different opinions exist as regards the amount of realism required for meaningful results. Everything between PC and full-bridge set-up with CGI has been used. It has been generally agreed that the experiments must be run in real time. This gives realistic time scale for observation and decision-making. In the following, the basic types are described more in detail.

2.2.1 Simulator types and their properties

The idea behind the most comprehensive type of ship simulators is to achieve the maximum degree of realism possible. This is deemed to require a full-size completely equipped bridge assembly with an adequate presentation of the night and day visual field surrounding it. Some sacrifices of authenticity are unavoidable, but in general the results achieved so far have been quite impressive. The most severe drawback for this class of simulators is the high cost involved. In COST 311-area simulators of this type are available only in Wageningen (NL) and Espoo (SF).

For cost reasons interactive simulation applications based on microcomputers are very interesting [8]. For a number of tasks they are obviously quite suitable, although the interface with the operator(s) is rather coarse. Despite the already long tradition of ship manoeuvring simulators, no-one really knows quantitavely what degree of simulator complexity is required for a given task. At least for preliminary studies they are ideally suited, and being easily portable, their use is not restricted geographically. The hydrodynamic part of the simulation model completely meets the degree of accuracy attained by any type of commercial bridge simulator provided that an advanced computational model is used.

2.2.2 Requirements for the hardware

The apparent realism of a simulator facility certainly plays a role in creating valid surroundings for the test personnel. As the cost of computers has been falling continuously, the degree of realism incorporated in the bridge and image projection system virtually determine the cost level of a facility. How much realism is really required for meaningful results? Or what part of the set-up is there just for apparent authenticity's sake. No-one really knows what could be left out.

One interesting point is the updating rate of the visual image presented to the navigator on the simulator bridge. If it is true as quoted "The shiphandler's performance is mainly dependent on movement perception and to a lesser extent on position perception, as far as the outside view is concerned"[2,9], it is obvious that a low rate of refreshment, say below 15Hz, must have an influence on perception validity.

From mere cost-effectiveness reasons just an adequate degree of realism is to be aimed at, but how? Modern desk top simulators have proven their usefulness in design and training tasks, and even onboard ships. On the other hand, more sophisticated simulators with a high degree of realism probably have their most favourable area of application in somewhat different tasks, as demonstrated in [1].

2.2.3. Requirements for the software.

What has been said above about the fast time simulation requirements on the ship and environment model applies here also. Of course there are very demanding tasks in the modelling and control of the user interface elements, which require the necessary background for understanding the importance of the total perpception process on the simulated bridge.

2.2.4. Pilot behaviour on the simulator bridge.

Does the pilot in simulator runs behave exactly as on a real one ? Does the degree of realism he encounters influence his adaption ? And how about the lack of legal liability etc as encountered in the real word. Is he simply feeling that he is playing a big video game ? Thos e are some open questions awaiting clarification. It is anyhow clear that the performance of pilots in simulator experiments is clearly below that in reality. This has been observed on the Finnsim (10) as well as in ref. (1) The phenomon is probably not as clear and discouraging in straightforward runs in rather spacious fairways as in ref. (11), but in more difficult passges like the Helsinki Approach, it has been recorded clearly (12).

It is well understood that pilots use some per se rather secondary cues in the scenery as virtual aids to navigation, but probably they are not always distinguishable from other features that merely serve as essential symbols for a given shoreline.

2.3. Quality criteria for transit safety.

2.3.1. Acceptable level of risk.

Well-defined risk level values are currently used in many disciplines of activity like offshore technology or road traffic engineering. In fairway design it is seldom used, even if it could be quite precisely defined from casualty statistics. For the reasons mentioned aboce, simulator experiments, at least as normally performed with very limited numbers of runs, are not suited to long-term extreme value predictions. One might apply the distributions of Gumbel and Weilbull as suggested in ref. (2) byt the number of runs for each condition should be 30-50 and the results could be expected to be far too pessimistic.

2.3.2. Interpretation of simulator results.

The only well-established means judging simulator runs is subjective scoring by test pilots. In the Netherlands statistical methods with varying degrees of sophistication have been applied (2), but the fact that every pilot has his own strategy in making a run, and the strategy also depends on the external conditions, makes it very difficult to achieve a reasonable realism in predictions. The relativly poor performance of pilots in simulator experiments is also clearly manifested in the acceptable grounding criteria of one per cent presented for simulations in 5 per cent worst conditions ie. 0.05 in ref. [2]. In the real word an acceptable value could probably be 0.001 per cent. Ref. [1] also considers that no direct means of translating simulator results to a risk level in reality can be found.

To improve the dissemination of knowledge in fairway design the results of as mamy simulator experiments as possible should be systematized to aid in assessing the safety levels of candidate configuration as easily as possibly. The method developed by the U.S. Coast Guard as described in [13] could be regarded as a rather promising approach. Further work has been reported by USCG recently in [14].

2.4 Training of ship officers and pilots

Training is probably the most obvious use of interactive ship handling simulators. Here there are many levels of students and ambition. Thus it is apparent that simulators of different levels of complexity should be applied. A full-bridge simulator is clearly too expensive for teaching basics at nautical schools, but even relatively simple desk-top simulators may serve rather well in specific training tasks, if the manoeuvring model involved is good enough. To clarify the terminology it could be useful to rate different types of simulators to defined classes to optimize the actual cost benefit ratio in various training exercizes. This is today done in the aeronautics.

An important type of simulator is the on-board simulator, which is a PC-based desk-top unit on board, where it may be used for general training as well as for practising specific manoeuvres under difficult external conditions etc. This type of simulator developed at VTT has been tested in fast time mode onboard the ferry "Silja Serenade"(Helsinki-Stockholm)[15].

2.5 Some promising applications of interactive simulators

Certain types of tasks are more easily tackled with the aid of simulator experiments: Direct comparison of two or more fairway design alternatives or aids to navigation arrangements. In this case only well recognized items are changed in the simulation model, and the very effect of that difference should become apparent in the resuts even, if the measured absolute transit safety should be biased.

Another important application of full mission simulators is in development of new methods for better presentation of the present and future state of the vessel. Here again the analysis is reduced to mere comparison of alternatives. A different question is, if well advanced displays could make the outside view obsolete in the navigation process.

It must be realized, however, that even in above mentioned straightforward tasks the signal-to-noise ratio may be surprisingly poor. As the samples in simulator testing are in statistical sense always small, advanced methods are needed in prcessing them. Better analytical methods should also be developed for enhanced assesment of transit safety

3. SIMULATION OF VTS FUNCTIONS

3.1 Introduction

As already mentioned in 1.1, simulation of VTS functions has been undertaken mainly in the framework of the COST 301 European Project. Studies of this type investigate what operational benefits (or drawbacks) can result from particular VTS functions. They are less concerned with how VTS works and more with what effects VTS has on traffic.

The specific VTS functions considered in this research were of two types: Strategic Planning and Tactical Assistance, which are described in [16].

3.2 Studies reported

Of the many proposals for simulation studies within COST 301, the following 3 were finally selected:

3.2.1 Feasibility study for a real-time algorithm to optimize Strategic Planning for ferries in the Dover Strait. [16].

3.2.2 Evaluation of the interaction between a VTS operator giving Tactical Assistance and navigators with regard to collision avoidance manoeuvres around offshore structure[17,16].

3.2.3 Evaluation of the interaction between a VTS operator giving Tactical Assistance and a navigator with regard to stranding-avoidance manoeuvres in a narrow fairway [16].

3.3 Methods and equipment used

Two types of simulation methods have been used to carry out these studies:

- study mentioned in 3.2.1 by fast time simulation
- studies mentioned in 3.2.2 and 3.2.3 by interactive simulation.

Simulation of these types are feasible with rather simple or sophisticated facilities: a Macintosh Plus microcomputer for the study mentioned in 3.2.1; four ARPA simulators, one VTS console simulator and a simulated VHF communication system for the study mentioned in 3.2.2; a full-bridge simulator linked to a VTS console simulator and a VHF communication system for the study mentioned in 3.2.3.

Similar exercises are feasible for the generic problem. On the other hand it seems obvious that many functions now performed by VTS-operators could be handled by computers. An interesting approach to applying AI-techniques is presented in [18].

In a more traditional navigation context, the USCG has also been experimenting with different types of navigation data presentation [19]. It should also be pointed out that the rapid development of AI-techniques might benefit this area as well [20,21].

3.4 Assessment of improvements in safety

Most often, the results of an assessment are valid for and only for the scenario within which this assessment has been made. The scenario identifies many of the assumptions made in the assessment process and the experimental factors, these factors being either constant or controlled.

Scenarios are structured descriptions of studies [16]. The role of scenarios, and the activity which lead to their definitions are to:

- Provide the means to communicate study description,
- Provide common frames of reference for parallel investigations,
- Assist in defining priorities for studies,

Enable all the assumptions and data limits to be defined, thus indicating the limits in the validity of the results.

3.5 Training and VTS-simulation

VTS-system simulators are generally recognized as being powerful tools for operator training purposes. Therefore it is natural that also in the present study careful attention to this aspect must be given, especially when new methodology is introduced to the scope of VTS-activities.

4. REFERENCES

1. Webster, W.C.(Editor):Shiphandling Simulation Application to Waterway Design, National Academy Press, Washington D.C. 1992

2. Capability of ship manoeuvring simulation models for approach channels and fairways in harbours. Supplement to PIANC Bulletin No 77(1992)

3. Perdok,J. et al: The use of real time and fast time simulation in ship control studies. CAMS-89, IFAC Workshop on Expert Systems and Signal Processing in Marine Automation, Lyngby, August 28- 30 1989.

4. Bogaerts, M.: Brief summary of Dutch programmes. COST 311 Note Oct.1988 See also Papenhuijzen, R.: Modelling the planning and control behaviour of the navigator. 7th European annual conference on human decision making and manual control, Paris 1988

5. Papenhuyzen, R.: On the modelling of the behaviour of a navigator: background and proposal for a control theoreticalpproach, (TNO-IWECO) 1988, Training, Human Decision Making and Control (J. Patrick and K. D. Duncan editors)

6. "On the modelling of the behaviour of a navigator" by R. Papenhuyzen (TNO-IWECO), H. G. Stassen (Delft University of Technology) 1987, Eight Ship Control Systems Symposium, Volume 2.

7. "Modelling the planning and control behaviour of the navigator" by R. Papenhuyzen (TNO-IWECO) 1988, Conference Annuelle Europeenne; prise de decision en controle manuelle.

8. Jia,X.L. et al: Design and application of a compact ship manoeuvring and control simulator. CAMS-89, IFAC Workshop on Expert Systems and Signal Processing in Marine Automation, Lyngby, August 28-30 1989.

9. Wylie, F.J.:The use of radar at sea, The Institute of Navigation, London, 1976

10. Heikkilä, M.:Comparison of fairway alternatives for Rauma approach(in Finnish), VTT Ship Laboratory Rep. LAI-2261/92, March 1992

11. Smith,M.W. et al.: Short Range Aids to Navigation Systems Design Manual for Restricted Waterways, U.S. Coast Guard, CG-D-18-85, March 1985

12. Heikkilä, M.:The evaluation of manoeuvrability through a narrow strait using full-bridge shiphandling simulator. MARSIM&ICSM 90, Tokyo 1990

13. Sukselainen, J.: Systematization of bridge simulator use in fairway design tasks. COST 311 Note 24.2.89

14. Brown, W.S. et al: Positioning experiment... Interim report, U.S. Coast Guard Contract DTCG-23-86-C-20030, Oct. 1988

15. Lehtosalo, J.:The development of an on-board simulation program for passage analysis, Maritime Research News 1/92 Maritime Institute of Finland 1992.

16. Degré, T. & al: COST 301 Final Report - Annex to main report, volume n° 7. Apr 1987/ AN 0109/.

17. MARITECH (UK) "Evaluation of interaction between VTS operator and navigators with regard to cllision avoidance". COST-T.2.62- Aug 1986.

18. Koyama, T. and Yan, J.: On the design of the marine traffic control system. Journal of SNAJ Vols. 162 & 164 1988/89

19. Smith, M.W.: Preliminary findings for the radio aid experiments. Ship Analytics Note to USCG from Nov.30 1988.

20. Brown, W. et al: Factors to consider in developing a knowledge-based autopilot expert system for ship manoeuvring simulation. SNAME STAR Symp. New Orleans, 1989

21. Grabowski, M.: Decision aiding technology and integrated bridge design. ditto

2ND SESSION

SIMULATION WITHIN EURET

PRESENTATION OF EURET PROJECTS

By Mr Jose ANSELMO
(European Commission - DG VII)

Presentation

By Council Decision of 21 December 1990 the European Communities approved the implementation of the EURET programme for a period of three years starting on 21 December 1990 (*OJ n° L 8 - 11 January 1991*).

In the early stage of programme implementation, a 1 month's call for expression of interest (*OJ n° C 146 - 15 June 1990*) was launched in view to help interested organizations to find partners all over Europe for future partnerships. During this short period 600 expressions of interest were received by the Commission and lead to the publication of a document (*Collection of expressions of interest - July 1990*).

On 15th January 1991, the Commission of the European Communities published its first call for proposals for all modes of transport under the EURET programme (*OJ n° C 9 - 15 January 1991*). Of the 42 valid proposals received, involving 300 organizations and representing a total cost of about 138 Millions ECUs, 9 were selected for Community support.

The present publication describes the 9 projects which were selected for support; it provides a summary of the objectives and the technical description of each project, the project coordinator an a list of the other major participants (contractors). The total cost of these projects represents more or less 37 Million ECUs, of which more than 19 Million ECUs is being funded through the Community.

The success of this first call for proposals for all mode of transport can be measured in the variety and calibre of the partnerships, and in the significant level of European collaboration which resulted in spite of the relatively modest funds available.

Further information on the Transport programmes will be sent automatically to all those who are included in our mailing list, registration for which should be made using the form at the end of this publication.

OBJECTIVES AND CONTENT OF THE PROGRAMME

The EURET Programme has three specific objectives:

- optimizing transport network exploitation,
- optimizing logistics, and
- reducing harmful externalities.

These specific objectives may be analysed as follows:

1. OPTIMUM TRANSPORT NETWORK EXPLOITATION

1.1. Cost-benefit and multi-criteria analysis for new road construction

The objective is to measure the feasibility of establishing a Europe-wide system of reference for analysing and establishing a coordinated method for evaluating road construction projects, taking into account the specific characteristics of the peripheral regions of the Community and the transit countries.

1.2. European rail traffic management system

The objective is to design a control system for rail traffic, both passenger and goods, to evaluate the location and transmission equipment and develop the main software components of the system.

This is based on a close interaction between infrastructure and the rolling stock,involving ground-to-train communications and of the system whereby trains measure the distance they have travelled.

Only a first phase could be carried out under EURET. However, it is important that the remaining phases of the project, i.e. the development of the hardware components, the establishment of the system, and its experimenting could be started in due time.

1.3. Design and assessment of a vessel traffic management system

The objective is an assessment of the benefits and feasibility of measures which would make the best use of investment already made or now being made in Vessel Traffic Services System (VTS), and an assessment of the possibility of some of the existing or planned VTS being capable of forming part of one or more general maritime traffic management service in European waters. It should lead to a system providing users with services such as relevant information on the present situation and probable future context in which the traffic is or will be operating, as well as the traffic itself, and in particular on maritime areas with high traffic density.

1.4. Trials in automated air/ground data exchange for Air Traffic Management systems in Europe

The objective is, within the framework of a future air traffic system in Europe, to define, develop and evaluate the applications, requirements and methods of data exchange between ground and airborne systems and between the pilot and controller as a means of backing up voice communications.

The first elements of a programme to investigate the system development and integration aspects have been initiated under the terms of reference of the Programmme of Harmonized Air Traffic Management Research in EUROCONTROL (PHARE).

1.5. Study on the controller work station in Air Traffic Management in Europe

The objective is to improve automated support to air traffic controllers resulting from the development of new contoller work stations, using up-to-date man/machine interface technologies, in order to help achieve, in the medium term, the increase needed in European air capacity. The programme will require a multidisciplinary approach with the participation of controllers, human-factor experts and engineers.

2. LOGISTICS

2.1. Economic scenario and demand projections for freight transport in the Community

The objective is to evaluate the extent to which the transport system currently available can be adapted to meet the developing demand for freight transport so that the necessary innovations can be introduced in good time including, where appropriate, new transport systems.

2.2. Economic and technical research on the transfer of goods - Design and evaluation of rapid transfer systems

The objective is to design and evaluate an innovative and efficient system of rapid loading and unloading of goods between different modes of transport, in particular railways.

2.3. Optimization of manpower in maritime transport: Improvement of competitiveness in Community maritime transport through implementing advanced technology

The objective is to determine the optimum crew composition for different types of vessel and marine transport systems according to different circumstances, taking into account the increased use of advanced technology.

2.4. Taking human factors into consideration in the man/ship system

The objective is to assess a better match between the vessel (and its equipment) and human behaviour by assessing the tasks assigned to crew members and their behaviour in various operational situations and to develop measures to reduce human error, in particular in ferry transport services.

3. REDUCTION OF HARMFUL EXTERNALITIES

3.1. Improved methods of evaluating the road safety of car and trailer trains

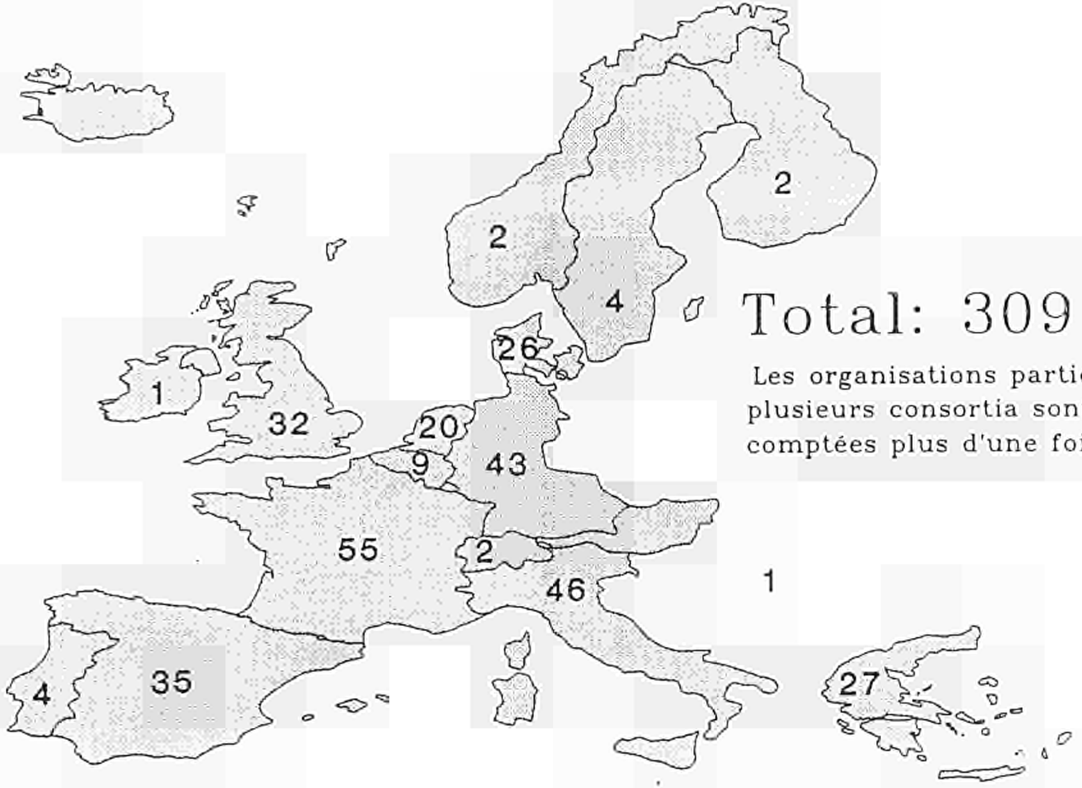
The objective is to assess the scale and significance of the problem at the European level of accidents involving private cars towing trailers and to make recommendations to improve their road safety.

The main action could aim at establising an analytical methodology and completion of statistical studies.

3.2.. Assessment of the driving safety of possible truck and trailer combinations

The objective is to analyse the present type-approved arrangements for truck/trailer combinations and to carry out a technical analysis of a number of different types of road train with a view to drafting new safety regulations.

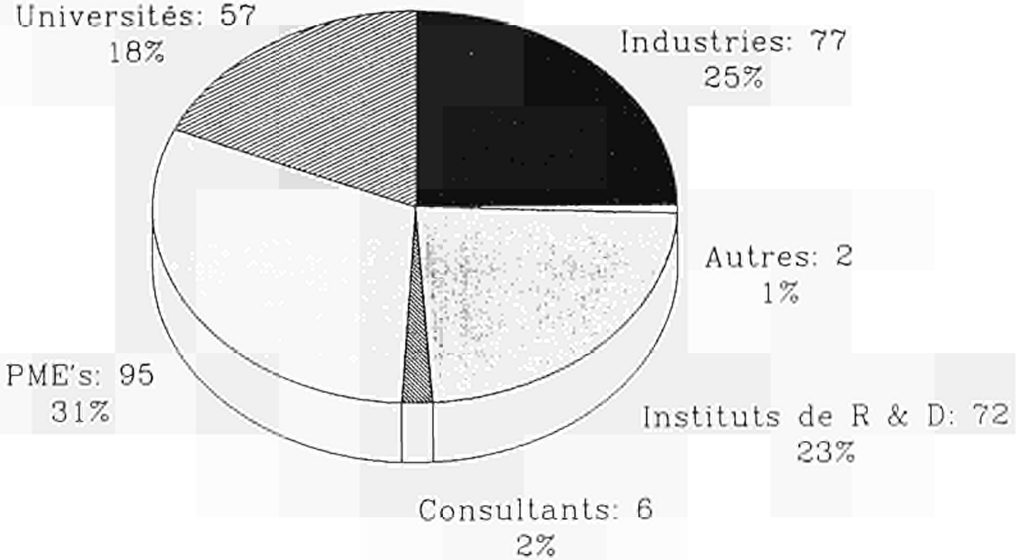
Répartition géographique des organisations ayant participé à l'appel à propositions.



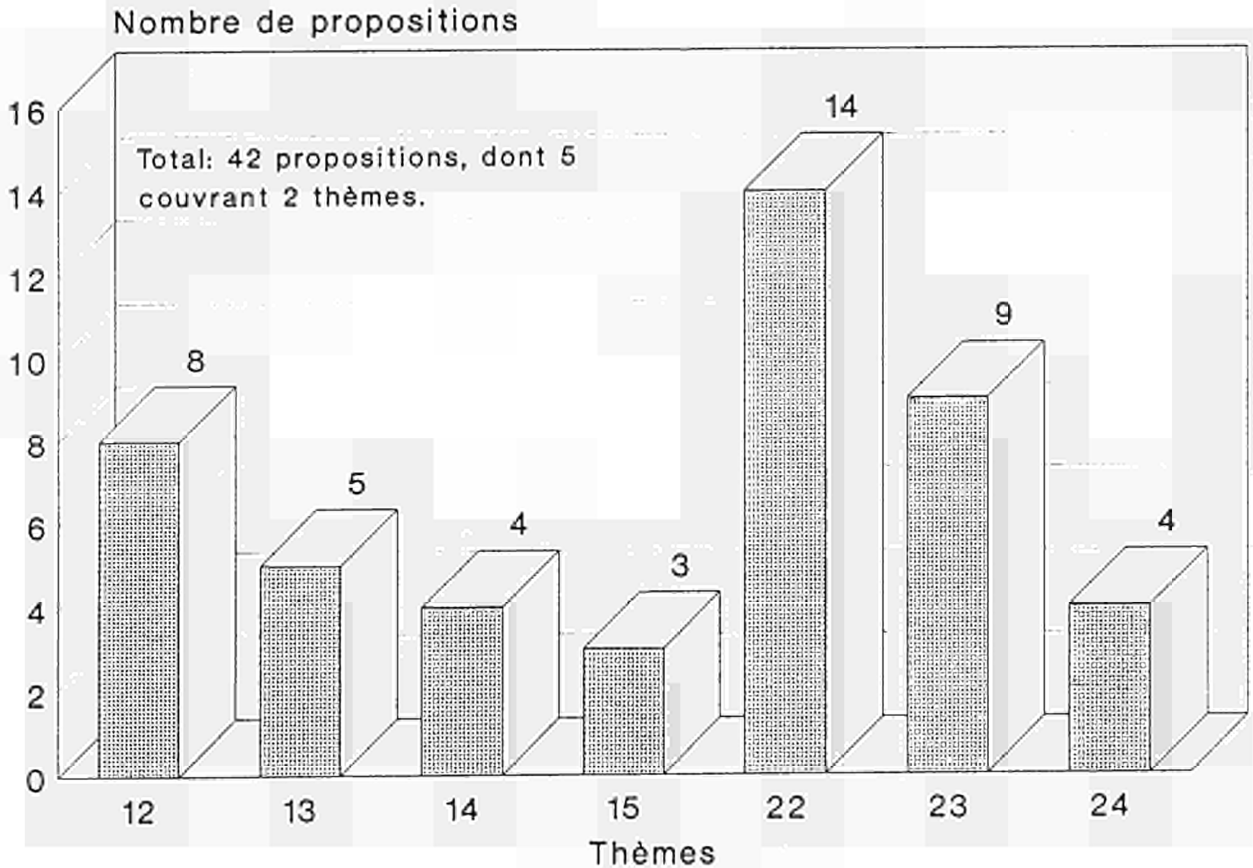
Total: 309

Les organisations participant à plusieurs consortia sont comptées plus d'une fois.

Répartition des organisations par type d'institution.



Nombre de propositions par thème.



- E U R E T -

LIST OF PROJECTS FOR MARITIME TRANSPORT

1.	**RTIS**	Regional Traffic Information Service
2.	**TAIE**	Tools to Assess Vessel Traffic Systems and to Increase the Efficiency of VTS
3.	**ATOMOS**	Optimization of Manpower in Marine Transport. Improvement of competitiveness in community transport through implementing advanced technology.
4.	**MASIS**	Human factors in the MAN/SHIP system for the European fleets

RTIS - Regional Traffic Information Service

Contract N° 8101-CT91-1301

Proposal n° PL 910026

Total Cost	: 2.59 MECU
Duration	: 30 Months
Coordinator	: Opeform sarl (F)
EC Contributions	: 1.31 MECU
Starting date	: 1 Feb. 92
Contact person	: Mr C. DEUTSCH
Phone	: +33.1.46.57.94.69

Partners: Ditel (I), Cetemar SA (E), Marine Technology Development Company SA (GR), Marine Analytics BV (NL).

Summary and objectives:

The project will study the feasability and if appropriate elaborate the specifications of an information service which would provide the actors of maritime traffic with information intended to make easier their own decision processes.

Special emphasis will be put on the use for shiphandling purposes of information made available in real time. The proposed service will take benefit of available information currently collected and/or processed by entities such as existing and planned VTS, search and rescue organisations, pilotage, shipping agents, meteorological services, ships' routeing agencies, etc...

The main objective of the project is to reduce maritime traffic costs.

Costs will be considered in a broad sense.

They will encompass :

- all costs resulting from the normal operation of means used for the performance of activities generating maritime traffic. Thus they will include in addition to the ship amortization and running costs, the costs of services provided at sea, in ports and fairways.
The cost of waiting times due to services unavailabilities is also included:

- costs of organisations or services responsible for preventing or maintaining at an acceptable level dysfunctionments of the traffic production systems;
- losses and damages caused by anomalies and accidents of any kind;
- costs of remedying or alleviating their consequences amongst which the impact of pollutions of may be catastrophic.

