



Esprit

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for Research and Development in
Information Technology**

The Project Synopses

Office Systems

Volume 5 of a series of 7

April 1988

**Directorate General XIII
Telecommunications, Information Industries and Innovation
Commission of the European Communities**

The Project Synopses
Office Systems
Volume 5 of a series of 7

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OFFICE SYSTEMS

Introduction

Information is an important instrument of competition. This concept is now widely recognised. Office Systems provide a major vehicle through which information can be applied as an aid to navigation through the present turbulent changes in business, technology, commerce and government.

While the potential contribution of information technology to improve effectiveness can be easily recognised, the delivery of solutions to the information problem areas is an entirely different matter. The problems are "fuzzy" and frequently the solution processes appear to be artistic rather than scientific. The users of information frequently have little or no knowledge of the technological content and necessary technical processes that are involved in processing information.

The majority of users require total solutions and not isolated products. These solutions have to be reasonably complete and this implies that integrated systems must be provided, not only in the sense of the inter-relationship of the technical components (both hardware and software) but also in terms of the functions that these components perform as a support to the day-to-day operations, planning and strategy development of organisations.

The challenges facing Office Systems development include:

- Providing integrated information system architectures and scenarios for their implementation that will allow rapid, economic and reliable adaptation to the changing needs of a great variety of private and public enterprises.
- Understanding and supporting the non-deterministic tasks of a wide range of office workers and not just providing a technological update of traditional and limited office functions.
- Achieving major improvements in human-system interfaces that realistically allow effective use of office systems by a wide range of office workers.
- The development of solution oriented approaches to office problems. Delivering product elements and some services and expecting the user to create the total own solution cannot continue.

The key European opportunity relates to the development of system solutions. The implications of European requirements must be that these solutions have an adaptability, flexibility and inbuilt interworking capability that will be a real strength outside Europe. This will only be true if the application of technology reflects a degree of user sensitivity ahead of our major competitors.

Research work in the field of Office Systems can be characterized as follows: on the basis of fundamental and methodological developments in VLSI, software technology, knowledge representation and some other fields. Integrated and applied system solutions are developed which take into consideration user requirements and foreseeable evolutions in the technical, social and economical field.

The Office Systems programme provides the key elements and concepts that mark the development from classical data processing to integrated information processing in administrations and industrial and service enterprises, by which the future work environment will be characterised. For that purpose, systems architectures, functional modules and communication networks with standardised interfaces are necessary.

In developing these systems, which are essential for the survival of our industrial companies, human and social factors have to be considered in the early stages of planning. Only in this way can we ensure that the systems will eventually be accepted by the users and that economic expectation will also be met.

Taking into account the above mentioned integrated approach, the subprogramme has been divided into five research areas. The aims are:

Office system science and human factors

To analyse current and predicted office activities to determine how information technology might be applied to improve the effectiveness of office work and organisation of the enterprise as a whole. Besides automation of various functions and the use of knowledge management methods, this means better support particularly for administrators, professional and managerial staff in executing their judgmental tasks.

To improve understanding of human, social and cultural factors in the office and to ensure high performance of users when interacting with the systems, whilst at the same time offering optimal working conditions and ensuring adequate organisation and individual acceptance.

Advanced workstations and human-machine interface

To establish major new human-machine interface technologies, peripheral technologies document representation technologies and information manipulation relevant to the development of office workstations for use in advanced office systems.

Communication systems

To create the basic technologies required for advanced office communication systems including technical fundamentals in communication systems architecture, optical technologies as a particularly

significant technology, the management of resources connected by networks, and system aspects of value added services.

Advanced multi-media information storage and retrieval systems

To acquire the system and applications expertise related to storage and retrieval of all forms of office information in electronic storage systems in a user organisation in an adequate way.

Integrated office information systems

To create flexible, reliable and economical total information system architectures and implementation scenarios, and to check the validity of the total information concepts in environments that are realistic and allow quantitative evaluation.

Priority is given to integration projects throughout, especially in this area.

