Esprit

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for Research and Development in
Information Technology

The Project Synopses

Information Processing Systems

Part II: ESPRIT II Projects

Volume 4 of a series of 8

September 1989

Directorate General XIII
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Commission of the European Communities

The Project Synopses

Information Processing Systems

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Volume 4 of a series of 8

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XIII/321/89

LEGEND

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C	Coordinator
P	Partner
S	Sub-Contractor
A	Associate Contractor

INDEX BY PROJECT NUMBER

INDEX BY ACRONYM

Projects without acronym can be found in the main index

INFORMATION PROCESSING SYSTEMS

Part II

INTRODUCTION

This directory contains information on the 47 projects currently supported within the Information Processing Systems area of the second phase of the ESPRIT programme. The entry against each provides a summary of its objectives. In the main, these projects have commenced work over the period from late 1988 up to May 1989, and consequently it is too early to report on results. Further information can be obtained from the person indicated on the project sheet.

The Information Processing Systems sector is the result of merging two ESPRIT I areas, Software Technology and Advanced Information Processing. This merger is the result of the experience gained in the management of the ESPRIT I projects. It was also one of the recommendations from the mid-term review board. From a technical point of view, it has helped with the development of a global system approach: software developers, computer architects and knowledge-engineering experts are now working together.

The main objective of the Information Processing Systems (IPS) sector is to provide the industrial technology required for the development of the IT products likely to emerge onto the market in the 1990s. To support this objective, the programme of work defined within this sector is aimed at the management and control of system complexity, reducing development and operational costs, and improving the quality, reliability and performance of systems. Against this background, the drive towards systems engineering and a true systems approach to IT product development is gaining momentum.

In order to provide a manageable workprogramme and maintain a sensible continuity with ESPRIT I, IPS has been divided into five subareas (Systems Engineering, Knowledge Engineering, Advanced Systems Architectures, Human-Computer Interfaces and Sensor-Based Systems). However, it is clear that these are not wholly separate areas for R&D.

1. Systems Engineering

European enterprises are now critically dependent on the quality and relevance of the IT systems that they develop. Increasingly, the emphasis of these systems has switched from one of cost reduction to one concerned primarily with competitive advantage or the provision of high quality services.

The advent of 1992 will bring with it new dimensions of opportunity and competition. The competitive advantages offered by the use of IT will, for most industrial and service sectors, be a major focus of concern. It is essential that Europe can continue to conceive, design and build the IT systems that support

the drive of its industry to fully exploit the opportunities offered in a single European market, post-1992, and for the supporters of this drive to win increasing shares of the global markets that they serve.

In such systems the software component is becoming the dominant cost element. At the beginning of the decade it accounted for approximately 45% of total costs; by the end it is estimated that this will have risen to just short of 80%.

However, if Europe is to derive the greatest benefit from its scarce resources in skilled manpower, there is a need to stimulate the take-up of industrial-quality methods and tools; to support the skills base needed to deploy these effectively; and to bridge the gap between the "state of the art" and "current practice". The emphasis in this subarea is, therefore, on two major themes: Systems Engineering Technology Development, and Technology Transfer and Consolidation.

2. Knowledge Engineering

The speed at which European industry is able to fully utilise knowledge engineering technologies will have a significant impact on competitiveness in the 1990s and beyond.

The need for effective use of knowledge-based systems (KBS) in real-time environments is evident for many application domains. To date, work on KBS has reached the stage where the underlying principles of these systems are reasonably understood. Their role in decision support in non-time-critical areas has been established, and products are now emerging rapidly. The real-time domain, however, places very onerous demands on KBS and the underlying technologies - not least of which are speed of execution and speed of data retrieval. Within ESPRIT work has begun to address the major topics in this area, but it has now become necessary for European industry to launch the process of embedding real-time KBS into its next generation of products.

Emphasis is also put on the definition of more sophisticated development environments for KBS, addressing the issue of the next generation of expert system shells.

As the technology matures it will become more important to ensure rapid use of the results of the knowledge engineering programme. This will require experiments within a controlled industrial environment.

3. Advanced System Architectures

System architecture affects all aspects of Information Technology and Information Processing. It influences and is influenced by all related areas, from functionality on silicon, through man-machine interfaces and human factors, to software. This topic is of primary importance because of its basic role for the efficient

implementation of IT systems, either in terms of execution speed or in terms of development cost.

The future performance requirements for computers will not be met simply by developing ever faster processing elements. There is, therefore, a continuing requirement for the efficient application of increased levels of computational concurrency, and this needs to be addressed both by the development of highly parallel and distributed processor architectures and operating systems, and by the availability of application software capable of effectively using the degree of concurrency offered by these machines.

4. Human-Computer Interfaces

Human-Computer Interfaces (HCI) bridge the gap between the human user and (possibly very complex) technical computing systems. HCI need to match the requirements and capabilities of the user and enable the optimum use of the resources of the system. HCI addresses not only the professional, but also, with increasing emphasis, the inexperienced user. In addition, a well-designed HCI has a high multiplier effect on the market penetration of products and services.

The ESPRIT subarea for HCI encompasses Speech, Graphics and Hypermedia, Natural Language and Dialogue, and Interaction Principles.

5. Sensor-Based Systems

This part of the programme concerns the integration of sensors, signal processing, and understanding and control systems, into a unified architecture. Real-time capabilities are given a high priority. Modular approaches, both in hardware and software, are expected to lead to standardisation. Development tools that display powerful simulation facilities will be progressed.

The IPS Projects

The projects listed in this document are part of a developing portofolio that will increasingly reflect the more broadly based systems interests of the IPS sector while supporting the more detailed aims noted for each of the generic technology subareas identified above. In many cases, they will build on the results obtained so far in ESPRIT I projects and identified in Part I of this IPS document. In all cases they will aim to establish an increased emphasis on "marketplace" and "industrialisation" issues.

PROJECT SYNOPSES

EUROPEAN DECLARATIVE SYSTEM (EDS)

PROJECT NUMBER: 2025

Objectives/Programme of Work

The objective of EDS is to produce the prototype of an industrial technology combining parallel computing with the declarative/symbolic languages used to build large information and knowledge-based systems.

The system will run SQL, Lisp and Prolog and will be hosted on UNIX-based systems and on the partners' proprietary systems.

The workprogramme consists of the following packages:

- definition of the execution model to implement the EDS Process Control Language
- definition of EDS intermediate language set for Lisp, Prolog, SQL, ML and Hope +
- definition of the EDS machine architecture
- development of the project software development environment and hardware development tools
- definition of the full software structure of the declarative languages
- definition of the kernel and run-time system
- the development of debugging and performance monitoring tools
- project management and marketing.

Applications include :

- relational database management to a high bandwith data store
- a database co-processor
- a prototypical EDS implementation of a fourth generation language
- the apportionment of components between several chips and circuit boards to meet operational constraints
- the use of EDS Prolog

- handling large volumes of mixed media data in biomedical and health care applications

- the application of expert systems to the service and utility business areas including banking, finance, and telecommunications.

Progress and Results

After 3 months, the industrial objectives of the project have been clarified: the focus will be on the database server, which will feature parallel processing capability and will support an extended version of SQL called ESQL. In the extensions, the possibility of having users define abstract data types and complex objects will be offered.

Various language interactions, in particular between declarative languages such as LISP or PROLOG and ESQL, will be supported. The architectural implications, particularly at the level of the operating system, are being studied.

Applications are being selected, both real size and as examples, for some functionalities of the EDS system.

Exploitation/Time Horizon for Industrial Application

Development and the exploitation of the applications within the field of commercial information systems are to be coordinated by the senior management committee and the business and marketing group to be set up by Bull, ICL and Siemens.

ICL intends to use the technology in conjunction with its VME mainframe systems, and the first commercial use as a relational database accelerator is expected to be made in 1993/4.

Bull has further plans for a relational database accelerator, and exploitation in conjunction with UNIX and DPS7 system lines is envisaged.

Siemens plans a phased exploitation strategy culminating in the post-project introduction of new parallel hardware for LISP, Prolog and database applications for its mainframe and workstation product lines.

Contact Point

Mr. C.J. Skelton
ICL-INTERNATIONAL COMPUTERS LTD
Mainframe Systems
Wenlock Way *Tel: 61-2231301*
MANCHESTER M12 5DR *Fax: 61-2231301*
UK *Tlx: 22971 STCICL G*

Participants	Country	Role
ICL-INTERNATIONAL COMPUTERS LTD	*UK*	*M*
BULL SA	*F*	*P*
SIEMENS AG	*D*	*P*
EUROPEAN COMPUTER INDUSTRY RESEARCH CENTRE GMBH	*D*	*P*
CCIP-CHAMBRE COMMERCE & INDUSTRIE PARIS	*F*	*A*
SYSTEMS AND MANAGEMENT SPA	*I*	*A*
TELEFONICA SISTEMAS SA	*E*	*A*
UNIVERSITAT POLITECNICA DE CATALUNYA	*E*	*A*
UNIVERSITY OF MANCHESTER	*UK*	*A*
UNIVERSITY OF BRISTOL	*UK*	*A*
SWEDISH INSTITUTE OF COMPUTER SCIENCE (SICS)	*S*	*A*
INFOSYS	*F*	*A*
INESC-INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES	*P*	*A*
UNIVERSITY OF EAST ANGLIA	*UK*	*A*
THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY	*UK*	*A*
COMPUTER TECHNOLOGY INSTITUTE	*GR*	*A*

Start Date	Duration	Resources
21-FEB-89	*15 months (initial phase)*	*161 PY*

METRICATION AND RESOURCE MODELLING AID (MERMAID)

PROJECT NUMBER: 2046

Objectives/Programme of Work

The aim of MERMAID is to strengthen software project management by improving the provision of information. Tools to estimate interrelationships between the characteristics of a program and the manpower needed for its development, to assess risk levels in program performance and to monitor the use of manpower in project implementation, will be provided for use in the construction of the requisite information systems.

Hence the objective of the project is to develop a set of rule-based estimation tools for inclusion in PCTE and other European industry standard software engineering environments. The project will formulate the relationships between software development productivity and metrics relating to the product characteristics and the development process. The tool set will share a common data model and access will be possible through a variety of userinterfaces.

The three components of the MERMAID workprogramme are:

- the identification of the product characteristics and the development process metrics
- the development of an estimation model relating product and process characteristics
- the development of a set of tools for use in resource estimation and management.

The project will build on results from SPMMS (Project 282) and IMPW (Project 938) and from the Alvey Software Data Library. Industrial trials of the two tools sets to be produced will take place in banking and public administration.

Exploitation/Time Horizon for Industrial Application

Volmac intends to use the tools resulting from this project in its normal business of developing medium to large-scale information systems in a wide variety of environments. It is considered very likely that Volmac will undertake the marketing and sale of the tools resulting from this project through one of its subsidiaries. It is estimated that the packaging of tools in a commercially saleable product will take between one and two years.

Data Management intends to exploit the results of MERMAID to build a commercial product particularly aimed at software managers. In addition, Data

Management intends to use the tools from this project, internally for development of banking software, where she has a major market share in Italy.

NCC, UCC and the Management School of Imperial Science, Technology and Medicine all intend to expand their consultancy programme.

Contact Point

MR. Gerard Reckweg
VOLMAC
KLOMPENMAKERSWEG 2
NL - 3449 JB WOERDEN

Tel: 3480 20330
Fax: 3480 22933
Tlx: 70644 VOLM UT

Participants	Country	Role
VOLMAC	*NL*	*M*
DATA MANAGEMENT SPA	*I*	*P*
NCC-NATIONAL COMPUTING CENTRE	*UK*	*P*
UNIVERSITY COLLEGE CORK	*IRL*	*P*
THE IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE	*UK*	*P*

Start Date	Duration	Resources
24-OCT-88	*48 months*	*47 PY*

NEUROCOMPUTING (PYGMALION)

PROJECT NUMBER: 2059

Objectives/Programme of Work

The aim of PYGMALION is to create an independent European technological base for the applications, algorithms and software aspects of neurocomputing. It will lead to the coordination of research on connectionist computing techniques and provide the means for developing the necessary software tools for productive research.

The objectives are:

- to promote information exchange within the European research community
- to develop a portable European Neural Network Specification Language and tools to stand as an interface between applications and emulation architectures
- to demonstrate the potential of a neural approach through industrial applications, mainly of image processing and speech processing.

Pattern recognition and interpretation from remote sensing data, and the recognition and classification of workpieces in a factory automation context, constitute the image processing application domain. For speech processing, the investigation is centred on the application of efficient learning algorithms on artificial neural network architectures to isolated word recognition in various environments.

Exploitation/Time Horizon for Industrial Application

Thomson-CSF intends to commercialise the general purpose neurocomputer to serve as a fast application development environment, and the software environment for the investigation, simulation and analysis of neural models.

Philips intends to implement a neural network simulator on a DOOM machine.

Standard Electrik Lorenz intends to make speech recognizers based on artificial neural network methodology for office environments and information processing, as an OEM product.

CSELT will exploit progress from the demonstrator projects through the other companies of the STET holding of which it is the advanced research centre.

The academic and research partners will contribute to the technological diffusion.

Contact Point

Mr. Bernard Angeniol
THOMSON-CSF-DSE
Division Systèmes Electroniques *Tel: 1-40844610*
Rue des Mathurins 1 *Fax: 1-40844351*
F - 92223 BAGNEUX CEDEX *Tlx: 204780 TCSF*

Participants	Country	Role
THOMSON-CSF-DSE	*F*	*M*
CSELT-CENTRO STUDI E LABORATORI TELECOMUNICAZIONI	*I*	*P*
COMPUTER TECHNOLOGY INSTITUTE	*GR*	*P*
INESC-INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES	*P*	*P*
IRIAC	*F*	*P*
PHILIPS-LEP	*F*	*P*
UNIVERSITY COLLEGE OF LONDON	*UK*	*P*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*P*
STANDARD ELEKTRIK LORENZ AG	*D*	*P*
ECOLE NORMALE SUPERIEURE	*F*	*P*
CEA-LETI	*F*	*S*
UNIVERSITE DE GRENOBLE/JOSEPH FOURIER	*F*	*S*
POLITECNICO DI TORINO	*I*	*S*
SGS-THOMSON MICROELECTRONICS	*F*	*S*
CGE-LABORATOIRES DE MARCOUSSIS	*F*	*S*
INRIA	*F*	*S*

Start Date	Duration	Resources
19-JAN-89	*24 months*	*38 PY*

RECONFIGURABLE AND EXTENSIBLE PARALLEL AND DISTRIBUTED SYSTEMS (REX)

PROJECT NUMBER: 2080

Objectives/Programme of Work

The aim of REX is to facilitate the development and management of parallel and distributed systems. A methodology and a set of integrated support tools will be required for this, which it is the objective of the project to develop.

The strategy to be followed is to retain formal specification as the main point for checking system consistency, predicting timing behaviour and assisting in system modifications.

The project will develop:

- a methodology for constructing reconfigurable and extensible distributed and parallel systems
- tools to support all phases of the distributed application development and maintenance
- techniques to change running systems and to achieve reliable configuration
- tools to advise users on how to obtain better performance, based on the separation of the host development and a target operating system.

The main work-areas of the REX proposal are:

- specification of distributed and parallel systems
- system programming
- methodology for system development
- analysis and evaluation
- dynamic configuration and reconfiguration
- runtime support
- demonstrator applications.

Real-world applications will be used for proving the feasibility and usability of the REX methodology and its associated tools in industrial practice. Two testbed demonstrator applications from industrial automation and from telecommunications systems will be developed in the early phase of the project.

demonstrator applications from industrial automation and from telecommunications systems will be developed in the early phase of the project.

Exploitation/Time Horizon for Industrial Application

Stollman will incorporate the results from the demonstrators in applications in COM and telecommunications, and in a Unix-based package for software development.

2i will exploit the integrated REX toolset as part of a computer-aided software engineering environment product.

Siemens and Intracom anticipate that the REX development environment for distributed systems will be an important toolset for the development of future telecommunications systems.

GSI Tecsi intends to use the results of REX to produce a basis for a distribution and reconfiguration runtime component around existing products.