The project will address the Mediterranean area. It will therefore offer a regional coverage.

The project will be a pilot project. It intends to provide a basis for an experimental implementation. It is hoped that most of its features will be transposable to other maritime zones in Europe.

To this end, close co-operation will be established with the other EURET 1.3 project which the EC has taken into consideration.

TAIE - Tools to Assess Vessel Traffic Systems and to Increase the Efficiency of VTS

Contract n° 8101-CT91-1302

Proposal n° PL 910009

Total Cost	: 2.05 MECU	EC Contribution	: 1.22 MECU
Duration	: 30 Months	Starting date	: 1 Feb. 92
Coordinator	: Stichting Coördinatie Maritiem Onderzoek (NL)	Contact Person	: Mr Flameling
		Phone	: +31.10.413.09.60

Partners: Institut an der Fachhochschule Hamburg (D), BMT Fluid Mechanics Ltd (UK), Opeform (F).

Summary and objectives:

The project will study:

- a variety of tools which can assist in the design of an efficient VTS;

- determine the suitability for new external functions as shore based pilotage, resource management and contingency planning;

- improve the operational benefits to be reaped by improving the procedures in VTSs;

- improving and harmonize existing training schemes for VTS operators;

- collect, improve and determe basic traffic and casualty information as the basis for marine safety and expediency decision making as well as towards the determination for the nuisances to the environment caused by vessels.

The main objective of the project is to provide tools to assess the effects and the benefits of marine safety measures (notably VTS type measures) against the costs.

ATOMOS - Optimization of Manpower in Marine Transport. Improvement of competitiveness in community transport through implementing advanced technology

Contract n° 8101-CT91-2301 Proposal n° PL 910015

Total cost	: 4.72 MECU	EC Contribution	: 2.54 MECU
Duration	: 28 months	Starting date	: 1 Feb. 92
Coordinator	: Danish State Railways (DK)	Contact person	: Mr Kasten
		Phone	: +45.42.86.36.80

Partners: National Technical Univ. of Athens (GR), DMT Marinetechnik GMBH (D), Lloyds Register of Shipping (UK) and Soren T. Lyngso A/S (DK).

Summary and objectives:

The objective is to determine the optimum crew composition for different types of vessel and marine transport systems according to different circumstances, taking into account an increased use of advanced technology.

The ATOMOS (Advanced Technology to Optimize Manpower On board Ships) project has as its main goal to improve the competitiveness of the EC commercial fleet, through the application of advanced technologies and their integration with suitable manning, optimum crew composite and operational strategies. The result is intended to be a reduction in overall cost via improved system integration and simultaneously to obtain improved operator overview and increased safety.

The work proposed covers the total work programme as defined under Domaine 23 in the EURET Workplan (Dec. 1990), building upon the basis of existing Integrated Ship Control (ISC) systems, particularly the "Projekt Skib" and "Schiff der Zukunft" projects, with which the partners have detailed experience, and combining together a number of distinct and important areas into a coherent whole. Given the wide scope of the workplan and the restricted funding available, the majority of the work aims at defining requirements to new systems, interfaces or training needs. However, a number of system prototypes will be produced as requested in the Workplan.

Human factors in the MAN/SHIP system for the european fleets

Contract n° 8101-CT91-2401

Proposal n° PL 910029

Total cost	: 1.60 MECU
Duration	: 26 months
Coordinator	: Cetena (I)
EC Contribution	: 0.84 MECU
Starting date	: 1 Feb. 92
Contact person	: Mr Della Loggia
Phone	: +39.10.599.54.92

Partners: Cetemar SA (E), Marconsult SpA (I), Institute of Shipping Economics and Logistics (D), Univ of Strathclyde (UK) and Hellenmar (GR).

Summary and objectives:

The general aim of this research is clearly to improve the safety and the efficiency of the shipping not only in terms of reducing losses of human life, vessels and cargoes with the ecological damage to which they may lead, but also operational cost.

This objectives will be not complete without consideration of the role of the human operator. This should incorporate a task analysis and human error analysis to provide a basis for the assessment of all credible operator errors at each step of the task, and then an evaluation of the probability of each error. However, it should be noted that this analysis must be carried out within the specifing context of the scenario considered, with account taken of stresses which will affect performance.

For example, in a high stress situation with rapid changes of events where there might be a barrage of information and minimal time for response, operator reliability will be adversely affected.

In establishing the potential for error or inefficient operations these study will highlight the deficiencies, whether procedural, training based, design related response. This will then enable recommendations to be made for improvements where they will be most effective in the relevant systems, with the consequent improvement in performance and, hence, productivity and safety.

In the other hand, stringent manpower restrictions dictate the use of proven work study and human factors engineering principles in the development of future ship design and/or in the design of refitting of the existing ones.

Optimization of the shipboard system in terms of human operators, equipment and supporting software in the real operational environment have to be the future criterion.

The final objective of the proposed work plan is to improve the operational and functional interface between man and ship system in order that the on-board operator be effectively friendly interfaced with the technical system, in its varying complexity, represented by a modern merchant vessel in the European fleet scenario.

SIMULATION IN ATOMOS (EURET)

and

SIMULATION AT DMI

By Dr Stig E. SAND
(Danish Maritime Institute - Danemark)

Simulation in ATOMOS Project (EURET)

I. ATOMOS and Simulation

II. Simulation - Europe (SIG)

III. Real-Time Simulation (DK)

ATOMOS

(Advanced Technology to Optimize Manpower On Board Ships)

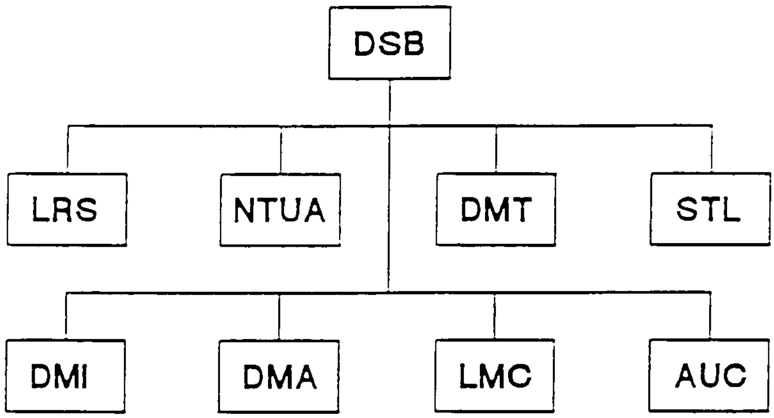
TITLE

OPTIMIZATION OF MANPOWER IN MARITIME TRANSPORT.
IMPROVEMENT OF COMPETITIVENESS IN COMMUNITY MARITIME TRANSPORT THROUGH IMPLEMENTING ADVANCED TECHNOLOGY.

OBJECTIVE

The objective is to determine the optimum crew composition for different types of vessel and marine transport systems according to different circumstances, taking into account an increased use of advanced technology.

ATOMOS ORGANIZATION



COORDINATOR

DSB : DANISH STATE RAILWAYS, DK.

CONTRACTORS

LRS : LLOYD'S REGISTER OF SHIPPING, GB.

NTUA : NATIONAL TECHNICAL UNIVERSITY OF ATHENS, GR.

DMT : DEUTSCHE MARINETECHNIK GMBH, D.

STL : SØREN T. LYNGSØ A/S, DK.

ASSOCIATED CONTRACTORS

DMI : DANISH MARITIME INSTITUTE, DK.

DMA : DANISH MARITIME AUTHORITY, DK.

LMC : LOGIMATIC A/S, DK.

AUC : AALBORG UNIVERSITY CENTER, DK.

ATOMOS TASKS

ECONOMICAL TASK ANALYSIS

INTEGRATED SHIP CONTROL (ISC)

VOYAGE PLANNING AND NAVIGATION

DAMAGE AND EMERGENCY CONTROL

DIAGNOSIS AND ALARM HANDLING

PLANNED MAINTENANCE

INTERFACE REQUIREMENTS TO MACHINERY AND SYSTEMS

DESIGN REQUIREMENTS FOR SHIP CONTROL CENTRE (BRIDGE)

RISK ANALYSIS AND SAFETY EVALUATION

REQUIREMENTS TO BUILT-IN TEST SYSTEMS AND FAULT DIAGNOSTICS

REQUIREMENTS TO DATA RECORDING AND TRANSMISSION

REQUIREMENTS TO DOCUMENTATION AND INSTRUCTIONS

SHIP MANAGEMENT

FUTURE IMO REQUIREMENT TO LOOKOUT FUNCTIONS

FUTURE REQUIREMENTS TO EDUCATION

TOTAL COST BENEFIT ANALYSIS

SIMULATION IN ATOMOS

Software Tool for GENeraTion of Sensor Data (GENTS)

Purpose of GENTS:

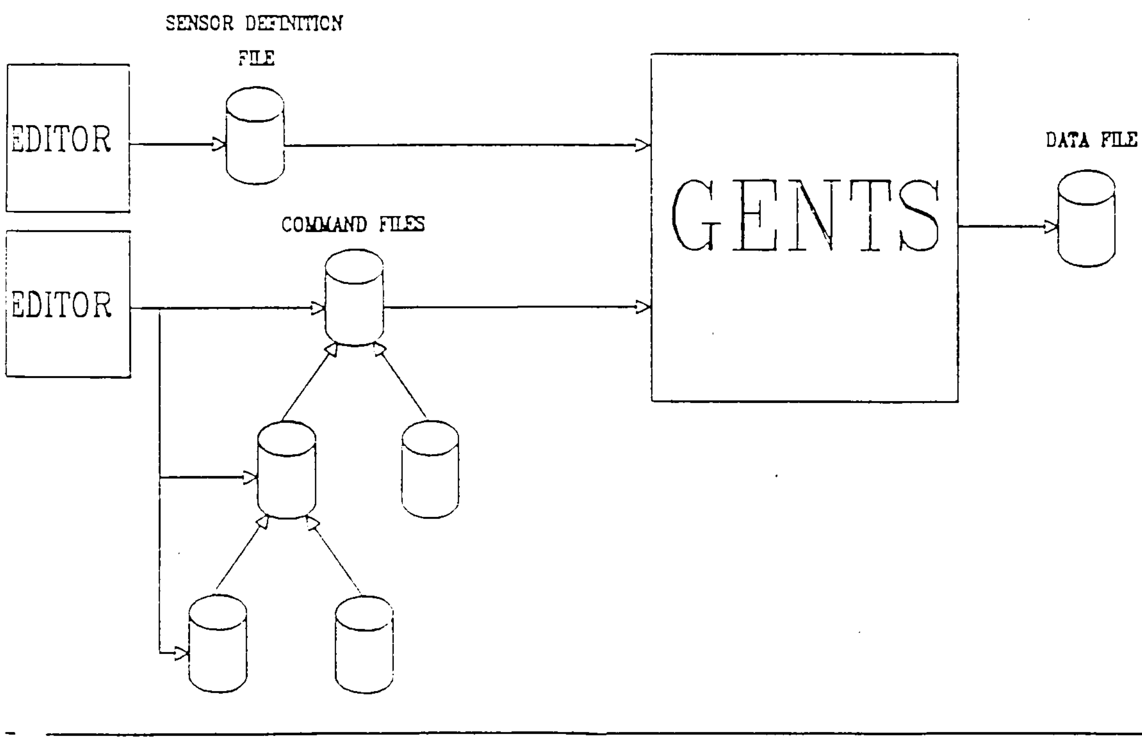
1. The purpose of the GENTS program is to establish a tool that can be used to generate time-history data from specification of a set of sensors and the desired time history.

2. The users of GENTS are the designers or test engineers from the ATOMOS team.

3. The purpose of GENTS is to enable generation of sensor data which imitate those from a real machinery sub-system in both normal and abnormal conditions.

4. GENTS is required to be an off-line task that generates a data file in ASCII format as its output. Real-time generation of data is not within the scope of GENTS.

5. The GENTS tool must support distributed development within the ATOMOS consortium by enabling test files to be generated by different parties. The tool must enable these files to be used in a flexible way in the integration testing phase of the ATOMOS project.


SENSOR DEFINITION
FILE
EDITOR
EDITOR
COMMAND FILES
GENTS
DATA FILE

SIMULATION - EUROPE (SIG)

(CEC - DG XIII)

Purpose:

- Increase awareness of simulation.
- Disseminate knowledge
- Link scientific world with industry management

Kernel Group:

- 5 selected persons (steel, economy, maritime, chemical)

Steering Group:

- 20 invited scientists and industry representatives.

SIG ON SIMULATION

- EXAMINE THE USE, NEEDS AND EXPERIENCES OF SIMULATION IN INDUSTRIES IN THE EC MEMBER COUNTRIES AS WELL AS IN THE ESPRIT PROJECTS. SPECIFIC INTEREST AREAS WILL BE THEREFORE IDENTIFIED (LIKE GENERIC TOOLS, HUMAN-COMPUTER INTERFACES, ETC.). REPORT THE RESULTS.

PROVIDE AN ADEQUATE STANDARDIZATION OF THE TOOLS OFFERED BY SIMULATION BASED ON CLASSIFICATION AND TAXONOMY, IN ORDER TO SUPPORT ITS ROLE OF INTERFACING AND INTEGRATION WITH THE ONGOING DEVELOPMENTS (PROMOTE MODULARITY AMONG TESTED SUB-COMPONENTS).

PROPOSE INITIATIVES LEADING TO INCREASING AWARENESS OF SIMULATION AND A WELL-COORDINATED DISSEMINATION OF KNOWLEDGE.

ENSURE THE RAPID AND CONSISTENT DISSEMINATION AND EXPLOITATION OF NEW RESEARCH IDEAS BY MEANS OF SELECTED WORKSHOPS, SYMPOSIA AND TUTORIALS.

DISSEMINATE THE KNOWLEDGE AND EXPERTISE AVAILABLE WITH THE INTERNATIONAL AND NATIONAL SIMULATION SOCIETIES ACTIVE IN EUROPE. (THIS KNOWLEDGE AND EXPERTISE HAS BEEN PUT DOWN IN MANY BOOKS, CONFERENCE PROCEEDINGS AND DIRECTORIES).

Qualification Tests

Purpose:

- To register development in navigation skills
- To compare the performance of navigators individually
- To analyse typical actions and errors
- To validate the simulation tool

Team:

- DMI simulation staff
- Navigation teacher
- Cognitive engineer

Error Analysis

- Observation errors
- Decision errors
- Action errors

Procedure

- Planning of simulation run
  - with respect to course, speed, modes, etc.
  - view to increasing environmental conditions
- Performance
  - changing captain / officer
  - observation by navigation teacher

Debriefing / Evaluation

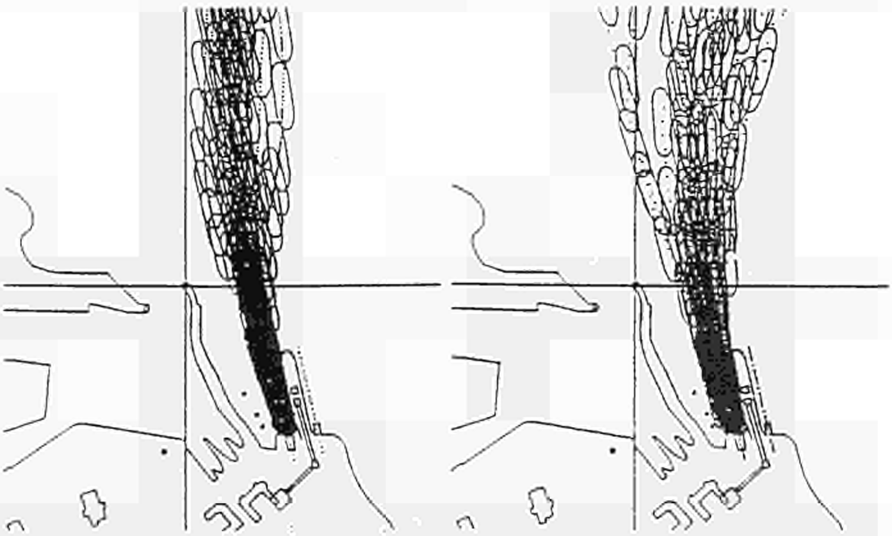
- Captain / Officer, Navigation teacher, Cognitive engineer
- Comparison of plan and actual performance
- Discussion of errors
- Analysis of logged data
- Evaluation of communication / cooperation

VALIDATION

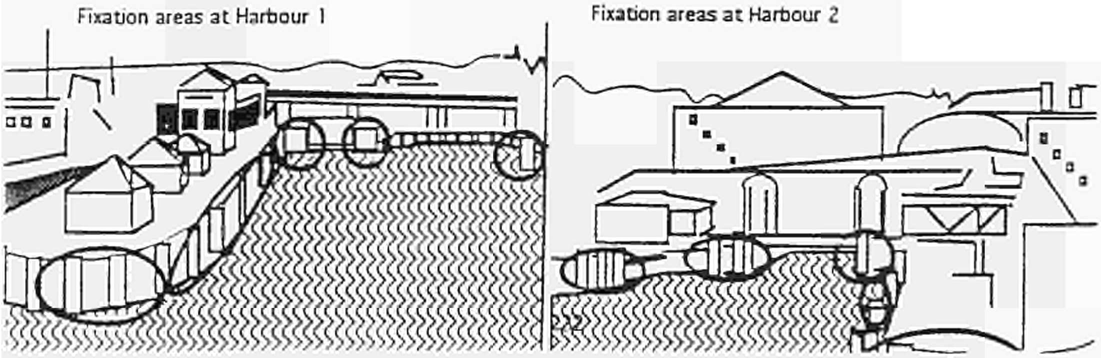
1. Test programme
2. Test of program packages
3. Test of full dynamic response
4. Main-in-the-loop testing of simulator
   - 17 experienced captains.
   - Joystick-controlled ferry - two harbours
   - Training and evaluation of crew in simulator
5. Field monitoring programme
   - 55 crossings
   - Recording of speed, position, course (GPS)
   - NAC V Eye Mark Recorder for perception
6. Repeated simulator exercises
   - Subjective data ("think-aloud-protocols")
   - Questionnaire
   - Data logging

Course	Simulator training			Reality			Sim. follow-up		
Harbour	Mean	SD	No.	Mean	SD	No.	Mean	SD	No.
1	262	5.60	95	262	7.60	55	260	6.29	15
2	45	5.55	60	48	3.81	55	44	3.29	7

Speed	Simulator training			Reality			Sim. follow-up		
Harbour	Mean	SD	No.	Mean	SD	No.	Mean	SD	No.
1	4.2	1.60	95	6.5	0.96	55	6.4	1.48	15
2	5.3	1.34	60	7.6	0.83	55	6.9	0.70	7



Swept path plots of simulated (left) and real (right) entries of Harbour 1.



Coordination of Knowledge / Tasks with:

SUPERNODE II ESPRIT P2528
Jesper LARSEN
Danish PARSIM Consortium, Denmark
Richard EVANS
Defence Research Agency, England

GP MIMD ESPRIT P5404
Arwed EXNER
Parsytec, Germany

KBSship ESPRIT P2163
Stig SAND
Danish Maritime Institute, Marine Simulations Dept., Denmark

CIMSIM ESPRIT P5467
Jean-Paul DE BAETS
Cap Gemini Innovation, Belgium

OLDS ESPRIT P3200 / VIEWS ESPRIT P2152
Heather LIDDELL
University of London, Dept. of Computer Science, England

ITSIE ESPRIT P2615
David SCOTT
MARCONI Simulation, Scotland

DISCOURSE DELTA project
Kenneth TAIT
University of Leeds, Computer Based Learning Unit, England

SAM DELTA project
Guy ENGELEN
Research Institute for Knowledge Systems, The Netherlands

CORYS company
Stephane SIEBERT
Simulation, Training, Computer Engineering, France

MARCOL company
Adam WILLIAMS
Space Division, England.

RESEARCH IN R.T.I.S. PROJECT

(EURET)

By Christian DEUTSCH
(OPEFORM - FRANCE)

Our presentation will be organised along the following three parts :

A. General introduction to RTIS

B. Types of simulations for RTIS

C. Major opportunities to implement simulation technics

SUB PROGRAMME 1.3

DESIGN AND ASSESSMENT OF A REGIONAL TRAFFIC MANAGEMENT SYSTEM

R.T.I.S.

RTIS (Regional Traffic Information System) aims to design and assess a regional traffic management system ostensibly modelled on the Mediterranean area, but meant to be transposable anywhere in Europe.

Worth 2.59 MECU, RTIS is a pilot project which aims to reduce maritime traffic costs. It will be looking into the faesibility and specifications for a real-time information system to improve decision-making by the different actors involved in maritime traffic and its management.

View N° 1

Seminar **MARITIME TRAFFIC AND SIMULATION**

R.T.I.S.

The main objective of the project is to reduce maritime traffic costs. Costs will be considered in a broad sense.

They will encompass :

- all costs resulting from the normal operation of means used for the performance of activities generating maritime traffic. Thus they will include in addition to the ship amortization and running costs, the costs of services provided at sea, in ports and fairways. The cost of waiting times due to services unavailability is also included;

- costs of organisations or services responsible for preventing or maintaining at an acceptable level dysfunctionments of the traffic production systems;

- losses and damages caused by anomalies and accidents of any kind;

- costs of remedying or alleviating their consequences amongst which the impact of pollutions may be catastrophic.

View N° 2

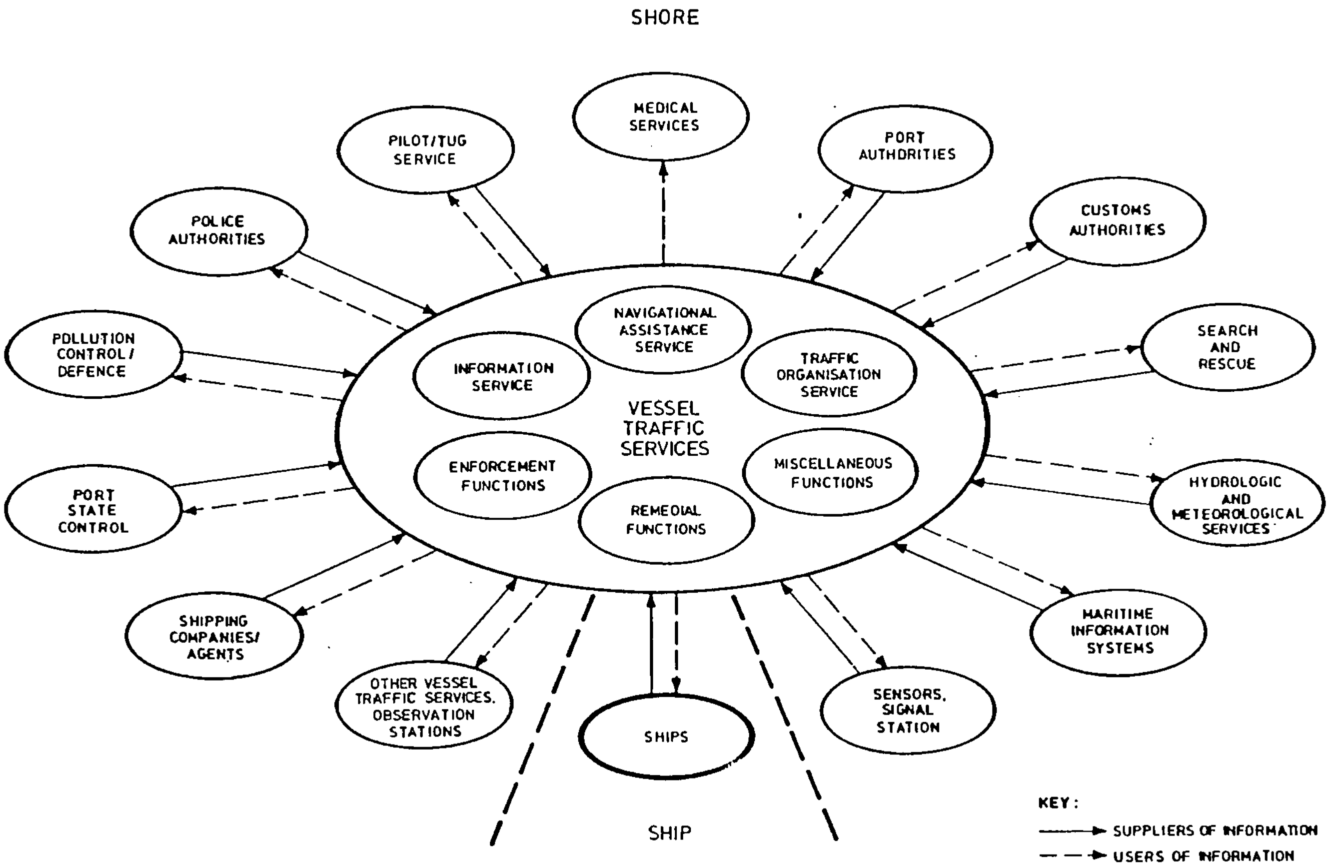
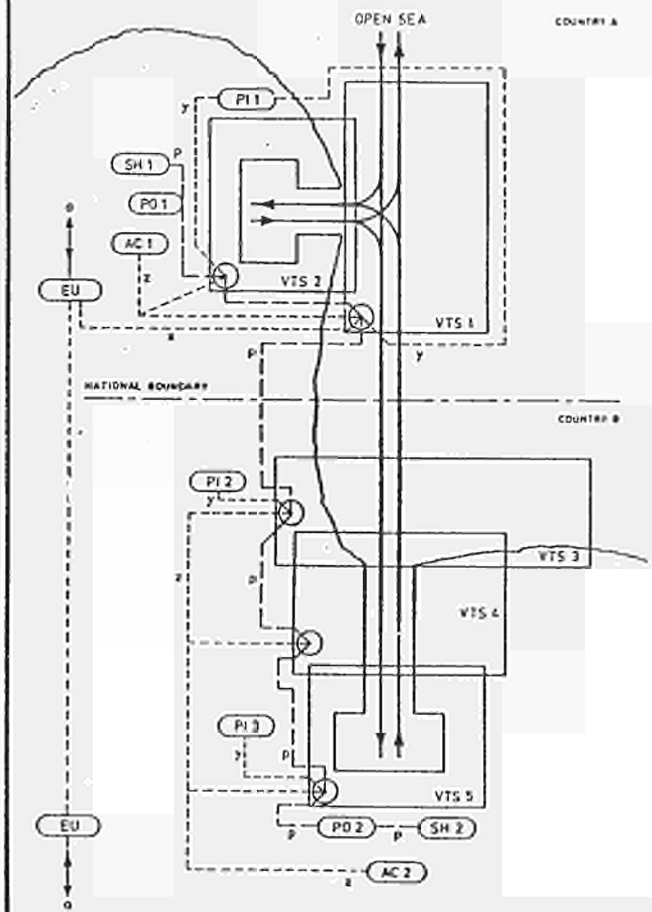


Fig.5.3 GENERIC DATA EXCHANGE RELATED TO VESSEL TRAFFIC SERVICES

Seminar MARITIME TRAFFIC AND SIMULATION



Key:

- Countries

  A and B

- Vessel Traffic Services

  VTS 1 : Coastal VTS in A
  VTS 2 : Port VTS in A
  VTS 3 : Coastal VTS in B
  VTS 4 : Port approaches/estuary VTS in B
  VTS 5 : Port VTS in B.

- Authorities

  AC : Emergency services, for example, SAR, pollution
  EU : (European) maritime information system
  PI : Pilot services
  PO : Port authorities
  SH : Shipping organisations, companies, agents and reporting services.