Office Systems Science and Human Factors

This research programme has been devised to give a better understanding of the office environment. Offices are the "nervous system" of any enterprise. These must be organised, staffed and equipped for effective and efficient operation, and interfaced with other branches of the enterprise (such as research laboratories and manufacturing) and the external environment.

At present the understanding of this field is patchy. There is no formal science of office automation, as there is for example for production automation. This programme, however, makes possible coherent approaches to the problems, ranging from empirical studies to consistent operational classifications and definition of computer based analysis and design tools.

Consistent with this approach, the main topics identified are (a) office systems analysis, (b) office systems design, (c) human factors and (d) the possible application of knowledge based methods. The analysis part of the programme delivers useful input for the design oriented phases.

It is evident that the incorporation of human factors, especially into a technology-oriented programme is an essential pre-requisite for effective use and a broad acceptance of the envisaged systems and thus for their final economic success. The research programme therefore includes specific research projects on human factors related to the office environment. This leads to programmes for cognitive aspects together with work structuring, qualification and training. Human factors laboratories are also seen as key competence centers and catalysers, offering the possibility of unbiased judgment about experimental systems and on commercial products.

The topics to be studied in this area include:

Office systems analysis

- (a) Operational and functional analysis of office requirements
- (b) Cost benefits analysis
- (c) A glossary of agreed terminology
- (d) Analysis of human tasks within the office

Office systems design

- (a) Office system design methodology
- (b) Modelling and simulation of office information systems
- (c) Transaction monitor
- (d) Deterministic and judgmental function
- (e) Techniques for user interface design

Human factors

- (a) Human factors laboratories
- (b) Human-machine cognitive compatibility
- (c) Qualification and work
- (d) User aids and learning tools
- (e) Human-machine interface specification languages
- (f) Natural language interpretation and production

Advanced Workstations and Human-Machine Interfaces

The workstation is the user's gateway to the office system. User acceptance and user performance depend on the design of the corresponding human-machine interface.

The most important channel for information input to the human user is the visual channel. This channel, as well as the bi-directional vocal channel, has evolved to provide information for motoric activities which should be adequately integrated in operating the interface. In consequence, VDU's and touch keyboards and speech receptors will emerge to form an integrated input/output device suitable to manipulate text and images by direct manual and vocal control. Preferably the screens should have the dimensions and portability of paper (electronic paper). Another approach to a more comfortable 'visual input' will be the large screen display. The need for multi-functional capabilities will require the development of devices which allow graphic input and editing, on line handwriting and ideogrammatic conversation.

As long as there is no portable paperlike display, printing will be necessary and the need will be growing for faster, more versatile (text, graphic, colour) printers at lower cost. The provision of human-machine interfaces which support the complete range of functions traditionally carried out by pen or paper is necessary.

A high proportion of telephone or face-to-face communication indicates that visual and spoken information will be preferred whenever it is applicable.

Visual communication will require the development of high definition colour video scanning devices with the necessary processing capabilities for efficient storage and transmission and the use of the multifunction flat panel display.

The voice channel cannot handle as much information as the vision channel but is our most efficient carrier of natural language. Voice communication will require the development of sophisticated processing for improving the acoustic environment, and the development of coding schemes. Voice communication between man and the office system will require the development of efficient speech recognition and of a natural speech synthesizer.

An important aspect of facilitating the standardisation of the interface with the human world and the paper world is the use of formalised languages. These are to be designed in a way which allows the user, rather than the computer professional, to specify his needs directly to the system.

The implementations and testing of user decision support functions are considered to be embedded in the workstation. Availability of these functions is supposed to be a key-factor in the competition among office products.

The development of specific system interface components should lead to a general architecture which will allow the integration of the subsystems in an architecturally homogenous solution. Although the work items are phased in terms of integration into a physical workstation, projects are not necessarily confined to assume that all the associated functionality is resident in the workstation. Solutions involving distributed functionality accessed over communication links are equally relevant.

Much of the software that supports the user will reside in the workstation. Any rules that are, or will be, agreed upon in order to improve portability of software, should be implemented. This applies as well to rules and agreements with respect to other aspects of the system.