Contact Point

Mr. Axel Wegner
STOLLMANN & CO GMBH
Max Brauer Allee 81
D - 2000 HAMBURG 50
Tel: 40-38900331
Fax: 40-3809224
Tlx: 17403226

Participants	**Country**	**Role**
STOLLMANN & CO GMBH	*D*	*M*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*P*
2I INDUSTRIAL INFORMATICS GMBH	*D*	*P*
UNIVERSITAET KARLSRUHE	*D*	*P*
GSI TECSI SOFTWARE	*F*	*P*
TECHNISCHE UNIVERSITAET BERLIN	*D*	*P*
SIEMENS AG	*D*	*P*
INTRACOM SA	*GR*	*P*
THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY	*UK*	*P*
UNIVERSITY OF OXFORD	*UK*	*A*

Start Date	**Duration**	**Resources**
01-APR-89	*60 months*	*148 PY*

APPLICATION OF NEURAL NETWORKS FOR INDUSTRY IN EUROPE (ANNIE)

PROJECT NUMBER: 2092

Objectives/Programme of Work

The aim of ANNIE is to find out which of several generic problem areas, such as pattern recognition, sensor fusion, and adaptive control and optimisation, are best approached using neural networks.

To do this, the partners will prototype neural network solutions in simulated problems chosen from automatic inspection, condition monitoring, robotics, control and scheduling.

Specifically, the neural network principles will be applied to:

- the recognition and classification of ultrasonic images in non-destructive testing
- parallel signal processing of acoustic emission from multiple transducers in condition monitoring
- sensor fusion and planning in mobile robots
- scheduling the optimal allocation of hospital beds.

The workpackages and their objectives are as follows:

- Systematics and capabilities of neural networks: the definition of useful features of neural networks and publication of a taxonomy; the evaluation of new approaches.
- problem analysis and criteria for success in generic problem areas: the definition and understanding of problem classes; criteria development and benchmaking for neural networks.
- Software and hardware for neural network emulation and development of user interface: evaluation of simulators, development of user interface, the establishment of software standards.
- Applications: solving real industrial problems using neural networks; small-scale prototyping and organising a seminar for industry.
- project management and information dissemination: organisation of an industrial workshop.

Exploitation/Time Horizon for Industrial Application

The partners have common interests in the application domains. They have the resources required to follow through pre-competitive work into the production systems of either a dedicated analogue device or an application specific integrated circuit. They are also in a position to contribute towards the further development of fully adaptive network hardware using optics and new materials technology.

Contact Point

Dr. A.T. Chadwick
UKAEA ATOMIC ENERGY AUTHORITY
Harwell Laboratory
Building 521
HARWELL OX11 0RA *Tel: 235-24141 X.5208*
UK - OXFORDSHIRE *Fax: 235-432974*

Participants	**Country**	**Role**
pUKAEA ATOMIC ENERGY AUTHORITY	*UK*	*M*
ALPHA S.A.I.	*GR*	*P*
BRITISH AEROSPACE PLC	*UK*	*P*
CETIM-ETABLISSEMENT DE SENLIS	*F*	*P*
IBP PIETZSCH GMBH	*D*	*P*
SIEMENS AG	*D*	*P*
ARTIFICIAL INTELLIGENCE LTD	*UK*	*P*
TECHNISCHE HOCHSCHULE DARMSTADT	*D*	*S*
NATIONAL TECHNICAL UNIVERSITY ATHENS	*GR*	*S*
KGMG PEAT MARWICK TREUHAND GMBH	*D*	*A*

Start Date	**Duration**	**Resources**
15-NOV-88	*36 months*	*35 PY*

INTEGRATION AND DESIGN OF SPEECH UNDERSTANDING INTERFACES (SUNSTAR)

PROJECT NUMBER: 2094

Objectives/Programme of Work

The objective of this project is to show the benefits and enhancements that human/computer interfaces can offer when they are based on speech input/output. The project will demonstrate this by realizing prototypes in two fields of speech application which represent market sectors of rapidly growing importance:

- a professional, office-type environment

- a public telephone network environment.

The project is application-driven in the sense that it concentrates on the integration of speech functions into demonstrator systems, and not primarily on fundamental research issues of speech recognition and speech output.

Dialogue design and the associated ergonomic aspects are of high importance to the project, to gain wider acceptability for speech interfaces in real-world applications. Another key issue in this project is the integration of speech technology with other input/output devices.

Exploitation/Time Horizon for Industrial Application

The project concentrates primarily on the integration of existing technologies; the first industrial products and services are expected to emerge from work in this project during 1992.

Contact Point

Dr. Joachim Irion
AEG OLYMPIA AG
Buecklestr. 1-5
D - 7750 KONSTANZ

Tel: 7531-862447
Fax: 7531-862421
Tlx: 733233

Participants	Country	Role
AEG OLYMPIA AG	*D*	*M*
TELEFONICA	*E*	*P*
INDUSTRIE FACE STANDARD SPA	*I*	*P*
FRAUNHOFER GESELLSCHAFT	*D*	*P*
JYSK TELEFON (JTAS)	*DK*	*P*
AEG AG	*D*	*S*
INESC-INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES	*P*	*S*
AEG AG	*D*	*S*
UNIVERSITAET STUTTGART	*D*	*A*

Start Date	Duration	Resources
01-APR-89	*60 months*	*166 PY*

ADVERSE-ENVIRONMENT RECOGNITION OF SPEECH (ARS)

PROJECT NUMBER: 2101

Objectives/Programme of Work

The objective is to develop improved algorithms for speech understanding in the presence of noise, and to build a hardware real-time demonstrator. The demonstrator will both verify algorithm performance, and address the problem of speech-based man-machine dialogue, as a system interface in practical applications.

Two application environments have been chosen: car and factory. The system will have a vocabulary in the order of 100-500 words, chosen by each national group of partners and tailored to the specific application environment.

Advances will be made in:

- reduction of the effects of noise on speech signals in speech preprocessing
- feature extraction through pattern matching
- the study and refinement of algorithms for speech pattern processing in noisy environments
- dynamic system adjustment to user feedback and the development of error-correction strategy in the human interface
- development of hardware modules for real-time speech recognition.

The real-time demonstrator is based on a parallel processing architecture, attached to a host computer, typically a personal computer. The host, directly accessed by the parallel processor, provides for development support of software algorithms and for fileserver function to the required databases. Performance evaluations will first be made in the laboratory by simulating operating noise conditions and measuring the resulting rate of correct recognition. Performance under field conditions will then be assessed from a prototype fitted in a car.

The project will liaise with DRIVE and with other European projects dealing with car applications.

Exploitation/Time Horizon for Industrial Application

Speech recognition systems with high performance in adverse environments are currently not available commercially, and the results of the project will find applications in:

- the collaboration between several companies to add the facility of voice commands to the mobile radio terminal that ITALTEL is manufacturing and marketing and that the Italian telephone-operating company SIP will introduce
- hands-free mobile telephones for cars
- the enhancement of existing voice-operated quality control systems in vehicle manufacturing
- the enhancement of an existing real-time continuous speech recognition product
- the development of cochlear implants
- technology transfer through licensing agreements, etc.

Contact Point

Dr. Giancarlo Pirani
CSELT-CENTRO STUDI E LABORATORI
TELECOMUNICAZIONI
Via G. Reiss Romoli 274
I - 10148 TORINO

Tel: 11-2169391
Fax: 11-2169520
Tlx: 220539 CSELT I

Participants	Country	Role
CSELT-CENTRO STUDI E LABORATORI TELECOMUNICAZIONI	*I*	*M*
ENST-ARECOM	*F*	*P*
MATRA COMMUNICATION	*F*	*P*
CAMBRIDGE UNIVERSITY ENGINEERING DEPT.	*UK*	*P*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*P*
UNIVERSITY OF KEELE	*UK*	*P*
PAGE IBERICA SA	*E*	*P*
LOGICA UK LTD	*UK*	*P*
LOGICA SDS LTD	*UK*	*P*
POLITECNICO DI TORINO	*I*	*A*

Start Date	Duration	Resources
23-JUN-89	*36 months*	*47 PY*

MULTI-LANGUAGE SPEECH-TO-TEXT AND TEXT-TO-SPEECH SYSTEM (POLYGLOT)

PROJECT NUMBER: 2104

Objectives/Programme of Work

The goal of this project is to demonstrate the feasibility of multi-language voice input/output for a number of commercially promising applications.

The objective of POLYGLOT is to integrate phonetic, lexical, and syntactic knowledge common to text-to-speech and speech-to-text conversion, providing greater generality, lower cost, and easier extensions.

A set of technologies and working prototypes is planned:

- Very large vocabulary (tens of thousands of words), isolated words, speaker-adaptive speech recognition on a PC, for speech-to-text conversion in seven European languages, to be implemented and tested. Continuous speech recognition will be addressed as well, but merely up to the stage of producing a strategy for implementation on a PC.

- High quality, language-sensitive, unrestricted vocabulary, text-to-speech conversion in seven European languages.

- Tools for easy extension of both the recognition and synthesis technologies to additional languages.

- Application development tools for recognition and synthesis.

- Development of demonstrators, for language teaching, voice feedback for a blind typist, remote access to an electronic mailbox, access to a mail directory, and natural language access to a database.

The project is based on the results of ESPRIT I Project 860. An existing isolated-word speech recognition system which was developed by one of the partners will be extended, under this project, to six other languages.

Exploitation/Time Horizon for Industrial Application

So far, the acceptance of speech recognition and synthesis systems on the market has been marginal due to unsatisfactory performance, high purchase costs, and the lack of application development tools.

The project aims to establish the technology for a wide variety of modular, multi-lingual, speech input/output systems, mostly based on personal computers. Such

a range of applications promises a high-volume market for products aimed at end-users and small system houses. These systems are believed to provide an important contribution to the development of a market demand for an even wider range of speech technology products.

Contact Point

Mr. V. Vittorelli
ING. C. OLIVETTI & C. SPA
DOR Speech and Languages Laboratory *Tel: 11-748162*
Corso Svizzera 185 *Fax: 11-746511*
I - 10149 TORINO *Tlx: 210030*

Participants	Country	Role
ING. C. OLIVETTI & C. SPA	*I*	*M*
BULL SA	*F*	*P*
PHILIPS KOMMUNIKATIONS INDUSTRIE AG	*D*	*P*
TA TRIUMPH-ADLER AG	*D*	*P*
UNIVERSITY OF PATRAS	*GR*	*P*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*P*
RUHR UNIVERSITAET BOCHUM	*D*	*P*
UNIVERSITY OF EDINBURGH	*UK*	*P*
KATHOLIEKE UNIVERSITEIT NIJMEGEN	*NL*	*P*
NEDERLANDSE PHILIPS BEDRIJVEN BV	*NL*	*P*
LIMSI-CNRS	*F*	*P*
SOFTWARE SISTEMI SPA	*I*	*S*
UNIVERSIDAD NACIONAL DE EDUCACION A DISTANCIA	*E*	*S*

Start Date	Duration	Resources
21-AUG-89	*36 months*	*140 PY*

AN INTEGRATED MODELLING SUPPORT ENVIRONMENT (IMSE)

PROJECT NUMBER: 2143

Objectives/Programme of Work

The aim of IMSE is to facilitate the use of systems engineering methods throughout the design cycle by the development of a support environment for performance modelling. The related goals are to improve the integration of currently available modelling tools with one another and with the design process, and to extend their scope to cope with new systems architectures and increasingly complex designs.

These goals are supported by the project objective, which is to provide the means whereby performance modelling tools and techniques can be used effectively to support systems design and development.

Development work will be focused on the development of the support environment, tool integration and the extension of tool functionality.

Among the features of the environment will be advanced graphics work-stations; an extensible tool-set supporting alternative performance modelling paradigms, queue-networks, process-interaction, and Petri-nets; the integration of tools via a common object management system; graphics support and reporting facilities; and a structured system specification. Integration with system engineering environments is an important consideration.

The toolset will be targeted on the application areas of computer systems architecture, real-time systems, and distributed systems; there will also be evaluation exercises in the areas of network systems, computer-integrated manufacturing (CIM), and information systems.

Research work will be concerned with the automation of the modelling process, the derivation of performance models from system descriptions, and the development of new modelling techniques for existing and new architectures.

Exploitation/Time Horizon for Industrial Application

STC and Thomson intend to exploit the results of the project through in-house systems engineering activity in several application areas: STC in computer systems architectures, distributed and communication networks, and Thomson in telecommunications, large-scale software systems and computer architecture.

Simulog will seek to exploit the IMSE through CIM applications in the data-processing industries. IPK will use the IMSE as a vehicle for its research and development activities in CIM and other problem domains.

Contact Point

Mr. P.H. Hugues
STC TECHNOLOGY LTD
System Engineering Methods
Copthall House, Nelson Place *Tel: 782-662212*
NEWCASTLE-UNDER-LYME ST5 1EZ *Fax: 782-636602*
UK - STAFFORDSHIRE *Tlx: 36404*

Participants	**Country**	**Role**
STC TECHNOLOGY LTD	*UK*	*M*
FRAUNHOFER GESELLSCHAFT	*D*	*P*
SIMULOG	*F*	*P*
THOMSON-CSF-LABORATOIRE CENTRAL DE RECHERCHE	*F*	*P*
THOMSON-CSF-CIMSA-SINTRA	*F*	*P*
UNIVERSITA DEGLI STUDI DI PAVIA	*I*	*P*
UNIVERSITY OF EDINBURGH	*UK*	*P*
UNIVERSITAET DORTMUND	*D*	*P*
SINTEF	*N*	*P*
INRIA	*F*	*P*
UNIVERSITA DI MILANO	*I*	*S*
UNIVERSITA DI TORINO	*I*	*S*
UNIVERSITE RENE DESCARTES	*F*	*S*

Start Date	**Duration**	**Resources**
01-JAN-89	*36 months*	*51 PY*

VALIDATION METHODS AND TOOLS FOR KNOWLEDGE-BASED SYSTEMS (VALID)

PROJECT NUMBER: 2148

Objectives/Programme of Work

VALID aims to advance the ability to verify and validate knowledge-based systems.

The objective is to develop a tool-box, or general logical model, within which the verification and validation concepts may be defined and analysed.

The approach is to develop the following methodologies:

- the definition of a KBS quality plan, with special attention to validation actions during the different phases of KBS life-cycles
- a general logical model in which verification and validation issues may be defined
- a common conceptual representation in which most KBS can be expressed
- the definition of a validation metalanguage (VETA) to provide the abstract mechanisms necessary to build verification and validation tools.

These will provide the basis for several software products:

- an implementation of VETA
- a set of representative tools for validation and verification
- interfaces to a set of existing KBSs.

The workprogramme is organised round four workpackages: validation models definition, implementation, evaluation and management.

Exploitation/Time Horizon for Industrial Application

VALID will meet the need for the development of a uniform approach to the verification and validation of knowledge-based systems and the provision of the associated generic products.

The results from VALID will be marketed by COGNITECH and related to its existing ES System applications and shells. They will also be used by the company in its consulting activities.

Computer Resources International plans to apply the results in the markets in which it is active. It will combine the integrated software development

environments supporting the development life-cycle with the more stringent development of expert systems. Customer views, especially from ESA and the space market, will be taken into account in the VALID approach. CRI aims to obtain orders for the prototype validation tools from selected markets.

Centre d'Estudis Avancats de Blancs will be making research use of the VALID results and incorporating them with its own expert system building tool.

The AI Laboratory of Universidad Politecnica de Madrid plans to use the VALID approach in both its applied and theoretical courses.

Contact Point

Mr. Pierre Francois Kerdiles
COGNITECH
Etudes et Productions
Rue du Chevaleret 167
F - 75013 PARIS

Tel: 1-45837300
Fax: 1-45848765
Tlx: 200722 COGNIT F

Participants	**Country**	**Role**
COGNITECH	*F*	*M*
CENTRE D'ESTUDIS AVANCATS DE BLANES	*E*	*P*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*P*
CRI A/S	*DK*	*P*

Start Date	**Duration**	**Resources**
01-DEC-88	*36 months*	*30 PY*

SOFTWARE CERTIFICATION ON PROGRAM IN EUROPE (SCOPE)

PROJECT NUMBER: 2151

Objectives/Programme of Work

The aim of SCOPE is to support supplier/customer relationships throughout the internal market by facilitating product certification. Product certification will assist customers in the selection of IT products, and clarify the legal position of suppliers. For this to happen, the establishment of a strengthened certification procedure will first be necessary.