- Improved Information Flow

  e : Static and Variable data in EU
  p : Static, Variable and Dynamic data by Primary link
  x : Data from EU to VTS
  y : Data between VTS and pilot services
  z : Data between VTS and emergency services.

Fig.5.4 DATA TRANSFER: VESSEL TRAFFIC SERVICES AND ALLIED SERVICES: IMPROVED OPTION

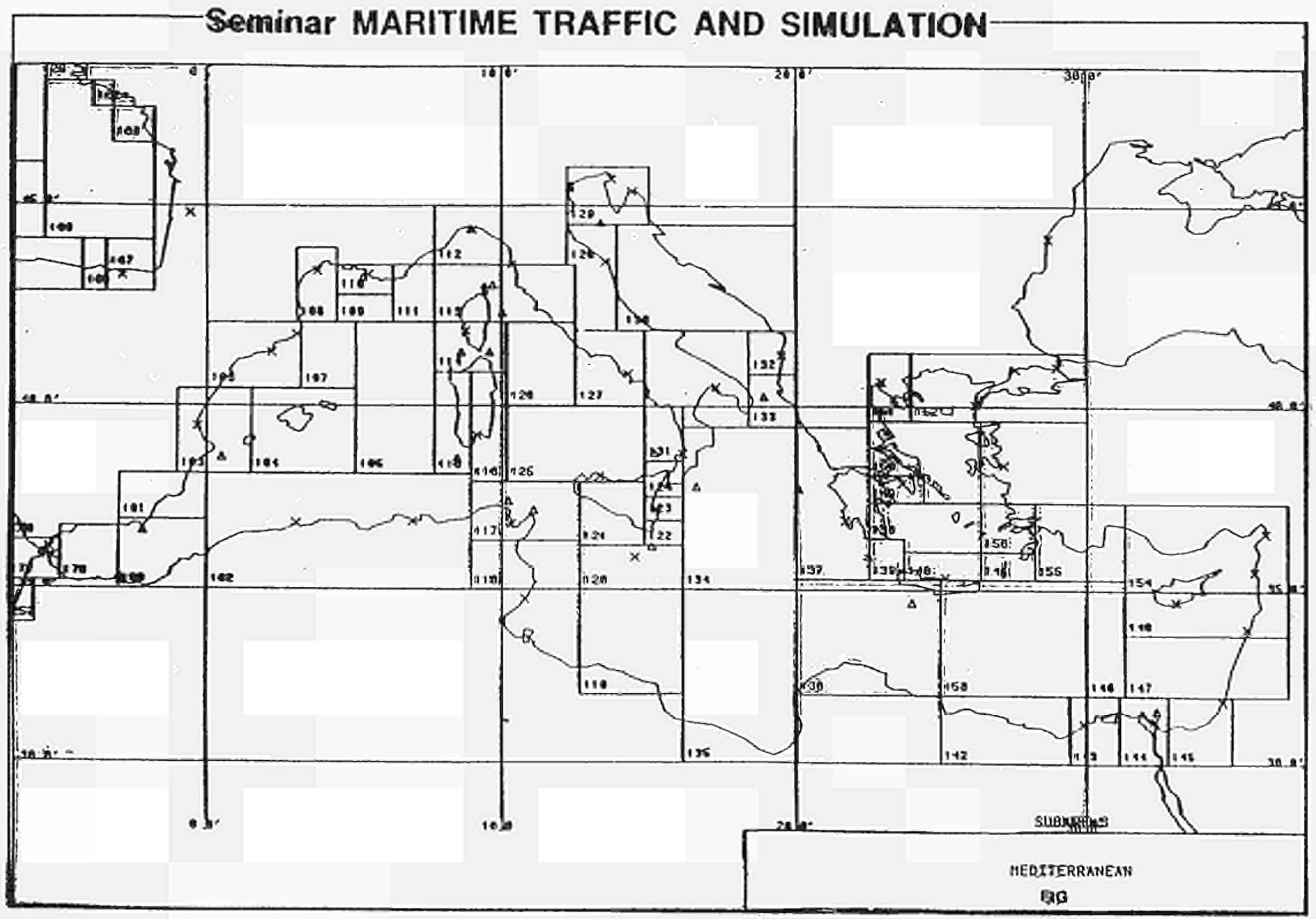
R.T.I.S.

The project will address the Mediterranean area. It will therefore offer a regional coverage

The project will be a pilot project. It intends to provide a basis for an experimental implementation. It is hoped that most of its features will be transposable to other maritime zones in Europe.

To this end, close co-operation will be established with the other EURET 1.3 projects which the EC has taken into consideration.

View N° 3


Seminar MARITIME TRAFFIC AND SIMULATION
SUBAREAS
MEDITERRANEAN
BIG

R.T.I.S.

Research Plan

The EURET workplan issued by the EC in December 1990 is the basis of the research plan.

It is composed of 8 major themes as follows :

0 Basic Research
I Allocation of space
II Transmission of information
III Traffic image
IV A regional system
V Operational procedures
VI Training
VII Impact of measures.

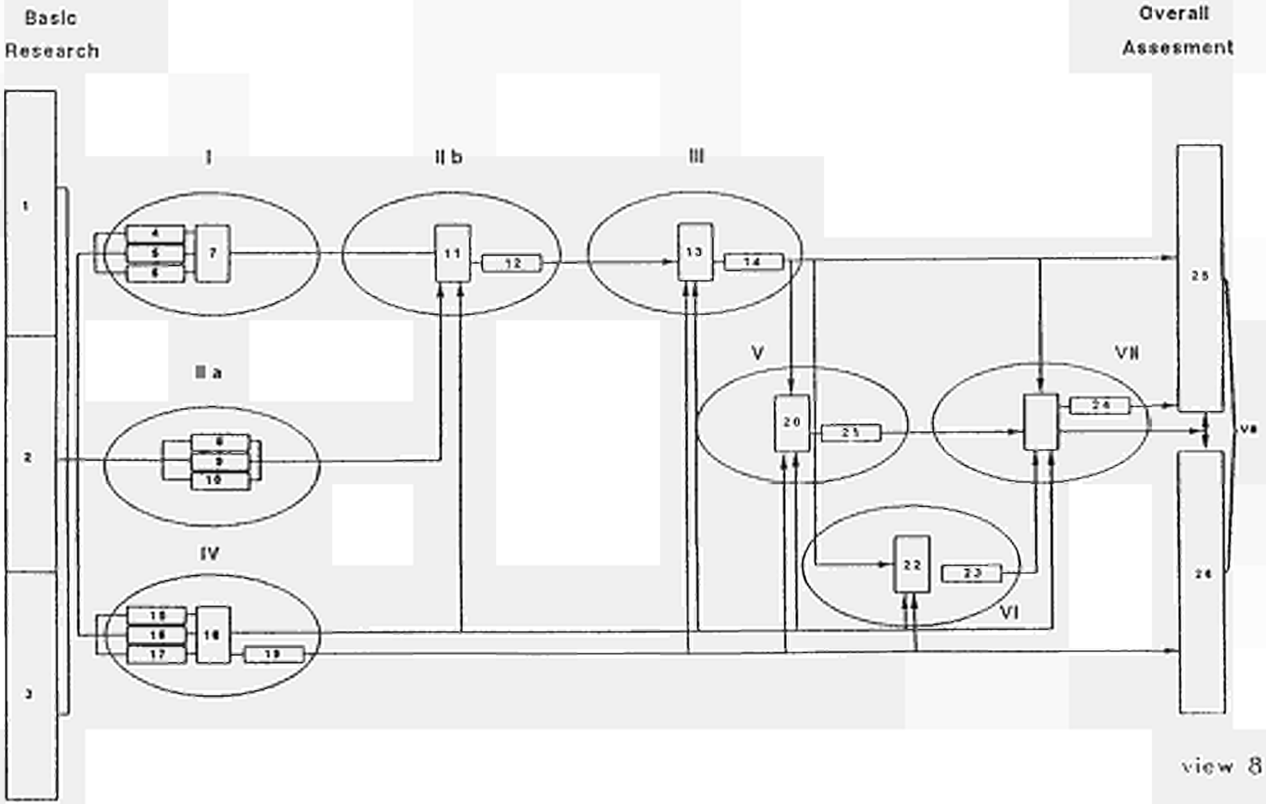
These major technical themes, together with management and the production of reports, have been divided into 28 tasks, comprising in total 55 subtasks.

View 7

Seminar MARITIME TRAFFIC AND SIMULATION

R.T.I.S.

Research Structure



view 8

R.T.I.S.

General Model for RTIS Assessment

The elementary unit to be considered to implement RTIS is the transit voyage (t) of a ship between the two points where she enters and leaves the RTIS coverage area.
For each potential user (p) of the information expected to be available at the RTIS level, the transit voyage will be taken in charge in different symptomatic and/or critical events (e) to process a given transit voyage of the participant considered.

The principle of the assessment of the RTIS role is to evaluate :

(1) $c\,(t, p, e)$ = cost of processing the event (e) associated to the transit voyage (t) of a participant (p)

(2) $p\,(t, p, e)$ = probability of the occurrence of the event (e) for the participant (p) in relation with transit voyage (t)

The assessment is then obtained through the global evaluation formula (E) :

$$\sum_{(t)} \sum_{(p)} \sum_{(e)} p\,(t, p, e) \;.\; c\,(t, p, e).$$

To simplify the use of this formula, it could be considered that :

$$c\,(t, p, e) = w\,(t, p, e) \;.\; c\,(t, p)$$

where (3) $c\,(t, p)$ = total cost of processing transit voyage (t) of participant (p)

and (4) $w\,(t, p, e)$ = % of the total cost defined above of taking into account event (e)

View 9

R.T.I.S.

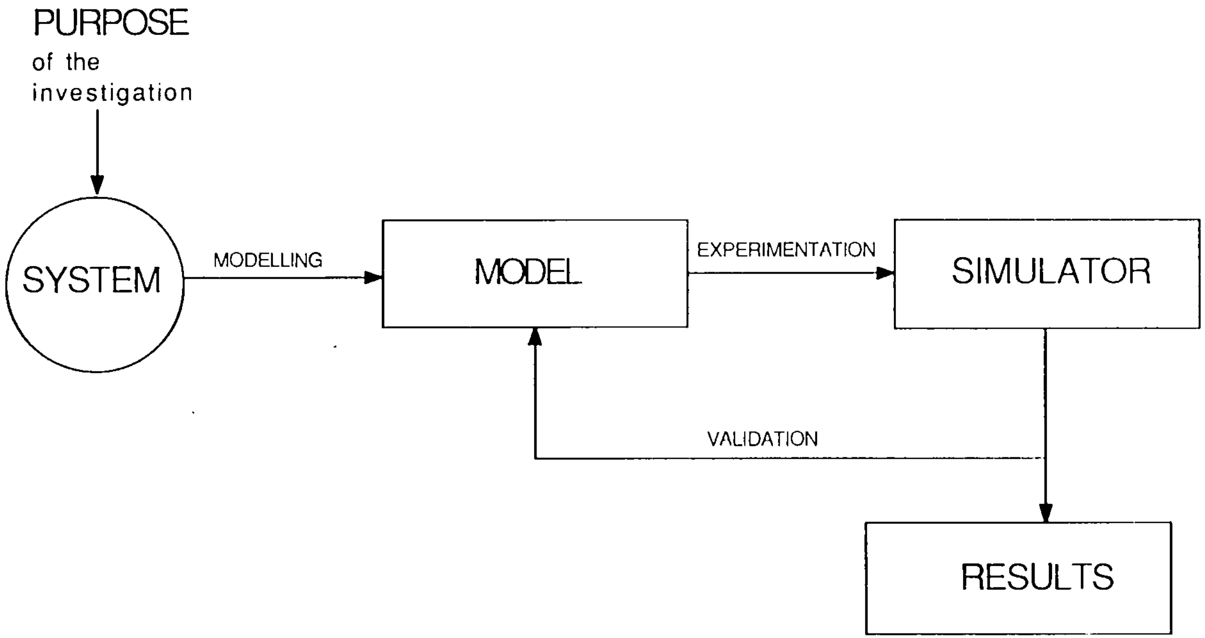
List of users	List of sources
I. Primary	
a) local (port/coastal) VTS operators	) port authorities and / or
b) port authority (VTS part)	) competent(*) administration
c) shipmasters	) pilots
d) pilots	)
e) fishing vessel shipmasters	fishing vessels shipmasters
f) pleasure craft skippers	professional organizations
II. Allied services	
a) pilotage stations	chief pilots
b) towage and salvage organisations	) port authorities
c) mooring organisations	)
d) meteo info, weather routing center	) competent administration
e) hydrographic offices	)
f) reception facilities for waste disposal	)
g) suppliers of fuel, spares, provisions	) professional organisations
h) stevedores	)
i) shipyard, dry docks, repairs, maintenance	)
j) PSC systems centre	competent safety agency
k) harbour police offices/fireboats/patrol vessels	maritime police
l) Search and Rescue organisations (SAR)	) port authorities and / or
m) Sea Pollution Combat Center (SPCC)	) competent administration
n) Maritime Medical Radio Center (MMRC)	)
o) aids to navigation services	)
p) NAVTEX	
q) ECDIS	
r) port management authorities	
III. Other users	
a) immigration, port health services	) competent administration
b) customs houses	)

View 10

Seminar MARITIME TRAFFIC AND SIMULATION

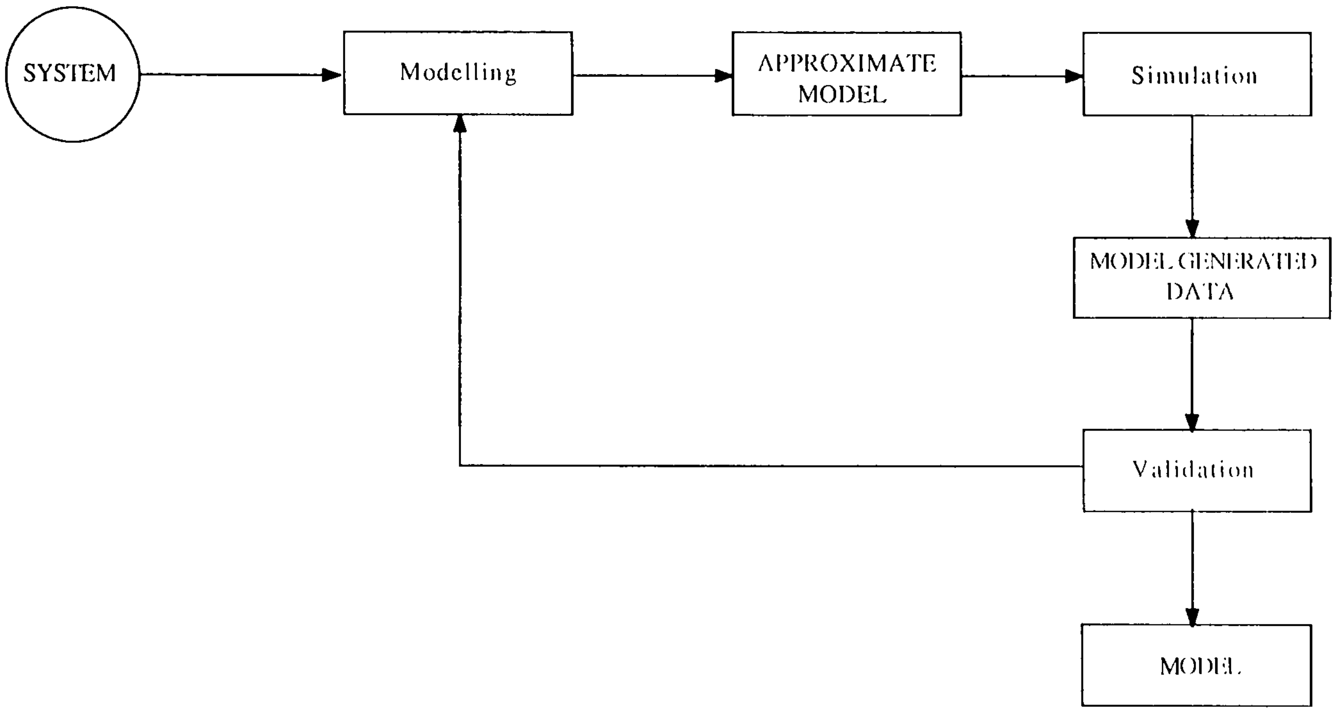
Simulation is used

to study the dynamic behaviour of
a system by means of
experimentation with a model
of that system

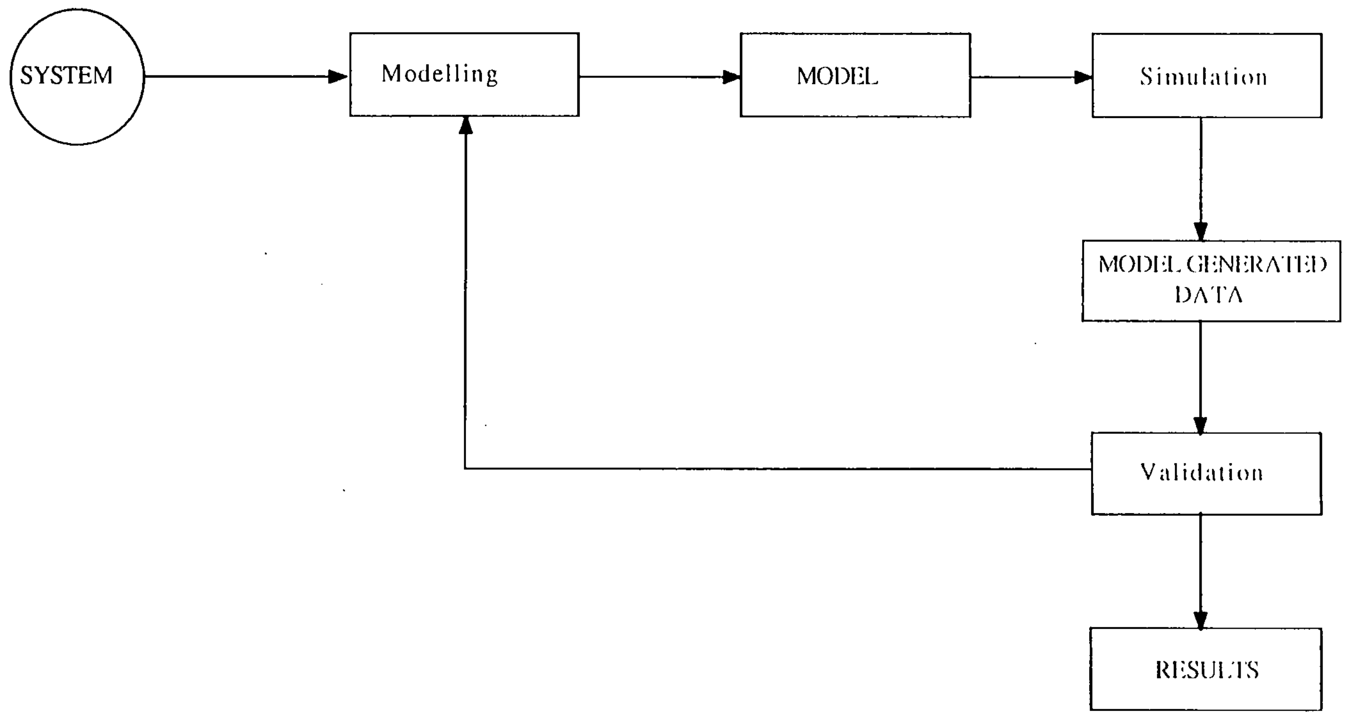


SOURCE : SIERENBERG & DE GANS BV

Seminar MARITIME TRAFFIC AND SIMULATION

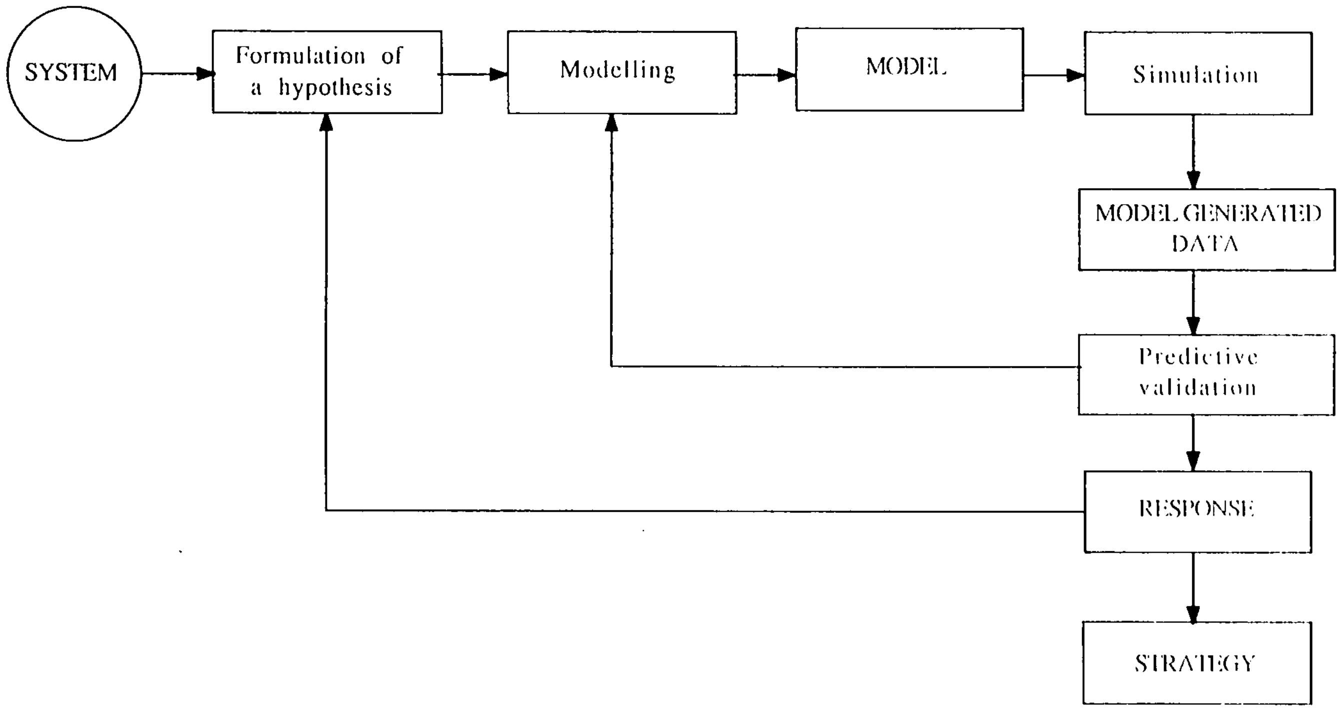


SOURCE : SIERENBERG & DE GANS BV



SOURCE : SIERENBERG & DE GANS BV

Seminar MARITIME TRAFFIC AND SIMULATION



SOURCE : SIERENBERG & DE GANS BV

COMPONENTS HAVE TO BE SPECIFIED BY ATTRIBUTES

COMPONENT	ATTRIBUTES
MACHINE	CAPACITY PRODUCTION SPEED DISTURBANCE RATE
STORE	CONTENTS OUTPUT

ATTRIBUTES HAVE VALUE'S THAT MAY CHANGE

* IN A DISCRETE WAY

* IN A CONTINUOUS WAY

SOURCE : SIERENBERG & DE GANS BV

Seminar MARITIME TRAFFIC AND SIMULATION

EACH MODEL CONSISTS OF TWO SECTIONS :

* DEFINITION SECTION :

SHOWS HOW THE MODEL IS COMPOSED

* DYNAMIC SECTION :

DESCRIBES THE DYNAMIC BEHAVIOUR OF THE COMPONENTS

SOURCE : SIERENBERG & DE GANS BV

R.T.I.S.

Role of inventories, surveys and interviews

1. Identification of participants

2. Inventory and characterisation of symptomatic/critical events for processing transit voyages,

3. Statistics on transit voyages and casualties,

4. Identification of resources involved for the processing of the symptomatic events,

5. Identification of major elements included in the estimation of w(T,P,e) and P(T,P,e),

6. Definition of categories of participants and of classes of transit voyages,

7. Evaluation of costs c(T,P) by categories and classes,

8. Estimation of balancing elements w(T,P,e) and p(T,P,e).

View 11

RESEARCH IN T.A.E.I. PROJECT

(EURET)

By Prof. C. GLANSDORP
(Marine Analytics - The Netherlands)

THE EURET 1.3. PROJECT: DESIGN AND ASSESSMENT OF VESSEL TRAFFIC MANAGEMENT SYSTEM: A PROJECT TO IMPROVE THE TOOLS TO ASSESS VTSs AND TO INCREASE THE EFFICIENCY OF VTS

by

C. C. Glansdorp, MSc, FRIN

CMO / Marine Analytics B.V.

1. Introduction

This paper summarizes the objectives and the structure of a European project (EURET 1.3) within the EURET transport research programme. The contract for this project was signed on 31/01/92. The completion of the project is planned in September 1994.

2. Background of the project

The present project is the result of co-operation of companies, institutes, authorities and consultancies of five Northern European countries. These entities are interested in some specific aspects of marine traffic management. A number of these entities has assessed the results of the COST 301 project and they thought it worthwhile to co-operate as soon as the EEC announced that project proposals could be submitted. The financial contribution of the EEC consists, generally, of 50 % of the real costs made during the execution of the project with a predefined maximum. Some universities are allowed to participate under the principle of marginal costs.
The workplan 1.3. "Design and assessment of a vessel traffic management system", as issued by DG VII of the EEC in Brussels, may be seen as an action originated on the basis of the recommendations of COST 301. Despite the progress made in recent years still many problems of maritime safety and expediency exist in the waters around North West Europe. A number of these problems is listed below:

(i) The operational benefits of some of the existing VTSs are not clear and some Administrations feel that there is room for improvement. The pressure of public opinion is very large when in a VTS covered area a collision or a stranding occurs when a considerable expenditure have been made for setting up a VTS in the area.

(ii) The VTS is seen in some countries as a tool to contribute to a balanced distribution of safety and expediency according to predetermined standards, when in national waters. VTS can be seen as regulating and affecting the safety level in a co-ordinating role of safety measures, which are, among others: pilotage, aids to navigation, surveillance and the like.

(iii) Special problems are becoming manifest in areas with low density of marine traffic. Basic services are necessary to ensure a regular flow of shipping under a variety of conditions. This will necessitate an optimum use of the resources (examples of these resources are pilots and ice-breakers required by ships in a difficult and icy archipelago) by some kind of resource management.

(iv) The services which are required by many seagoing vessels entering European ports are complex and expensive. One of the major services which is required, is the local expertise of the pilot in order to safely guide the vessel from the pilot station to its berth and vice versa. These services are expensive and the question is repeatedly asked, whether and if so, these services can be provided in another way. One solution to the problem might be that pilots render services to ships from a shore based position. Questions which are important are: to which ships shore based advice can be given and in what manner these services should be provided. In areas where already a VTS exists, the equipment of such a facility may be used for the transfer of the different information flows.

(v) The VTS training is still a point of large concern. The present situation in many European countries is that VTS operators are being trained on the job, sometimes with the provision of more general knowledge in a classical form. Some exceptions exist: a few countries in Western Europe do have their own training schemes, partly based on Vessel Traffic Service simulators and partly on classical group training. Many authorities in the field of maritime safety are still concerned about the effect of differences in approach of the training of VTS operators in different countries. It is generally thought that those differences will not make a VTS as efficient as it could be. It is thought by a number of participants in Northern Europe that a co-operation in the way of training of VTS operators, centralized in a small number of European training centres in a wide area network might considerably contribute to the safety of maritime traffic in European waters.