The following R & D topics are identified:

System aspects

- (a) system aspects of workstation design
- (b) workstation security

Vision

- (a) vision interface
- (b) flat panel workstation design
- (c) high resolution video imager
- (d) image coding

Paper

- (a) paper interface
- (b) advanced scanner
- (c) advanced printer
- (d) microfilm interface
- (e) graphics coding
- (f) graphics recognition
- (g) intelligent graphics recognition

Speech

- (a) speech interface
- (b) speech coding
- (c) speech recognition
- (d) intelligent user function support
- (e) user to user multimedia communication

Office languages and procedures

- (a) office document architectures and languages
- (b) office interface languages
- (c) multi-media document manipulation
- (d) intelligent user function support
- (e) user to user multimedia communication

Communication Systems

Office communication presents a number of possible long lead time research topics. Technological advances are needed in microelectronics and in fibre optics, and research is necessary on the principles of future communication systems such as wideband local area networks (LAN), the interconnection of LAN's and the gateway facilities for multimode functionality . R & D should lead to new systems and to standards consistent with the ISO reference model for open systems interconnection (OSI). Besides these technical problems, there are non-technical problem areas which have to be addressed in order to support the progress of office communication systems. The requirements of office communication have to be explored more systematically to get a more solid basis of future telecommunication system design. The special aspects of human interface with communication have to be studied, and the future relationship of the PTTs to new local communication systems has to be considered. New languages and operating system facilities are necessary in connection with distributed systems.

Within this scope of possible research activities, four main topics which cover some key issues have been determined.

The first topic is dedicated to the fundamental question - how to provide a common communication system for all office communication needs. This question becomes more and more urgent, since non-voice communication will

be needed at almost every desk in the future and video communication is on its way.

The second topic addresses the wide band LAN, including the application of optical fibres, and all the technical problems related to this. It is also concerned with the role of switched communication in the office. It addresses the problems of advancing from current single services switching techniques towards multiservice variable bandwidth switching which will allow the interconnection of all office peripherals and resources.

The third topic deals with resource management in a distributed environment.

The fourth topic intends to advance the standardisation of value added communication services in the office e.g. in the form of mail box messaging for text, image and voice, and for multi-media information systems such as advanced videotex.

Architecture

- (a) communication system architectures
- (b) security in communications
- (c) harmonisation issues in communication

Technology

- (a) optical wideband
- (b) advanced switching techniques

Resource management

- (a) distributed systems

Services

- (a) multi-mode messaging
- (b) ISDN-based advanced videotex
- (c) teleconferencing
- (d) advanced services

Advanced Multi-media Storage and Retrieval Systems

Information technology and office automation are fundamentally concerned with the storage, accessing and movement of information, covering data, text, graphics, voice, images and other forms. Investigations leading to the definition of an advanced data-base model for office applications and studies of the security, privacy, authority of access and information distribution are fundamental to a wide range of office systems research.

The proposed research is oriented toward construction of a number of experimental prototype office information servers, and the operation of

these in realistic conditions, alone and in association with each other, to gain practical experience in the systems implications of building these servers, loading them with practical information and using them in a realistic way. The work is therefore divided into three general classes: systems issues, usage and needs, and components.

Systems issues: these cover the design and operation of office information servers, including high-performance filters and investigations of new information models and the development of metrics relating to these. Servers must be considered in relation to the other components of a comprehensive office system including other information servers and the distribution of information and functions between them. Work on the filing interface-related aspects of query languages and declarative content languages is identified.

Usage and needs: this topic addresses the nature of the information (data, text, graphics, images etc...) that will be held in office information servers in terms of quality, quantity and combination and the usage of that information. An internal adaptive interface is to be investigated that responds to the needs and experience of users.

Components: the development of hardware, software and systems elements that will be incorporated into advanced filing systems, primarily in information servers, but also in advanced workstations. These include filters, the systems management issues relating to using optical discs in advanced office systems, the systems techniques required to achieve very high perceived reliability, and the application of advanced information processing techniques to advanced filing and retrieval systems.