The objective of the project is to demonstrate the feasibility of a European software certification procedure. It will define, experiment with, and validate an economic European software certification procedure applicable to all types of software, acceptable and legally recognised throughout Europe.

Its goals are to:

- define procedures to evaluate software compliance with a specified set of attributes, so enabling a seal of approval to be granted
- develop new, efficient, and cost/effective certification technologies for approving the award of this seal of approval
- promote the use of modern software engineering technologies to be used during the development of the software and contributing to the delivery of the seal.

The certification procedures which the project will apply will be developed by:

- their definition by a panel of experts
- experimental validation on real-world industrial case-studies
- the evaluation of the results, followed by modification or release of the procedures.

The different certification procedures will be evaluated on various kinds of software through numerous experiments. A sophisticated database system will be provided for the exchange and analysis of data.

The project will be implemented through two workpackages:

- definition and feasibility demonstration phase
- main experimentation and evaluation phase

Impact/Time Horizon for Industrial Application

SCOPE is industrially important in the harmonisation of European standards. It aims to obtain the involvement of all the parties concerned and thence have a major influence on software and systems standardisation in Europe.

Contact Point

Mr. Frederic Copigneaux
VERILOG — *Tel: 61-403888*
rue Vauquelin 150 — *Fax: 61-408452*
F - 31081 TOULOUSE CEDEX — *Tlx: 532288*

Participants	Country	Role
VERILOG	*F*	*M*
CITY UNIVERSITY	*UK*	*P*
ERIA	*E*	*P*
GLASGOW COLLEGE	*UK*	*P*
GRS GESELLSCHAFT FUER REAKTORSICHERHEIT	*D*	*P*
UNIVERSITY OF STRATHCLYDE	*UK*	*P*
UKAEA ATOMIC ENERGY AUTHORITY	*UK*	*P*
NIHE-NATIONAL INSTITUTE FOR HIGHER EDUCATION	*IRL*	*P*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*P*
ETNOTEAM SPA	*I*	*P*
ELEKTRONIK CENTRALEN	*DK*	*P*

Start Date	Duration	Resources
21-FEB-89	*48 months*	*109 PY*

VISUAL INSPECTION AND EVALUATION OF WIDE-AREA SCENES (VIEWS)

PROJECT NUMBER: 2152

Objectives/Programme of Work

The objective of VIEWS is to demonstrate the feasibility of a computer vision system for real-time surveillance of outdoor scenes which comprise moving objects in a known, wide-area and structured environment.

VIEWS addresses R&D issues in the field of computer vision related to situation representation and reasoning and real-time control of various asynchronously arriving data streams. VIEWS will also include the provision of support tools for acquiring the scene and object knowledge.

The VIEWS system prototype will be integrated into a generic architecture from a number of different components developed by different partners in the project, and will be demonstrated in two areas of application:

- surveillance of ground traffic in airports, as an assistant to the ground movements controller;

- surveillance of vehicle traffic on roads and motorways for traffic control purposes.

These demonstrations will be developed and assessed in close cooperation with potential end-users (airport and road authorities).

Exploitation/Time Horizon for Industrial Application

The project will demonstrate the feasibility of computer vision for surveillance of moving objects in a structured and known environment. With rapidly decreasing costs for components, and the technical solutions obtained in this project, these vision systems are expected to be marketable by the partners within the next 5 years, for applications in traffic control, external supervision of robots, and machinery with moving components.

Contact Point

Dr. D. Corrall
MARCONI COMMAND & CONTROL SYSTEMS LTD
Chobham Road, Frimley
Technology Group *Tel: 276-63311 x.3050*
CAMBERLEY GU16 5PE *Fax: 276-29784*
UK - SURREY *Tlx: 858289 MCCS G*

Participants	Country	Role
MARCONI COMMAND & CONTROL SYSTEMS LTD	*UK*	*M*
FRAUNHOFER INSTITUT FUER INFORMATIONS UND DATENVERARBEITUNG	*D*	*P*
FRAMENTEC	*F*	*P*
MARCONI COMMAND & CONTROL SYSTEMS LTD	*UK*	*P*
UNIVERSITY OF READING	*UK*	*P*
QUEEN MARY COLLEGE	*UK*	*P*
FRIED. KRUPP GMBH	*D*	*P*
GEC RESEARCH LABORATORIES	*UK*	*S*
GEC MARCONI RESEARCH CENTRE	*UK*	*S*

Start Date	Duration	Resources
01-MAR-89	*60 months*	*77 PY*

MACHINE LEARNING TOOLBOX (MLT)

PROJECT NUMBER: 2154

Objectives/Programme of Work

The project will build a basis for the commercial use of machine learning techniques. This will be done in three ways:

- A toolbox of different learning algorithms will be adapted and developed. The algorithms will cover a broad range of applications and will be made robust enough to stand industrial use. The delivery hardware and software will both comply with industry standards.

- An advisory consultant for the system ("MLT-Consultant") will be developed. The consultant will allow users unfamiliar with machine learning to incorporate this technology in their application.

- A series of applications will be used to guide development of the above components. Evaluation and implementation methodologies will be developed from the experience gained, which will be in the field of vision and network maintenance.

Exploitation/Time Horizon for Industrial Application

Although machine learning techniques are still in their infancy, it is expected that the two main effects of the project will be:

- to act as a focal point for machine learning activities n Europe, and pave the way for the definition of standard interfaces and representation formalisms

- to enable test to be made on real-life industrial applications of the usability of these techniques: plans are currently concerned with manufacturing applications, the consolidation of an advanced knowledge-engineering environment, and the development and implementation of a knowledge-based clinical support system.

Contact Point

Dr. Werner Mellis
NIXDORF COMPUTER AG
R & D Department
Pontanusstr. 55
D - 4790 PADERBORN

Tel: 5251-146488
Fax: 5251-146105
Tlx: 936753

Participants	Country	Role
NIXDORF COMPUTER AG	*D*	*M*
BRITISH AEROSPACE PLC	*UK*	*P*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*P*
INTELLISOFT SARL	*F*	*P*
UNIVERSITY OF ABERDEEN	*UK*	*P*
CGE-LABORATOIRES DE MARCOUSSIS	*F*	*P*
UNIVERSITE DE PARIS SUD	*F*	*P*
INRIA	*F*	*P*
FOUNDATION FOR RESEARCH & TECHNOLOGY - HELLAS	*GR*	*P*
THE TURING INSTITUTE	*UK*	*A*
UNIVERSITE DE PARIS DAUPHINE	*F*	*A*
UNIVERSIDADE DE COIMBRA	*P*	*A*

Start Date	Duration	Resources
01-FEB-89	*48 months*	*116 PY*

SHIPBOARD INSTALLATION OF KNOWLEDGE-BASED SYSTEMS: DESIGN AND INSTALLATION (KBS-SHIP)

PROJECT NUMBER: 2163

Objectives/Programme of Work

The objective is to develop design concepts for the implementation and utilisation of advanced integrated IT systems in ships. The project aims to assist bridge and engine-room officers in duties ranging from voyage planning to alarm handling by providing:

- a decision support system for the safe and economic operation of a ship and the efficient handling of equipment of growing complexity by a small crew
- a framework for the integration of data communication and information systems in ships.

In earlier design specification phases of the project, performed under ESPRIT I (Project 1074), concepts for an overall architecture for the KBS-SHIP system were drawn up. In this phase of the project the architecture will be further developed and implemented.

The viability of the concepts will be ensured by building a prototype KBS-SHIP system incorporating a limited number of expert systems. This will include one expert system managing the communication and collaboration between a number of task-solving expert systems operating on a common database structure. The task-solving expert systems have been selected because of their potential contribution to cost savings and improved safety in ship operations. They will serve as decision support tools for optimization of voyage plans, the preparations of maintenance schedules, alarm handling and making loading plans. Each will be supported by a system for applying ship operational regulations.

The project will focus on methods for resolving conflicts between cooperating expert systems integrated and demonstrated in a suitable land-based facility. Methods for system performance assessment and validation will be developed and used in connection with the integration. Two of the expert systems will be evaluated in a real environment.

Exploitation/Time Horizon for Industrial Application

The project is concerned with engaging the support of the marine industry for the introduction of KBSs expected by the early 1990s. It is expected to influence international standards for local area networks in ships as well as the design of maritime surveillance and control equipment.

The project will exploit the results of earlier work. An expert system for navigation - the Voyage Pilot Expert System - is to be developed into a product by Krupp-Atlas Electronik, and an expert system for machinery operation is to be developed by Soeren T. Lyngsoe.

Contact Point

Mr. Aage Damsgaard
DANISH MARITIME INSTITUTE — *Tel: 2/879325*
Hjortekaersvej 99 — *Fax: 2/879333*
DK - 2800 LYNGBY — *Tlx: 37223 SHILAB DK*

Participants	Country	Role
DANISH MARITIME INSTITUTE	*DK*	*M*
THE EAST ASIATIC COMPANY LTD A/S	*DK*	*P*
FRIED. KRUPP GMBH	*D*	*P*
NATIONAL TECHNICAL UNIVERSITY ATHENS	*GR*	*P*
SOREN T.LYNGSOE A/S	*DK*	*P*
LLOYD'S REGISTER OF SHIPPING	*UK*	*P*
INSTITUTO SUPERIOR TECNICO	*P*	*P*
CAMBRIDGE CONSULTANTS LTD	*UK*	*S*
DANMARKS TEKNISKE HOJSKOLE (TECHNICAL UNIVERSITY OF DENMARK)	*DK*	*S*
SOFT INTERNATIONAL BV	*NL*	*S*

Start Date	Duration	Resources
02-JAN-89	*42 months*	*50 PY*

AN INTELLIGENT REAL-TIME SYSTEM FOR SIGNAL UNDERSTANDING (AITRAS)

PROJECT NUMBER: 2167

Objectives/Programme of Work

The objective is to design and develop AITRAS, a knowledge-based system for signal understanding. AITRAS is to comprise a system shell and the design tools for building systems for the real-time analysis and interpretation of instrumentation signals.

Though sophisticated real-time techniques have been applied successfully in this field, for several reasons their success has been limited. The huge amount of data to be processed slows the response; the experts needed to interpret the results are in short supply; and even the use of knowledge-based systems to emulate expert reasoning does not reduce the delays sufficiently.

In attempting to reduce these shortcomings, the intention is to design AITRAS around a Real-Time Inference Engine (RTIE), tightly-coupled to a signal processing subsystem, and to design and develop an architecture for real-time environments.

Subsequent validation of the AITRAS system will be by three industrial applications:

- the non-destructive examination of steam generator tubes in nuclear plants by the analysis of eddy current signals
- the use of the same technique for heat exchangers and condensers
- fault prediction by the analysis of vibration signals for the maintenance of bearings.

The workprogramme for each application begins with the elicitation of expert knowledge and the creation of the system specification. The demonstration of an initial prototype follows. Static and dynamic validations are then made and the performance is refined within an operational environment.

Exploitation/Time Horizon for Industrial Application

The partners expect benefits from the project in three main targeted markets: data fusion (eg the real-time interpreter from AITRAS), non-destructive examination techniques, and the intelligent process control of complex factories.

The project applications will be industrialised by LABORELEC and TECNATOM and the generic prototype will be used by COGNITECH and AI Systems in signal-processing systems.

LABORELEC will use the signal-processing shell for in-house use and on-site plant applications, leaving the marketing arrangements to its holding company TRACTEBEL.

COGNITECH will market the AITRAS knowledge-based development system for industrial signal-processing applications, and intends to link AITRAS with an existing proprietary workbench for knowledge acquisition and manipulation.

AI SYSTEMS intends to use the experience and results from AITRAS in the development of the real-time expert system tool RTEX and in AI consultancy, and to explore opportunities for designing knowledge-based products for the manufacturing market.

Contact Point

Mr. Pierre Francois Kerdiles
COGNITECH
Etudes et Productions
Rue du Chevaleret 167
F - 75013 PARIS

Tel: 1-45837300
Fax: 1-45848765
Tlx: 200722 COGNIT F

Participants	**Country**	**Role**
COGNITECH	*F*	*M*
ARTIFICIAL INTELLIGENCE SYSTEMS SA	*B*	*P*
TECNATOM SA	*E*	*P*
LABORELEC	*B*	*P*
CRIN/ADILOR	*F*	*P*

Start Date	**Duration**	**Resources**
15-JAN-89	*36 months*	*33 PY*

GENERATION OF INTERACTIVE PROGRAMMING ENVIRONMENTS II (GIPE II)

PROJECT NUMBER: 2177

Objectives/Programme of Work

The proposed project plans to use a generic interactive environment as a basis for work in two directions:

- design, implementation, and experimentation of real-size environments for industrial applications

- advanced research in the area of interactive environments, based on formal specifications.

This project takes as a starting point the interactive programming environment generator that was the successful outcome of ESPRIT I Project 348 (GIPE). This system uses as input the complete formal description of a programming language and produces a specific environment for that language. The resulting environment includes an editor, an interpreter/debugger, and other tools, all of which have uniform graphics man-machine interfaces.

The main result of the GIPE project has been to demonstrate that this technology was feasible. Its follow-up, GIPE II, aims to make it mature by providing support for the construction of large formal language definitions, extending the functionality and performance of the generated environments, and demonstrating the approach in a number of selected industrial applications, such as the construction of a development environment for scientific computing and the development of an environment for the LOTOS specification language.

Exploitation/Time Horizon for Industrial Application

A first version of the Centaur system, resulting from ESPRIT I, has been distributed by the GIPE consortium since February 1988. This distribution is based on a licence policy either for the non-commercial use of Centaur (including a free licence for research institutes), or for business development (normal commercial conditions).

The GIPE II project will continue this effort and broaden the applicability of the system by taking the difficult case of a concurrent language (ie LOTOS, a language designed and used for the formal specification of telecommunication protocols - strong links have been established between this project and Project 2304, LOTOSPHERE, which aims at building an environment for LOTOS).

The system will also affect the development of a European scientific-oriented workstation to be developed in the context of Project 2569, EWS, for which it will provide a Fortran 77 environment.

Contact Point

Mr. Jacques Lacoste
SEMA METRA
DSSH Division — *Tel: 1-46571300*
rue Barbes 16 — *Fax: 1-46569653*
F - 92126 MONTROUGE CEDEX — *Tlx: 200601 SEMATRA F*

Participants	Country	Role
SEMA METRA	*F*	*M*
ADV/ORGA F.A. MEYER AG	*D*	*P*
CWI-CENTRUM VOOR WISKUNDE & INFORMATICA	*NL*	*P*
GIPSI S.A.	*F*	*P*
PLANET SA	*GR*	*P*
PTT RESEARCH TELEMATICA LABORATORIUM	*NL*	*P*
INRIA	*F*	*P*
BULL SA	*F*	*P*
UNIVERSITEIT VAN AMSTERDAM	*NL*	*S*
UVA	*NL*	*A*

Start Date	Duration	Resources
02-JAN-89	*60 months*	*73 PY*

SPEECH UNDERSTANDING AND DIALOGUE (SUNDIAL)

PROJECT NUMBER: 2218

Objectives/Programme of Work

SUNDIAL addresses the problem of speech-based cooperative dialogue as an interface for computer applications in the information services domain. The main technology to be developed will be continuous speech recognition and understanding, and oral dialogue modelling and management.

Speech input will be sentences of naturally spoken utterances of good quality in the first phase of the project, and standard PCM "telephone quality" speech in the final phase. The recognition vocabulary will be of the order of 1000-2000 words for each of the applications. The grammar will be based on a subset of the four partners' languages (English, French, German and Italian). Whilst the project will commence with speaker-dependent recognition, the objective for the second phase is to achieve automatic on-line speaker adaptation. The dialogue manager will allow users to express themselves in a restricted natural language.

Prototypes will demonstrate the technology for two applications: voice mail servers allowing access to an electronic mail system, and telephone access to a public inquiry system, eg for tourist information. Each demonstration system will be evaluated through extensive user trials.

For all demonstrators, the project will define a common general architecture, common formalisms for grammar representation across languages and common semantic representations for dialogue management and message generation.

Progress and Results

The project started on 1 September 1988 with a number of definition studies for the general architecture, and studies on application scenarios. A small vocabulary, speaker-independent recogniser is under development for demonstration in July 1989.