(vi) Contingency planning is an issue for the national authorities, if one looks to the planning of resources to abate oil spills and other chemical wastes due to vessel calamities. The present state of the art enables planning authorities to predict the consequences of disasters and to estimate the resources needed to abatement. Since a major catastrophe is a rare occurrence it might be possible to develop contingency plans on a regional basis rather than on a national basis.

These points have led to a discussion between representatives of some companies in the United Kingdom, Germany, France, Finland and the Netherlands to discuss in what way a contribution to solve these problems can be given and what role might be played by the EURET 1.3 project: "Design and assessment of a vessel traffic management system". Representatives of these companies have approached their administrations. Officials of Germany, France and the Netherlands have had a meeting about a co-operation. The common conclusion reached was that the project EURET 1.3 was a good opportunity to address a number of the problems listed above.
Consequently the Northern countries which were now being supported by the U. K. Ireland and Finland decided to concentrate on:

- improvement of assessment tools
- improvement on VTS operations
- explore "add-ons" on existing VTS (shore based pilotage, resource management, contingency planning, environmental surveillance)

- harmonize VTS training in Europe and explore the possibilities for a European training programme.
- improvements in the traffic management system's architecture (VTS-architecture).

3. Project management of the project

It was decided after consultation with the participants, that the programme management will be in the hands of the Foundation of the Co-ordination of the Maritime Research in the Netherlands (CMO). This Foundation has a long standing experience in the development, contracting and monitoring of projects within maritime research programmes. Especially the experience in financial control mechanisms is a valuable asset for the programme manager. No specific knowledge of maritime traffic management was available and CMO asked the present writer of this paper to act as the project manager of this project.

4. Co-operation with other EURET 1.3. projects

The present consortium is organized in such a way that it complies fully with a requirement for co-operation. The presence of Opéform as the project manager of the Southern Consortium for project EURET 1.3 will offer all opportunities required to harmonize tasks and to avoid overlapping.

5. Objectives and expected achievements of the project

The objectives of the project are:

"To increase the safety and efficiency of traffic flows in North West Europe by:

- improve the design tools which are available to assess the effects of VTS
- determine the suitability of VTS for new external functions as shore based pilotage, resource management and contingency planning
- improve the operational benefits to be reaped by improving the procedures in VTSs
- *assess the usefulness of new technology for application in a VTS*
- improve and harmonize existing training schemes for VTS operators
- collect, improve and determine basic traffic and casualty information as the basis for marine safety and expediency decision making as well as for the determination for the nuisances to the environment caused by vessels".

The results of the project can be characterized as innovative with regard to the methods which will become available as well as with respect to new hardware elements which might be integrated in future designs.
The results will be used to improve existing VTS, to improve the design of new VTS, to improve the training of VTS operators, to determine the right balance between safety systems and to assess the necessity to design a Regional Traffic Information System.

6. Description of the structure of the project

The relations between the main participants are given in the following table.

Country/Role	Name of institute / company
Co-ordinator	Foundation of the Co-ordination of the Maritime Research in the Netherlands (CMO)
National co-ordinators:	
Netherlands	Foundation of the Co-ordination of the Maritime Research in the Netherlands (CMO)
Germany	Forschungsstelle für die Seeschiffahrt (FSSH)
United Kingdom	British Maritime Technology (BMT)
France	Opéform (OPE)
Finland	National Technical Center Finland (VTT)

These 5 partners form the Group of National Co-ordinators (GNC). They are also the main contractors of the project. Each main contractor has contracts with its national companies and institutes, which are called in EEC jargon: associate contractors.

The national co-ordinators are primarily responsible for the financial and administrative flow of documents. These flows are mainly progress reports and cost statements.
The technical co-ordination is carried out by CMO in the Concertation Committee TAIE (CCT). The project co-ordinator deals primarily with contractual and financial issues. The project leader discusses problems on work level with the task leaders (TL) of the task groups (TG) and also discusses the quality and objectives of the deliverables, which are essentially the task reports.
For contractual issues the Group of Participating Organisations will be consulted.
Every semester the Project Steering Committee TAIE (PSCT) of the EEC will be informed and discussions will take place regarding the progress of the project.
Figure 1 shows the organization of the project.
The total amount of money which is involved in this project amounts to approximately 2.15 MECU.

The present project is organised in a number of themes. Each theme is organised in tasks. The themes and tasks may be described as follows.
Theme 0, "Basic research" consists of task 1: "Analysis of vessel traffic", task 2:"Institutional and regulatory context, task 3: "Methodology ".

In theme 0 the following companies and institutes are co-operating:

Netherlands:	Maritime Simulation Centre Netherlands (MSCN)
	Rotterdam Port Authority (GHR)
	Technical University Delft (TUD)

	Marine Analytics (MARAN)
United Kingdom:	British Maritime Technology (BMT)
	Eagle Lyon & Pope (ELP)
Germany:	Universität Wismar, Fachbereich Seefahrt (URFSF)
Ireland	Cork Regional Technical College (CRTC)
Finland:	National Technical Center Finland (VTT)

Task 1 is divided in 4 subtasks. These subtasks deal with traffic problems and casualties
Subtask 1.1: "European traffic databank" deals with a marine traffic model for the North Sea.
Subtask 1.2: "Historical data on local traffic" will attempt to collect more data regarding all types of vessels using the navigable space of which no information is available. The categories are work vessels, ferries, fishing vessels and pleasure craft.
Subtask 1.3: "Casualty Databank" will address the recurring problem of the collection of casualty data, the scope of this data the compatibility of the data and the potential use for it.
Subtask 1.4: "Casualties in a VTS" is a special extension of task 1.3. This task is partly originated by the deep public concern, when a casualty occurs in a VTS covered area and partly by the need to investigate the technical reasons for a casualty to happen. A detailed analysis might reveal potential conflicts within a VTS which has hampered the avoidance of such a casualty. This type of information is very important for a scrutiny of all procedures and external functions of a VTS.
Task 2 consists of an update of the existing inventory of VTSs in the North West European area with special emphasis on the present formal and informal ways of co-operation between VTSs. The context, legal as well as regulatory, is also a point of large concern and will be addressed in this task. All these data will be made available to task leaders of other tasks as soon as they are available. The content of this task coincides with the wording of the task in the workplan.
Task 3 is divided in three subtasks. These subtasks are all related to the first two paragraphs of task 2 in the workplan. In fact three major problems are scrutinized where a possible external functions of a VTS may impact on the safety and expediency of the traffic flow.
The first subtask (3.1) is a feasibility study into shore based pilotage and the role to be played by a VTS. Pilotage is an important function related to safety and efficiency of traffic flows in ports and port approaches. This function can be carried out as long as it possible to bring the pilot on board. This requires an infrastructure (the physical part of the pilotage organization) which can be affected by:

a) a shortage of personnel
b) adverse weather conditions

Under these last conditions, within certain limitations, remote piloting has been successfully used between the pilot boarding station (where the pilot

usually boards the ship) and a safe location where safe boarding is possible for the pilot (usually inside the breakwaters) and from where the vessel is being advised by a pilot in person.
The question arises whether, and if so, under which conditions and with which additional means, a shore based pilot would be able to conn a ship from the pilot station to a location near a berth, where the dock pilot takes over for the final docking and mooring manoeuvre. This process would be called Shore Based Piloting (SBP). In this process VTS equipment (or similar) may be used. However, SBP shall always function as a standard, routine-based, approach which should be technically and organisationally provided for by the pilotage organization and within an accepted safety standard. It may be expected that an important role for SBP may rapidly emerge
Subtask 3.2 addresses the problems of resource management. Resource management may be important in those cases where the resources are scarce and there is considerable difficulty in providing ships with these resources. Precise and timely traffic information may be an important factor for a sound resource management. The present task will focus on a coastal area with a low shipping density where vessels need resources to sail safely to their ports of destination. However each port will be interested in the benefits which may be reaped from precise and timely traffic information when it comes to allocation of resources and the results which may be obtained are of interest to the port officials.
Subtask 3.3 attempts to explore the contingency planning problems which might be originated as the result of a major catastrophe. These catastrophes are thought to be vessels sinking with a large number of passengers and crew with respect to rescue or major calamities with spills of pollutant substances. An information system with the position of the major technical resources (planes, vessels, pollution abatement equipment) would be helpful to plan all actions. Optimal stations for these technical resources may be found using simple simulation techniques on the basis of the traffic database, the casualty database and the major technical characteristics of the technical resources.
Task 3 in total is, consequently, an overview of what external functions of any existing VTS may be enhanced or what external functions may be supplemented when traffic information as well as information regarding technical resources will be available.

Theme I of the project: "Allocation of space and systematic use of navigation plans" consists of task 4: "Functional problems", task 5: "Functions of the system", task 6: "Methods of installation" and task 7: "Scenarios".

In theme I the following companies and institutes are co-operating:

Germany	Forschungsstelle für die Seeschiffahrt (FSSH)
	Systemgruppe Nord (STN)
	Universität Wismar, Fachbereich Seefahrt (URFSF)
United Kingdom	British Maritime Technology (BMT)
Finland	National Technical Center Finland (VTT)

Task 4 addresses the problems of a systematic description of the symptomatic events and attempts to characterize the parameters and variables which are important. If the events for a large number of "normal "navigational " situation have been listed, these situations may be classified to their potential of being affected by the intervention of the system. The results of this task will be used in task 5.
Task 5 consists of two major modules. The first module is the collision avoidance function of the system and it will concentrate on the symptomatic events that will trigger the system to intervene using a prediction tool. Such a tool should compare the present situation with a safe state of this situation, predict the development of the present situation and if deviations from a safe level are detected, to produce and assess a variety of solutions. The second module is oriented to stranding avoidance. This module reacts along the same lines as described in the preceding module.
Task 6 will concentrate on the method of installation by attempting to integrate the output of the modules for collision and stranding avoidance into a VTS system. An important issue is the use of an expert system which enhances the pattern recognition of symptomatic events which may lead to VTS intervention and to safe procedures for maritime safety planning. The information flows which are necessary are considered in detail.
Task 7 will carry out a scenario analysis of the proposed modules and their inclusion in a VTS by determining the operational benefits of the inclusion of these modules. In fact the present task will concentrate on the assessment given a number of carefully selected scenarios. The results of such a scenario analysis may indicate under which traffic conditions for a given complexity of the navigable space such modules are worthwhile to be considered in future traffic management systems.

Theme II of the project has been considered as an integral part. It is called "Transmission of information" It consists of task 8: "Functional problems", task 9: "Functions of the systems, task 10: "Methods of introduction", task 11: "Scenarios" and task 12: "Feasibility and costs"
In theme II the following companies and institutes are co-operating:

Germany	Institut für Seeverkehrswirtschaft und Logistik (ISL)
	Systemgruppe Nord (STN)
Netherlands	TNO Fysisch Electronisch Laboratorium (FEL)
	Hollandse Signaal Apparaten fabriek (SIGNAAL)

Task 8 addresses the question of the potential users and services offered by a VTS. These services are associated with the external functions of the VTS. The requirements for these external functions will be defined by the tasks described in Themes 0 and I and by results which may be found in literature, notably COST 301. When necessary, interviews will be held by potential users to cater for any other function left. The requirements will be elaborated by a structured analysis. This analysis will complete task 8 and will be the input for task 9.
Task 9 considers the external functions in more detail. The performance requirements for these functions will be identified. The external functions are supported and achieved by the system's internal functions. These internal

functions will be defined on this basis. To avoid overlaps in these internal functions a structural analysis should be performed enabling the generic requirements of the performance of the transmission systems to be precisely described. The analysis results (in the format of function packages) will be used as an input for tasks 10 and 12.
Task 10 studies the means of transmission flows of information in greater detail. Both, commercially available system as well as potential future systems will be identified and described in detail. The means of transmission are assessed with respect to their technical, operational and performance characteristics. The performance criteria derived from the study will be carefully compared with the performance of the transmission function packages and the results will be used as an input for task 12. It is to be remarked that the participating partners will work in parallel as to facilitate the integration of transmission of information in a total concept.
Task 11 defines a limited number of operational scenarios. This definition phase will be carried out in close co-operation with prospective users, decision makers and experts both nationally and internationally. (In this context, national means the national authorities of the participating countries). A limited amount of scenarios will be selected based on their relative importance for VTS applications. Each scenario should include an overview of the required external functions. These scenarios will be used in task 12.
Task 12 will produce preliminary system designs, with emphasis on the transmission of information part. Inputs to this task are the results of the tasks 9 (function packages), 10 (transmission of information) and 11 (scenarios). A generic framework is developed and this framework will be used as a toolbox for creating customized solutions, which may be tailored to the set of external functions which will be desired. Recommendations for further research to elaborate the preliminary designs are presented.

Theme III, called "Traffic Image" consists of two tasks. Task 13: "Scenarios" and Task 14: "Feasibility and Costs".
In theme III

Germany	Atlas Elektronik (ATLAS)

will be concerned.

Task 13 addresses the problem of the presentation of the traffic image to the VTS- operator in such a way that he is able to understand the traffic situation and can evaluate the information which is needed to make a decision. His workload should be reduced in acquiring the information so that he can concentrate on his main task. This task will also investigate the necessary hardware configurations which are needed to support the VTS operator.
Task 14 will address the problems of the information flows in more detail before making a final assessment of the presentation of the information. The costs of the hardware which is required to perform the required functions will be collected/estimated and a final assessment will be made of the potentialities of information presentation of the traffic information.
Theme IV will not be studied in this project, since it concerns a regional system. Consequently the tasks 15 through 19 according to the original project plan as issued by the EEC are not discussed.

Theme V "Operational procedures" consists of two tasks. Task 20: "Scenarios" and task 21: "Feasibility".

In theme V the following company will be involved,

Germany	Deutsche Aerospace (DASA)

Task 20 concentrates on the operational procedures on the basis of inputs from preceding themes especially theme 0, 1 and 2. the main activity is two devise a framework for the operational procedures on the basis of the identification of the symptomatic events and the way how the system will provide information to resolve the possible conflicts. This type of information should be put in fixed procedures and subsequent transmitted to the ship under the coverage of the system.
Task 21 will continue the work started in task 20 and detail the procedures which are devised within the framework. This task will conclude with an assessment of the operational procedures and recommendations will be made to separate procedures on a regional and local level.

Theme VI: "Training" consists of two tasks. Task 22 is called: "Scenarios" and task 23 is called: "Feasibility". This theme is of large importance when the present operational procedures are regarded. There is a need for European co-operation and the this theme addresses the present state of the art and provide the scenarios for a feasibility study for such a European co-operation.
The following companies are co-operating within this theme:

France	Opéform (OPE)
Netherlands	Rotterdam Port Authority (RPA)
Germany	Forschungstelle für Seeschiffahrt (FSSH)
United Kingdom	British Maritime Technology (BMT)
	Eagle, Lyon & Pope (ELP)
Finland	National Technical Center Finland (VTT)

Task 22 determines the scenario for the feasibility study on the basis of questionnaire with respect to a number of important parameters affecting training of VTS operators. The results of COST 301 will be used as a starting point. The collection of the information will be organized by using the international fora (IALA and IAPH). The results will be presented in a seminar or workshop organized on behalf of the EEC and an extensive discussion prior to approval of the scenario will take place with those officials responsible for the training of VTS operators.
Task 23 will formulate the objectives for an experimental training session and these training sessions will be held in three different European countries. The training material will be developed on the basis of the indications given in the questionnaire of the preceding task. The task will be concluded with an assessment of the results of the three experimental training sessions. The results of these tasks should be a contribution to the question whether or not harmonization of training will be possible and beneficial, the level required regarding policy, rules and regulations and the technical management to establish a European VTS training organization. The last important question would

be the methods and tools which should be applied on a European level to support the VTS training.
It is thought that such an approach will be very beneficial for the safety of maritime traffic in European waters and will contribute to the preservation of the environment.

Theme VII consists of three tasks interlinked with each other. These tasks are 24, 25 and 26. These tasks are called as follows. Task 24: "Evaluation of the operational benefits", Task 25: "Cost/Benefit Analysis" and Task 26: "Scenario compatibility checks".
The central question which will addressed is the assessment of the role of VTS. This role is important from a point of view of the administrations. Is VTS providing sufficient contributions to the safety and the efficiency of the traffic flows? How can the information flows on traffic be used to a good purpose?
This theme is devoted to strategical questions, which should be solved before starting to implement any system by an administration. The basic idea is that the efficiency of a safety system might be determined by its potential to avoid or to correct human errors in the navigation process made by the navigator. The tools developed in this Theme are not tools to be used in a direct operational context in association with an operational system and symptomatic to the traffic. It should use data in a statistical sense, which are acquired by the present VTS or port authorities regarding traffic, (such as volume of the traffic, characteristics of the vessels, arrival and departure times, delays), casualties (such as numbers, circumstances, causes, etc). These strategical questions are opposed to the problem of the day-to-day operations and the information which is required to perform satisfactorily.
In theme VII the following companies and institutes are co-operating:

Netherlands	Maritime Simulation Centre Netherlands (MSCN)
	Technical University Delft (TUD)
	Marine Analytics (MARAN)
France	Opéform (OPE)
United Kingdom	British Maritime Technology (BMT)
	Eagle, Lyon & Pope (ELP)
Finland	National Technical Center Finland (VTT)

Task 24 attempts to approach the problem from the navigator as the person deciding on the ship's courses and speeds to be followed, as affected by outside safety means. Two lines will be followed: the first line is an approach with task analysis to the activities of the navigator in order to describe what he is doing and what errors might be made. The second line is an approach with the aid of A(ccident) S(equence) P(recursor) M(ethod). The failure rates of navigators and the recovery rates (a failure made by the navigator, but an external system alerted the navigator in order to recover) are necessary to appraise the effect of external safety systems. This method is a part of Probabilistic Risk Analysis and the question is whether or not such a method can also be used in the maritime context, if the human factor plays a dominant role.

The results of the approaches will be assessed and if possible, the results will be integrated in a method to be used for the assessment of safety systems and VTS in particular. The potential use of the method will be demonstrated in two generic situations.
Task 25 will study the framework of the Cost/Benefit analysis and this framework should accommodate all the elements which play a role in each C/B analysis. Consequently this task depends heavily on preceding tasks, as tasks 1, 3 and 24. The basic idea is make a logical computing structure of the calculation of the benefits and the costs for a given safety (or traffic management system) and information system. The specification will be drafted for a PC based system.
Task 26 will address the problem of checks of compatibility of the measures and the design of safety components in different waterways, like port and approach situations as well as in coastal areas.
The three tasks mentioned should provide a sound basis for the assessment of the maritime safety and efficiency and in particular on the effect of VTS and the information which is needed to do so and the results may be a specification for an assessment system built for a PC.

Two tasks are remaining: Task 27 "Project management" and Task 28 "Drafting the final report".

The project management will be carried out by a project co-ordinator, assisted by a project manager and a financial controller and 4 national co-ordinators. They will manage the project, harmonize the tasks and trying to keep the time schedules. This team is called the Project Management Team (PMT). This team will be responsible for the progress reports to the EEC as well as the cost statements.

It was also decided.by the participants of the consortium that a concise reporting of the overall results of the tasks which were carried out, would largely contribute to the coherency of the project. Task 28 is designed to do exactly that. Apart from that, this final report will also contain a number of recommendations which can be used for the continuation of research in this field. In order to facilitate reading for decision makers it was decided that an executive summary would also be prepared.

7. Complementary of participating organizations.

The organizations which are involved in the project cover the total spectrum of those involved in the safety and expediency of maritime traffic:

- universities and institutes carrying out some basic and fundamental research on related issues (human error research, fundamental hardware features)
- consultancies which are using fundamental knowledge to advice their clients to solve traffic functional problems
- suppliers carrying out a system's approach of the hardware and software and supplying clients with equipment
- training facilities and simulator facilities to simulate the feasibility of solutions for the traffic functional problems
- the owners of traffic management systems (VTS): port authorities.

The national agencies of the five countries which are responsible for the safety of marine traffic in waters under their jurisdiction are co-operating in the background by supporting a number of tasks.

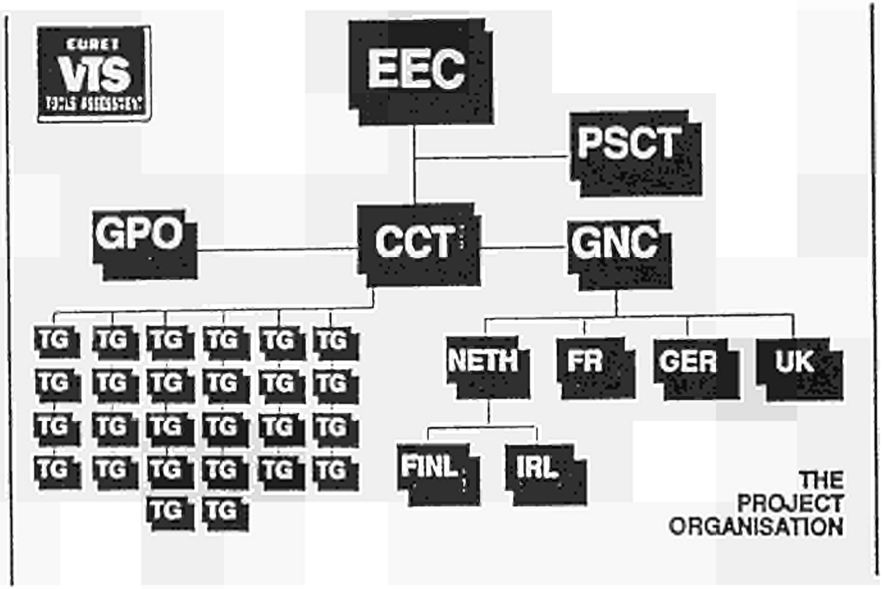
8. Progress made to date

The project officially started on Febr. 1st, 1992. The first reporting period was concluded on July 15th, 1992. The consolidated progress report for the EEC has been submitted. The conclusions regarding the first semester were that :

- the contract negotiations in some countries were tedious and took more time than expected. However these final negotiations were concluded in June of 1992 and from then on all scheduled tasks were under way.
- all taskleaders did not precisely understand the flow of documentation required by the EEC to monitor the progress of the project.

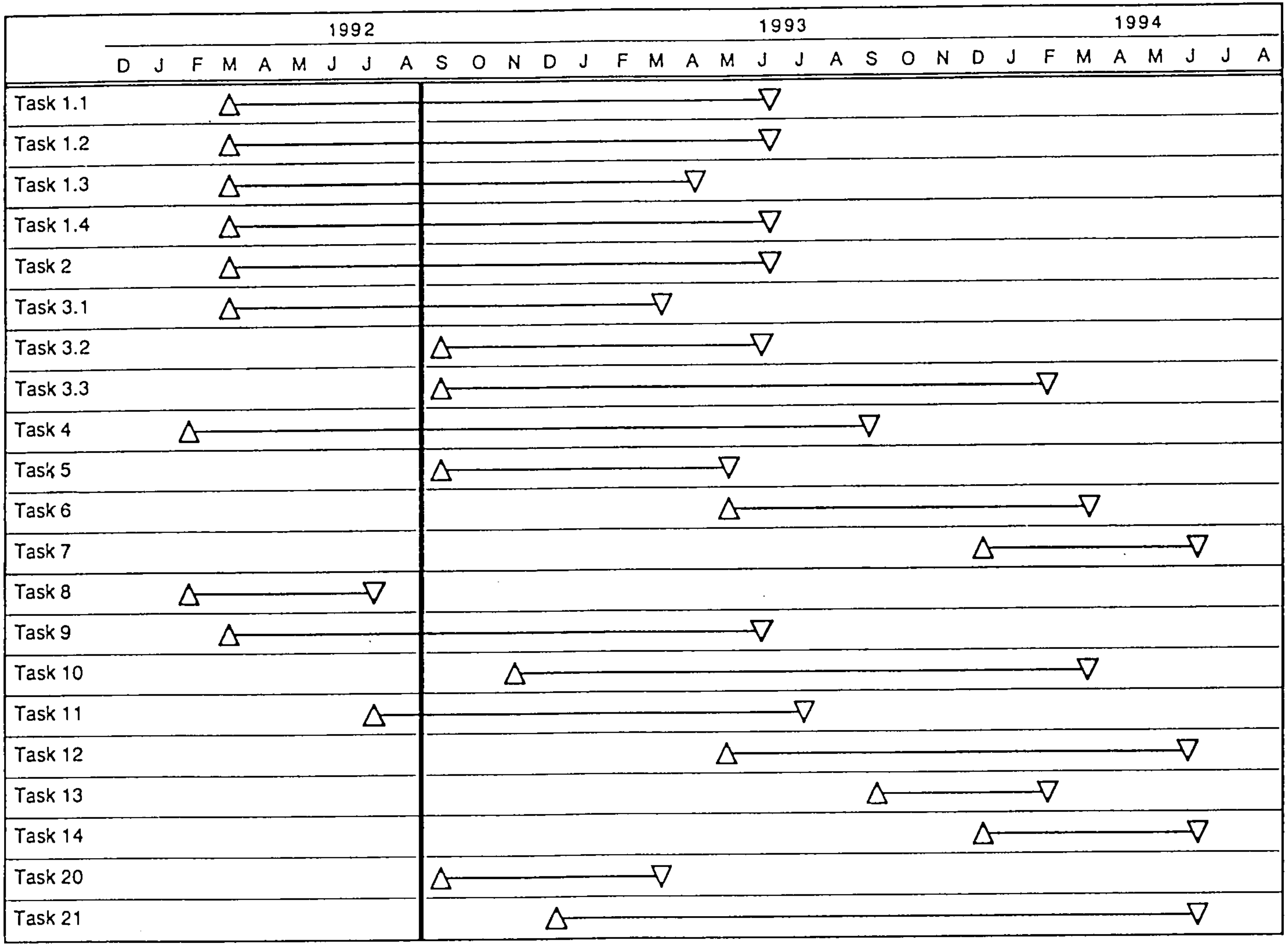
The delay that exists will probably be recovered in July 1993. Taskleaders were informed in October of this year of how they best can manage their tasks and in what way inputs and outputs could be structured. An improvement in the adherence to EEC procedures is expected in the semesters to come. Some results are being achieved, since the first technical workpackage and taskreports are starting to come in to be reviewed and discussed. However these reports do not allow a coherent picture of obtained results.

A discussion of the results of this projects should therefor wait for another occasion to be presented and discussed.