The topics covered by this R & D area include:

File server architectures

- (a) office information server design and evaluation
- (b) very high security systems

System issues

- (a) new information models
- (b) file query and declarative content languages

Usage and needs

- (a) nature and usage of filed information
- (b) user-file adaptive interface
- (c) performance of office information servers

Components

- (a) file filters
- (b) optical storage systems concepts

Integrated Office Information Systems

The research and the prototype development of components for office systems has to be supplemented by the research and evaluation of integrated office systems concepts for a variety of office environments. In an industrial R & D programme the testing of prototypes against requirements that are representative for market conditions, is the most important check on the relevance of the research done.

The architecture for distributed systems is a major area of concern. Distribution of functional units networked together can be considered the fundamental concept not only for office systems, but for all future information systems. Elaboration and implementation of this concept is by no means trivial, and requires many new ideas as well as the development of reference models and standards.

A particular aspect, system security, should be considered throughout the design process on the total system level as well as on component level.

Two topics are identified in the sub-area test and evaluation that are complementary but not necessarily mutually dependent.

- 1) The creation of test and evaluation environments for office system components and integrated office system prototypes, that allow qualitative and quantitative validation in a variety of simulated offices and enterprises. This work would also use the products of the work on office system science and human factors as well as other standards, performance and integration work.
- 2) The design, development and evaluation of advanced office systems prototypes based upon state-of-the-art components developed in Europe, possibly under the ESPRIT programme, and based upon the results of structures analysis in the office systems science and human factors areas.

The following R&D topics to be studied in this area include:

Information system architecture

- (a) system architectures
- (b) systems security

Test and evaluation

- (a) office system test and evaluation facilities
- (b) office systems application test beds

A MULTIMEDIA FILING SYSTEM (MULTOS)

Project Number : 28

The objective of the project is to develop filing services for multimedia documents using magnetic and optical storage media. Particular attention is paid to the needs of the office environment. The system will be implemented on a dedicated server that accepts requests from clients such as workstations or other devices. The units of information between server and client are multimedia documents rather than physical records or blocks.

The services provided by the server are those traditionally found in an information retrieval or database environment. However, the dual demands of a multimedia capability and application to offices introduce research issues. The server will be implemented in two phases:

- The first prototype deals with text and attribute data only (1987).
- The second version adds image and voice data (1989).

The global design of the system was completed in 1985. The first prototype specifications were successfully defined in March 1986. They cover:

- The server sub-system which comprises of an architecture for the multistorage file system, document storage, various feature processors, and a query processor.
- The client sub-system providing the interface from the surroundings e. g. users, application software and communication.
- The document model which is based on ODA and uses an Abstract Syntax Notation to define the logical and layout structure.

The first prototype was demonstrated at ECW'87. It was composed of the following modules:

- A text retrieval component allowing document retrieval based on text search.
- Query processor passing the individual queries.
- Type handler handling different document types.
- Client server providing an initial user interface and document entry.

The first commercially available multimedia file servers are expected in 1990 for office systems in business and administration based on a structure of workstations, LANs and/or WANs and other types of servers. This would be a milestone for the new generation of commercially integrated office systems.

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Country	Role
<i>I</i>	<i>M</i>
<i>D</i>	<i>P</i>
<i>GR</i>	<i>P</i>
<i>D</i>	<i>P</i>
<i>GR</i>	<i>P</i>
<i>E</i>	<i>P</i>
<i>I</i>	<i>P</i>

Start Date: 01-FEB-85

Duration: 60 months

**STANDARDISATION OF INTEGRATED LAN SERVICES AND SERVICE ACCESS
PROTOCOLS (E-INTERFACE)**

Project Number : 43

The objective of the project is to define the services to be provided by an integrated traffic LAN and to define a stable interface between terminals (DTE: Data Terminal Equipment) and LAN access unit. This interface will comprise the physical interface and the service access protocols by means of which the services can be used. The definition of service parameters, events, etc., will be presented for standardisation to ECMA and IEEE.

After having analysed several possible types of standard interface(s) (parallel interface, serial interface, computer-bus type interface), the project is now focusing its effort on the external, serial link E-Interface, which is seen as the most competitive and the most likely to become a standard.