The aim of developing a common formalism for a grammar representation across all languages has been modified, because the grammars brought in by the partners proved to be too diverse. Since they represent substantial investments of earlier work, it was decided that, besides exploring the differences, all extensions to existing representations would be done with a view of achieving maximum coherence.

Exploitation/Time Horizon for Industrial Application

SUNDIAL is targeted at natural-language, oral dialogues, particularly for information services. This technology will find its prime application in telephone based services, ie, when other terminals are not available. Applications range from business-related services (eg calling the home computer through a telephone), to services aimed at the general user. Particularly with the latter application, market penetration has been very difficult, because the performance of currently available technology is still unsatisfactory.

Contact Point

Mr. Jeremy Peckham
LOGICA UK LTD
Speech and Language Department
Hills Road 104 *Tel: 223-66343*
CAMBRIDGE CB2 1LQ *Fax: 223-322315*
UK *Tlx: 27200*

Participants	Country	Role
LOGICA UK LTD	*UK*	*M*
AEG AG	*D*	*P*
CNET-CENTRE NATIONAL D'ETUDES DES TELECOMMUNICATIONS	*F*	*P*
SARIN SPA	*I*	*P*
UNIVERSITAET ERLANGEN-NUERNBERG	*D*	*P*
POLITECNICO DI TORINO	*I*	*P*
SIEMENS AG	*D*	*P*
IRISA-RENNES	*F*	*P*
CSELT-CENTRO STUDI E LABORATORI TELECOMUNICAZIONI	*I*	*P*
CAP SESA INNOVATION	*F*	*P*
UNIVERSITY OF SURREY	*UK*	*A*

Start Date	Duration	Resources
01-SEP-88	*60 months*	*154 PY*

DEFINITION AND DESIGN OF AN OPEN DEPENDABLE DISTRIBUTED SYSTEM ARCHITECTURE (DELTA-4)

PROJECT NUMBER: 2252

Objectives/Programme of Work

The aim of the proposal, based on an existing ESPRIT project, is to formulate, develop and demonstrate an open, fault-tolerant distributed system architecture. The proposed project has direct applicability to wide application areas which include computer integrated manufacturing, office systems, integrated information, processing systems and process control systems.

As an Open System, Delta-4 has three important properties:

- Implementations based on "off-the-shelf" heterogeneous computer systems are possible; the fault-tolerant properties of the architecture are in no way dependent on the use of proprietary, fail-safe or self-checking processors.

- The architecture conforms to the OSI model and implementations are able to coexist with, and interwork with systems communicating by the use of current standard ISO/OSI protocols.

- The dependability and distribution properties of the architecture are offered in a transparent way to the user. Both incremental dependability and incremental performance are offered on a service-by-service basis.

The proposal has both a generic component and an implementation component. The generic component is already contributing to basic concepts in the areas of dependability, multi-point communications, system administration and open distributed processing; these concepts are of value to other ESPRIT projects and to the standards community. The implementation component serves to demonstrate the validity of the concepts; the use of an experimental site and pilot-sites is intended to enable their correctness to be established.

Exploitation/Time Horizon for Industrial Application

Two demonstrators are planned. One will be in a car production plant and one in a bank. Increasing commercial interest in fault-tolerant systems make these demonstrators important in bringing this technology to market in a 5 year horizon.

Contact Point

Mr. S.D. Drackley
FERRANTI ELECTRONICS LTD
Wythenshawe Division
Simonsway *Tel: 61-4993355*
WYTHENSHAWE, MANCHESTER M22 5LA *Fax: 61-4993355*
UK *Tlx: 668084*

Participants	Country	Role
FERRANTI ELECTRONICS LTD	*UK*	*M*
BULL SA	*F*	*P*
INESC-INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES	*P*	*P*
CNRS-LAAS-LABORATOIRE AUTOMATIQUE/ ANALYSE DES SYSTEME	*F*	*P*
UNITED KINGDOM ATOMIC ENERGY AUTHORITY - UKAEA	*UK*	*P*
RENAULT	*F*	*P*
UNIVERSITE J. FOURIER - GRENOBLE I	*F*	*P*
SEMA METRA	*F*	*P*
UNIVERSITY OF NEWCASTLE	*UK*	*P*
THE MICROELECTRONICS APPLICATIONS RESEARCH INSTITUTE	*UK*	*P*
CNR-IEI	*I*	*P*
FRAUNHOFER INSTITUT FUER INFORMATIONS UND DATENVERARBEITUNG	*D*	*P*
CREDIT AGRICOLE - UNIBANQUE	*F*	*P*

Start Date	Duration	Resources
03-JAN-89	*36 months*	*118 PY*

TOOLS FOR PROCESSING MULTI-SENSORIAL SIGNALS FOR PLANT MONITORING AND CONTROL (TOPMUSS)

PROJECT NUMBER: 2255

Objective/Programme of Work

The aim of TOPMUSS is to facilitate the development of systems for multi-sensorial signal processing for advanced process monitoring and the diagnosis of technical systems. The approach is to provide the means for evaluating the feasibility of a multi-sensorial processing task and for swift and economic prototyping.

Research will be centred around the acquisition and representation of knowledge, and on signal and information processing techniques.

The development objective is to provide a toolbox for assisting the development of run-time systems for plant monitoring and diagnosis.

The work will be concentrated in three main fields:

- development of techniques and methods for the acquisition and representation of knowledge about plants, signal processing and context information
- development of knowledge-based signal and information processing techniques for heterogeneous sensor channels
- development of an open software architecture configurable to particular domains.

The goal is the design of a software system for the construction of fault-monitoring and diagnosis systems, containing all the tools developed in the course of the project.

Impact/Time Horizon for Industrial Applications

Audi intends to demonstrate that the TOPMUSS methods and techniques can also be used for production monitoring and control.

Brunel University expects to use the results in consultancy and research programmes.

For ESACONTROL, TOPMUSS opens the possibilities of developing a prototype of a control system with enhanced diagnostic facilities and incorporating an industrialised version of the real-time tools in products.

The GEC Engineering Research Centre, will seek to extend its existing professional system analysis software and design toolbox on the basis of TOPMUSS results.

Contact Point

Mr. Hubertus Rathke
KRUPP ATLAS ELEKTRONIK GMBH
RUP4 *Tel: 421-4572293*
Sebaldsbruecker Heerstr. 235 *Fax: 421-4572900*
D - 2800 BREMEN 44 *Tlx: 2457460 KA D*

Participants	Country	Role
KRUPP ATLAS ELEKTRONIK GMBH	*D*	*M*
AUDI AG	*D*	*P*
EROVI ENGINYERIA DE ROBOTICA I VISIO SA	*E*	*P*
FRAUNHOFER INSTITUT FUER INFORMATIONS UND DATENVERARBEITUNG	*D*	*P*
ESACONTROL SPA	*I*	*P*
STEWART HUGHES LTD	*UK*	*P*
BRUNEL UNIVERSITY	*UK*	*P*
UNIVERSITAET HANNOVER	*D*	*P*
DANMARKS TEKNISKE HOJSKOLE (TECHNICAL UNIVERSITY OF DENMARK)	*DK*	*P*
THOMSON INFORMATIQUE SERVICES	*F*	*P*
THE ENGLISH ELECTRIC COMPANY LIMITED	*UK*	*P*
GEC ELECTRICAL PROJECTS	*UK*	*P*
ALCATEL ISR	*F*	*P*
FRAUNHOFER INSTITUT FUER INFORMATIONS UND DATENVERARBEITUNG	*D*	*S*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*87 PY*

ARCHITECTURE FOR COOPERATIVE HETEROGENEOUS ONLINE SYSTEMS (ARCHON)

PROJECT NUMBER: 2256

Objectives/Programme of Work

The proposed project aims at the development of an architecture for cooperative expert systems for industrial applications. This development will take place in two phases and several steps, the first phase being the creation of a development environment and the second phase its application in two large-scale demonstrators. The very first step concerns the development of the basic concepts of cooperation between autonomous and semi-autonomous systems. These concepts, together with those concerning possible interactions (in the sense of protocols or messages), will feed into the computational model of a virtual machine. This virtual machine will be realized in extensive prototyping/testbed environments of large scale industrial applications. The development environment around the virtual machine will provide appropriate tools to port any prototype developed on this machine onto existing run-time environments. These run-time environments may be of very different natures, ranging from single processor machines via multiprocessor environments to distributed systems consisting of different hardware and software.

Exploitation/Time Horizon for Industrial Application

Increasingly, industrial applications demand large complex expert systems. The cooperative expert system approach is one of the more promising paths towards supplying these requirements. The generic architecture and support tools aimed at in the project will open the door to numerous and various industrial applications. Moreover, the project will propose standards for knowledge interchange protocols between expert systems.

Contact Point

Dr. Thies Wittig
FRIED. KRUPP GMBH
RUP 4
Seebaldsbruecker Heerstr. 235
D - 2800 BREMEN 44

Tel: 421-4572465
Fax: 421-4572900
Tlx: 2457460 KAD

Participants	Country	Role
FRIED. KRUPP GMBH	*D*	*M*
AMBER SA	*GR*	*P*
ELECTRICITY COUNCIL	*UK*	*P*
FRAMENTEC	*F*	*P*
IBERDUERO SA	*E*	*P*
QUEEN MARY COLLEGE	*UK*	*P*
UNIVERSITEIT VAN AMSTERDAM	*NL*	*P*
UNIVERSIDADE DO PORTO	*P*	*P*
VOLMAC	*NL*	*P*
CERN	*CH*	*P*
HUSAT RESEARCH CENTRE	*UK*	*S*
UNIVERSITE LIBRE DE BRUXELLES	*B*	*A*
UNIVERSITY OF LIVERPOOL	*UK*	*S*
UNIVERSITY OF ATHENS	*GR*	*A*
LABEIN	*E*	*A*
CEC-JRC ISPRA ESTABLISHMENT	*I*	*A*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*112 PY*

NEW ARCHITECTURES FOR OPTICAL PROCESSING IN INDUSTRIAL APPLICATIONS (NAOPIA)

PROJECT NUMBER: 2288

Objectives/Programme of Work

The feasibility of optical processors for object recognition has been successfully demonstrated within the ESPRIT I Projects 534 and 1035.

The goal of this project is to integrate the latest device and material developments with these new architectures in practical processors for use in industrial inspection, quality control, associative classification and signal processing. The first phase is a definition phase in which different architectures in optical processing will be considered so as to fully exploit the technology developed in Projects 534 and 1035 towards new applications.

In spite of being extremely powerful, optical systems often lack the flexibility of electronic systems. Consequently, it will be necessary to also consider hybrid optical/electronic approaches for multi-layer type architecture implementations.

To achieve this goal, a comparison of optical processing schemes with reference to device technology will be carried out and the impact of nonlinear optical devices will be analyzed.

At the end of the first phase, the question of whether or not to implement practical demonstrators for the selected applications will be decided. If the evaluation is positive, the programme will continue, and demonstrators will be produced and tested.

Exploitation/Time Horizon for Industrial Application

The feasibility of using optical processors in industrial environment has already been demonstrated in Project 1035; at the same time, some parts of the system requiring optimisation or redesign have been identified. It is expected that at the end of the first phase, the redesign of the system will be completed, leading eventually at the end of the implementation phase to an industrial prototype for industrial exploitation in manufacturing industry.

Contact Point

Mr. Jean-Pierre Rajbenbach
THOMSON-CSF-LABORATOIRE
CENTRAL DE RECHERCHE
Domaine de Corbeville
F - 91401 ORSAY

Tel: 1-60197656
Fax: 1-60197751 EXT7683
Tlx: 204780 TCS F

Participants	**Country**	**Role**
THOMSON-CSF-LABORATOIRE CENTRAL DE RECHERCHE	*F*	*M*
KRUPP FORSCHUNGSINSTITUT	*D*	*P*
UNIVERSITAET ERLANGEN-NUERNBERG	*D*	*P*
RISO NATIONAL LABORATORY	*DK*	*P*

Start Date	**Duration**	**Resources**
01-SEP-89	*24 months*	*14 PY*

THE DEVELOPMENT OF A METHODOLOGY FOR SPECIFYING NON-FUNCTIONAL REQUIREMENTS (ORDIT)

PROJECT NUMBER: 2301

Objectives/Programme of Work

The specification of information technology systems gives emphasis to functional requirements, but most specification methods have difficulty making formal and explicit a variety of non-functional requirements which may be critical if the system is to be acceptable in an organisational environment. These requirements may be on behalf of the whole user organisation, such as requirements for dependability, flexibility, and compatibility. They may also arise from the needs of end-users for systems which are usable and acceptable, that is, do not threaten privacy, job satisfaction, health, etc. Studies of the IT uptake process often demonstrate that it is these factors which prevent implementation or encourage disuse.

It is the aim of this project to produce a computer-based methodology which will enable design teams to make explicit the non-functional requirements for their product or system. The methodology would use concepts at the organisational and work-role levels of description to represent the requirements and will contain a database of standards, models and knowledge about the characteristics and needs of different classes of computer user. The methodology will also facilitate the testing of proposed technical solutions for matching with organisational requirements and for their implications within the organisational environment.

The construction of this methodology will be by a user-centred, iterative development process. The participants will be organisational theorists and human factors specialists working with system software specialists. Early prototypes of the core of the methodology will be produced which will be subjected to user testing. The methodology will thereafter undergo several rounds of modification, extension and progressively more rigourous and realistic user testing. This process is to ensure the resultant methodology not only meets the functional needs of design teams but also meets their non-functional requirements for acceptable and usable tools.

Exploitation/Time Horizon for Industrial Application

The project will contribute significantly to the understanding of the capture and representation of non-functional requirements and will result in a methodology and tools for exploitation.

Contact Point

Mrs. S.D.P. Harker
HUSAT RESEARCH CENTRE
Human Sciences *Tel: 509-223016*
LOUGHBOROUGH LE11 3TU *Fax: 509-324651*
UK - LEICESTERSHIRE *Tlx: 34319*

Participants	Country	Role
HUSAT RESEARCH CENTRE	*UK*	*M*
ALGOTECH SRL	*I*	*P*
WORK RESEARCH CENTRE LTD	*IRL*	*P*
UNIVERSITY OF NEWCASTLE	*UK*	*P*
THE MICROELECTRONICS APPLICATIONS RESEARCH INSTITUTE	*UK*	*P*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*55 PY*

LOTOSPHERE (LOTOSPHERE)

PROJECT NUMBER: 2304

Objectives/Programme of Work

The aim of this project is the exploitation by industry of mathematically sound formal design techniques. This will be achieved by project engineering and by using a viable, fully tool supported, formal system design and development methodology.

The methodology is centred on the emerging international standard Formal Description Technique (FDT) LOTOS (IS8807). The project intends to convert LOTOS into an industrial tool applicable to system design and system implementation. This includes the development of design structuring techniques, integrity-preserving transformations, a test theory and methods, language enhancements, and an integrated toolset. These methods and tools will be applied to industrial pilot specifications and implementations.

Until now FDTs have been primarily developed and used with the objective of reporting the architectural design and specification phase. The aim has been the development of correct, implementation-independent specifications that faithfully reflect an architecture. LOTOS is a particularly flexible and expressive FDT which can support a variety of specification styles (object-oriented, constraint-oriented, etc.). This makes LOTOS a natural and appropriate foundation on which to base high-quality software engineering of concurrent and distributed systems. Such a LOTOS environment will support the entire implementation path, thus permitting the rapid development of correct, high-quality implementations from architectural specifications.

Exploitation/Time Horizon for Industrial Application

Successful completion of the project will represent a major advance in the industrial use of LOTOS. This will significantly enhance the activity of some European IT companies in providing quality software of verifiable functionality, and place them at the forefront of formal methods applications worldwide.

The adoption of LOTOS by relevant European industries will facilitate technical cooperation (eg strategic OSI issues) by providing a common language and methodology.

Some of the results achieved in the context of this project will be of critical importance for further downstream developments in the RACE programme.

Strong links have been established between this project and Project 2177, GIPE II, which is providing the basis for the development of a LOTOS environment.