THE PROJECT ORGANISATION

Chart 2


1992
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D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A
Task 1.1
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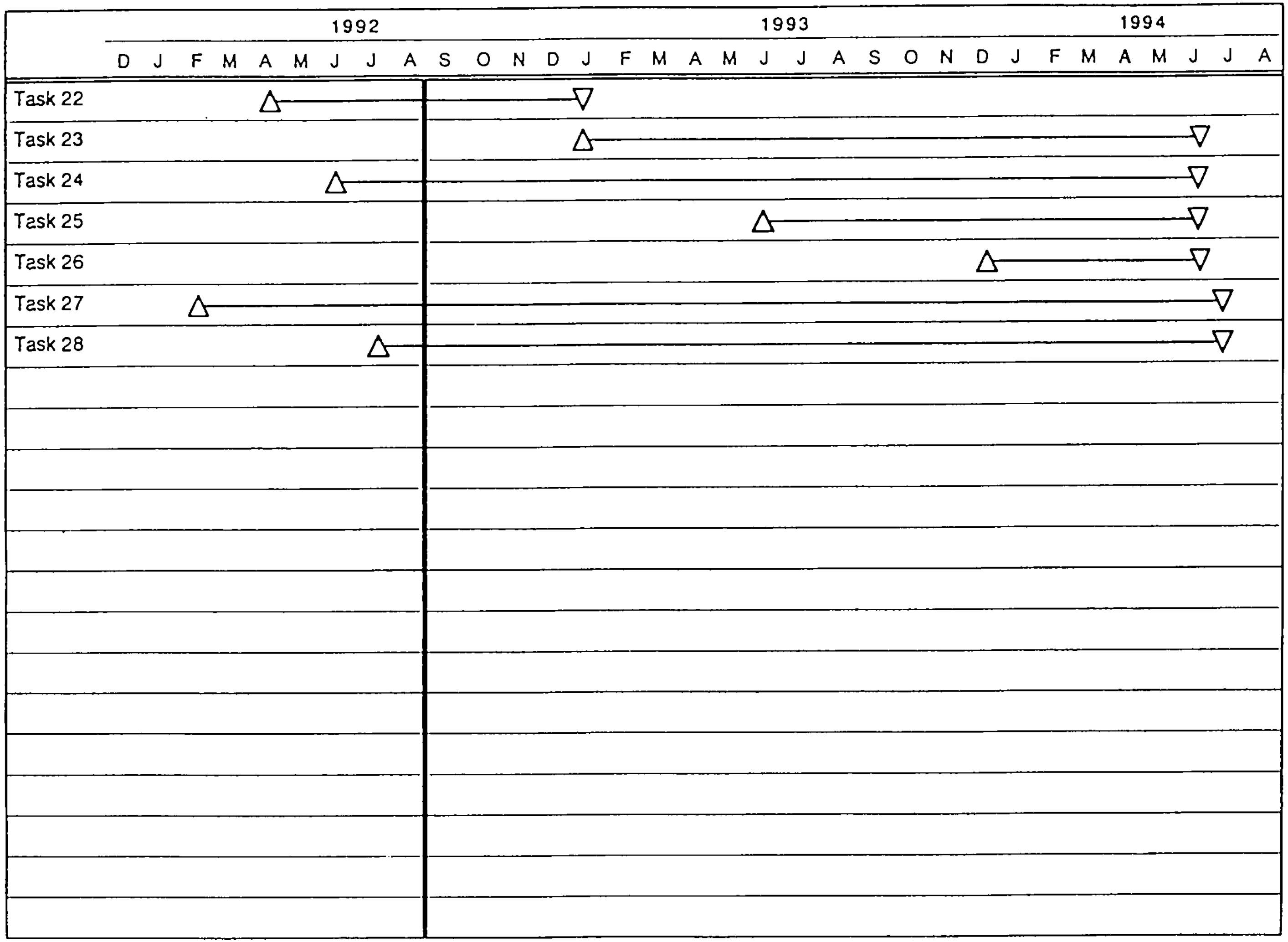
Task 21

CMO/Marine Analytics B.V.

Chart 2



3RD SESSION

SIMULATION WORLDWIDE

SUMMARY OF THE SESSION

By Prof. SUKSELAINEN
(VTT Ship Laboratory)

MARITIME TRAFFIC AND SIMULATION

Comments on the 3rd Session, Simulation Worldwide

Capt. J. Froese, SUSAN, Hamburg, presented his approach to simulator application in research and training. He stressed the importance of communication training in general and especially in VTS context. The necessary constructive attitude, which is crucial for safe ship operations, can according to him, never be achieved on simulator.

Capt. F. Weeks, Univ. of Plymouth, presented the relevant developments in the U.K. He emphasized the fact, that there is no central administration for the harbor-VTS, but they are completely independent. Presently there are 4 full-mission simulators in the country and a new VTS-simulator is receiving finishing touches in Southampton, BMT, Southampton Institute (Warshaw), and Plymouth Univ. are the most important simulation centres in U.K.

Mr H. Blaauw, MSCN, NL, presented his simulator centre, which is a joint effort of Marin and Delft Hydraulics. The number of technical staff is 27.

Capt. H. Högbom, Merchant Marine Academy, Kalmar, presented the Scandinavian developments of recent times. He mentioned, that Wallenius-personnel is trained in Kalmar. Other highlights were the constant radius navigation and the new Elsinore-Helsingborg ferries.

Capt. H.J. Crooks, IMSF, USA, presented US-practices as well as relevant philosophy on simulator training. He emphasized the need for quantitative methods to assess the increase of performance of trainees. He also underlined the usefulness of simulators when introducing new instrument on the bridge.

Mr S. Nakamura, Yusen Marine Science Inc., Tokyo, presented an interesting method to analyse the local collision risk. As example the choice of two altrnative gas tanker routes to Yokohama Harbour was studied. The collision danger was judged to be pronounced if the encounter frequency exceeds one in two minutes !

As conclusion it can be stated, that simulator training leads to improved skills and increased consistency of manouvers by the trainees. On the other hand there are no means availbale to train the attitude of students or to guarantee a target probability of safe passage in certain area.

As most important research targets were recorded :

- develoment of methods to assess safety levels by use of simulators,
- development of quantitative means to measure success of training.

SITUATION IN GERMANY

By Capt. FROESE
(Fachhochschule Hamburg)

MARINE SAFETY

all measures and conditions

minimizing

potential danger and harm

likely to be caused by operating vessels

to men, objects and environment

SUSAN Schiffsführungs- und Simulationsanlage	Marine Safety	Folie 2

Potential danger of shipping

does not exist permanently

and is not always obvious to the public

SAFETY MEASURES

* technical measures and provision

* organizational measures

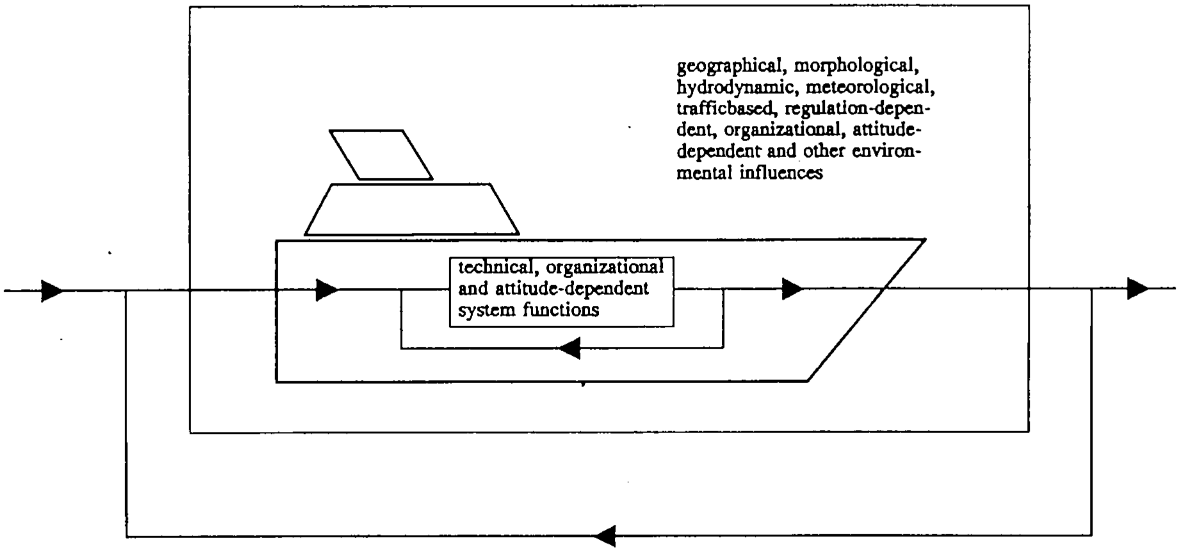
* behavioural measures

Principal factors that influence a vessel's passage and berthing

- ☐ Vessel Characteristics
- ☐ External Manoeuvring Aids
- ☐ Pilots
- ☐ Allocation of space and traffic
- ☐ Aids to Navigation
- ☐ Surveillance and control of traffic
- ☐ Weather
- ☐ Tide
- ☐ Time
- ☐ Jetty
- ☐ Disturbances

SUSAN Schiffsführungs- und Simulationsanlage	Principal factors	Folie 3

Man-Machine-Environment Model



SUSAN
Schiffsführungs- und Simulationsanlage

Man-Machine-Environment Model

Folie 9

SHIP SIMULATION

presents

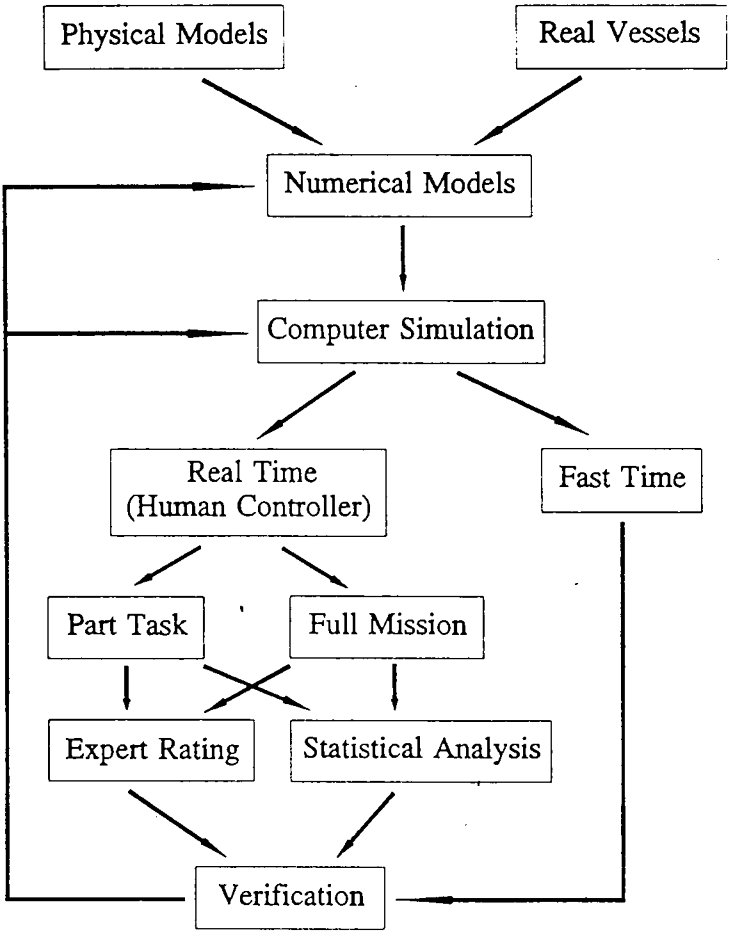
a powerful tool

to investigate

the

MAN-MACHINE-ENVIRONMENT SYSTEM

SUSAN Schiffsführungs- und Simulationsanlage	Ship Simulation	Folie 13



Ship Simulation

SUSAN Schiffsführungs- und Simulationsanlage	Ship Simulation	Datum: 14.02.1992 Bearbeiter: Froese/Schack

CLASSIFICATION OF SHIP SIMULATION

Non-interactive Simulation

Fast Time Simulation

a) Restricted to Physical Behaviour of Vessels

b) Including Auto-Pilot Model

Interactive Simulation

Physical Models steered by Human Beings

a) Remote controlled

b) Manned Models

Real Time Simulation

a) Part Task

b) Full Mission

Simulation Technique:

Which technical feature results in which impression of realism?

What minimum effort is required to fulfill which objective?

Simulation of the Man-Machine-Environment System "Ship and Port"

Advantages

- ☐ realization of all relevant conditions
- ☐ control of conditions
- ☐ reproduction of scenario
- ☐ evaluation of recorded results
- ☐ free of risk
- ☐ low cost

Simulation of the Man-Machine-Environment System "Ship and Port"

Disadvantages

- ☐ alertness of operator not necessarily the same as in reality
- ☐ workload, social and physical situation different from reality

SUSAN Schiffsführungs- und Simulationsanlage	Simulation of "Ship and Port"	Folie 2

Simulation of the Man-Machine-Environment System "Ship and Port"

Shortcomings

- ☐ accuracy of mathematical modelling
- ☐ visual systems
- ☐ evaluation tools and methods

Vessel Traffic Management System:

Observation

Information

Guidance of Ships

Hamburg	Vessel Traffic Management System	

Vessel Traffic Management System

- Allocation of decisions and responsiblity
- Optimum ship - shore communication
- Operational procedures
- Prediction of manoeuvres
- Application of ship **and** traffic simulation

Requirements of Training Simulation:

Knowledge of Operational Objectives

Meeting Future Requirements, too

Professional Trainers

Contributing to Quality Assurance

Improve conditions

before

they may lead to an incident!

DETECTION

of **weak areas** by

* analytical method

* casualty investigation

SUSAN Schiffsführungs- und Simulationsanlage	Detection of weak areas	

Special training

aiming at

improved operational skills

does not necessarily reduce

probability of casualties!

SUSAN Schiffsführungs- und Simulationsanlage

Operational Skills

Most important

TRAINING OBJECTIVES

to obtain marine safety

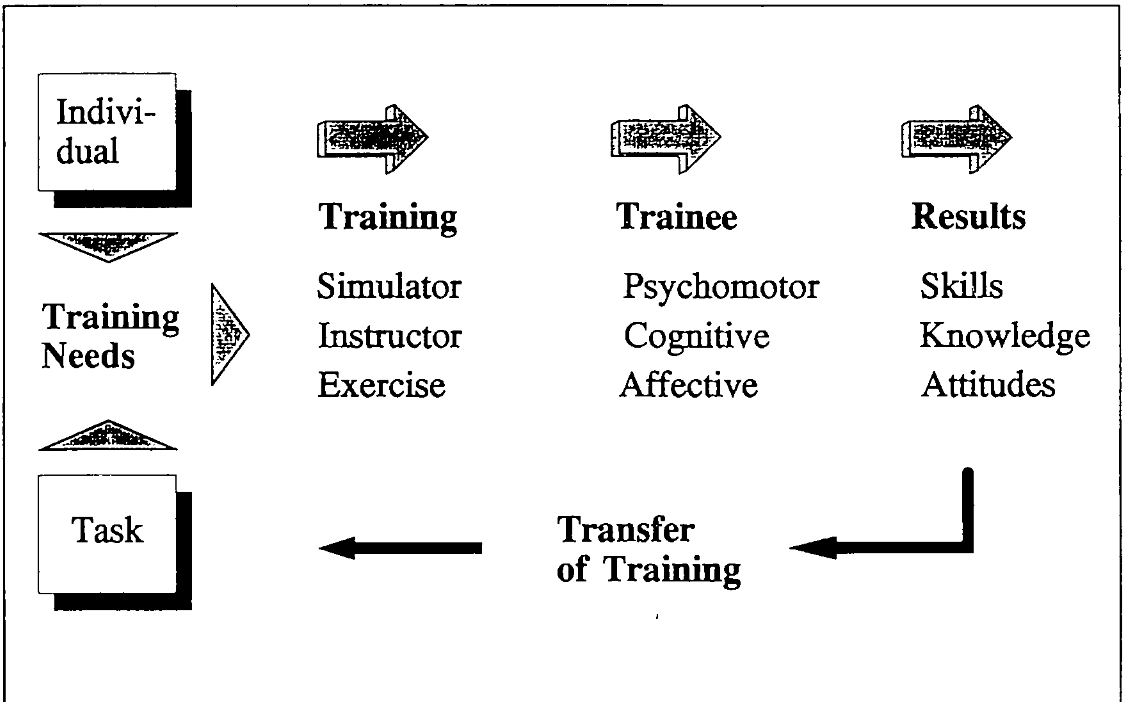
are

knowledge (of potential dangers)

and

attitudes

SUSAN Schiffsführungs- und Simulationsanlage	Training Objectives	



SUSAN Hamburg

Elements of Simulation Training

Maritime Simulation in Europe:

Concentracion of maritime training and research activities in Europe urgently required!

SUSAN Hamburg	Maritime Simulation in Europe	

Situation in the United Kingdom

By Captain WEEKS - University of Plymouth / United Kingdom.
(ABSTRACT)

Simulation Applied to Marine Traffic ; The U.K. Situation

The paper describes the many projects currently being carried in independent British research organizations and Universities.

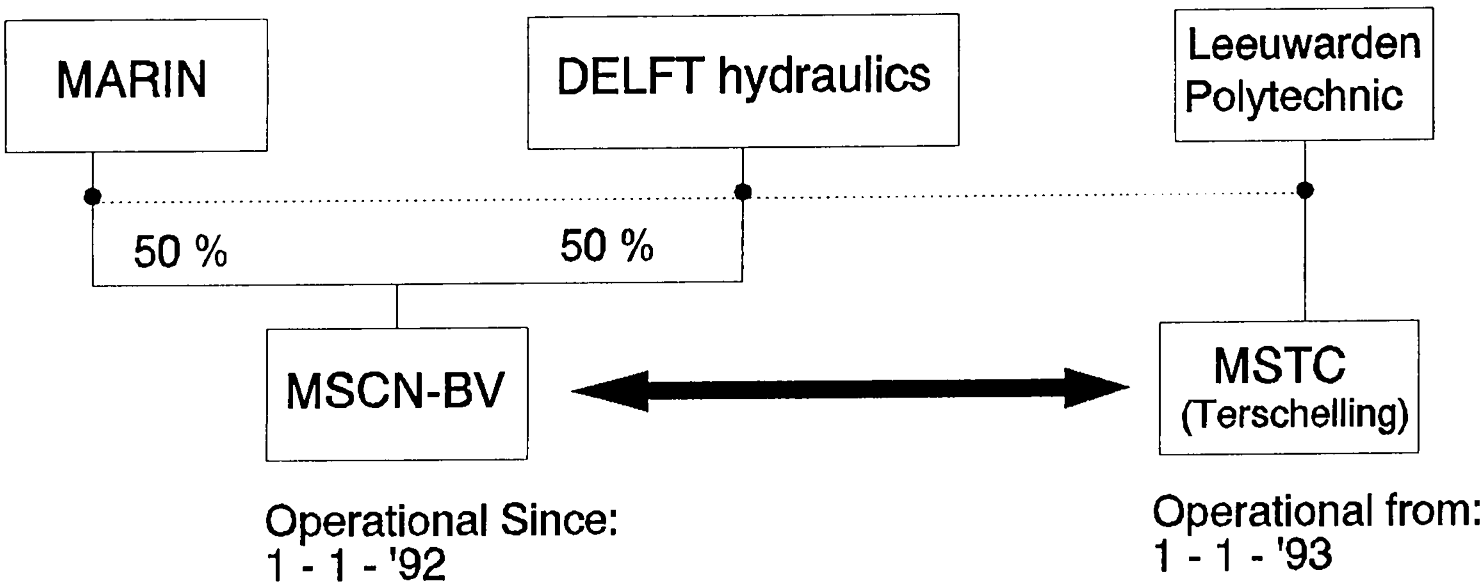
It shows how, despite the almost complete absence of British Government or other external official funding, the research establishments concerned continue to carry out projects which are in the forefront of Worl developments. These include developments in Physical Model testing, Time-Domain Simulaiton, Ship Handling Studies, Risk Analysis, traffic Surveillance analysis, Traffic Modelling, Collision Risk Prediction, Operating Schedule Optimiseation, and Port Marine Traffic Planner Concepts.

Within the University sector, it will show how British Higher Education establishments continue to make VTS orientated research contributions, despite a difficult financial climate.

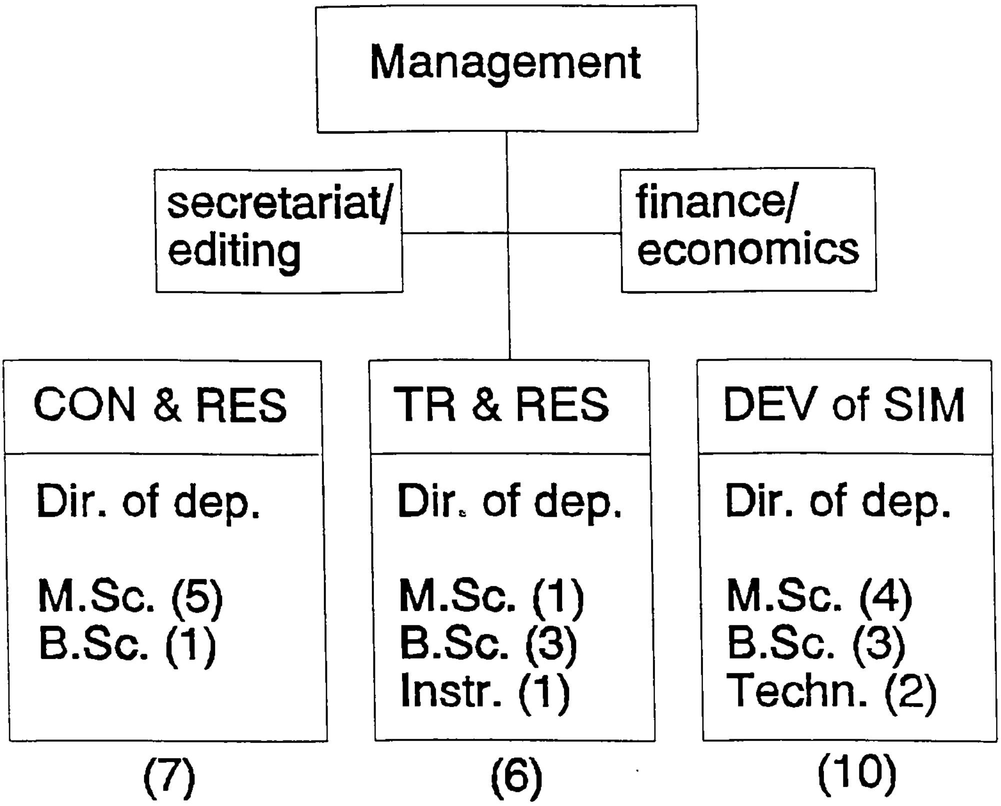
OPINION OF PERMANENT INTERNATIONAL ASSOCIATION AT NAVIGATION IN CONGRESSES

By H. BLAAUW
(Maritime Research Institute - Rotterdam)

INTRODUCTION



MSCN - ORGANISATION



M.Sc.	14	+ Naval architects
B.Sc.	7	+ Mathematicians
Others	6	+ Applied education technologists
	---	+ Civil engineers
	27	

MSTC: 1 director
6 instructors

CONSULTANCY AND RESEARCH

- i) Ship Design
- ii) Harbour and fairway design
- iii) Nautical Safety and Assessment

Strong Cooperation with:

i) MARIN

II) DELFT HYDRAULICS CONSULTANTS

DEVELOPMENT OF SIMULATORS

* Full mission (integrated) simulator system
  - manoeuvring
  - engine room
  - cargo handling

* Part-task simulators
  ^ functions engine room
  ^ aspects of manoeuvring
  ^ aspects of cargo handling

* Multi-media-teaching

Strong Cooperation with:

* Rietschoten & Houwens
* Radio Holland

Some examples of projects:

* Borgerhout (Belgium)
* Cedex (Spain)
* Leeuwarden Polytechnic (integrated simulator system)
* Royal Dutch Navy

TRAINING

* Technical training Professionals	→	Skill
	→	Procedures
	→	Familiarisation
* Non-technical training	→	Instructor
	→	Bridge Management
* Technical training Student	→	Skill

<u>Strong Cooperation with:</u>

KLM flight crew training centre / University of Twente

<u>Some examples of projects:</u>

* Passage Benelux Harbour	North Sea Ferries
* Port of Tauranga	Tauranga Port Auth.
* Ashdod	Ashdod Port Auth.
* Training Dutch Pilots	Neth. Pilot. Corpor.
* Training HAL	HAL
* Training VTS	NNVO

A. PROCEDURE TRAINING

- For: Professionals
  - Training of bridge procedures during complicated situations

* Modules:
  - Confined waters
  - Roads
  - Port approach

PROCEDURE TRAINING

A. • Nautical and Educational knowledge

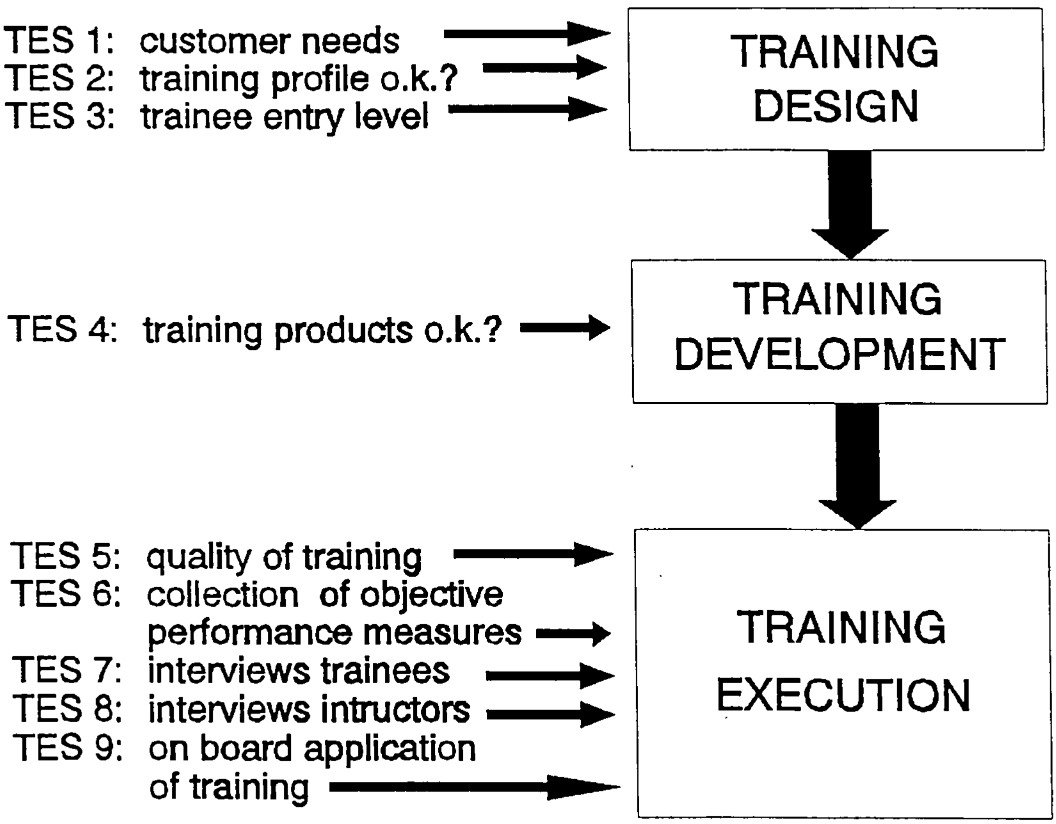
B. • Basic Training Modules

• Training Evaluation System (TES)

PROCEDURE TRAINING ON BASIS OF:

- Existing Basic Training Modules // TES
- New specific training modules // TES

Training on basis of MSCN-Basic Trianing Modules



WHAT IS TES?