The final specification of this interface has already been produced and validated and has been submitted to ECMA for approval in January 1987. The E-interface is currently being implemented. On the basis of the established standard, it is possible to connect DTEs of different type and manufacturers to LANs of different type and manufacturers, independent of the structure and media used. The large potential LAN and terminal market development depends heavily on the existence of such a recognised standard.

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Country	Role
<i>NL</i>	<i>M</i>
<i>UK</i>	<i>P</i>
<i>I</i>	<i>P</i>
<i>D</i>	<i>P</i>
<i>UK</i>	<i>P</i>
<i>F</i>	<i>P</i>
<i>F</i>	<i>P</i>
<i>NL</i>	<i>P</i>
<i>UK</i>	<i>P</i>
<i>F</i>	<i>P</i>
<i>F</i>	<i>S</i>
<i>NL</i>	<i>S</i>

Start Date: 01-SEP-84

Duration: 43 months

FUNCTIONAL ANALYSIS OF OFFICE REQUIREMENTS (FAOR)

Project Number : 56

The FAOR project aims to develop and validate a methodology to be applied in an organisational setting to identify and evaluate the requirements which determine the design of office systems, in such a way that they achieve certain organisational objectives. The main objectives of this project were:

- The development and validation of a methodology that may be used to understand a client's objectives for improving the operation of his office.
- The application of the methodology, which will be adapted for each client study, based on an understanding of the client's objectives will then be used to assist the client in understanding his task and related issues.
- Determination of Information Technology (IT) requirements for the client to improve his ability to meet his objectives.
- A cost-benefit analysis method, which is able to clearly and concisely demonstrate both the tangible and intangible costs and benefits to clients of alternative IT options, is an integral part of the methodology.
- The development of a generic model of the office together with a means of tailoring the model so as to reflect specific office categories. This tailored model will be used in a pre-analysis phase and will help to synthesise a tailored version of the generic methodology that may be more effectively applied in a given client's office.
- To define a formal approach to multi-client surveys. This will involve the determination of mechanisms for abstracting from a number of client studies a generic (or multi-client) view of IT requirements. These requirements may be used to plan research and development for future IT products. The product planning does not, however, form part of the FAOR project.

FAOR has drawn together several different methodological and modelling components to form a comprehensive approach to the analysis of IT requirements. This is structured around a 'loosely procedural' framework of analytical activities called the Activity Framework. The main activities are : office exploration, method tailoring and requirements analysis and evaluation. FAOR employs the Soft System Methodology (SSM) developed by Peter Checkland as a general framework for co-ordination of the analytical activities and as a conceptual basis for determining requirements for changing the office organisation.

The Generic Office Frame of Reference (GOFOR) supported by a library of perspectives has been developed. This will make it easier to understand the different office perspectives (information/ function/ task/ communication/ resource/ time and personnel) and assist in the client-specific tailoring of instruments,

GOFOR contains the reference base of office knowledge structured as multiple perspectives and formally described with the aid of Petri-Nets. Various instruments provide tools, techniques and applications guidelines for the practical application of the multiple perspectives in a client investigation.

A benefits analysis framework has been produced which supports the evaluation of requirements and changes represented by a proposed office system. Practical evaluation of the developed methodology has been aided by carrying out a Field Study at Essex County Council in England.

A comprehensive final report covering the whole FAOR approach and including extensive application guidelines is being published as a book.

The "openness" of the FAOR Activity Framework to the incorporation of further office perspectives and other instruments, offers an approach to office analysis which may yet evolve in the future.

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Country	Role
<i>UK</i>	<i>M</i>
<i>D</i>	<i>P</i>
<i>D</i>	<i>P</i>
<i>DK</i>	<i>P</i>

Start Date: 01-SEP-84

Duration: 30 months

**NEW INFORMATION MODELS FOR OFFICE FILING AND RETRIEVAL
(MINSTREL)**

Project Number : 59

The MINSTREL Project (Models for Information Storage and Retrieval) identifies and develops software techniques for future office filing and retrieval systems. The focal point is the development of an office information model which can be used to describe the properties of and operations used on all forms of office information.