Contact Point

Prof. C. Vissers
UNIVERSITEIT TWENTE *Tel: 53-893675*
Computer Science *Fax: 53 333815*
NL - 7500 AE ENSCHEDE *Tlx: 44200 THTES NL*

Participants	Country	Role
UNIVERSITEIT TWENTE	*NL*	*M*
ALCATEL STANDARD ELECTRICA SA	*E*	*P*
BRITISH TELECOMMUNICATION PLC	*UK*	*P*
CPR-CONSORZIO PISA RICERCHE	*I*	*P*
GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*P*
INRIA	*F*	*P*
OCE-NEDERLAND BV	*NL*	*P*
SYSECA LOGICIEL	*F*	*P*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*P*
UNIVERSITY OF STIRLING	*UK*	*P*
TECHNISCHE UNIVERSITAET BERLIN	*D*	*P*
CNRS-LAAS-LABORATOIRE AUTOMATIQUE/ ANALYSE DES SYSTEME	*F*	*P*
PTT NEDERLAND NV	*NL*	*P*
ASCOM HOLDING LTD	*CH*	*P*
CNR - CNUCE	*I*	*A*
TECSIEL SPA	*I*	*A*
CNR-IEI	*I*	*A*

Start Date	Duration	Resources
01-JAN-89	*36 months*	*96 PY*

MULTI-SENSOR IMAGE PROCESSING (MUSIP)

PROJECT NUMBER: 2316

Objectives/Programme of Work

The objective of MuSIP is to develop general purpose tools for the interpretation of multi-sensor imagery and the fusion of image information with non-image data from many other sources.

The MuSIP system will provide an integrated environment for the interpretation of image and spatial data in conjunction with other disparate data and knowledge.

Existing and novel image-processing tools will be integrated into a knowledge-based environment with powerful data handling facilities. New tools will be developed for sensor fusion, for the incorporation of auxiliary knowledge (eg sensor characteristics), and for knowledge-based control structures.

Two demonstrators will be produced: one for applications in flood and deforestation monitoring in remote sensing, and one for medical imaging. The data to be interpreted will include spatial models (eg digital maps or anatomical atlas), spectral databases and models (eg radar cross-section models, or a tissue response database), and applications facilities will be provided for image interpretation on a powerful workstation with transputer-based accelerators.

Exploitation/Time Horizon for Industrial Application

The minimum available market worldwide for image-processing systems like MuSIP is estimated at $41 billion per annum.

The partners intend to apply MuSIP in the field of remote sensing, eg in the identification of landslides in land survey, by exploiting applications developed during the project.

The results will be exploited in the design of an Environment Protection Satellite System and a Comet Approach and Landing System, planned by ESA.

The development of tools for image analysis and information processing will form the basic cores of an operational capability for environmental monitoring, and of a knowledge-based approach for signal interpretation by a data fusion process.

Two families of products are expected to be developed from the project: an intelligent workstation for remote sensing applications, and a programmable parallel machine for use either as an accelerator to the workstation or as a general mapping device.

Contact Point

Mr. F.G. Sawyer
MARCONI SPACE SYSTEMS LTD
Remote Sensing And Science Div.
Anchorage Road *Tel: 705-674468*
PORTSMOUTH PO3 5PU *Fax: 705-690455*
UK - HAMPSHIRE *Tlx: 86666*

Participants	Country	Role
MARCONI SPACE SYSTEMS LTD	*UK*	*M*
THOMSON-CSF-LABORATOIRE ELECTRONIQUE DE RENNES	*F*	*P*
MARCONI COMMAND & CONTROL SYSTEMS LTD	*UK*	*P*
NATURAL ENVIRONMENT RESEARCH COUNCIL	*UK*	*P*
UNIVERSITA DI GENOVA	*I*	*P*
MBB MESSERSCHMITT BOLKOW BLOHM GMBH	*D*	*P*
GEC MARCONI RESEARCH CENTRE	*UK*	*P*
HUNTING TECHNICAL SERVICES LTD	*UK*	*P*

Start Date	Duration	Resources
01-JAN-89	*24 months*	*25 PY*

DEMONSTRATION OF ADVANCED RELIABILITY TECHNIQUES FOR SAFETY-RELATED COMPUTER SYSTEMS (DARTS)

PROJECT NUMBER: 2354

Objectives/Programme of Work

The aim of DARTS is to facilitate the selection of reliable systems for safety-critical applications. It will do so by moving towards the establishment of a single, universally agreed method of certifying computer-based, safety-critical systems and by reporting the cost-effectiveness of various approaches to software reliability measurement.

Accordingly, the objective of the project is to demonstrate the use of advanced reliability techniques for the selection of safety-critical computer systems.

DARTS is based on the design and licensing of a four-channel, safety-critical computer-based system. The development of the four diverse software versions will focus on a variety of methodologies, each using different tools and techniques, and each originating from different project teams. Four teams will each design of one of the channels; one team will design the test environment; and two teams will act as licensing bodies. Once a licence has been granted, the prototype system will be installed in the test environment. An evaluation of comparative channel performance and of the selection process will be provided by monitoring system performance.

The main stages of the project are:

- the provision of cost-effectiveness measurements of currently available methods and tools for creating and assessing software systems for safety-related applications from industrial trials

- the preparation of guidelines for the production and assessment of computer-based systems for use in safety-critical applications

- the evaluation of the level of reliability achieved by combining a number of diversely produced channels in one configuration. The results of REQUEST (Project 300) will be used in the evaluation

- the provision of a benchmark environment as a basis for a service to European enterprises involved in the development of safety-critical systems.

Exploitation/Time Horizon for Industrial Application

The benchmark service could be made available at the end of the project as an integral part of a European Certification Scheme for safety-critical software.

DARTS is strongly linked to the nuclear power industry through its partners.

Contact Point

Mr. Ian Smith
UNITED KINGDOM ATOMIC ENERGY AUTHORITY
218/B41
WINFRITH, DORSET
UK - DORCHESTER

Tel: 305-631112015
Fax: 305-631113479
Tlx: 41231

Participants	Country	Role
UNITED KINGDOM ATOMIC ENERGY AUTHORITY	*UK*	*M*
CEGB	*UK*	*P*
EDF-ELECTRICITE DE FRANCE	*F*	*P*
GRS GESELLSCHAFT FUER REAKTORSICHERHEIT	*D*	*P*
CESELSA	*E*	*P*

Start Date	Duration	Resources
23-MAY-89	*48 months*	*24 PY*

METRICS EDUCATION TOOLKIT (METKIT)

PROJECT NUMBER: 2384

Objectives/Programme of Work

The aim of this project is to accelerate the transfer of results on software metrics into the industrial workplace by providing enhanced tools for the education of current and future software engineers, project managers, technicians and other types of practitioners.

The objective of METRICS is to produce a metrics educational toolkit capitalizing on the results of ESPRIT and national projects. This toolkit will include computer-aided learning packages as well as a wide range of other educational approaches. The tool kit will be evaluated and exploited by the partners, and also offered to a wider circle of users across Europe during the course of the project.

The main stages in the project are:

- to identify industrial and academic needs in the application of software quality and productivity metrics, and to determine the associated training requirements
- to rationalise the existing knowledge in metrics and to set up mechanisms to exploit new advances
- to identify educational technology suitable for use in metrics training activities
- to design and implement courseware and computer-based tools to teach software quality and productivity metrics
- to evaluate the academic and industrial use of the tools, and to enhance them accordingly.

Exploitation/Time Horizon for Industrial Application

Software engineers trained during the course of the project will be capable of leading innovative applications of software quality and productivity metrics at or before project completion. The training tools will also be further exploited with the external or internal customer base of the partners.

Contact Point

Dr. J.R. Hemsley
BRAMEUR LTD
High Str. 237
ALDERSHOT GU11 1TJ *Tel: 252-313437*
UK - HANTS *Fax: 252-22580*

Participants	Country	Role
BRAMEUR LTD	*UK*	*M*
BRITISH TELECOMMUNICATIONS PLC	*UK*	*P*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*P*
SOUTH BANK POLYTECHNIC	*UK*	*P*
VERILOG	*F*	*P*
SES SOFTWARE ENGINEERING SERVICES GMBH	*D*	*P*
*DIDA*EL SRL*	*I*	*P*
CAP SCIENTIFIC LIMITED	*UK*	*P*

Start Date	Duration	Resources
01-JAN-89	*36 months*	*47 PY*

PROCESS OPERATORS MULTIMEDIA INTELLIGENT SUPPORT ENVIRONMENT (PROMISE)

PROJECT NUMBER: 2397

Objectives/Programme of Work

The aim of this project is to support safer and more efficient real-time operator action in process control. This will be achieved by providing knowledge-based system multimedia interfaces. These interfaces will handle complexity, be operator-centred, and will respond effectively to rare or unforeseen situations.

The objective is to develop the techniques and tools to create such interfaces.

The approach will be user-centred and the ensuing changes in system performance will be evaluated. Presentation mechanisms will assist knowledge-based designers in the visualisation of the reasoning processes of the intelligent systems under construction.

The project will use the Expert Systems Builder from Project 96, and will draw on the knowledge-based dialogue for process control of GRADIENT (Project 857).

The approach will be tested through front-ending intelligent knowledge-based system applications to an existing system in corrosion monitoring and to large new control systems in power generation and chemical production.

Exploitation/Time Horizon for Industrial Application

Exploitation plans include:

- including the results in a general AI toolkit for commercialisation.
- making specific applications to the chemical, petrochemical, steel and electrical industries both in-house by the industrial partners and, externally, to these sectors generally.
- incorporating the knowledge gained in consultancy services for the water industry.
- transferring the technology through university and commercial channels and start-up companies, and by a mid-project workshop.
- in-house use worldwide.
- the further development of multimedia man-machine interface techniques and their application to other areas.

Contact Point

Mr. P. Puncello
TECSIEL SPA
Via S. Maria 19
I - 56100 PISA

Tel: 50-502502
Fax: 50-502758

Participants	Country	Role
TECSIEL SPA	*I*	*M*
DOW CHEMICAL NEDERLAND BV	*NL*	*P*
IDS-INTELLIGENT DECISION SYSTEMS SA	*E*	*P*
KATHOLIEKE UNIVERSITEIT LEUVEN RESEARCH & DEVELOPMENT	*B*	*P*
UNIVERSITY COLLEGE DUBLIN	*IRL*	*P*
WORK RESEARCH CENTRE LTD	*IRL*	*P*
UNIVERSITY OF STRATHCLYDE	*UK*	*P*
SOUTH SCOTLAND ELECTRICITY BOARD	*UK*	*P*
DENAC	*B*	*S*
ALGOTECH SISTEMI	*I*	*A*
REALACE LTD	*IRL*	*A*

Start Date	Duration	Resources
14-APR-89	*60 months*	*70 PY*

ENVIRONMENT FOR QUALITATIVE TEMPORAL REASONING (EQUATOR)

PROJECT NUMBER: 2409

Objectives/Programme of Work

The objective of the proposal is to bring together existing techniques for reasoning about the behaviour of process-based systems in time, to develop and extend these techniques as necessary, and to make them available for use in the construction of large-scale knowledge-based systems in several industrial and commercial application areas which require them for their future development.

The proposed project will deliver a software development environment for time-dependent applications within which a system builder may find the reasoning mechanism or mechanisms appropriate to his problem, to apply them singly or in combination, and to tune them as far as possible to function within applicable run-time operational constraints. This environment will be designed to meet the needs of a number of specified applications selected for their diversity and economic importance, and will be evaluated by re-implementing two of these as demonstrators.

Exploitation/Time Horizon for Industrial Application

Many real-world applications need an understanding of time and, especially, temporal reasoning. The very pragmatic approach taken in the project, starting from application requirements and extending existing time-dependent reasoning techniques, will quickly provide a powerful development environment for such applications, the development of which has been severely constrained until now.

Contact Point

Mr. Ruben Gallego Rodriguez
ERIA
R & D Department
Condesa de Venadito 1
E - 28027 MADRID

Tel: 1-4051513
Fax: 1-4046579
Tlx: 44442 ERIA E

Participants	Country	Role
ERIA	*E*	*M*
CISE SPA	*I*	*P*
ELECTRONIC TRAFFIC SA	*E*	*P*
FERRANTI COMPUTER SYSTEMS LTD	*UK*	*P*
ECOLE POLYTECHNIQUE FEDERALE, LAUSANNE	*CH*	*P*
SYSECA LOGICIEL	*F*	*P*
UNIVERSITY COLLEGE OF LONDON	*UK*	*P*
SWIFT SC	*B*	*P*
LABEN INDUSTRIE PER LO SPAZIO E LE TELECOMUNICAZIONI	*I*	*P*
CENA	*F*	*A*
THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY	*UK*	*A*
POLITECNICO DI MILANO	*I*	*A*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*103 PY*

ADVANCED KNOWLEDGE-BASED ENVIRONMENTS FOR DATABASE SYSTEMS (KIWIS)

PROJECT NUMBER: 2424

Objectives/Programme of Work

The purpose of the project is to design and develop the KIWIS industrial prototype of a knowledge-base system to support sophisticated applications requiring complex operations on data and knowledge, possibly located in other systems.

KIWIS will provide an integrated knowledge-representation language and programming environment for user modification, and establish an open environment with extensible, friendly graphical interfaces to distributed databases and knowledge bases. The KIWIS system will connect to external, traditional database systems, and give a complex-object view of their data. It will also establish a cooperating network environment consisting of distributed knowledge-based systems, by enabling an intelligent dialogue with other KIWIS systems.

The KIWIS system architecture will support a persistent knowledge representation language, based on object-oriented and logic programming paradigms, that will be tightly integrated. The architecture will be composed of a number of layers that incrementally add power to the system, thus providing both low-level facilities (eg, for the storage and manipulation of persistent complex objects in central and in secondary memory), and sophisticated operators to implement every feature of the language.

KIWIS will draw on the results of ESPRIT I KIWI (Project 1117).

The workpackages are concerned with the specification, design, implementation, and testing of the following components:

- the interface to external databases for data integration
- the object virtual machine, providing an environment for the manipulation of complex objects
- the basic language machine, which adds functionality to the object virtual machine
- the abstraction layer for supporting the knowledge-representation language
- the knowledge-base view module for the user interface and the cooperation manager
- the user interface to exploit all the capabilities of the knowledge-base language

- the cooperation manager, which uses a metalanguage to extract information from other KIWIS systems.

Exploitation/Time Horizon for Industrial Application

The industrial partners, namely Philips, Crai and Enidata, envisage the exploitation of the project results for the provision of high-quality information systems.

Contact Point

Mr. John J. Snijders
PHILIPS INTERNATIONAL BV
Corporate ISA/AIT
Building VN3 *Fax: 40-735940*
NL - 5600 MD EINDHOVEN *Tlx: 35000 PHTC NL*

Participants	Country	Role
PHILIPS INTERNATIONAL BV	*NL*	*M*
ENIDATA SPA	*I*	*P*
UNIVERSITAIRE INSTELLING ANTWERPEN	*B*	*A*
UNIVERSITA DELLA CALABRIA	*I*	*A*
UNIVERSITY OF CRETE	*GR*	*A*
UNIVERSITA DELL'AQUILA	*I*	*A*
SISU	*S*	*A*
CONSORZIO PER LE RICERCHE E LE APPLICAZIONI DI INFORMATICA	*I*	*A*

Start Date	Duration	Resources
01-JAN-89	*36 months*	*53 PY*

TRANSPARENT OBJECT-ORIENTED PARALLEL INFORMATION COMPUTING SYSTEM (TROPICS)

PROJECT NUMBER: 2427

Objectives/Programme of Work

The aim of TROPICS is to ensure the exploitation of the next generation of data processing systems, by reducing:

- execution times for a wide range of applications, through the use of parallelism
- the cost of computation, through the exploitation of VLSI technology
- the cost of producing computer software, by the development of methods and tools.

TROPICS will research and develop a symbolic, parallel computer system technology to meet the high-performance demands of symbolic applications that constitute the next step forward in office automation, and in other fields. This will be expressed in the delivery of an industrial prototype of a parallel processing system, using the object-oriented approach for exploiting parallelism.

The workpackages are planned for the following functions:

- defining the architecture of the processing node and its constituent components, followed by VLSI designs and implementations for the components.
- the design and implementation of the parallel processing units and their integration into a complete TROPICS system.
- the design and implementation of the TROPICS operating system.
- the design and implementation of support software to provide a platform on which applications can be developed.
- making available the object-oriented programming language POOL as the TROPICS main programming language, other languages to offer a migration path, and a set of software development tools.
- realising application software targeted for office environments on the TROPICS system.
- facilitating the transfer of results and the investigation of the application domain by a transfer desk.