= Collection of procedures and instruments in order to:

- obtain info on elements of training process

TO

optimize overall quality of training

By means of:

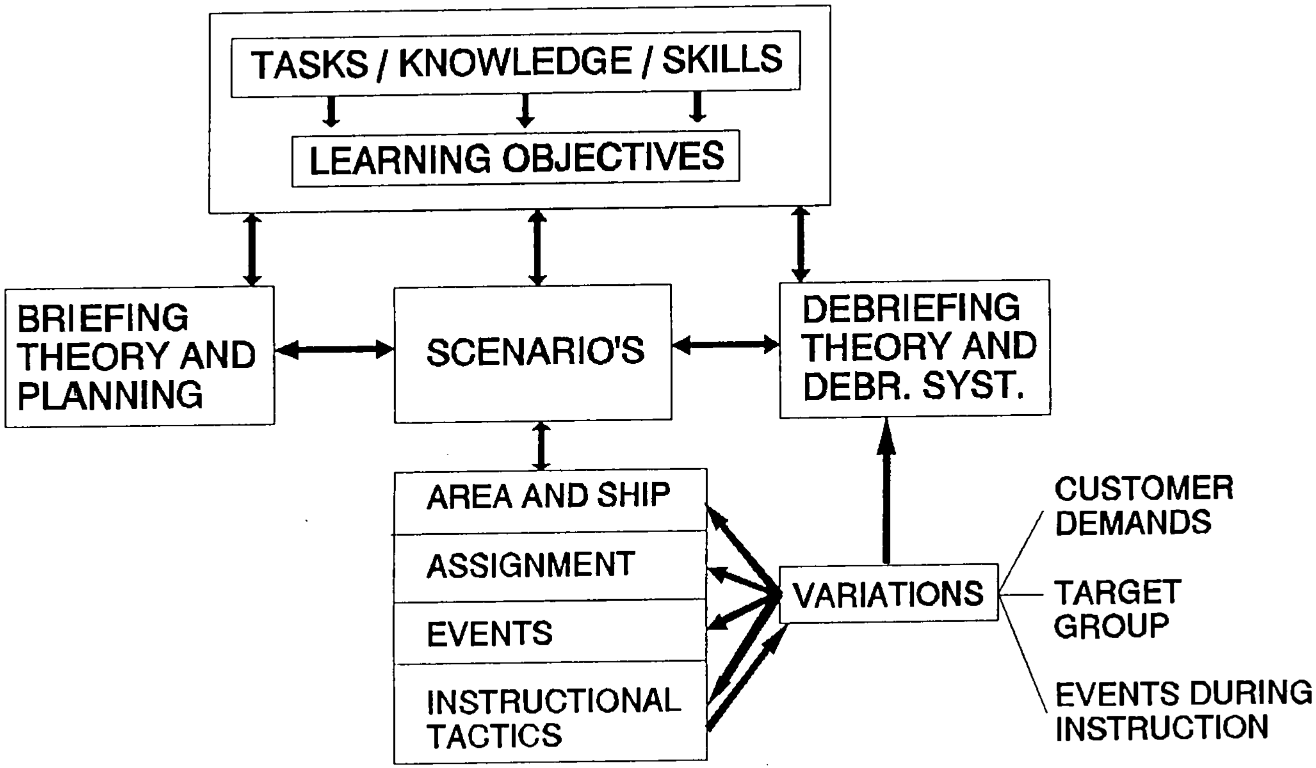
- questionnaires
- observations
- interviews
- simulator data analyses

FROM:

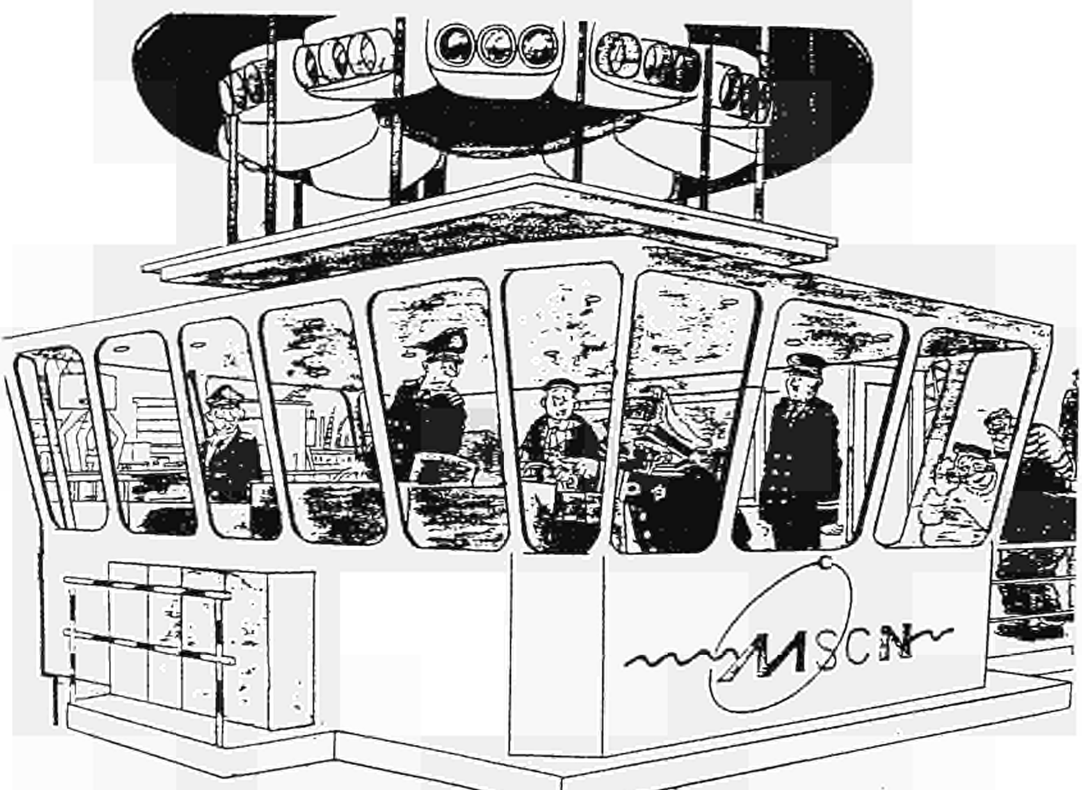
* The customer (TES 1, 3, 9)
* MSCN - training experts (TES 2, 4, 5)
* The instructor (TES 8)
* The trainees (TES 7)
* The simulator results (TES 6)

TRAINING MODULE

ESTABLISHED BASIS



MSCN BRIDGE MANAGEMENT TRAINING



B. BRIDGE MANAGEMENT TRAINING (cooperation KLM)

- For: Professionals

  - Create an effective and reliable bridge organisation with an optimal Problem Solving ability

* MODULES:
- Communication
- Motivating people
- Rational decision making
- Thinking under pressure
- Speaking-up
- Cultural, political and group differences
- Stress-management

Thinking under pressure:

Effects (time) pressure on human information processing is trained to enhance the quality of decisions involved.

Speaking-up:

Team members monitor the decision making processes.
Team members must dare to speak up to their superiors if so required.

Cultural political and group differences:

Impact of these differences on communication to avoid miscommunication.

Stress-management

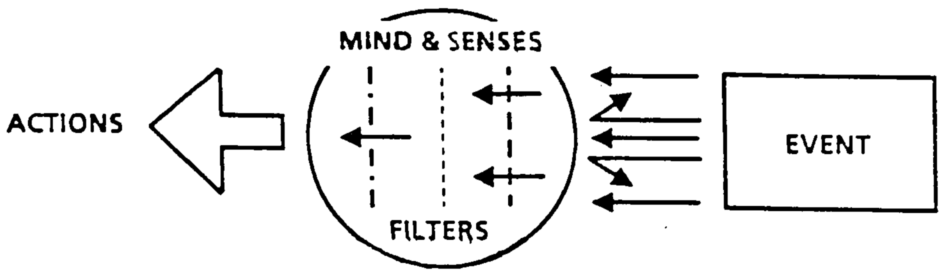
- Recognition of stress symptoms
- When detrimental, when functional
- Managing stress
- Reinforcement of immunity against stress

Duration:	5 days:	3 days:	BMT
		2 days:	practice on simulator

MSCN BRIDGE MANAGEMENT TRAINING

Communication:	Styles of communication and their effects on task performance
Motivating people:	Awareness how certain actions and communication styles affect work motivation

Rational Decision Making:



7 step method for Rational Decision Making (fact finding, distinguishing facts from assumptions, judgements, prejudices)

Situation in SCANDINAVIA

By B. HÖGBOM
(University of KALMAR-SWEDEN)

SEMINAR COST 311

MARITIME TRAFFIC AND SIMULATION

SITUATION IN SCANDINAVIA *

In the Scandinavian countries Denmark, Norway and Sweden there are at the moment a number of simulators suitable for training and research in the marine traffic field.

1. Denmark
   At the Danish Maritime Institute (DMI) in Lyngby in the northern part of Copenhagen DMI has a shiphandling simulator, which is very suitable for different research work on for instance fairway construction and port construction and for training of officers on different ship models and under different conditions.
   The DMI simulator has a 180° field of view, daylight or night.

   The two nautical colleges at Fanö and Svendborg have modern navigation simulators but no visual facilities.

2. Norway
   The Ship Manoeuvering Simulator Center (SMS) in Trondheim is a modern research and training simulator center. The simulator earlier belonged to the Trondheim Polytechnic but from 1990 it is ownmed by a group where Det Norske Veritas Classification AS, the Norwegian Shipowners, the Norwegian shipofficers Union, Norcontrol AS, Statoil and a group of shipowners may be mentioned.
   The simulator with 220° angle of view will be used for research work on shipboard management, human reactions, bridge procewdures (Veritas), tanker handling specially at Single Buoy Mooring (Statoil and others), high-speed craft handling and navigation in confined waters as well as other more normal training of officers.
   The Norwegian Shipping Authority has already accepted, that two weeks simulator training at SMS equals two months sea-going experience.

*
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Captain, consultant
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The Norwegian Nautical Colleges are well equipped with simulators. Nine colleges have the slightly older navigation simulators NavSim, three colleges have the more modern NMS-90 simulators and among them the colleges at Tönsberg and Haugesund are equipped with visual systems with 180° angle of view. Those two simulators will even be used for rersearch work and some more specialized training for instance high-speed craft handling.

3. Sweden
   At the Swedish Ship Research Institute in Gothenburg there is an older research simulator but this simulator is more seldom in use for modern research purposes.

   The two Swedish nautical colleges in Gothenburg and Kalmar ere equipped with NavSim simulators, about 15 years old.
   In Kalmar has a few weeks ago a new simulator been installed. It is a 5-own ship simulator with one cubicle equipped with a visual system with 135° angle of view and a further development of the NMS-90 navigation simulators.(fig.1)
   This new simulator has been planned in co-operation with Det Norske Veritas Classification AS and has a cock-pit lay-out in accordance with the recommendations for one-man operated bridge. This new simulator will be used not only for the normal students´training but even for advanced officers´and pilots´ training in navigation and shiphandling and for research on for instance fairway and port construction.

Simulator Projects

In the three Scandinavian countries some projects of special interest may be mentioned.

In Norway special interest is shown to navigation and handling of high-speed crafts.
In November 1990 one high-speed Sea Cat ran aground at high speed in very bad weather in a very narrow fairway on the Norwegian westcoast and a number of passengers were injured.

As a result the Norwegian Shipping Authorities immediately started an investigation in order to find out the special circumstanses around the accident and to take the necessary steps in order to avoid further accidents.
Consequently now always two officers shall be on the bridge during a passage, working in a pilot-copilot system, special safety instructions must be prepared, the crew must be specially trained for their duties, the navigation systems should be based on Differential GPS and maybe even digital charts should be used.

The propulsion system is completly different from the older ferries. Instead of the more normal 2 propellers. bowthruster and rudder the new ferry is equipped with four thrusters, one in each "corner" of the ferry. The ferry has no rudder or bow-thruster.
The four thrusters are normally connected via a computer to a joy-stick on the bridge. Under normal conditions the ferry is manoeuvered only with the joystick and a small knob for steering. The system is not new, it has been used on smaller ferries earlier in sheltered waters.
The big problem here is that in the Öresound between Helsingborg and Helsingör the ferries often encounter strong northerly or southerly wind and current, which makes the passage out and into the ports very tricky at times.

In harbour area "Positioning" the ship will move in the direction of the joy-stick without changing course.
The heading is controlled via the steering knop, which can be in either "manual" or in "automatic" mode. In manual mode the knob acts as a rudder-wheel, in automatic mode the knob determines the ships heading like an autopilot.

In open sea "Transit" mode is used in stead of "Positioning" mode. The joy-stick will only determine the ship´s speed. The heading is controlled as in harbour.

In different emergency situations other methods have to be used but they are not mentioned here.

This completely new shiphandling method is of course very different from the traditional methods, which all officers were used to. All officers for this new ferry had to learn to think and act in a different way.

SweFerry determined to organize a complete training programme for all officers, captains and chief officers, who should sail the new ferry.

The programme contained the following parts:

All officers were tested by psychologists,who normally are carrying out pilot-tests for the Scandinavian Airline System.

The officers passed a theory-course, dealing with the new systems and their functions.

All officers got a five-day simulator course at the Danish Maritime Institute´s shiphandling simulator, which was specially equipped and programmed for the new ferry and the two ports Helsingborg and Helsingör.
Four officers took part in the simulator-training each week.

Regarding the bridge procedures Cockpit Resource Management (CRM) from civil aviation should be carefully studied and integrated when applicable.
The officers should pass adequate simulator training.
As a result the SMS in Trondheim and the two simulators in Tönsberg and Haugesund are planning for adequate training programmes.
The very special circumstances with narrow fairways, fog, strong winds and often even snowstorm makes it necessary to give special training to the officers, serving in those high-speed vessels.

In Denmark among other projects a great number of training courses have been given at DMI to officer from container feeder-vessels, which usually have one-man operated bridges and special charasteristics.

In Sweden at the Kalmar College special interest has been given to "controlled navigation" with large vessels in narrow fairways. It is wellknown that the jumbo-ferries sailing between Stockholm in Sweden and Helsinki or Turko in Finland are navigating in very difficult fairways with small margins and tight scheaules.
On board those ferries, belonging to the Silja Line and the Viking Line special methods with very accurate navigation under all circumstances have been developed.
The jumbo ferries are 203 m long, 32 m wide and have a draught of about 7.0 m.(fig.2)
Using Differential GPS the position accuracy is now always better than 5 meter.
There are some very difficult passages, one of them is the passage through the Sveaborg islands just outside of Helsinki. But here the Finnish shiphandling simulator at the Ship Laboratory in Espoo has been used for training of the officers and for finding out how to make a safe passage.

One might belive that this very special navigation is only suitable for the jumbo-ferries, but not so.

<u>"Controlled navigation" training</u>

The ferries sailing between Sweden and Finland have developed a special and safe method of safe and "controlled navigation".(fig.3)

In short the method is based upon the use of very accurately preplanned routes, where every course and turn is preplanned and written down on the chart and stored in the computer-based navigation system.
Every alteration of course shall start at a predetermined position and the turning radius is predetermined.
If the vessel´s autopilot is equipped with constant radius facility this will of course make the turning easier but it is sufficient if the vessel is equipped with a rate of turn indicator as there is a simple relation between rate of turn, ship´s speed and radius of turn:

rate of turn = ship´s speed / radius

If for instance the speed is 10 knots and the rate of turn is $20^{o}/_{min}$ the radius will be 0.5 miles.

The alteration of course must be ordered a short distance before the turning circle starts due to the ship´s inertia and on a turning line (bearing) parallell to the new course.
During the course alteration the ship´s position can continously be checked, using the bearing line, parallell to the new course.

On the ferries the ship´s position is continously given by the DGPS and shown on the digital chart.

This method of "controlled navigation" which has only been explained very briefly here, can easily and with great advantage be used by all vessels in narrow fairways.
The only necessary instrument is a rate of turn indicator.

At the nautical college in Kalmar a number of simulator courses have been given to officers from both big car-carriers and [illegible] during the last five years.
The car-carriers, belonging to the Wallenius Company are visiting about 50 different ports all around the world and have now prepared the planning for most of them and have the planning stored on PC discs, available onboard all vessels.

The training areas used in Kalmar are usually the narrow fairways i the Gothenburg and the Stockholm archipelagoes and very often an experienced pilot, who himself is using the method, is assisting as simulator instructor.(fig.4a,b)

Training of ferry-officers.

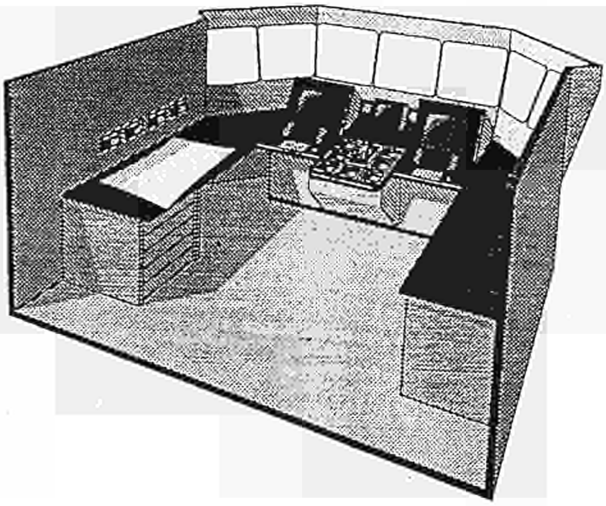
The Swedish ferry-operators SweFerry should take delivery of a new and very different ferry for their route between Helsingborg in Sweden across the Öresound to Helsingör in Denmark.
The older ferries were about 60 m in length but this new ferry is loa 110 m, breadth 28.2 m , draught 5.5 m, speed abt 15 knots.(fig 5)

During the simulator-training two instructors and one psychologist followed all exercises and presented debriefing after each exercise.
(Fig 6 shows the ferry entering Helsingör with 20 m/sec SE wind and 3 knots N-going current. Fig 7 shows the ferry entering Helsingör with 15 m/sec NW wind and 3 knots S-going current.)
When the ferry was delivered from the yard it was used for training purpose only during four weeks, 24 hours a day, before the ferry was put into regular traffic.

When the whole training programme was completed an evaluation was made and the experience and result was collected.

A general comment from the participating officers was that the simulatortraining, followed by the practical training before the ferry was put into traffic had given them very good confidence.

Kalmar
3 November 1992



SILJA SERENADE

Car- and passenger ferry built by Masa-Yards, Turku New Shipyard, for EffJohn Oy Ab, Helsinki. Trading for Silja Line on the route Helsinki-Stockholm.

Newbuilding No 1301

Delivered 15 November 1990

Class: Lloyd's Register of Shipping + 100 A 1, Passenger-Car Ferry, + LMC, UMS, Ice Class 1AS, 1WS, "Movable Decks". Finnish-Swedish Ice Class 1 A Super.

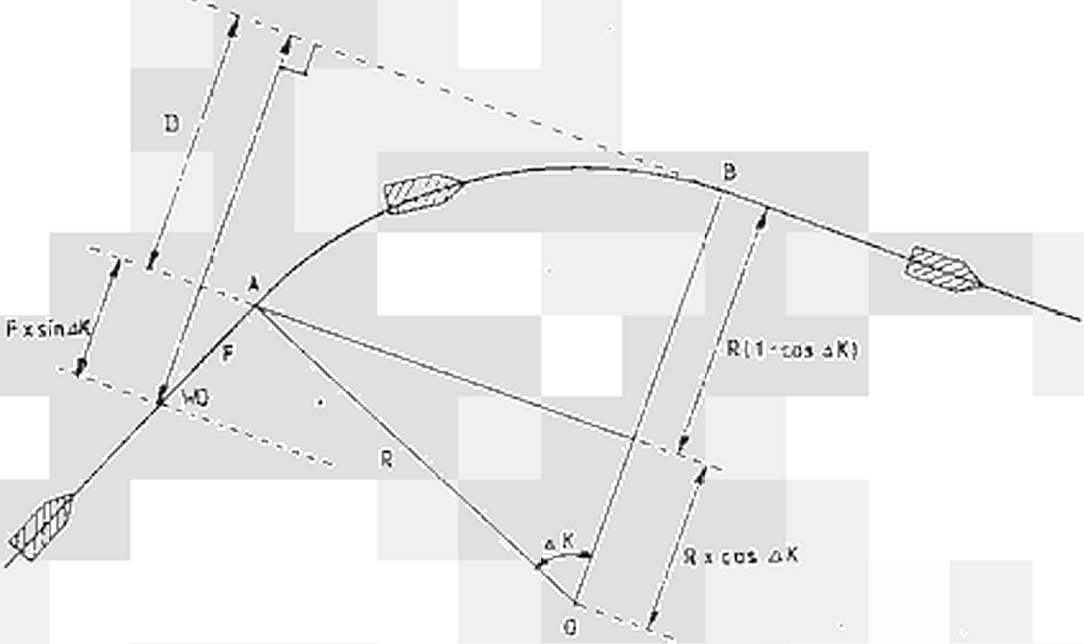
L.o.a.	203.0 m
L.p.p	180.7 m
Beam	31.5 m
Beam, extr.	35.8 m
Draught, design	6.8 m
Draught, max	7.1 m
GRT	58 376
NRT	35 961
DWT(DWL/max)	3 500 5 000
Passenger cap.	2 500
Cabins	952
Beds	2 614
Crew	264

Car deck capacity (lane m)

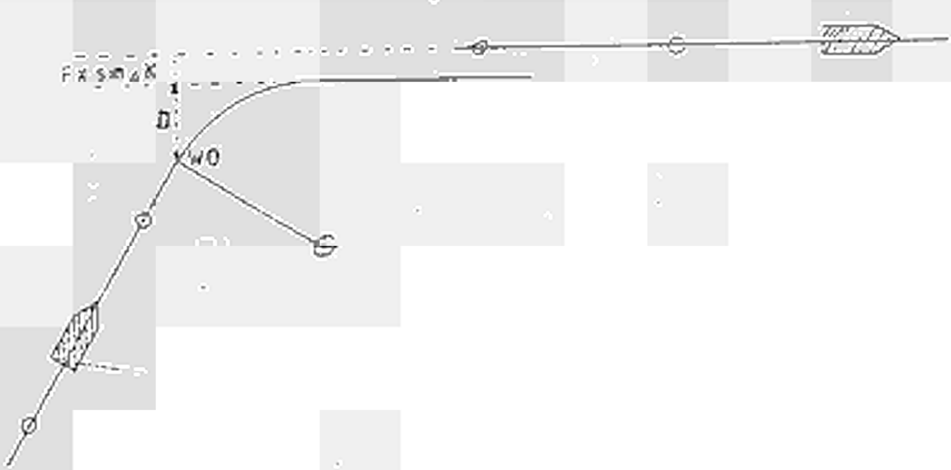
Trailer deck	950
Hoistable platforms	600
Garage	225

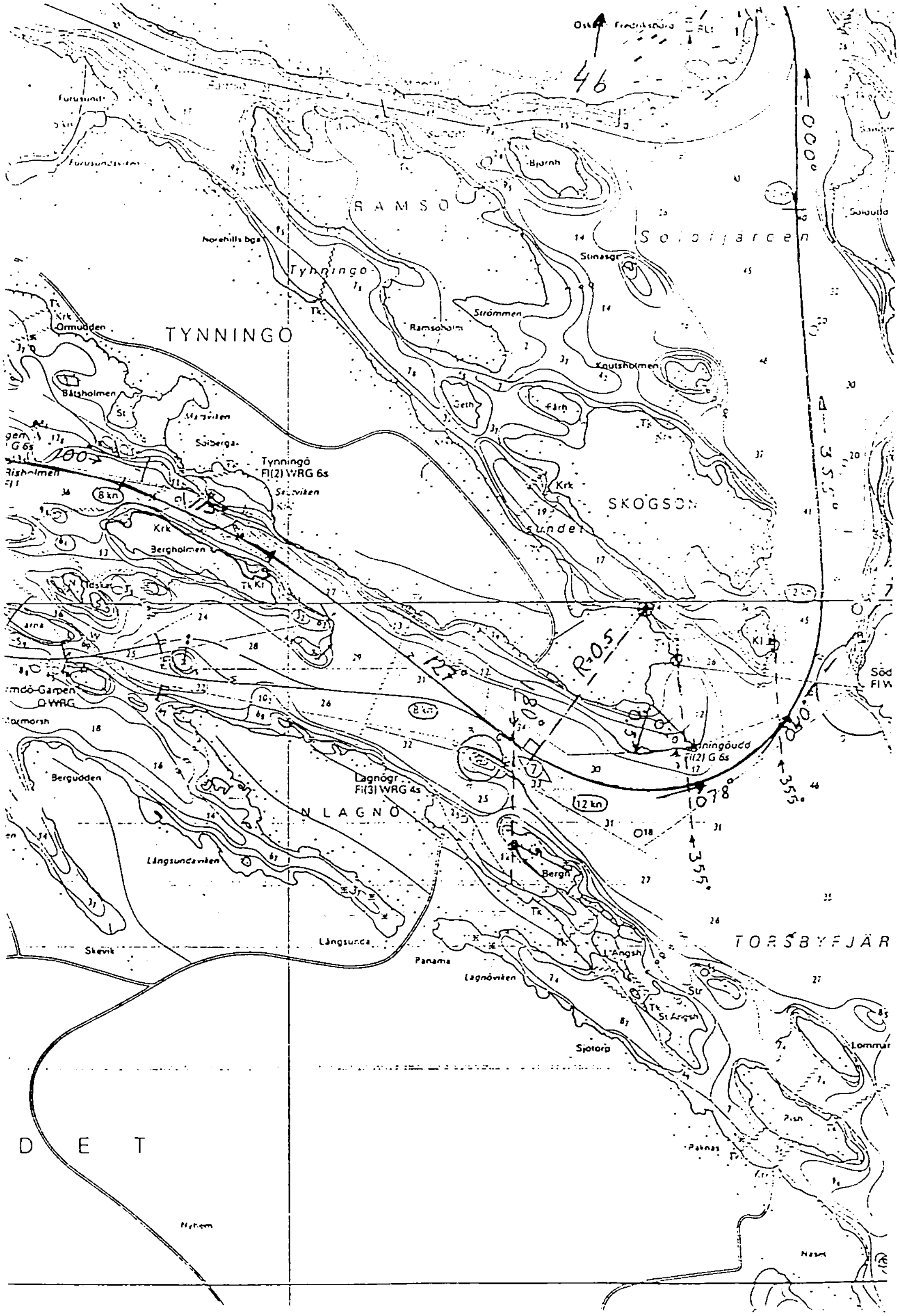
4 Wartsila Vasa 9R46

kW	8 145
at rpm	500
Speed (serv./max)	21 23 kn



F = advance





TYNNINGO
RAMSO
SKOGSÖN
Tynningö Fl(2) WRG 6s
Lagnögr Fl(3) WRG 4s
Bergholmen
Båtsholmen
Ramsoholm
Strömmen
Knutsholmen
Bergudden
Långsundsviken
Skevik
Långsunda
Panama
Lagnöviken
Sjotorp
Nyhem
Bjornh
Stinasgr
Solberga
Krk
Ormudden
TORSBYFJÄR
D E T
46
000°
355°
100°
127°
180°
078°
040°
R-0.5
8 kn
12 kn