In MINSTREL, the existence of a large and varied body of information is assumed. This will be comprised of images, sound, graphics, text and numerical data. There will also be a demand for greater functionality and a higher degree of integration of computerised office support tools. Consequently, future office systems must be built with a more flexible and powerful architecture. The chosen architecture is based on three major principles : modularisation, layering of functions and a single uniform data representation.

The central task is the development of the office information model which can provide a single uniform data representation, and thus play a role similar to a database management system. The other tasks in MINSTREL are aimed at developing techniques that improve the effectiveness with which an office worker can retrieve the information he requires from such a filing system. The research ideas developed in the project are being validated by integrating them in a prototype implementation of an office filing system, which ranges from a graphic-based user interface to efficient storage structures.

The project is now completed and the following results have been achieved :

- A complete, formal specification of a comprehensive office information model.
- A prototype implementation of a subset of this office information model, including a specially developed storage management system for efficient access.
- A prototype implementation of a dialogue manager, which provides a uniform user interface to all office applications.
- The use of graphics to construct a user-friendly interface that utilises various presentation forms to clearly manifest the underlying organisation and structure of the stored data.
- A formal specification and prototype of a query language that allows convenient querying of both structured data and text, and which can handle imprecision, both in query criteria and in the stored data values.

- A text retrieval algorithm which uses syntactical analysis to achieve a more accurate match of queries and documents.
- The specification of an access control system, within the office information model, which provides a pseudo-mandatory, as well as a discretionary, security policy.
- A prototype implementation of a data entry subsystem that can input paper documents using a scanner in an adaptive manner, ie so that it can separate images from text and recognise characters despite poor-quality copies, font changes and certain other irregularities.

Some of the results, such as the graphical user-interface, the handling of imprecision, the content retrieval mechanism, the access control system and the data entry subsystem can be applied to present day office information systems. Some of these will be exploited by the industrial partners. The system architecture and the office information model are very relevant for future office information systems with major requirements for multi-media data and integration of application programs. In particular, the office information model is ideally suited for representing structured documents, as in the Office Document Architecture standard, and for integrating them into a general filing and retrieval system.

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Start Date: 01-SEP-84

Duration: 36 months

SPEECH INTERFACE AT OFFICE WORKSTATION (SPIN)

Project Number : 64

The objective of the project is the development of the basic components of a comprehensive speech interface and their integration into a workstation. The components are identified as speech analysis, speech recognition, speaker verification, speech coding and decoding, and speech synthesis. For the integration of the components it is important to have an understanding of the usage of speech in human-machine communication. The quality/functionality aspects must allow the interface to be accepted by the human users. The languages covered are Italian, French and modern Greek. Speaker independent isolated word recognition will be addressed. Over a five year span, the demonstrating workstation will support a multimedia dialogue with voice input/output facilities. It will be tested in a real office environment.

Progress so far consists of :

- Five state-of-the-art reports available for the ESPRIT community. These examine speech recognition, speaker adaptation, automatic speaker verification, speech coding, speech synthesis and intelligibility evaluation.
- Phonological and prosodic rules for Italian and French are defined. Report on synthesis in modern Greek.
- Quality evaluation of speech coding systems.
- Analysis of parameters relating to speaker variability; this information will support the implementation of an adaptive recogniser.
- Corpus for speaker verification.
- Speaker independent 130 word vocabulary recogniser on a PC compatible board.
- specification of a speech processing VLSI.

A prototype office workstation speech interface based on results of experiments and simulation tests has been designed and tested. Starting in 1989 the results are expected to be applied to the workstation market.

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<i>Start Date: 01-JUL-84</i>	<i>Duration:</i>	<i>60 months</i>

BROAD SITE LOCAL WIDEBAND COMMUNICATION SYSTEM (BWN)

Project Number : 73

This project is concerned with the research and development of a local area wideband communication system for broad sites (BWN: Broad site local Wideband Network). The prototype system developed will meet the anticipated future communication requirements of large industrial, scientific and administrative organisations. The project takes into account data, text, voice and graphics communication needs, and it will provide backbone networks and gateways for heterogeneous LANs.