- project management.

Demonstrator and industrial prototypes of a workstation will be developed to serve as a user interface to the system. Multimedia, cartographic, multilingual and knowledge support applications will be made in the office area.

Exploitation/Time Horizon for Industrial Application

Philips expects new products to develop from the industrial prototype for the office automation market. Nixdorf plans to make a general integration of the results in its product line, Targon. Olivetti will make an immediate transfer of project results to its divisions for product development. Cap Gemini Sogeti aims to exploit TROPICS results in customer products and services for parallel systems. Thomson-CSF intends to use the TROPICS database, computer server and workstations in large parallel systems for traffic control, communication control and command, security and banking systems.

Contact Point

Mr. E.A.M. Odijk
NEDERLANDSE PHILIPS BEDRIJVEN BV
Building WB3
NL - 5600 JA EINDHOVEN

Tel: 40-742644
Fax: 40-743843
Tlx: 35000 PHTC NL

Participants	Country	Role
NEDERLANDSE PHILIPS BEDRIJVEN BV	*NL*	*M*
CAP SESA INNOVATION	*F*	*P*
ING. C. OLIVETTI & C. SPA	*I*	*P*
NIXDORF COMPUTER AG	*D*	*P*
THOMSON-CSF-CIMSA-SINTRA	*F*	*P*
CWI-CENTRUM VOOR WISKUNDE & INFORMATICA	*NL*	*S*
INFOSYS	*F*	*S*
KATHOLIEKE UNIVERSITEIT NIJMEGEN	*NL*	*S*
UNIVERSITEIT TWENTE	*NL*	*S*
DELPHI	*I*	*A*
STOLLMANN & CO GMBH	*D*	*A*

Start Date	Duration	Resources
31-DEC-88	*60 months (15 months initial phase)*	*711 PY*

EXTENSIBLE KBMS FOR LARGE KNOWLEDGE-BASE APPLICATION (STRECH)

PROJECT NUMBER: 2443

Objectives/Programme of Work

The objective of the proposal is to design, implement and experiment with a system supporting the representation and manipulation of knowledge bases of large size. Storage of persistent objects will be provided by a disk-resident database which will support non-traditional data structures and operations for knowledge representation and management. Moreover, the system will exploit large central memories of recent workstations.

A major effort in the proposed project is to provide a physical and conceptual object-manager for the storage and manipulation of knowledge and data in an integrated manner. This system will allow extensibility of typing, operations, access methods, and concurrency control. The object manager will support several linguistic paradigms:

- A rule-based language defined by extending current logic languages to include complex objects, negation, null values, and update facilities

- An object-oriented language, based on hierarchies of abstract data types, integrating declarative and procedural knowledge;

- An SQL-based language, to enable the continuity of relational applications in this new environment.

These three languages will constitute a multi-paradigm programming environment to accommodate a number of applications. Early experimentation of the proposed rule-based and object-oriented linguistic styles will be obtained by rapid prototyping. The conceptual object manager will provide an internal notation, suitable as a pivot for all language processors.

Exploitation/Time Horizon for Industrial Application

The availability of large knowledge-bases, managing and manipulating in an integrated way various types of information (data, knowledge, complex objects), will significantly increase the deployment of IT applications in many fields.

To demonstrate the convenience of the linguistic notation and to evaluate the system's performance, the project includes industrial-size studies in the following areas : Intelligent Training Systems (ITS), Flexible Manufacturing Systems (FMS), Document Management Systems (DMS), and Configuration Management Systems (CMS).

Contact Point

Mr. Max Fontet
CGE-LABORATOIRES DE MARCOUSSIS *Tel: 1-64491131*
Route de Nozay *Fax: 1-64490821*
F - 91460 MARCOUSSIS *Tlx: 692415 LABMARC F*

Participants	Country	Role
CGE-LABORATOIRES DE MARCOUSSIS	*F*	*M*
AGUSTA SPA	*I*	*P*
POLITECNICO DI MILANO	*I*	*P*
SAGEM	*F*	*P*
TXT-TECH.SOFT E TELEMATICA	*I*	*P*
FERNUNIVERSITAET - GH - HAGEN	*D*	*P*
MBP SOFTWARE & SYSTEMS GMBH	*D*	*P*
INRIA	*F*	*P*
INFOSYS	*F*	*A*
STZ GESELLSCHAFT FUER SOFTWARE-TECHNOLOGIE MBH	*D*	*A*

Start Date	Duration	Resources
01-JUN-89	*30 months*	*40 PY*

A EUROPEAN, DISTRIBUTED MEMORY, PARALLEL SUPERCOMPUTER FOR NUMERICAL APPLICATIONS (GENESIS)

PROJECT NUMBER: 2447

Objectives/Programme of Work

The objective of GENESIS is to develop a highly parallel architecture for very high-performance numerical computing.

The GENESIS architecture is a concept for a family of supercomputers meeting the following goals:

- highest possible performance, obtained through a highly parallel MIMD-SIMD architecture with distributed memory
- optimum cost-effectiveness, achieved by exploiting the latest advances of VLSI technology
- wide-range scalability and extensibility of the system
- long product life, ensured by defining the abstract machine independently of the current state of technology
- high reliability, ensured by an optimal degree of fault-tolerance
- the exploitation of highly parallel architecture by the provision of a programming environment.

The goals of the definition phase are to define all aspects of GENESIS, and specifically:

- to specify a complete architecture, covering node architecture, interconnection, operating system, languages and compilers, user interface, peripherals, etc.
- to make a preliminary specification of the consequential system requirements
- to specify performance goals, and to demonstrate their feasibility of achievement
- to plan and specify the development of application software
- to define the organisational structure for the main phase
- to initiate the development of the next generation of components
- to refine the marketing options and to define the organisation structure for exploiting project results.

Contact Point

Mr. Jean-Philippe Jouas
BULL SA
DSG Poste Courier FRCL B2/228
Rue Jean Jaures
F - 78340 LES CLAYES SOUS BOIS
Tel: 1-34627632
Fax: 1-34627879
Tlx: 696054

Participants	Country	Role
BULL SA	*F*	*M*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*P*
FRIED. KRUPP GMBH	*D*	*P*
SIEMENS AG	*D*	*P*
STOLLMANN & CO GMBH	*D*	*P*
SUPRENUM GMBH	*D*	*P*
INMOS LIMITED	*UK*	*P*
CHORUS SYSTEMES	*F*	*A*
SYSECA LOGICIEL	*F*	*A*
UNIVERSITY OF OXFORD	*UK*	*A*
UNIVERSITY OF SOUTHAMPTON	*UK*	*A*
UNIVERSITY OF LIVERPOOL	*UK*	*A*
SIMULOG	*F*	*A*
ONERA-OFFICE NATIONAL ETUDES ET RECHERCHES AEROSPATIALES	*F*	*A*

Start Date	Duration	Resources
15-NOV-88	*6 months (pre-study phase)*	*34 PY*

INTEGRATING DATABASE TECHNOLOGY, RULE-BASED SYSTEMS AND TEMPORAL REASONING FOR EFFECTIVE SOFTWARE (TEMPORA)

PROJECT NUMBER: 2469

Objectives/Programme of Work

The aim of TEMPORA is to support the development of reliable, flexible and maintainable business information systems.

Its objective is to implement a paradigm for specifying a business system by a knowledge-base of rules, and to extend the implementation by incorporating a commercially available database management system (DBMS) for industrial use, and mechanisms for explicitly modelling temporal relationships.

It will build on such components of current technology as relational databases, rule-based modelling and logic programming.

Exploitation/Time Horizon for Industrial Application

The project aims to meet an expressed market need for software engineering tools for the software industry, including DBMS manufacturers and other types of software product companies, and for in-house systems development by users.

The partners have identified three main areas of exploitation:

- the in-house use of the tools for the production of customised software by the software houses BIM, LPA and Hitec.

- the marketing of the Sybase relational database translated into a mature application development environment by the integration of Tempora tools.

- the marketing of the tools as a general software engineering toolset to information system implementors. Since there is no software engineering toolset based on Prolog and present-generation relational databases currently available, the Tempora-derived products would occupy a unique position in the market place.

Contact Point

Mr. Raf Venken
BIM SA
R & D Div.
Kwikstraat 4B
B - 3078 EVERBERG

Tel: 2-7595925
Fax: 2-7594795
Tlx: 63518 BIMSA B

Participants	Country	Role
BIM SA	*B*	*M*
HITEC LTD	*GR*	*P*
SINTEF	*N*	*P*
SWEDISH INSTITUTE FOR SYSTEMS DEVELOPMENT	*S*	*P*
UNIVERSITE DE LIEGE	*B*	*P*
UNIVERSITY OF MANCHESTER	*UK*	*P*
LOGIC PROGRAMMING ASSOCIATES LTD	*UK*	*P*
THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY	*UK*	*P*
SYBASE LTD	*UK*	*A*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*63 PY*

PARALLEL EXECUTION OF PROLOG ON MULTIPROCESSOR ARCHITECTURES (PEPMA)

PROJECT NUMBER: 2471

Objectives/Programme of Work

The objective of this project is to refine and complete the design of an existing parallel execution model for PROLOG for possible industrial exploitation on the range of shared memory machines available on the market. In addition, the proposal aims to design two alternative execution models to run on message-passing machines designed from the outset to be transputer-based.

It is envisaged that one model will implement a combination of OR-parallelism with dependent AND-parallelism via a shared virtual address space, while another model will implement OR-parallelism and possibly AND-parallelism via communicating processes. The models will be compared on the basis of how well they perform in large-scale applications.

Simulation studies will be made to investigate how the software models can best be supported by hardware, with particular reference to architectures based on the transputer or similar principles.

Finally, an extension of Prolog will be defined and implemented that further exploits the potential of these parallel models. The ultimate aim is to have a language and implementation that combines the capabilities of the existing classes of logic programming languages.

Exploitation/Time Horizon for Industrial Application

The project started from the idea that PROLOG is already in use in industry for the development of non-trivial applications and that parallel implementation should not change the syntax nor the semantics of the language. It will therefore contribute to the strengthening of a PROLOG standard currently under discussion.

The industrial partners of this project are committed to the commercial exploitation of the results.

The academic partners will contribute in the further education of the next generation of European researchers, scientists and software developers. They are committed to further extend their teams and to continue research based on the results of this and other PROLOG-related projects.

Contact Point

Mr. Raf Venken
BIM SA
R & D Div.
Kwikstraat 4B
B - 3078 EVERBERG

Tel: 2-7595925
Fax: 2-7594795
Tlx: 63518 BIMSA B

Participants	Country	Role
BIM SA	*B*	*M*
KATHOLIEKE UNIVERSITEIT LEUVEN	*B*	*P*
UNIVERSITY OF BRISTOL	*UK*	*P*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*P*
SWEDISH INSTITUTE OF COMPUTER SCIENCE (SICS)	*S*	*P*
MEIKO LTD	*UK*	*P*

Start Date	Duration	Resources
13-APR-89	*36 months*	*45 PY*

A MULTI-MODAL INTERFACE FOR MAN-MACHINE INTERACTION WITH KNOWLEDGE-BASED SYSTEMS (MMI2)

PROJECT NUMBER: 2474

Objectives/Programme of Work

The MMI2 proposal will undertake research and development into multi-modal interfaces to knowledge-based systems (KBS).

The interface will allow the user to communicate with the underlying application KBS using natural language, direct manipulation and gesture, as well as a command language. It will also allow the application to communicate with the user through natural language and structured graphics. Natural language modules will be developed for English, French and Spanish. The English system will be based on previous results and prototypes obtained in an ESPRIT I project. The ergonomic aspects of the interface will receive special attention, in order to maximize its readability and efficiency and favour its use even in real-time situations.

The interface will incorporate a dialogue management and mode selection system which will use knowledge of the specificities of individual modes, knowledge of the context of previous interactions, and knowledge of the application domain to determine the content of system output and select the most appropriate mode in which to present particular information. A user modelling module will interact with dialogue management, so that the system will react appropriately to different classes of users and individual users.

The interface developed will be designed to be portable across a range of potential applications of Prolog-based KBS. The project will focus on real practical problems and will be demonstrated and evaluated using a specific application, an expert system in computer network design. This application will also be developed inside the project, but is based on preliminary studies and exploratory prototypes already performed and developed by the lead partner. Two demonstrator prototypes of the interface integrated with the application will be produced, after two and five years.

Exploitation/Time Horizon for Industrial Application

User interface building tools and environments are key factors in the development of applications targeted to human users: any application software equipped with an advanced interface will have a competitive market advantage. The user-centred approach taken in the project will provide the means to give a concrete form to such advanced interfaces.

Contact Point

Dr. Jean-Louis Binot
BIM SA
R & D Div.
Kwikstraat 4
B - 3078 EVERBERG

Tel: 2-7595925
Fax: 2-7594795
Tlx: 63518 BIMSA B

Participants	Country	Role
BIM SA	*B*	*M*
ADR-CRISS	*F*	*P*
INTELLIGENT SOFTWARE SOLUTIONS SA	*E*	*P*
UNIVERSITY OF LEEDS	*UK*	*P*
RUTHERFORD APPLETON LABORATORY	*UK*	*P*
ECOLE DES MINES DE SAINT-ETIENNE	*F*	*P*
INRIA	*F*	*A*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*60 PY*

MAINTENANCE, VALIDATION AND DOCUMENTATION OF SOFTWARE SYSTEMS (REDO)

PROJECT NUMBER: 2487

Objectives/Programme of Work

The aim of REDO is to assist software engineers in the maintenance, restructuring, and validation of large software systems and their transportation between different environments.

The objective is to articulate a theoretical framework for doing this and to develop the requisite methods and prototype tools.

The approach will be to integrate artificial intelligence techniques with current developments in the field of formal methods, software engineering, software validation and human factors.

The work will be structured as follows:

- problem definition
- domain-specific prototype applications
- research and development in maintenance and validation
- the application of knowledge-based systems
- toolkit construction and integration
- evaluation.

Exploitation/Horizon for Industrial Application

The partners intend to industrialise specific tools and to join a successor organisation to the REDO project concerned with the eventual production of the REDO toolkit.

Among the partners interested in the exploitation of the results are:

- Lloyd's Register, in its independent assessment of engineering systems
- Marconi Command and Control Systems Ltd, in using the REDO techniques to validate real-time software prior to its incorporation in their equipment
- Delft Hydrauliques, in restructuring its own software for hydraulics and hydrodynamics for in-house use and for marketing
- Electicité de France, in the maintenance of its own programs
- ITS, in commercially exploiting a tool to provide online test restructuring
- NIHEL, in setting up technology transfer agencies for industry.

In the longer-term, exports to North America are planned by Grumann Daten-Kommunikation GmbH, and to Central and South America by Centrisa.

Contact Point

Dr. P.S. Katsoulakos
LLOYD'S REGISTER OF SHIPPING
Advanced Engineering Services
Fenchurch Str. 71
LONDON EC3M 4BS — *Tel: 1-6814774 X. 2836*
UK — *Fax: 1-6816814*

Participants	Country	Role
LLOYD'S REGISTER OF SHIPPING	*UK*	*M*
CENTRISA-CENTRO DE TRATAMIENTO DE INFORMACION SA	*E*	*P*
DELFT HYDRAULICS	*NL*	*P*
ITS-INGENIERIA Y TECNOLOGIA DE SISTEMAS SA	*E*	*P*
NIHE-NATIONAL INSTITUTE FOR HIGHER EDUCATION	*IRL*	*P*
UNIVERSITY OF OXFORD	*UK*	*P*
UNIVERSITY OF DURHAM	*UK*	*P*
MARCONI COMMAND & CONTROL SYSTEMS LTD	*UK*	*P*
GRUMANN DATEN-KOMMUNIKATION GMBH, DR. JENS	*D*	*P*
EDF-ELECTRICITE DE FRANCE	*F*	*P*
COMPUTER TECHNOLOGIES CO	*GR*	*P*

Start Date	Duration	Resources
03-JAN-89	*36 months*	*107 PY*

VARIABLE OBJECT IDENTIFICATION, LOCATION AND ACQUISITION (VOILA)

PROJECT NUMBER: 2502

Objectives/Programme of Work

The aim of the VOILA vision research pilot project is to develop the basis for advancing computer vision applications in a range of tasks in varied industrial environments.