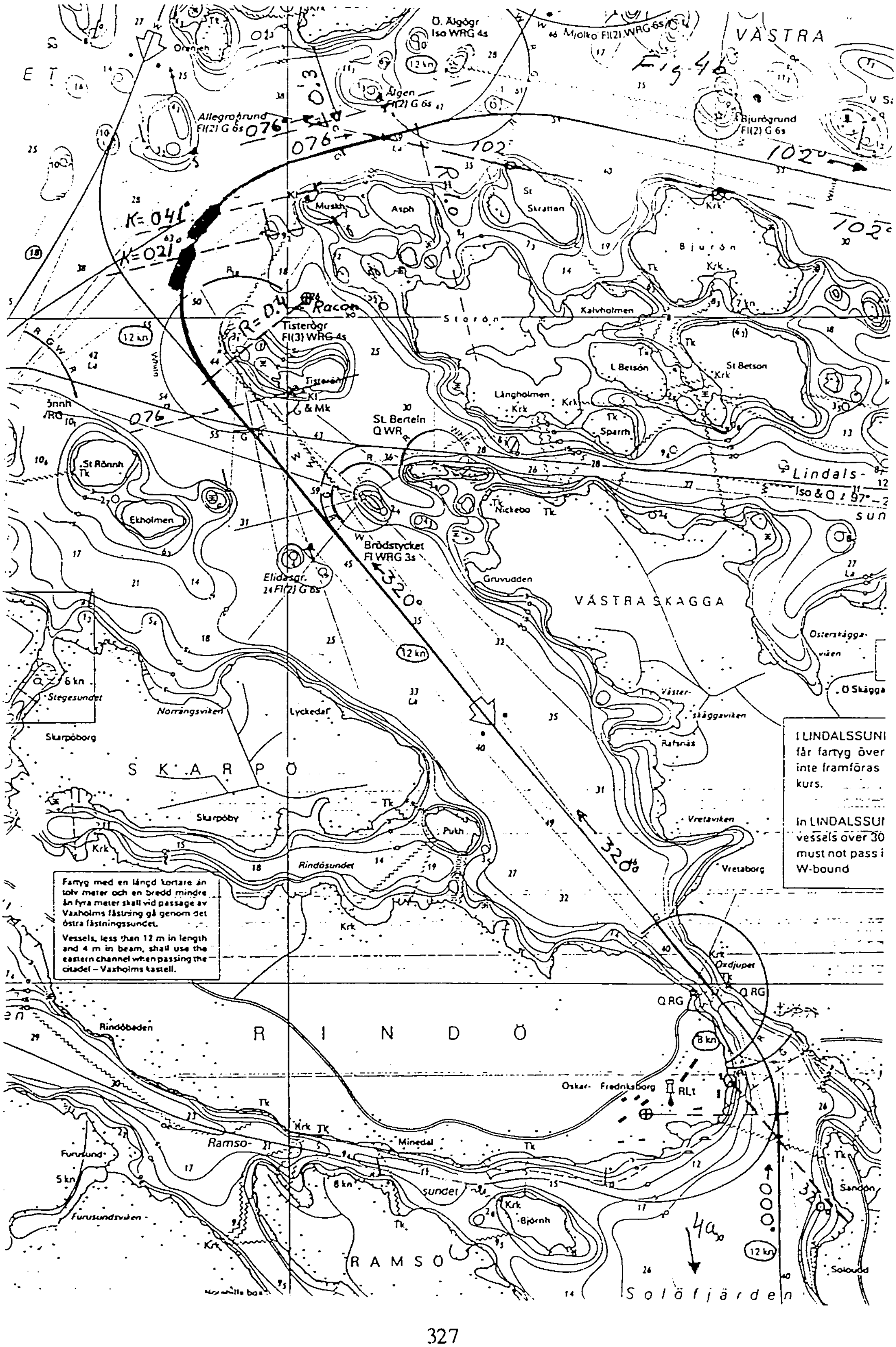
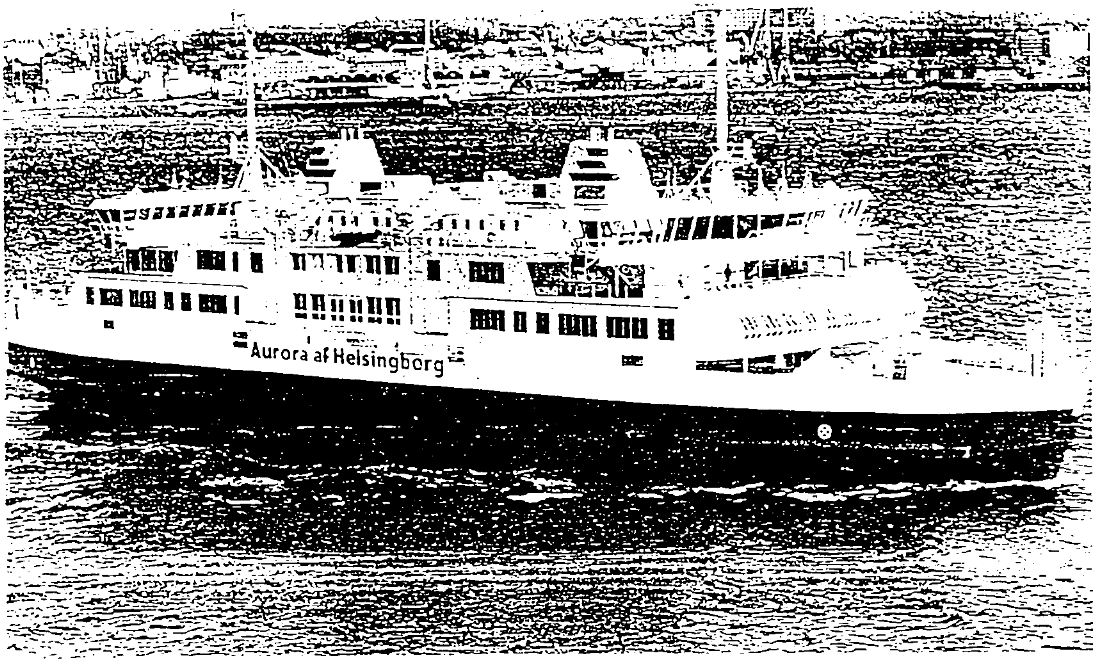
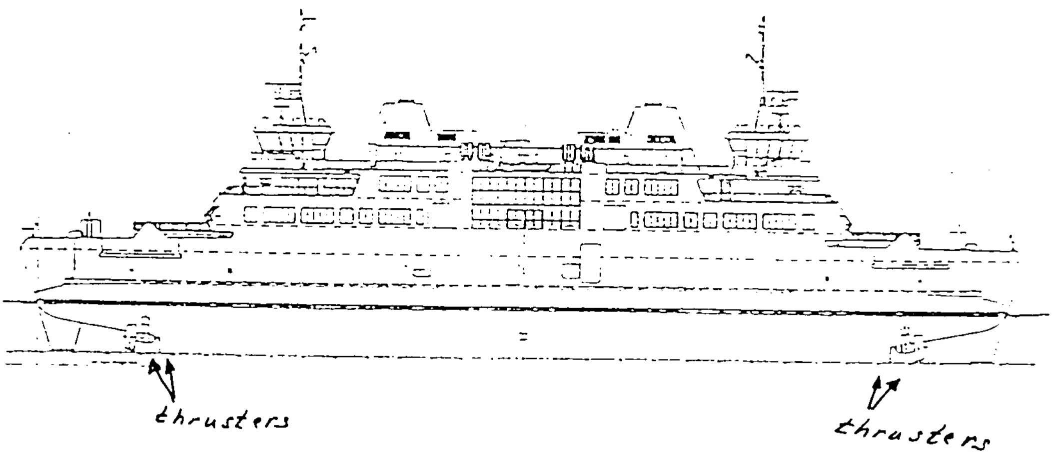


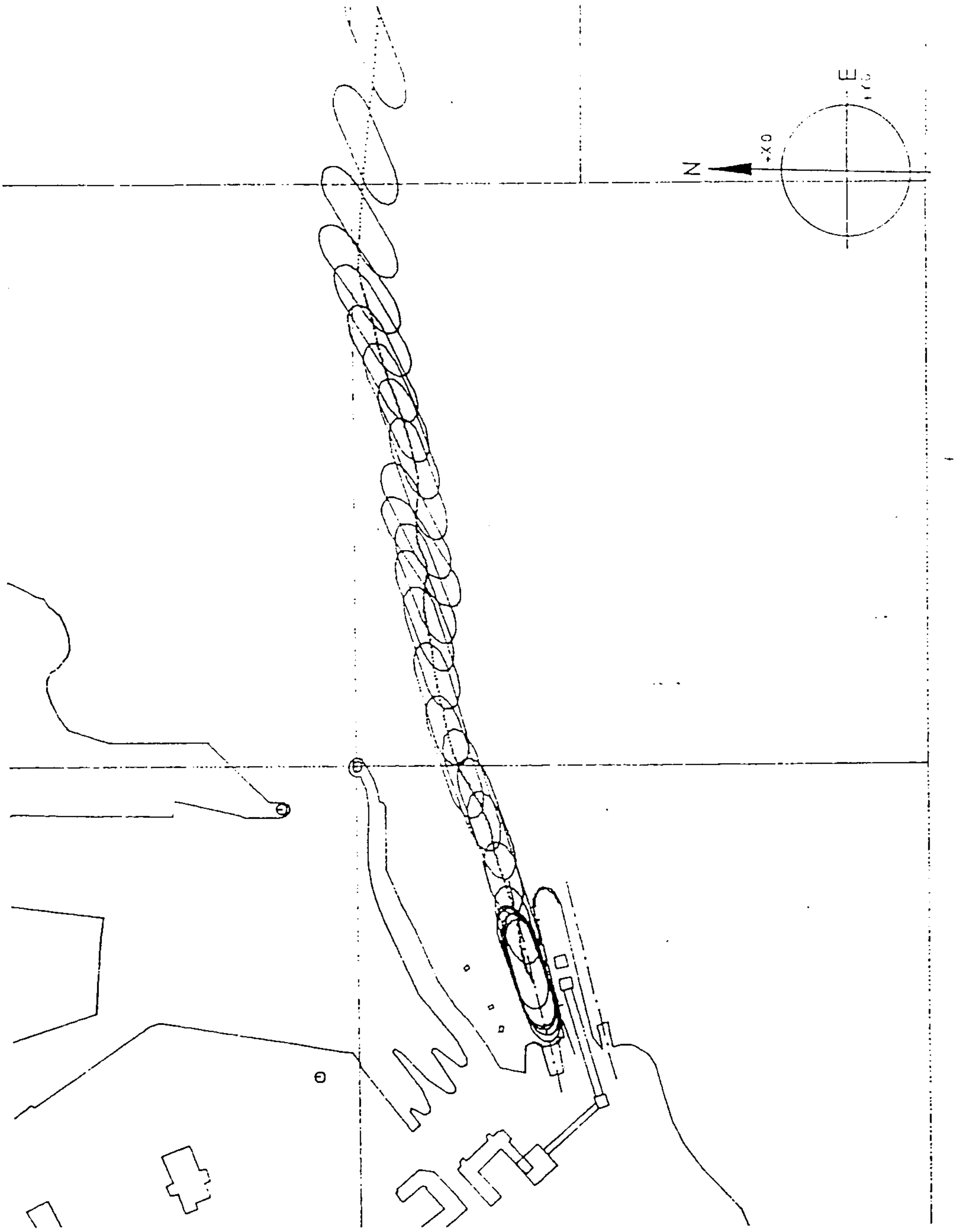
Fig. 4b
VÄSTRA
Ö. Älgögr Iso WRG 4s
Mjölkö Fl(2) WRG 6s
Älgen Fl(2) G 6s
Allegrundsgrund Fl(2) G 6s
Bjurögrund Fl(2) G 6s
076°
102°
K = 041
K = 021
R = 0.4
R = 0.3
Racon
Tisterögr Fl(3) WRG 4s
Muskö
Asph
St Skratten
Bjurön
Kalvholmen
Storön
L Betsön
St Betson
Långholmen
Sparrh
St. Berteln Q WR
Lindals-
Iso & Q
sun
St Rönnh
Ekholmen
Brödstycket Fl WRG 3s
Elidasgr. Fl(2) G 6s
Nickebo
Gruvudden
VÄSTRA SKAGGA
Österskägga-viken
Ö Skägga
Västerskäggaviken
Rafsnäs
Vretaviken
Vretaborg
320°
Stegesundet
Norrängsviken
Lyckedal
Skarpöborg
SKARPÖ
Skarpöby
Puth
Rindösundet
Oxdjupet
Q RG
RINDÖ
Rindöbaden
Oskar-Fredriksborg
RLt
Ramsösundet
Minedal
Furusund
Furusundsviken
Björnh
RAMSÖ
Sandön
Solöudd
Solöfjärden
4a
000°
Fartyg med en längd kortare än tolv meter och en bredd mindre än fyra meter skall vid passage av Vaxholms fästning gå genom det östra fästningssundet.
Vessels, less than 12 m in length and 4 m in beam, shall use the eastern channel when passing the citadel – Vaxholms kastell.
I LINDALSSUN
får fartyg över
inte framföras
kurs.
In LINDALSSUN
vessels over 30
must not pass i
W-bound


Aurora af Helsingborg


thrusters
thrusters

VIND HASTIGHED: 20 M/S wind VIND RETNING: SE

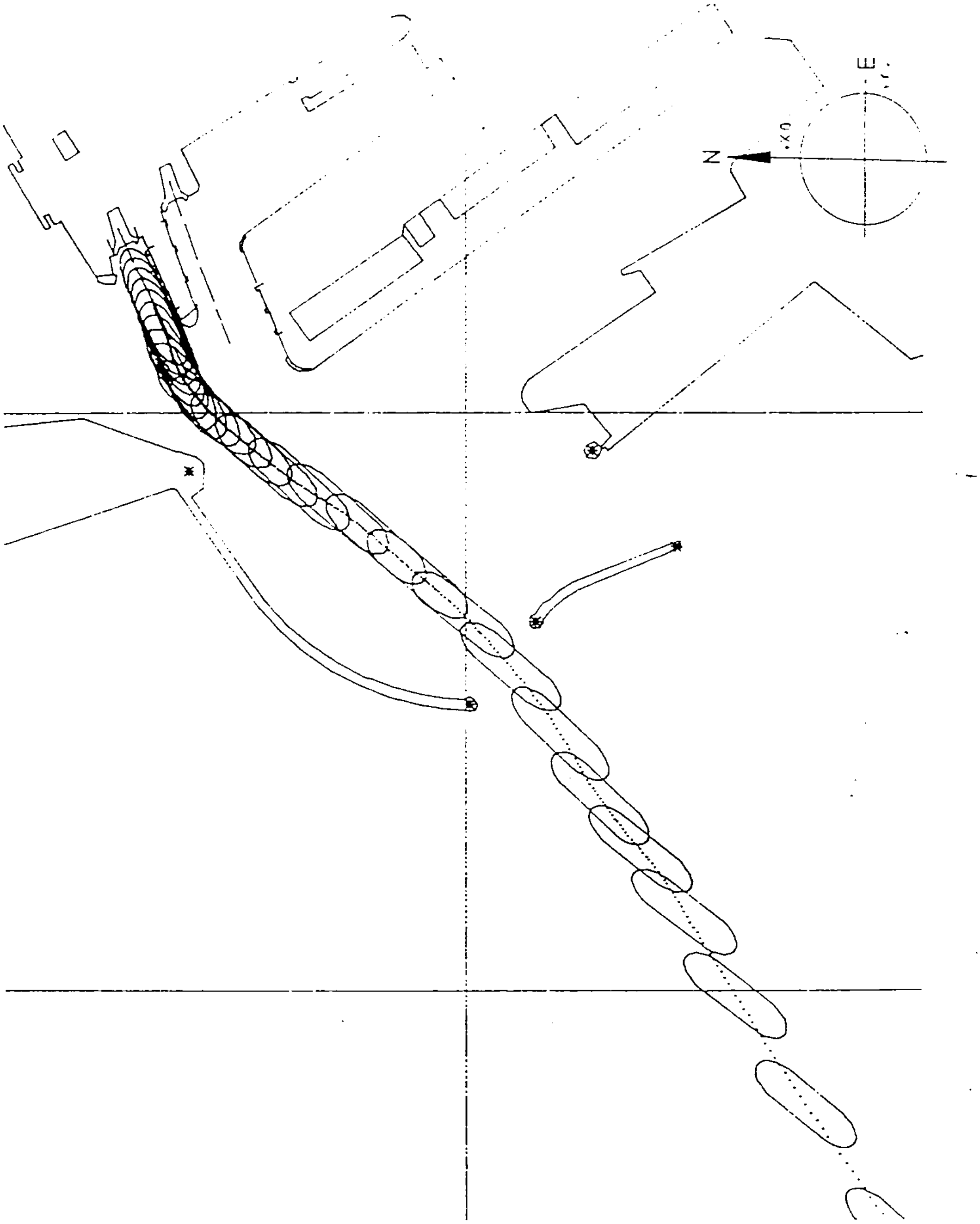
NOMINEL STRØM: 1.5 M/s = 3 knots current STRØMRETNING: N



SKIBSTEKNISK	SWEFERRY HELSINGØR HAVN	ORDRE SL- 91196
LABORATORIUM	HAVNEMODEL NO. 14	
LYNGBY DANMARK	SKIB 1242	LØB NR.

wind
VIND HASTIGHED: 15 M/S VIND RETNING: 315°

current
NOMINEL STROM: 1.5 = 3 knots STROMRETNING: S



SWEFERRY

SKIBSTEKNISK LABORATORIUM
LYNGBY DANMARK

ORDRE SL- 91196

HAVNEMODEL NO. 12

SKIB 1242

LØB NR.

SIMULATION WITHIN THE UNITED STATES

TRAINING AND RESEARCH

Captain Harry J. Crooks
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October, 1992

INTRODUCTION

In recent years, domestic and international concern regarding the safety of merchant vessels, crews, and types of cargoes has increased substantially. Increasing vessel size, expanding port facilities and an ever increasing list of environmentally dangerous products being shipped have drastically reduced the margins for error and set the stage for a potentially catastrophic situation. Recent events in the mideast drove home the demand for sea-born commerce; airplanes just can not carry the weights and volumes of goods needed. This rapidly changing sea going environment spotlights the potential applications of technology to the on-going training during the working life of the mariner.

Although these changes could have a vast impact on the economic well-being of the marine transportation industry, the decades of the 1970's and 1980's witnessed the development of potential mitigating measures such as simulation of the total man-ship-environment. Technology has made possible simulation of sufficient realism that it is now productively used in both applied research and problem solving as well as the training of operational personnel.

Examples of the technology available to the marine industry, with the ability to provide objective information regarding the many aspects on man-ship-environment interaction, are demonstrated at the various academies and training facilities through-out the United States. Integrated training and research facilities are designed to comprehensively address the broad range of problem solving, training and safety requirements which exist in the total marine transportation system. What makes this integrated approach unique to the United States is the underlying philosophy with which simulation training and research are approached and which we will discuss below briefly today.

The focal-points of these systems are the full-mission shiphandling, engineroom and radar/navigation simulators which provide realistic simulation of the total man-ship-environment.

(Appendix A provides a detailed list of the locations and capabilities of simulation within the United States.)

SIMULATOR SYSTEM COMPONENTS

In order to fully comprehend the scope of work to which simulation can be applied, one must take an in depth look into the system components which provide the realism. Later we will also integrate the rationale for simulation as a training and problem solving tool. Realistic simulation of the total man-ship-environment is a vital component in molding desirable behavior, for both maritime training, and in analyzing human operator behavior in research applications. Facilities with full-mission bridge, engineroom, and radar simulators provide this realism through a:

- Navigation Bridge - Full-scale, fully-equipped wheelhouse's (including radar) from which the mariner actively participates in the simulation.

- Engineroom - Complete engineroom including a control room, ballast simulator, electrical switch board, and generator room which can be operated independently or in conjunction with the shiphandling simulator.

- Radar/Navigational Trainer - Ownship control consoles which can be operated in conjunction with the shiphandling simulator to provide additional student operational input.

- Control Stations - Consoles from which simulator operators or instructors can start, monitor and terminate simulator exercises, as well as control other traffic ships, environmental conditions or ship system failures.

- Visual Scene - Visual screens that surround the bridge with up to a 360 degree panorama of full color Computer Generated Images (CGI) these images move in realtime displaying surrounding geographic features, cultural features, navigational aids and other traffic ships.

- Host Computers - Digital computers that generate the CGI visual scene and required radar PPI information, stimulate various repeaters/indicators on the bridge, engineroom and radar/navigational trainer, and control the motion of the vessel and traffic ships in accordance with their respective equations of motion.

- Classrooms - Various areas utilized by trainees and instructors for formal lectures, presentations of closed circuit TV audio/visual material, exercise planning, mission briefing, monitoring and post-exercise critiques.

- Monitoring Stations - Remote monitoring locations with capabilities which permit trainees to learn by observing the performance of others on the simulator. These stations include closed circuit TV, audio and visual monitoring, radar/PPI monitors, visual scene monitors, and communications equipment.

- Graphic Feedback Display - Large screen television or projection systems which can display a variety of computer graphics applications used in the playback of recorded exercise data to reinforce the on-bridge training. Ship control parameters, such as rudder angle and engine RPM, and the actual track of the simulated vessel, can be presented to trainees in graphic format for post-exercise critique of their individual performance.

When fully integrated, these simulators are uniquely capable of providing that feeling of "being at sea" through:

- total vessel management
- detailed day or night visual scene
- clear or reduced visibility effects
- variable wind and current
- up to a full 360 degree view
- bottom, channel, bank effects and forces
- simulation of assisting tugboat forces
- maneuvering vessel traffic
- twin screw/single screw configuration with fixed or controllable pitch propellers
- bow and stern thrusters
- full range of vessel control, navigation, engineering, and communication equipment and instruments
- engine control systems
- propulsion systems and auxiliaries
- general diesel operating procedures
- radar/restricted visibility navigation training

TRAINING PROGRAM DEVELOPMENT AND IMPLEMENTATION

Having discussed the "hardware" of the system it is important to elaborate on the conceptualization of simulation.

The United States maritime industry has made great advances in the area of training personnel with simulators. The critical link in obtaining effective results is the instructor. He must be fully aware of the various training methodologies available as well as the capabilities of the training device. It is the interaction between student, instructor, and technology that provides for a coherent training system. Instructor's are provided with an instructional model by which a training course can be planned and executed. This approach can aid in planning when and how to use this training device, along with other training aids and methodologies (classroom lecture, problem solving, exercise feedback, etc) in an effective mixture so that the goal of successfully upgrading of important skills and knowledge is attained. It also helps in determining which tasks and training objectives are best taught with the aid of a simulator, and which tasks and objectives are better left to other methods.

The underlying philosophy for training of officers in the maritime community is based on achieving competence through experience. With the advances in simulation, simulation can provide meaningful experienced based training. Such a coherent training system can be incorporated into a training model from which training courses can be planned and executed.

The United States Coast Guard requires that deck and engineering officers attain a given level of skill and knowledge in a variety of areas and tasks. An upgrade in license requires an increase in knowledge and skill in these and additional areas.

As new technology introduces new machinery, different ship and bridge designs, different shiphandling characteristics, etc., it typically becomes necessary to add to or modify, the tasks or requirements of senior and junior grade personnel. When these new or modified tasks are not being handled by existing training courses, the approach is to first determine whether or not a need for formal instruction exists, or whether on-the-job (OJT) training is sufficient. Then the impact of changes in the job requirements on existing instructional systems must be determined.

The training model defines:

- who is to be taught
- what instruction is required
- what methods are to be used to provide instruction
- what resources are needed

The type and amount of instruction may differ depending upon whether the training is for novice deck/engineering personnel, experienced junior officers, or experienced masters/chief engineers, or pilots. In program development, the instructor must consider who is to be trained, their present level of expertise, and how much they should know before even entering the training program. This last point, entry level knowledge, is an important factor. Any training, and particularly simulator training is costly.

The sequence of training and the specifics of course and test/evaluation content must be determined. This will provide a guide for the development of new lecture and textual material, training scenarios, exercises and evaluations. After this step, simulation exercises are designed that will meet the training goals.

The most important aspect of the training plan and courses is that they be predicated on the present needs of the industry. As new requirements or equipment arise, which may require operational instruction, new training objectives must be incorporated into the existing courses and programs to reflect these changes.

One extremely important consideration which must be kept in mind during training program development is the ability to measure the effectiveness of the training after it has been completed. The overall objective of training is to improve the level of performance of a set of skills and procedures; thus methods for measuring this improvement should be incorporated into the program.

Once the methods of quantifying performance and criterion levels are established, evaluating program effectiveness involves determining whether trainees perform noticeably closer to criterion after training than they did before. A pre-test/post-test format is the most direct way of accomplishing this comparison and generally consists of a comprehensive scenario, incorporating all of the skill tasks to be trained, through which trainees "sail" prior to training and again afterward. While the post-test is ultimately important in determining the final level of performance of the trainees, the pre-test is necessary in evaluating the training program itself. Without pre-testing, it could not be determined whether final performance was a result of training, or whether the trainees possessed certain abilities beforehand. Whereas the training scenarios will tend to isolate certain skills and incorporate training aids or progressively more difficult problems, the test scenarios will be a real-world situation requiring many skills to be performed together. This scenario, although adding somewhat to the length of the curriculum, need not be inordinately costly or time consuming.

Finally, those areas of the program in which improvement has not been demonstrated can be revised. Each training procedure thus is directed toward the establishment of certain behaviors at certain skill levels. If post-test scenarios are not acceptable levels of performance, the training procedure should be examined to determine whether it actually performs its intended function. It may be, for example, that the feedback does not provide the trainee with the appropriate information, or that the information is not in an understandable format. Using valuative techniques, the training curriculum can constantly be revised and updated to provide the most efficient instruction possible.

RESEARCH PROGRAM DEVELOPMENT AND IMPLEMENTATION

The vessel research focus utilizing of these systems within the United States is on the effective use of both technology and manpower to assure safe and efficient vessel operations. While such research may begin with an assessment of the technology - of navigation, of shiphandling, of propulsion systems - it must always include the mariner before its conclusion. Thus, research is always founded on examining and improving the man-ship-environment as an integrated system.

Automatic collision avoidance systems, electronic charts (associated with global positioning systems), and automated enginerooms are illustrative of these potential applications of technology. While these all have clear application potentials and offer reasonable cost/benefit trade-offs, their implementation raises two issues of concern in the maritime environment which may be addressed through research studies.

The first issue is the placement of the new instrument or instruments on the bridge or in the engineroom. While weight, size, and cable length probably must be considered in such placement, the relationship between current and new instruments may be of greater significance. This is, how should the instruments be positioned so that they complement rather than contradict the current employed technology e.g. an ARPA/CAS radar placed "away from" the standard radar may be ignored.

The second issue of such technological innovations concerns the impact they may (or may not) have on the management of operating systems aboard the vessel. It is not uncommon that mariners ignore such new instruments. Such additions to the work space may be poorly understood, may be perceived as potential job threats or simply confuse the pattern of "information scanning". They may also dramatically impact the organization or team structure of the vessel's work group.

These man-in-the-loop issues must be addressed concurrently with the issues of placement. Research thus can provide the ship owner or instrument manufacturer with alternative recommendations for instrument placement, instrument use, and/or training in instrument management and use that is ergonomically maximized.

The nature of maritime employment has been characterized as "hours of boredom interspersed with moments of terror" (excitement may be substituted). A current challenge in marine operations is to understand the relationships between boredom, fatigue, stress, loneliness, and physical/mental effort. These relationships are often noted as "contributing factors" in maritime accident investigations. The measures of workload and the establishment of bench-marks for these elements of the maritime environment are part of the research effort.

An approach to such issues concerns the vessel organization and its contribution to accidents or near-misses. Research questions involve the nature of the coordination-communication-integration processes of the vessel-team, bridge-team, and engineroom-team. Thus, there appears a correlation between organizational structures and accident prevention.

The advances in technology may also be contributors to lessened vessel safety and efficiency. Automated vessel positioning or engineroom functions limit the required expenditure of energy (physical and mental) on the part of watchstanders, officers or skilled assistants. Such "low workloads" <u>may</u> eventually be deemed as potentially dangerous as "high workloads". There is some research into near-misses which suggests that vessel organization may be an effective means to reduce the potential of accidents caused by either extreme.

The second research focus is on the nature of the port and the waterway and their effect on safe vessel operations. These efforts are of three kinds: port models, operating models, and risk analysis.