In general terms the objectives cover the design, implementation and prototype testing of a multimedia (data, voice, still image) high performance communications infrastructure with the following characteristics:

- Data rate of 140 Mbps.
- Data access rate of typically 2 Mbps full duplex.
- Broad site coverage of typically 100 km.
- Interconnections to LAN of differing topologies and access protocols.
- Gateways to public and satellite networks.
- Compatibility with existing and emerging standards of the ISO-OSI reference model.

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Start Date: 01-SEP-84

Duration: 60 months

INTELLIGENT WORKSTATION (IWS)

Project Number : 82

The project aims at the development of a complete system that will provide assistance to office workers. In particular, the office activities will be represented (documents, organisation and procedures) and these representations will be used in order to provide advice on actions required. Furthermore, the required actions can be automated and monitor subsequent actions until the goal is achieved. Hardware and software aspects are concerned with a special stress application oriented developments and user interface. For this purpose the project is divided into six modules:

- The assembly of the hardware for the construction of the workstation. Dedicated hardware such as filtering mechanisms developed during the first year will be taken into account when necessary in the workstation and/or servers. The hardware will be selected from products available on the market.
- The operating system of the workstation. It will be network oriented and ensure multitasking and synchronisation with all the necessary mechanisms for increasing the reliability of the distributed system.
- The implementation of the LISP environment and Knowledge Representation System (KRS).
- Focus on the layer of office system tools that embed office semantics.
- Concrete applications to be implemented with the office system tools.
- The user interface, which is divided into three parts :
 - Natural language processing and an author system.
 - Enhancing the user interface with multimedia features (sound and image).
 - Defining and implementing a conceptual model of the user interface.

The project uses Artificial Intelligence techniques to design an office system that employs on the one hand, knowledge about office organisation and procedures, and on the other hand, the necessary tools for a natural interface with the user (natural language and multimedia).

The basic components and tools for complex applications have been successfully developed and verified.

Interim versions of several prototypes which will be issued as an

integrated prototype from IWS have already been built and demonstrated at the Hannover Fair 1987 and the Esprit Conference Week 1987.

The workstation hardware, based on BULL Metaviseur, provides a high table top office engine with high-speed large real memory (40-190 Mbytes on 5.25" hard disk), efficient graphic and voice support, 32 bit-micro-processor, Ethernet communication support and telephone interface.

The operating system environment is UNIX based and has efficient graphic and audio support. Upon this operating system, the intelligent environment is made of a LE-LISP compiler with its object oriented and virtual graphical extensions.

A set of natural language processing (NLP) tools have been already provided for Dutch and are under development for English in order to support two different applications. These are an intelligent word processor or author environment and a dialogue system which enables natural interactions.

The Knowledge Representation System (KRS) as an interactive integrated environment for Knowledge representation contains all the necessary tools for rapid construction of knowledge based systems and applications. KRS is adapted to the workstation environment and extended with the new formalisms required by office applications. Using these formalisms, three levels of applications will be built: office process analysis, office process advisor and office process assistants.

A User Interface Management System (UIMS) is related to the development of a general tool (ACHILLES = A Computer-Human Interface Lexical Library and Extensible Syntax) for faster specification and generation of user interfaces for the particular applications. This will enable naive users to enter and revise instances of the organisational model, the document and the facilities model, as well as requesting simple actions.

A complete prototype of an office workstation connected to servers through a network and based on artificial intelligence techniques will be available at the end of 1989. The results will be immediately transferable into a broad spectrum of workstations. These will be the focal point of information systems in the 1990's. Spin offs from the IWS have already been introduced in product developments.

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Start Date: 01-MAR-85

Duration: 48 months

**HANDLING OF MIXED TEXT/IMAGE/VOICE DOCUMENTS BASED ON A
STANDARDISED OFFICE DOCUMENT ARCHITECTURE (HERODE)**

Project Number : 121

The project aims at the design, prototype development and demonstration of co-operative tools for the handling of mixed text/image/voice documents in future office systems. The activity is based on the Office Document Architecture (ODA). ODA supports both the logical and the layout structure of documents. The ODA document-type definition allows the tools to be adapted easily to the actual type of document. This reduces the time taken by the user carrying out routine tasks and allows automatic checking of document input.