The project will extend the capability of systems for handling environmental, object and task complexity and will develop system intelligence.

The objective is to demonstrate the applicability of a flexible, robust, high-level vision system to an autonomous guided vehicle operating, for example, in a factory, in a stockyard or on a road.

It is intended:

- to develop the concepts and techniques required for rapid, reliable and efficient object identification location and acquisition
- to develop a flexible high-level vision system
- to demonstrate its applicability.

The targets are:

- to develop a dynamic vision system capable of continuous, ongoing information integration in a changing environment.
- to be able to handle a wide variety of scenes, objects and shapes.
- to develop a vision system capable of focusing and tracking objects.
- to develop an integrated internal model or knowledge base of the system's capabilities.
- to develop a vision system capable of reasoning about the geometry, location and motions of objects in the environment.
- to explore parallel implementations of the system utilizing communicating dynamic processes.

Meeting these objectives will require significant advances in the state of the art in the fields of early vision and the use of stereo and motion; in the use and exploitation of predictive feed-forward and dynamic vision; in the range and type

of models that can be utilised in a vision system; in the design of the vision system architecture and its control structures; and in the implementation of vision systems in a multiprocessor environment.

Exploitation/Time Horizon for Industrial Application

The results of VOILA will be fed through GEC Research to GEC Electrical Products for the development of its guidance and navigation system for an autonomous guided vehicle.

Elsag will use the VOILA results to enhance its industrial products by exploiting flexible systems in factory automation and in making complex process monitoring applications in postal service automation sorting systems.

Matra intends to exploit the results through a systems engineering approach to advanced vision in large systems, particularly for transportation.

Plessey intends to build up a capability in the intelligent elements of robotic systems (for example, the 3-D recognition of image features) to aid segmentation of objects in surveillance images.

Contact Point

Mr. B.F. Buxton
GEC RESEARCH LABORATORIES
Hirst Research Centre
East Lane
WEMBLEY HA9 7PP
UK - MIDDLESEX

Tel: 1-9089281
Fax: 1-9047582
Tlx: 923429

Participants	Country	Role
GEC RESEARCH LABORATORIES	*UK*	*M*
ELSAG SPA - ELETTRONICA SAN GIORGIO	*I*	*P*
MATRA S.A.	*F*	*P*
UNIVERSITA DI GENOVA	*I*	*P*
UNIVERSITY OF SHEFFIELD	*UK*	*P*
UNIVERSITY OF OXFORD	*UK*	*P*
PLESSEY COMPANY PLC	*UK*	*P*
INRIA	*F*	*P*
UNIVERSITA DI GENOVA	*I*	*P*

Start Date	Duration	Resources
01-APR-89	*36 months*	*65 PY*

OPERATING SYSTEMS AND PROGRAMMING ENVIRONMENTS FOR PARALLEL COMPUTERS (SUPERNODE II)

PROJECT NUMBER: 2528

Objectives/Programme of Work

This proposal aims to design and develop appropriate operating systems and environments for general-purpose parallel computers, for a range of tasks including run-time support, program development, multi-user support, and real-time applications. To do this it will use, and enhance, an existing parallel computer architecture, Supernode, developed under ESPRIT I, and its existing software base. Additional software components, which will be thoroughly integrated through clearly defined interfaces, will be based principally upon existing environments, tools and languages with modifications for parallel systems. Specific tools and libraries required for the effective usage of parallel architectures will be designed and implemented.

A primitive executive kernel, resident on each processing element in the system, will be developed.

A number of operating systems and environments will be constructed on top of the primitive executive, including an X/OPEN compatible system and the Portable Common Tool Environment (PCTE).

An integrated Project Support Environment (ECLIPSE) will be ported onto a version of PCTE running on the parallel machine, and this will subsequently be parallelised.

Software tools will be developed which will readily interface to a parallel version of the PCTE. These will include compilers for widely used languages, such as Fortran 77, C, and SQL.

Libraries of numerical routines suitable for parallel computer architectures with various numbers of processors will be written.

Wherever possible, the higher-level components will be designed so as to be architecture-independent. Four applications (image synthesis, simulation of heterogeneous systems, CAD for VLSI, and oil reservoir simulation) will also be implemented to provide a testbed for the major software components.

Exploitation/Time Horizon for Industrial Application

By capitalising on some of the most successful work on parallel architectures achieved in ESPRIT I, this project has an extremely high potential in terms of industrial exploitation. The Supernode machine is already marketed by two

companies, but the availability in a near future of a large range of basic software running on this equipment will undoubtedly boost its market penetration. The market segment currently addressed is mostly scientific applications (with Fortran, Ada and numerical libraries to be made available), but the machine is flexible enough to cover multi-purpose needs (hence the plan to offer PCTE and a SQL front-end).

Contact Point

Dr. David M. Watson
THORN EMI LTD
Information Processing Dept.
Dawley Road
HAYES UB3 1HH
UK - MIDDLESEX

Tel: 1-8486522
Fax: 1-8486565
Tlx: 934135 EMICRL G

Participants	Country	Role
THORN EMI LTD	*UK*	*M*
GRUPO APD SA	*E*	*P*
APTOR	*F*	*P*
NUMERICAL ALGORITHMS GROUP LTD	*UK*	*P*
INSTITUT NATIONAL POLYTECHNIQUE DE GRENOBLE	*F*	*P*
RSRE-ROYAL SIGNALS AND RADAR ESTABLISHMENT	*UK*	*P*
SYSTEM SOFTWARE FACTORS LTD	*UK*	*P*
TELMAT INFORMATIQUE	*F*	*P*
SYSECA LOGICIEL	*F*	*P*
DANISH PARSIM CONSORTIUM	*DK*	*P*
ALSYS LTD	*UK*	*A*
SOFTWARE SCIENCES LTD	*UK*	*A*
UNIVERSITY OF LIVERPOOL	*UK*	*A*
OVE ARUP & PARTNERS	*UK*	*A*

Start Date	Duration	Resources
09-JAN-89	*48 months*	*263 PY*

INCREMENTAL CONSTRUCTION AND REUSE OF REQUIREMENTS SPECIFICATIONS (ICARUS)

PROJECT NUMBER: 2537

Objectives/Programme of Work

Requirements Engineering (RE) is the activity of investigating the customer's needs in the context of a software development project. The specification of requirements, which describes functional and non-functional properties of the system and of its environment, can be distinguished from the specification of the design, which describes the system alone for the benefit of software engineers.

The proposed research is concerned with the study of formal methods for building requirements specifications. Three levels of analysis can be identified in the study of such methods: the specification product (the description of the desired system in its environment); the specification process (the set of activities by which the specification is produced); and the specification rationale (the set of reasons that have led to the choice of a particular process).

The project aims to study each of these three levels. There are some prerequisites for a rigourous study of methods in RE:

- practically, as methodological concerns in RE have not so far been addressed, investigations are restricted to functional and performance (eg real-time) requirements;

- a study of real world practice will be undertaken to get insights into RE processes and rationales

- formal techniques for supporting methods must be defined, which requires a formal system for modelling specification products, processes and rationales.

Putting RE methods into practice will be ensured by the development of a prototype of an integrated RE environment actively supporting such methods, and by the performance of realistic case studies. The environment will be based on a process-driven RE assistant integrating active analyst guidance, consistency and completeness checking, specification visualisation and prototype generation. A qualitative assessment of the formal concepts and tools developed will be achieved by performing case studies on selected families of real-world applications.

Industrialisation will proceed incrementally, according to the particular procedures of each participant.

Exploitation/Time Horizon for Industrial Application

The correct specification of requirements is often regarded as the most important step necessary to increase productivity and quality. This five-year project will make important contributions to the topic.

Contact Point

Dr. Pierre Wodon
PHILIPS SA
Avenue Van Becelaere 2
B - 1170 BRUSSELS
Tel: 2-6472268
Fax: 2-6472299

Participants	Country	Role
PHILIPS SA	*B*	*M*
ALCATEL STANDARD ELECTRICA SA	*E*	*P*
CGE-LABORATOIRES DE MARCOUSSIS	*F*	*P*
SEMA METRA	*F*	*P*
UNIVERSITAT POLITECNICA DE CATALUNYA	*E*	*P*
FACULTES UNIVERSITAIRES NOTRE-DAME DE LA PAIX	*B*	*P*
INRIA	*F*	*P*
TEICE CONTROL SA	*E*	*S*
REALACE LTD	*IRL*	*A*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*160 PY*

ATMOSPHERE (ATMOSPHERE)

PROJECT NUMBER: 2565

Objectives/Programme of Work

The ATMOSPHERE project aims to develop standardised facilities in support of system engineering activities. The facilities to be developed comprise a framework, and associated integrated tools and services. These will form a basis for the development of the application-specific, integrated, system-engineering environments. These environments are to be constructed in turn from integrated tool-sets hosted on the framework and will provide engineering management functions in addition to the system engineering functions relevant to the application domain.

The project views and addresses system engineering as composed of at least three stages: an early technologically independent stage, concerned with the development of the system requirement and the development of high-level functionality; a later stage concerned with the transformation of this functionality into technologically dependent implementable designs; and even later, stage, concerning the integration of the application system components and their maintenance through configuraion and version control.

The project is targeted to support system engineering for applications in the information technology world, covering switching systems, manufacturing systems, office administrative systems and embedded systems.

Throughout ATMOSPHERE a standards-based approach is to be adopted. This approach is bidirectional in that existing standards, international, national and industrial, will be adopted in the development of the ATMOSPHERE framework, tools and services and their interfaces. Conversely, it is expected that through exploitation and marketing activities these interface standards will be adapted to enable them to encompass a wider range of strongly interrelated technologies.

In addition to being standards-based, the project follows a technology integration approach by bringing together, and re-engineering only where necessary, many of the tools, methods, techniques and environments developed within the European and other international information technology projects.

The project team recognises the complex issues of large application-domain, system-engineering project management and the relevance of this complexity to its own highly distributed and diverse functionality. For these reasons a strong project management structure is followed. This structure is also required since the project is to draw extensively on the results and to integrate and coordinate the outputs of several international and ESPRIT projects.

Exploitation/Time Horizon for Industrial Application

The project will provide a standard framework for European tool and platform vendors and the most complete environment available for application systems procedures.

Contact Point

Mr. Axel Voelker
SIEMENS AG
2FEF2 SOPI
Otto-Hahn-Ring 6
D - 8000 MUENCHEN 83

Tel: 89-63648824
Fax: 89-63648322
Tlx: 5210911 SIE D

Participants	Country	Role
SIEMENS AG	*D*	*M*
BULL SA	*F*	*P*
ESF	*B*	*P*
GEC MARCONI LTD	*UK*	*P*
SFGL-SOCIETE FRANCAISE DE GENIE LOGICIEL	*F*	*P*
NEDERLANDSE PHILIPS BEDRIJVEN BV	*NL*	*P*
NIXDORF COMPUTER AG	*D*	*P*
BELL TELEPHONE MFG CO	*B*	*S*
UNIVERSITY OF STRATHCLYDE	*UK*	*S*
UNIVERSITAET - GH PADERBORN	*D*	*S*
GIE EMERAUDE	*F*	*S*
2I INDUSTRIAL INFORMATICS GMBH	*D*	*S*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*S*
ADVANCED MECHANICS & ENGINEERING LTD.	*UK*	*A*
CAP SESA INNOVATION	*F*	*A*
CRI A/S	*DK*	*A*
CWI-CENTRUM VOOR WISKUNDE & INFORMATICA	*NL*	*A*
INESC-INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES	*P*	*A*
TELE LOGIC AB	*S*	*A*
UNIVERSITAET DORTMUND	*D*	*A*
MINISTRY OF DEFENCE	*UK*	*A*
SOFTWARE SCIENCES LIMITES	*UK*	*A*
SEMA METRA	*F*	*A*
SERC	*NL*	*A*
NOKIA CORPORATION	*SF*	*A*
GRUPO DE MECANICA DEL VUELO SA	*E*	*A*
INTECS SISTEMI SPA	*I*	*A*
GENERICS SOFTWARE LIMITED	*IRL*	*A*
GMD-GESELLSCHAFT FUER MATHEMATIK UND DATENVERARBEITUNG MBH	*D*	*A*
GEC SOFTWARE LTD	*UK*	*A*
E2S - EXPERT SOFTWARE SYSTEMS NV	*B*	*A*
TECHNISCHE UNIVERSITEIT EINDHOVEN	*NL*	*A*
DATAMAT INGEGNERIA DEI SISTEMI SPA	*I*	*A*

COMPUTER TECHNOLOGIES COMPANY LTD	*GR*	*A*
CRANFIELD INSTITUTE OF TECHNOLOGY	*UK*	*A*
HONEYWELL BULL ITALIA SPA	*I*	*A*
BRIGHTON POLYTECHNIC	*UK*	*A*
AEG AG	*D*	*A*

Start Date	**Duration**
01-MAR-89	*12 months (initial phase)*

MAINTENANCE CAPABILITY FOR SOFTWARE (MACS)

PROJECT NUMBER: 2570

Objectives/Programme of Work

MACS aims to support software maintainers in error diagnosis and debugging, program porting, performance improvement and system enhancement and evolution, and in other aspects of their work. It will do so by the provision of a system for assisting the analysis of applications.

The project objective is to define and implement a prototype system to assist software maintenance. Design graphs will be incorporated in the system to meet the software maintainer's requirements for information concerning applications design decisions and their intent. Application designs will be portrayed at different levels of abstraction to provide structured information for use in software maintenance.

The workprogramme includes:

- the development of a knowledge representation system for software design graph recording and use
- the development of application and program design analysers for design graph construction
- applying human factors principles to the system conceptualisation and to the design of the man-machine interface
- the development of a prototype software maintenance assistance system
- integration of both the knowledge representation and the software evolution expert systems with a configuration management system
- validation by experimentation to existing software applications.

Progress and Results

The project started in January 1989. The first review was held in July 1989. Deliverables indicated progress in all the main workpackages. The combination of knowledge engineering and software engineering skills in the project gives some promise of useful results.

Exploitation/Time Horizon for Industrial Application

A prototype toolset is projected for the end of the project.

Contact Point

Mr. Mari Georges
SESA-SOCIETE ETUDES SYSTEMES AUTOMATION
Rue de Tocqueville 118
F-75017 PARIS

Tel: 1-49004212
Fax: 1-47784552
Tlx: 610022 F

Participants	Country	Role
SESA-SOCIETE ETUDES SYSTEMES AUTOMATION	*F*	*M*
UNIVERSITAET BREMEN	*D*	*P*
CISI INGENIERIE SA	*F*	*P*
UNIVERSITEIT VAN LIMBURG	*NL*	*P*
SOFTWARE SCIENCES LTD	*UK*	*P*
TECNOPOLIS CSATA NOVUS ORTUS	*I*	*P*
CENTRO DE CALCULO DE SABADELL SA	*E*	*P*

Start Date	Duration	Resources
02-JAN-89	*60 months*	*71 PY*

ACQUISITION OF KNOWLEDGE (ACKNOWLEDGE)

PROJECT NUMBER: 2576

Objectives/Programme of Work

The aim of ACKNOWLEDGE is to improve the efficiency of the process of acquiring knowledge at all phases of knowledge-based system (KBS) development.

The objective is to construct a Knowledge Engineering Workbench, or KEW, that will provide an integrated environment for knowledge elicitation and acquisition. Methods for integrating several knowledge acquisition (KA) techniques will be developed, and an environment that integrates a number of existing automated and non-automated techniques will be constructed.

The key constituents in this workbench are machine learning, knowledge elicitation and dialogue techniques. Learning mechanisms will support automatic deduction and organisation of new knowledge after new information is provided or a particular event observed. This capability is necessary to guide the decisions and reactions of the environment. Elicitation methods will be implemented in the environment and will thus define the protocols of interaction with the system. Mixed-initiative dialogue techniques, based on the recognition of intentions and the visualisation of knowledge bases, will provide the foundations for integrating learning mechanisms and elicitation methods in the same environment. The project will also develop a comprehensive framework for guidance at all stages in KBS development.

ACKNOWLEDGE starts by placing a selection of problem diagnosis and/or classification techniques in a common framework in order to produce a coherent toolkit for experimentation (by the end of the first year). It will then investigate potential integrations and synergies between KA techniques and will deliver a first prototype of the KEW by the end of the third year. The KEW will be validated by several jointly developed demonstrator applications.