The demands on ports and waterways continue to change with new developments and concepts of intermodal transportation, efficiencies of operations and demands for waterway access by other users. Clearly, the current direction in port development is for either a single focused effort (i.e., petroleum) or for highly integrated mixed-use. Access for truck, rail, and even aircraft and the rapid, automated handling of cargo are the keys to port success in the 1990's. Simulation facilities, using their electronic data-base and shiphandling simulation, are able to model an entire port with these interactive elements. Such port models include physical (natural) characteristics, cultural (man-made) characteristics, and waterway (channel, bank, and navigation) characteristics.

Operating models of a variety of vessels may be "sailed" into and out of these port models. The fleet of vessels includes all types of conventional vessels including, Coast Guard cutters, bulk carriers, military vessel, and VLCC's. Each of these hydrodynamic models may be employed in realistic passage scenarios to evaluate safe practices and techniques. Further, new vessels can be developed to meet changing demands or alternative operating concepts.

Commercial and recreational waterway users are often in conflict. Commercial users often operate large, cumbersome vessels with professional crews. Recreational users often operate small, highly maneuverable vessels with amateur owners/crews. Further, in many waterways, the demand for more recreational access to, and use of, the waterway is growing. The port models may be used to assess the risks involved in site selection for commercial and/or recreational development. The interactions between the two waterway users may be simulated in such a way that risk-reduction practices may be developed. Alternative sites or channel accesses may be recommended based on these interactive assessment scenarios. Both professional mariners and recreational vessel owners may be trained in safe practices.

A unique feature of this research structure is the current capability to create a "whole" vessel (bridge and engineroom) for experimental or training purposes. This whole vessel may be used to evaluate changes in technology; the use, placement, or operation of such technology; and the workload, management, and organization required by such a technology.

At the same time, the simulator facility has the capability of "gaming" that whole vessel against one or more additional ownship operations under independent and differential control. That is, one or more additional vessels may be operated by reduced-team crews in the same geographic area. Thus, research into the interrelationships of these separate vessels may be conducted simultaneously.

Additionally, simulation is a technique that hope can obviate unforseen costly mistakes in the development process.

CONCLUSION

The United States has achieved a worldwide leadership position in the utilization of simulators for both training and research. The future prospects of simulators for training and research is confronted by several factors that complicate the decision to use simulators. Given the range of technical considerations, careful examination of the capabilities, methodologies, and results of available simulations is needed to assess simulator suitability for each individual application. If these steps are followed the United States will continue to maintain this leadership position.

REFERENCES

1. Marine Board - Shiphandling Simulation, Application to Waterway Design. Washington, D. C. - 1992

2. Crooks, Harry J. - Shiphandling Simulators Training/Equivalency

3. Crooks, Harry J. and Douwsma, Doward G. Ph.D. - Marine Simulator for Training and Applied Research. - 1991

Situation in JAPAN

By Prof. Shinya NAKAMURA
(YUSEN Marine Science Inc. JAPAN)

Comprehensive Assessment System of Maritime Traffic Enviroment

Kiyoshi HARA (Kobe University of Meacantile Marine)
Shinya NAKAMURA (Yusen Marine Science Inc.)

To design new traffic routes or evaluate the changes of maritime traffic environment, efficient measures for assessment is required. In the present report the comprehensive assessment system of maritime traffic enviroment is expressed.

At first, the flow chart of maritime traffic enviromental research (Fig.1) and comprehensive assessment system is shown. Application of this system makes it possible to grasp in quantitative terms various issues conserning maritime traffic.

Secondly, as one of above mentioned system, a efficient measures for assessment of risk among ships is discussed. Authors analyzed factors concerned with risk assessment of ships collisions using ship handling simulator and other simulation technique. Based on the results, authors established a model for subjective risk assesment on collision. As a practical application, the assessment of risk categories for designing maritime traffic systems using above model are succesfully shown.

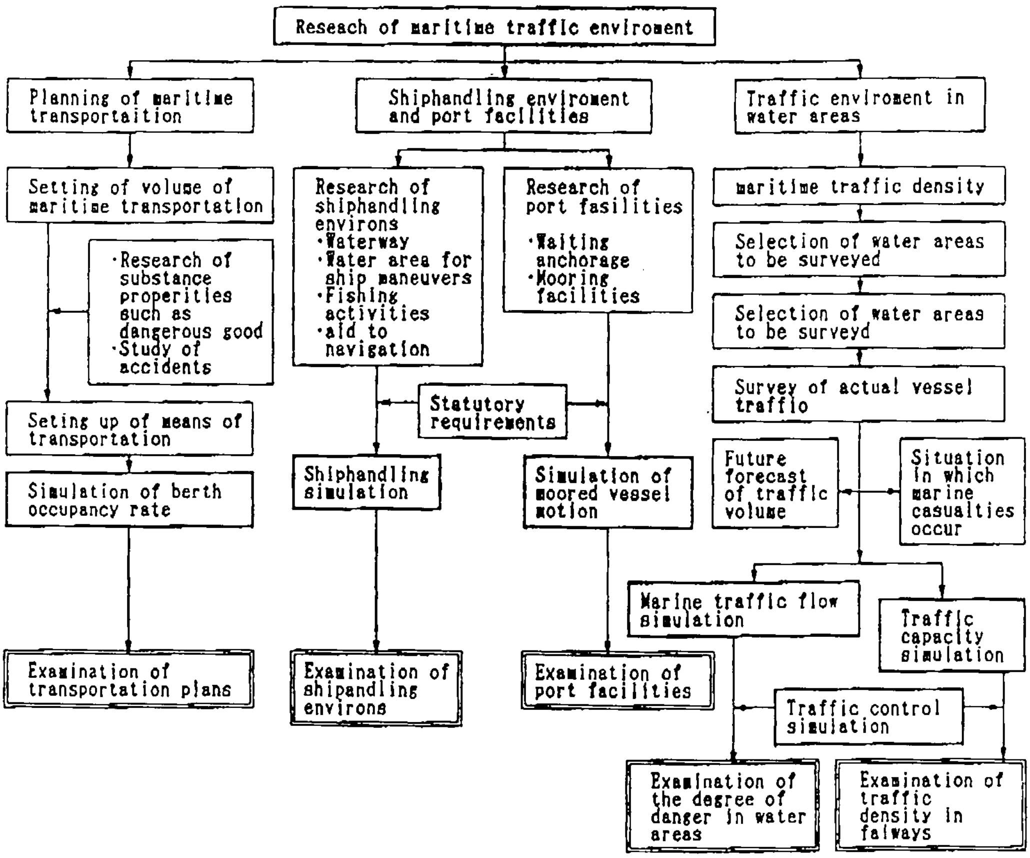

Fig.1 Flow chart of maritime traffic enviromental research

4TH SESSION

FUTURE DEVELOPMENTS

SUMMARY OF THE SESSION

By Mr. Thomas DEGRE
(INRETS - FRANCE)

SEMINAR ON COST 311

4th SESSION: FUTURE DEVELOPMENTS

Two papers were given during this session chaired by Mr. **Fabre**, Principal Administrator of DG VII:

Mr. Anselmo from DG VII of the European Commission gave first a presentation on new resarch projects in Europe at EC level which can be summarised as follow:
The Common Transport Policy (CTP) is at a turning point(European single market, Europe's opening to the East, Maastricht Treaty) and the objectives are to obtain a sustainable mobility through different measures among which TransEuropean Networks, Standards and Technical regulations, Research and Development.
R & D for Waterborne Transport will use the supplement to the 3rd Framework Programme, the 4th Framework Programme and the COST scheme. Soon, a workshop gathering National Delegations, Indutries, Users of Transport, Scientifists will be organised by DG VII with the aim to develop a coherent R & D Programme on Waterborne Transport.

Mr Salvarani from DG VII too gave then a presentation on the role of the Community on safety and pollution prevention and the use of simulation technics as a tool for the design and promotion of standards.
The role of the Community in securing compliance to the rules and the principle of subsidiarity comprises two aspects: MOU on PSC and VTS.
The main reason for the existence of the Memorandum of Understanding on Port State Control in Europe is the elimination of the operation of substandard ships from the waters of its signatories.
VTS has become an essantial feature on the matitime safety policies of several Coastal and Port States. The Commission believes that VTS are systems falling under the terms and objectives of articles 21 and 22 of the Law of the Sea when they are set up and operated to meet the objectives of safety of navigation and pollution prevention or fighting.

Harmonization of VTS procedures at least at European level is a key stone to garantee a standard safety level in the traffic production process.
In this respect, the Commission (DGVII, Maritime Safety Department) has launched a bid to promote an experiment in traffic assessment methods (EPTO Project)

These presentations were followed by a discussion chaired by **Mr. Koeman**, from the port of Rotterdam, between the audience and a panel composed of the ECSA, EMPA, IALA, IMSF and PIANC representatives, the chairmen and the speakers of the different sessions.

The main points which result from this discussion are the following:

1. There is today an increased use of maritime simulators
2. With regard to this situation it has been reconized the need to develop common criteria including performance tests to meet users' requirements
3. The chairman stressed the importance of the existence of a forum of the clients of the simulators in order to define the requirements in simulation and it has been reconized that this forum already exists. As a matter of fact the Intenational Maritime Forum (IMSF) get together all the simulator users.
An interesting idea could be to create a forum like IMSF plus the simulator manufacturers
4. The need for data bases providing information on simulators facilities (caracteristics, performances) has finaly been reconized.

NEW RESEARCH PROJECTS IN EUROPE

By Mr Jose ANSELMO
(European Commission - DG VII)

* THE CTP AT A TURNING POINT

- European Single Market

- Europe's opening to the East

- Maastricht Treaty on European Union

    . (TNS) Trans-European Networks (Art. 129 b,c and d) ->

        -> Transport Infrastructure (intelligent infrastructure)

    . Research & Technological Development (Art. 130 f to p)

    . Safety (Art. 75 (1)(c))

    . Protection of the Environment requirements (Art. 130 r)

Data :

. Energy Consumption Transport Sector = 30% Total Energy Consumption of the Community and

25% of Total Community CO2 Emmissions

. ROAD sector alone represents :

80% of Transport Sector Energy Consumption and

75% of its Output

*** HOW TO MEET THESE OBJECTIVES ?**

*** SUSTAINABLE MOBILITY**

(cornerstone of the CTP) efficient and safe transport under the best possible environmental and social conditions.

* EFFICIENCY

* SAFETY

* PROTECTION of the ENVIRONMENT

* SOCIAL (Qualifications/Training/Working Conditions)

Eg. Given the congestion affecting certain parts of the transport systems and the constraints on further expansion -> seek to exploit under-used capacities and ensure that the different modes can be combined as effectively as possible.

For Freight Transport this means making better use of the SEA, INLAND WATERWAYS and RAIL, in combination with ROAD, to provide new types of INTER-MODAL service in which **each mode is used for what it does more cost-effectively**

*** To meet the OBJECTIVES new/improved Transport Technologies are required**

*** The CTP contains three (interwoven) main VEHICLES for this :**

- **TransEuropean Networks**
- **Standards & Technical Regulations**
- **Research and Development**

* What is required in Europe is no longuer a mere reconstruction or extension of the infrastructure but a better and sustainable use of the existing one -> intelligent use of the infrastructure (telematics / TNS)

* Standards will guarantee that advanced Technological Tools for all modes of Transport are fully compatible in order to attain full inter-operability

* Research an Development to produce the required Advanced Technological Tools

Eg. If new technologies are developed in **common "up-stream"** it becames far easier to decide on the **application of those new technologies** through appropriate **Standards and Technical Regulations** for the subsequent development of **European Networks** in the interests of **compatibility, interconnection and interoperability**

THIS CONSTITUTES THE FRAMEWORK UNDER WHICH TRANSPORT R&D SHOULD BE DEVELOPED

*** COMPARATIVE ADVANTAGES OF THE EC (FOSTERED) R&D**

- **the SCOPE**
- **the MONEY RESOURCES**
- **the potential of HUMAN RESOURCES**
  (Europe's Scientific and Industrial communities)

* In Transport R & D is built upon three pillars :

. Telematics

. Technology innovation

. Strategic implementation oriented Research

* Telematics and Technology Innovation alone will fail to achieve the political targets of a "Sustainable Society". Strategic implementation oriented Research is required to encompass behavioral, socio-economic and organizational aspects in order to achieve an

INTEGRATED TRANSPORT NETWORK OF EUROPEAN DIMENSION

*** RESEARCH AND DEVELOPMENT**

Establishment of a coherent transport related R&D approach in the fourth framework programme

Continuation of actions concerning traffic management, logistics and demand for all modes of transport, transport related to environment issues

Establishment of practical cooperation with other European R&D organisations in the field of transport, notably EUREKA, EUROCONTROL, COST, OECD

COST-326 - ECDIS MARITIME TRANSPORT

1ST MEETING - BRUSSELS 2ND DECEMBER 1992

OBJECTIVES : The aim is to contribute to "Sustainable Mobility" by improving efficiency and Safety of Navigation as well as the Protection of the Environment in congested European Waters through the use of "ECDIS". The research to be carried will develop organisational and technical tools to enable implementation of the aforementioned.

under this framework, namely the following tasks will be considered :

* Organisational aspects of ECDIS including the devlopment of intelligent infrastructure
* Assessment of the impacts of ECDIS on the HUMAN Operator and remedial actions
* Interconnectivity with VTS and "Harbour Approach Systems"
* Impact of ECDIS on the European Transport and equipment Manufacturers Industries
* ECDIS Testbeds (selected areas and type of ships)

EXPECTED RESULSTS : The aforementioned aspects should develop into a European test programme that would enable Member States to a concerted position at International Forae regarding the adoption of International standards.

UNDERLYING PRINCIPLE : The work will be based on accepted International Recommendations and Standards and due recognition will be taken of research results and studies undertaken or about to be taken as well openness to cooperation with third parties where appropriate.

* R & D for WATERBORNE TRANSPORT

Three vehicles will be used :

* the "Supplement" to the 3rd Framework Programme
* the 4th Framework Programme
* the COST Scheme

COMMISSION OF THE EUROPEAN COMMUNITIES
DIRECTORATE GENERAL FOR TRANSPORT

EURET

EURET COMMITTEE

DRAFT PROPOSAL FOR WATERBORNE TRANSPORT RESEARCH AND DEVELOPMENT

FIRST DRAFT

WATERBORNE TRANSPORT RESEARCH

The Research Programme in this domain will aim at contributing to the development of a cost effective and efficient European Waterborne Transport network that meets the social demands for sustainable mobility and the European industry's demands for improved international competitivity.

To achieve those aims it is of paramount importance to reinforce the Waterborne transport industry scientific and technological basis in order to speed up the adjustment of industry to required structural changes.

The programme aims at bringing together industry, universities and research institutes in close co-operation in order to establish synergies between the existing potential of knowledge and technological capabilities thus allowing for a better exploitation of the research results.

The required advanced technologies cover the entire range of Waterborne Transport systems from an European point of view, allowing for the interconnection and interoperability of both National networks and different modes of transport.

In particular, new strategic (Cost effective and sustainable) Waterborne transport concepts and technologies are developed aiming at improving the waterborne links between Island, landlocked and peripheral regions and the central regions of the community, contributing to the achievement of the economic and social development of the Community as a whole and to the balanced development of its regions.

The research programme will be eminently of pre-normative nature. The scientific data thus obtained intends to produce common European user requirements that will enable decision makers at National and Community levels to be mutually consistent on producing common European standards.

Additionally the programme addresses the scientific and technological contents of standards that are implemented worldwide through International Organizations. Common user requirements, obtained through Community's co-ordinated research actions, will enable member states to assume a common position on "International Fora" thus ensuring that worldwide standards will take into account common European (industry and environment friendly) requisites. To achieve the aforementioned, Cooperation on research projects including demonstration will be required.

The intended programme will include demonstration on areas where the need to fine tune and verify the interconnection and interoperability of systems is required.

Accordingly, Research, Technological development and Demonstration actions will be centred on the following two large areas :

- Area 1 : Maritime Transport
- Area 2 : Inland Waterways Transport

In particular, it appears to be worthy of mention the fact that this specific programme, on the Waterborne Transport activity, reflects and expands on the essence of the EURET approach for the 2nd "FP", as far as its scientific and technological aims are concerned.

Finally, the development of Research actions on Waterborne Transport Systems that will address each one of its main components eg. Maritime Transport, Inland Waterways Transport and Ports, and main thematic issues eg. Safety, Protection of the Environment and Logistics, from a holistic type of approach will be of the essence, to the Community, as one of the tools to meet the demands for sustainable mobility, to reinforce the great market and to improve its performances for the international competition.

1. Methodology

The compilation of the proposed programme results from the contributions of a wide spectrum of participants that covered comprehensively the strategic issues. The aim of their participation was to set up a coherent and comprehensive set of terms of reference considered as priorities.

The technical Annexes include the main documents used, as a basis, to set the terms of reference and the required funds. Where different, but yet complementary, views were expressed, and were included as additional documents and will be taken into account when setting the terms of reference.

The draft proposal and its technical annexes try to find a balance between the need for a technically sound and comprehensive paper and the need to be flexible and accommodate new detailed items, as well as the need to fit in the "bid and offer" system that characterizes this type of Community sponsored research programmes.

The following Tables and Annexes may be found in the document :

* List of the participants involved in the compilation of the programme - **Table 1**

* Distribution of Subjects per National Delegations - **Table 2**

* Summary of Costs - **Table 3**

* Technical Annex on Maritime Transport - **Annex I**

* Technical Annex on Inland Waterways Transport - **Annex II**

TABLE 1

The participants involved in the compilation of the programme were :

Subcommittee in Waterborne Transport representing Member States :

Denmark	Danish State Railways	{	M. Prytz
		{	M. Schmidt
France	Institut Français de Navigation		M. Prunieras
France	Bureau Véritas - Branche Marine	{	M. Parizot
		{	M. Beghin
Germany	Bundesministerium für Verkehr		M. Christiansen
"	Institute of Shipping Economic and Logistics		Prof. Speidel
"	Forschungszentrum des Deutschen Schiffsbau		Dipl. Wilckens
Greece	The Ministry of Merchant Marine		M. Kanakis
Greece	National Technical University of Athens	{	Dr. Stathopoulos
		{	Dr. Psaraftis
Ireland	B&I Line		M. Coleman
Italy	DIST - Universita di Genova		Prof. Volta
"	CETENA		M. Faresi
Netherlands	DGSM		M. Sistermans
Portugal	Universidade Tecnica de Lisboa		Prof. Soares
"	Laboratorio Nacional de Engenharia Civil		M. Covas
"	Direcçao-Geral da Navegação e Transportes Maritimos		Dr. Martins
Spain	Seguridad Maritima y Contaminacion		M. Bauza
United Kingdom	Department of Transport	{	M. Wood
		{	M. Paloyannides

Universities representing Neptune Network

Belgium	Hogere Zeevaartschool Antwerpen	Cpt. Smet
Germany	Institute of Shipping Economics and Logistics and Fachhochschule Hamburg	Prof. Speidel Prof. Froese
Italy	Università di Trieste	Prof. Borruso
Netherlands	Delft University of Technology	Prof. De Kroes
Portugal	Escola Nautica Infante D. Henrique	M. Raposo
Spain	Instituto Vasco de Administracion Publica and Universidad Politecnica de Catalunya	M. Olabarria
Sweden	World Maritime University	Prof. Zade
United Kingdom	University of Plymouth	Cpt. Weeks

Representing the Commission

Mr Leonardi	DG VII
Mr Anselmo	DG VII

* Additional Contributions used for the compilation of the programme :

The relevant services of the Commission, namely, DG III/E/4 and DG VII/D/1/2/3/4, were consulted and contributed to the development of the programme.

TABLE 3

Summary

In Maritime Transport
Fast Waterborne Transport Systems Competitive Euro-Ship Demands of Maritime Traffic on ports and other infrastructures Human Element Maritime Traffic Control Competitiveness of the Community Shipping for the World Trade Protection of the Environment

In Inland Waterways Transport
Analysis and Simulation of Inland Waterway Traffic Traffic Safety and Control Developments for Inland Vessels and their operation Environment Protection, Ergomics and Human Element Demands of Inland Waterways Traffic on boundaries to Multimodal Transport

ANNEX I

MARITIME TRANSPORT

The objective is to improve the performances of both technologies and systems to enable both competitiveness in the industry and safer and more environmental friendly operations. Intended research will build on achievements obtained through EURET (2nd Framework Programme) and COST actions as well as on new strategic concepts.

In Maritime Transport
Fast Waterborne Transport Systems Competitive Euro-Ship Demands of Maritime Traffic on ports and other infrastructures Human Element Maritime Traffic Control Competitiveness of the Community Shipping for the World Trade Protection of the Environment

ANNEX II

INLAND WATERWAYS TRANSPORT

The objective is to improve the performances of the system and its technological tools, enabling it to compete with other modes of transport that are not so sustainable.

In Inland Waterways Transport
Analysis and Simulation of Inland Waterway Traffic Traffic Safety and Control Developments for Inland Vessels and their operation Environment Protection, Ergomics and Human Element Demands of Inland Waterways Traffic on boundaries to Multimodal Transport

FUTURE UTILISATION

By Mr R. SALVARINI
(European Commission)

A COMMON POLICY ON SAFE SEAS

SUMMARY

I. The Community is a to large extent dependent on reliable, cost effective and safe shipping services. Its maritime transport policy must therefore ensure that such services are undertaken at a minimum level of risk for all directly or indirectly concerned and for the marine environment.

II. The communication will look at the main factors which continue to determine accidents at sea with a view to identigying crucial areas which call for specific urgent measures at the international, Community, National, regional or local level, as appropriate.

The main lines of the proposed action programme for enhacing safety in maritime transport have already been included in the Commission's White Paper on "The future development of the Common Transport Policy" adopted by the Commission on 8 December 1992.

The detailed action programme will be fully in accordance with the subsidiarity principle. It is clear, as it shown by the data and facts in this Communication, that in the absence of this programme, adequate common standards will not be developed in full or on time, and will not be observed in practice. Moreover, required traffic rules and infrastructure will either continue to be lacking in certain aras of the Community or have low effectiveness.

The different initiatives will be based on the same principle and will therefore respect the role of other authorities : international, national, regional ans local.

III. Calls for intensified and urgent action have come on several occasions from the European parliament, which has complained about a lack of Community initiatives in this field, and more recently from the Council. Also the European industries, gathered in the Maritime Forum, have recognised the need and have proposed measures to enhace safety.

All these bodies have invited the Commission to present its Communication without delay.

IV. The approach proposed in the Communication will seek the enhancement of safety and prevention of pollution at sea through the elimination of substandard operators, vessels and crews from Community waters, irrespective of the flag of the ships. The main problem - given the universal regulatory approach in shipping stems from the striking variation in the level of safety performance between fleets, including Member States' fleets. This is, to a large extent, due to the different levels at which States, including Member States, are implementing and enforcing the inernationally agreed standards. Indivisual action by Memeber States has not produced adequate results in the past and is unlikely to do so in the future. The Community, thanks to its political and legislative machinery, is uniquely placed both to ensure that Memeber States apply standards to ships flying their flags in a more uniform and rigorous manner and to enforce, with common methods and rigor, respect of the same standards on vessels of all flags when operating in EC waters.

The action programme will be based upon a coherent package of measures including

i) measures to establish a convergent implementation of existing international rules in the Community ;

ii) measures to ensure a tighter and more effective control of ships by the State of the ports. They include uniform enforcement by coastal States of the international rules to vessels of all flags when they are operating in Community waters ;

iii) measures to promote coherent and harmonised development of navigational aids and traffic surveillance infrastructure, bringing maritime safety into the electronic age, with specific attention being given to traffic measures in environmentally sensitive areas ;

iv) measures to support international organisations enabling them to stengthen their primary role in international standard-setting.

Equally important are measures to improve training and qualification of crew so as to address the problem of human error, which remains the main cause of accidents. An intensive and re-orientated research programme couls also contribute to the overall goal of enhacing maritime safety.

In conformity with the principle of subsidiarity, all actions proposed will respect the criteria recently defined by the Commission, in particular the criteria of necessity and the criteria of proportianality.

CONCLUSIONS OF THE SEMINAR

By Mr. Jean PRUNIERAS

Seminar on Simulation of Maritime Traffic

1. The seminar was held in Brussels on the 3rd and 4th of December 1992 under the aegis of the Commission of European Communities as a follow-up of a research project adressing simulation and named Action-311.

   Representatives of :

   - The European Communities Shipowner Association (ECSA)
   - The European Maritime Association (EMPA)
   - The International Association of Lighthouses Authorities (IALA)
   - The Internaitonal Maritime Simulaiton Forum (IMSF)
   - The Permanent International of Navigation Congresses (P.I.A.N.C.)

   were attending together with 73 participants coming from 17 countries.

2. The seminar :

   - noted with interest Project COST-311 findings special attention was given to the updated review of the state of the art in the field, described in details in the final report ;

   - noted the role to be played by simulation during the development of the following projects part of the EURET I programme ;

   - gave due consideration to presentations delivered by representatives of :
     - . Germany and U.K. in their capacity as memeber states, of the Community
     - . Norway and Sweden, United States of America and Japan ;

   - was informed of :
     - . the objectives and current developments of a Community Maritime Policy to be implented in close liaison with international organizations and in particular with the International Maritime Organisation ;
     - . the objectives and the planning of research plans at EC level.

3. The seminar appreciated that since a few decades simulaiton has been developing in such a way that it may now provide efficient methods and tools applicable to various aspects of human activities at sea such as :

   i) forecast of maritime traffic volumes ;
   ii) planning of maritime transportation ;
   iii) design and assessment of means of transportation ;
   iv) design and assessment of port infrastructures and fairways ;
   v) analysis of the efficiency of port facilities and resources ;
   vi) shiphandling ;

vii) safety aspects amongst which :
- risk assessment ;
- impact of maritime transport on the environment ;
- analysis of critical situations and in particular casualties ;
- designa nd assessment of measures aiming at enhancing the safety of maritime activities and the protection of the environment and in particular procedures relating to the surveillance of the maritime space, and to search and research operations ;

viii) others.

4. The seminar also recognized that simulation facilities may play an important role in the training processes of all operators acting as decision makers in the development and conduct of maritime transport.

5. Thes eminar noted that, nevertheless, a large amount of work is still to be undertake with the aims :

   i) to assess on scientific grounds the validity of various types of simulaitons ;
   ii) to increase the cost efficiency ratio of simulaitons facilities ;
   iii) to develop common standards and or specifications including performance test to meet users requirements.

   In view of point ii), the seminar stressed the need for a close cooperaiton between all European organizaitons involved and for establishing cooperation on a regular basis, via the International Organizations concernend, with other national organizations all over the world.

   Generally the seminar demonstrated the need for involving in the process of design, implementaiton and validation of simulaiton professionals (pilots, shipmasters, etc...) as well as scientist (hydrodynamic, cognitive ingeneers, etc...) Their participation in the validation process and professional acceptance of simulations would indicate that reasonable success can be achieved with the state of practice by recreativy the adequat operational experience through modeling of waterway complexities, the physical environment and operational factors.

   It also stressed the need for data base able to provide information on simulation facilities (capabilities, scenaries) as well as on simulators performances.
   It recommended the implementation of the data base on simulation studies proposed by project COST-311.

6. The seminar expressed the opinion that the efficiency of the implementation of a Community maritime policy largely depends upon the levels of :

   - our knowledge of the maritime traffic considered as a physical/economical phenomenon,
   - the skill of all operators involved.

Therefore, it was felt that future research programmes at European level should encompass developments of simulation methods and tools, taking into account conclusions arrived at on point 3, 4 and 5 above.

7. Considering that one of the major aim of the Community Maritime Policy is to enhace the safety of navigation and protection of the environment, the seminar finally stressed that, as far a possible, policy makers should give the scientists guidance on the levels of safety to be attained.

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