Exploitation/Time Horizon for Industrial Application

Cap Sogeti Innovation already demonstrates the capabilities of knowledge acquisition techniques to Cap Gemini Sogeti customers using the initial toolkit. The first prototype will be considered for internal use.

GEC will exploit the ACKNOWLEDGE results internally, and they are expected to be invaluable in the commercial exploitation of KBS by the two GEC software houses. Telephonica will use the results in the creation and maintenance of knowledge bases and in the production of commercial tools. Computer Expert

Systems intends to exploit the results by enhancing internal productivity, or by jointly commercialising KEW, or by creating domain-specific tools.

The University of Amsterdam will exploit the results through publications, PhD dissertations and courses for industry, as will Nottingham University, with special emphasis on the dissemination and exploitation of ACKNOWLEDGE products. SINTEF will use the results in an academic context, and will participate in setting up an enterprise for their commercial exploitation.

Contact Point

Mr. Jean-Charles Marty
CAP SESA INNOVATION
Chemin du Vieux Chene *Tel: 76-908040*
F - 38240 MEYLAN *Fax: 76-410629*

Participants	**Country**	**Role**
CAP SESA INNOVATION	*F*	*M*
COMPUTAS EXPERT SYSTEMS A/S	*N*	*P*
MARCONI COMMAND & CONTROL SYSTEMS LTD	*UK*	*P*
UNIVERSITEIT VAN AMSTERDAM	*NL*	*P*
UNIVERSITY OF NOTTINGHAM	*UK*	*P*
SINTEF	*N*	*P*
TELEFONICA	*E*	*P*
GEC MARCONI RESEARCH CENTRE	*UK*	*S*
UNIVERSIDAD POLITECNICA DE MADRID	*E*	*A*

Start Date	**Duration**	**Resources**
01-JAN-89	*36 months*	*77 PY*

MULTILINGUAL SPEECH INPUT/OUTPUT ASSESSMENT, METHODOLOGY AND STANDARDISATION (SAM)

PROJECT NUMBER: 2589

Objectives/Programme of Work

The objective of this project is to develop methodologies, tools and databases for the assessment of speech systems in contexts where multilingual performance is required from the same basic equipment. The consortium is broad, with participants from six EC and two EFTA member states. The project is to provide techniques for assessing speech synthesisers and recognisers for at least the eight languages of the participating countries.

The participation of a large range of organisations ensures that the final recommendations will be widely adopted. Furthermore, close ties have been established with national projects in the participating countries.

During a definition phase of this project, supported under ESPRIT I Project 1541, a first multilingual speech database was established on CD-ROM for the purposes of assessment and analysis.

The activities in the main phase of the project will focus around three major areas:

- Speech Input assessment, including the setting up of tests, their scoring, and the delineation of performance factors.

- Speech Output assessment, including evaluation at the segment and suprasegmental level, and the definition of overall quality measures.

- Enabling Technologies, including the specification of uniform formats for the collection and management of speech data, of methods for annotating speech waveforms, and the design of a European workstation with tools for speech labelling, analysis and I/O assessment.

Exploitation/Time Horizon for Industrial Application

It is expected that the assessment methods developed within this project will lead to the establishment of a European standard. The SAM project will liaise with all other ESPRIT II speech projects and intends to offer the implemented assessment methods for speech I/O as a service to other ESPRIT projects involved in the development of speech I/O systems. Furthermore, contacts established with organisations ouside Europe suggest that acceptance may be propagated on an even wider scale.

Contact Point

Prof. Adrian Fourcin
UNIVERSITY COLLEGE OF LONDON
Phonetics and Linguistics
Stephenson way 4
LONDON NW1 2HE *Fax: 1-3807408*
UK *Tlx: 269018 UCLASU G*

Participants	Country	Role
UNIVERSITY COLLEGE OF LONDON	*UK*	*M*
AEG AG	*D*	*P*
CNRS-CRIN	*F*	*P*
CSELT-CENTRO STUDI E LABORATORI TELECOMUNICAZIONI	*I*	*P*
NETHERLANDS ORGANIZATION FOR APPLIED SCIENTIFIC RESEARCH	*NL*	*P*
TELEVERKET (THE SWEDISH TELECOMMUNICATIONS ADMINISTRATION)	*S*	*P*
ELAB	*N*	*P*
JYSK TELEFON (JTAS)	*DK*	*P*
CNR-CENTRO DI STUDIO PER LE RICERCHE DI FONETICA	*I*	*S*
FONDAZIONE UGO BORDONI	*I*	*S*
PTT NEDERLAND NV	*NL*	*A*
NATIONAL PHYSICAL LABORATORY	*UK*	*A*
SMITHS INDUSTRIES AEROSPACE & DEFENCE SYSTEMS	*UK*	*A*
RUHR UNIVERSITAET BOCHUM	*D*	*A*
UNIVERSITAET BIELEFELD	*D*	*A*
THE ROYAL INSTITUTE OF TECHNOLOGY	*S*	*A*
MINISTERY OF DEFENSE UK	*UK*	*A*
LOGICA UK LTD	*UK*	*A*

Start Date	Duration
01-FEB-89	*36 months*

A VISION SYSTEM DEVELOPMENT ENVIRONMENT FOR INDUSTRIAL APPLICATIONS (VIDIMUS)

PROJECT NUMBER: 2592

Objectives/Programme of Work

The aim of VIDIMUS is to support the quick and efficient development of better quality industrial vision systems.

The objective of VIDIMUS is to construct a Vision System Development Environment (VSDE) which can be used for forming vision systems for new industrial applications. The VSDE will have four major components - vision framework, functional representation knowledge-based system, intelligent application mapper, and algorithm performance library, brought together into a single integrated software system. A subsidiary aim is to design and specify hardware to demonstrate acceptable processing times for the VSDE.

The vision framework will permit the construction of complex image interpretation systems for object recognition, object registration and accurate measurement.

The functional representation knowledge-based system will permit the conversion of a high-level specification of an inspection process into a series of operations that can be executed by an image interpretation system.

The intelligent application mapper will produce a specific vision system based on application information supplied by the user.

The algorithm performance library will provide the intelligent application mapper with sufficient information for algorithm selection.

Computer hardware to demonstrate that the proposed VSDE can be implemented at the speeds demanded by the applications emerging from the above four software tasks will be mapped onto existing processors. Where algorithms are found not to be implementable on existing processors, new configurations will be designed and incorporated into the integrated computing environment.

Exploitation/Time Horizon for Industrial Application

B.Ae. has a need for advanced inspection systems for a wide variety of aspects of its production capability and provides an in-house route for the exploitation of this technology.

AEG has been engaged in the image processing field for 25 years and the product division intends to exploit results where appropriate. CEA also applies vision technologies in several areas, all of which will benefit from VIDIMUS. Philips

expects to be able to exploit results from VIDIMUS in industrial inspection and recognition problems.

Thomson/LER regards VIDIMUS as basic to its image domain activities, and plans to use VSDE as a development tool to decrease the time needed to process a new application of pattern recognition. Ibermatica has included the development of computer vision systems in its strategic business plan and expects to apply VIDIMUS in four areas.

Contact Point

Mr. J.S. Anderson
BRITISH AEROSPACE PLC
FPC 267
FILTON BS12 7QW
UK - BRISTOL

Tel: 272-366198
Fax: 272-692055
Tlx: 449452

Participants	Country	Role
BRITISH AEROSPACE PLC	*UK*	*M*
AEG AG	*D*	*P*
IBERMATICA SA	*E*	*P*
UNIVERSITY OF STRATHCLYDE	*UK*	*P*
VALVO UNTERNEHMENSBEREICH BAUELEMENTE DER PHILIPS GMBH	*D*	*P*
PHILIPS GLOEILAMPENFABRIEKEN NV	*NL*	*P*
THOMSON-CSF-LABORATOIRE ELECTRONIQUE DE RENNES	*F*	*P*
CEA-LETI	*F*	*P*

Start Date	Duration	Resources
01-JAN-89	*60 months*	*178 PY*

INTELLIGENT TRAINING SYSTEM IN INDUSTRIAL ENVIRONMENTS (ITSIE)

PROJECT NUMBER: 2615

Objectives/Programme of Work

The aim of this project is to improve the level of training for the operation and maintenance of complex physical systems and potentially hazardous processes through the provision of Computer-Based Training (CBT).

The main strategic objective of this project is to enhance the current generation of computer-based trainers and simulators for industrial applications through the use of knowledge-based systems techniques, in general, and qualitative modelling techniques, in particular.

The main technical objective is to develop a generic architecture for Intelligent Training Systems in Industrial Environments (ITSIE) that allows the domain to be modelled in several ways and presented in the form most appropriate to the user and the task to be learned. Conventional simulation languages will be employed to represent the numerical models of the systems. Such a system architecture will permit a variety of instructional strategies to be explored within a given system. This provides an enhanced architecture for training systems that will greatly extend the capability of current CBTs.

The project will utilise the techniques of qualitative modelling and, in particular, a component-based modelling language developed in ESPRIT Project 820, QUIC, and will be in two phases. The first will establish the requirements for the demonstrator applications for ITSIEs, utilising both qualitative and quantitative models. This will lead to the development of a set of tools to implement the identified modules.

The second phase will develop two working demonstrators to validate and refine the tools. The first is a support system for current training practice in safely maintaining and repairing the devices of an electrical distribution network. The second is the provision of a full range of training in both routine and emergency procedures for fossil fuel power plant operation. Also, during this phase, the tools will be synthesized and generalised to provide a generic architecture for ITSIEs. Finally, a critical evaluation of the performance of the demonstrators will be undertaken and recommendations for further work made.

Exploitation/Time Horizon for Industrial Application

ITSIE will provide the technology and know-how to solve industrial training problems and provide particular solutions in the demonstrator application domains. System suppliers will exploit ITSIE know-how in product development.

Marconi Simulation intends to use the ITSIE methodology as the basis of a new generation of trainers and simulators.

CRI looks forwards to demonstrating the ITSIE concept in the areas where it is already involved, to both system developers and customers. CISE are interested in the development of the electrical distribution trainer. Heriot-Watt University will exploit the results in research, teaching and consultancy. Iberduero intends to utilize the results for in-house use. Laboratoires de Marcoussis intends to exploit the results through links with several associates. Labein will engage in further ITSIE research and will develop ITSIES for industry.

Contact Point

Mr. K.D. Horne
MARCONI SIMULATION LTD
Donibristle Industrial Park,
nr. Dunfermline
FIFE KY11 5JZ
UK - SCOTLAND

Tel: 383-822131 EXT.3074
Fax: 383-824227
Tlx: 727779

Participants	Country	Role
MARCONI SIMULATION LTD	*UK*	*M*
AXION A/S	*DK*	*P*
IBERDUERO SA	*E*	*P*
CGE-LABORATOIRES DE MARCOUSSIS	*F*	*P*
HERIOT-WATT UNIVERSITY	*UK*	*P*
CISE SPA	*I*	*P*
UNIVERSIDAD DEL PAIS VASCO	*E*	*S*
LABEIN	*E*	*A*

Start Date	Duration	Resources
26-APR-89	*48 months*	*60 PY*

FRONT-ENDS FOR OPEN AND CLOSED USER SYSTEM (FOCUS)

PROJECT NUMBER: 2620

Objectives/Programme of Work

The aim of this project is to make software systems for industrial and scientific applications easier to use. The approach is to enable the human-computer interfaces to be enhanced by the presentation of software usage instructions and application-domain knowledge when needed. This facility will be provided by the attachment of Knowledge-Base Front-Ends (KBFEs) to the core packages, which are left unchanged.

Generic tools and techniques are required for the construction and maintainance of KBFEs: it is the objective of the project to develop these.

In phase one, state-of-the-art prototype KBFE systems will be used to generate and define generalised tools, techniques and methodologies. In phase two, these tools will be used for the construction of KBFE prototypes for closed user systems to be selected from free-standing software packages available within partner sites for a broad range of application domains. In phase three, prototype implementations of KBFEs for reusable software components and other open-user systems will be developed, and applied to an existing library of numerical and statistical programmes to establish the requirements of open user systems for KBFEs. In all phases of the project, on-site user evaluation will be continuous, and interactive feedback will be given to the developers of the open and closed system prototypes and the tools.

Progress and Results

A first action consisted in transfering and training in the use of the existing systems: SISP, provided by WWU and NAG.

Meanwhile a study of further techniques for front-ends began, and the development of a standard notation in which to specify the interface between the front and the back-ends was initiated. The design of the architecture for the front-end harness is presently under consideration.

Exploitation/Time Horizon for Industrial Application

Commercial exploitation of the software will begin during the project.

The close involvement of industrial users in the project will lead to the development of practical and usable tools and techniques for exploitation in the internal market.

Contact Point

Dr. Brian Ford
NUMERICAL ALGORITHMS GROUP LTD
256 Banbury Road *Tel: 865-511245*
OXFORD OX2 7DE *Fax: 865-310139*
UK *Tlx: 83354 NAGUK G*

Participants	**Country**	**Role**
NUMERICAL ALGORITHMS GROUP LTD	*UK*	*M*
THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY	*UK*	*P*
LUTCHI RESEARCH CENTRE	*UK*	*P*
SOLVAY SA	*B*	*P*
WESTFAELISCHE WILHELMS - UNIVERSITAET MUENSTER	*D*	*P*
UNIVERSITAT POLITECNICA DE CATALUNYA	*E*	*P*
PHILIPS INTERNATIONAL BV	*NL*	*P*
METEK SA	*GR*	*P*
INDECON	*GR*	*A*

Start Date	**Duration**	**Resources**
21-DEC-88	*48 months*	*58 PY*

COST MANAGEMENT WITH METRICS OF SPECIFICATION (COSMOS)

PROJECT NUMBER: 2686

Objectives/Programme of Work

The aim of this project is to support the cost management of software development for complex real-time systems.

The objective is to develop a computer-aided software engineering tool for the creation of appropriate Management Support Interfaces (MSI).

The MSI will present development managers with graphics output giving information on specification properties that affect cost and resource expenditure. The MSI will also advise on the interpretation of this information in relation to the software system, the development environment and other management tools, and will monitor, review and analyse management feedback.

Cost-management decision-making will be supported, on the one hand, with measurable information extracted during the software development life-cycle from the early definition phase through to the final acceptance of the system, by applying the theory of software metrics with the use of formal and semi-formal development methods. The acquisition of this information will be facilitated with the use of an enhanced version of an existing core metrics tool. Selection of the formal specification methods to be used in the observation studies will be based on identifying those methods which have genuine use or potential within the host organisations.

On the other hand, the COSMOS project will study common cost-management principles from different software development managers, in order to define a practical set of core metrics tool parameters and a user interface. The interface will use the formal information from the Core Metrics Tool, together with non-formal information input by the software manager.

The relationship with established cost models like COCOMO, SLIM and Price/S will be studied, and deliverables from ESPRIT I projects like SPMSS, PIMS and PCTE will be used when appropriate.

Evaluation and enhancement of the COSMOS tool will be achieved by conducting observation studies involving its use on real-time systems development projects, eg for telecommunication and industrial applications, selected and monitored by the industrial partners.

Exploitation/Time Horizon for Industrial Application

The Research Center of Alcatel Austria plans to integrate tools for measuring complexity and productivity and for estimating costs into a computer-aided software engineering environment developed in-house.

British Telecom intends to exploit the results for the understanding and management of their internal software development projects.

TechForce will exploit in consultancy work the experience gained.

Contact Point

Mr. F.P. Hirdshaw
TECHFORCE BV
Niels Bohrweg 11-13
NL - 2333 CA LEIDEN

Tel: 79-163500
Fax: 23-323338
Tlx: 41468 ALCOM NL

Participants	Country	Role
TECHFORCE BV	*NL*	*M*
ALCATEL AUSTRIA - ELIN	*A*	*P*
UNIVERSITY OF LONDON GOLDSMITH'S COLLEGE	*UK*	*P*
NIJENRODE UNIVERSITEIT VOOR BEDRIJFSKUNDE	*NL*	*P*
TELEFONICA SISTEMAS SA	*E*	*P*
BRITISH TELECOMMUNICATION PLC	*UK*	*P*

Start Date	Duration	Resources
23-MAY-89	*50 months*	*45 PY*