A prototype of the Document Handler has been developed and integrated. It comprises of:

- A Logical Structure Editor for creation and modification of the logical structure of a document.
- A Character Content Editor for editing text.
- A Geometric Content Editor for handling lines, curves and graphics.
- A Photographic Content Editor for editing picture information.
- A Layout Structure Editor for the automatic update of the document layout after each editing step.

A prototype of the Common User Interface and the Document Editor Shell was developed and integrated and provides a unified functional appearance for the user when employing the different editors.

The prototype of the Automated Document Entry Tool has been integrated. It supports the function of transferring a document with text, drawings and pictures into an electronic form. The following functional modules are available: preprocessing, area segmentation, geometrics recognition and coding and photographics recognition and coding.

The prototypes were demonstrated during the 1986 and 1987 ESPRIT Conference Weeks and are described in several public papers.

The project has had a major impact on the ECMA and ISO standardisation of ODA, and the results will be used in the PODA (1024) project.

This project, the foundation for the standardisation of electronic documents, is of major importance for information systems in business and administration. It will allow office documents including graphics and pictures to be transferred, stored and manipulated. The transfer, storage and manipulation can be effectuated on and between different systems, from

different vendors, based on the ODA standard. It will support the development of the market for document-based information systems, and improve the marketing potential for a large number of vendors.

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Start Date: 01-NOV-84

Duration: 36 months

LOCAL INTEGRATED OPTICAL NETWORK (LION)

Project Number : 169

The Local Integrated Optical Network (LION) project is implementing a local area network based on optical fibre technology, with major applications in office environments, industrial and research laboratories, universities, hospitals and manufacturing plants. The LION will guarantee multiple access to a number of independent users with requirements for distributed processing and distributed intelligence, and will handle voice, data, text and video traffic.

The general architecture of LION has been defined in terms of topology, communication protocols, basic design parameters, network management system and interoperability with external (local or public) networks.

Specific achievements are :

- Implementation of the hybrid (packet + circuit) communication protocol.
- Successful demonstration of an operational 140 Mbit/s LION node during 1987 and 1988.
- Connections to the network of different services such as phone sets, video equipment (2 Mbit/s), computers, personal computers and measurement equipment.
- Design of a software package for the simulation and validation of network operation through a specifically designed software tool.
- Functional specification of the gateway towards ISDN.

The project is working on further improvement eg. multinode environment. A study for increasing the speed to 565 Mbits/s will be undertaken.

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Start Date: 16-SEP-84

Duration: 52 months

DESIGN AND OPERATIONAL EVALUATION OF OFFICE INFORMATION SERVERS (DOEOIS)

Project Number : 231

The objective of the project is to design, build and evaluate a small family of working prototype office information servers (OIS) capable of holding in digital electronic form representations of all office information including that currently committed to paper. Both the design and evaluation will be based upon survey data derived from actual office applications.

A common (across all implementations) representation will be established both for the information held in the servers and the functions needed to manipulate and manage it. The intention is to demonstrate an open applications interface to make applications portable to any OIS conforming to a defined and published OIS Functional Interface. The key to the project is the consideration of the issues involved in handling office procedures with a view to being able to store their state in the OIS.

A major demonstration of the functionality of the Office Information Server interface is planned during the final year of the project. The project will end with the delivery of a report on the evaluation of the OIS model on two representative office applications and the publication of the final version of the External Functional Interface.

The use of text-file filters will also be explored in the context of OIS.

The following milestones have been achieved:

- Office analysis methods have been established for various types of organisations.
- Completion of office data collection work from selected field sites and presentation as a set of case studies.
- Adoption of ODA/ODIF for document interchange.
- Agreement on an External Functional Interface common to all partners. This includes: the Fact data model which is particularly suited to OIS requirements, the means of handling the state of procedures and transaction management.
- Completion of an OIS Functional Requirements Specification to form the metric against which the OIS prototypes will be evaluated.

The next phase of the project will cover:

- completion of the OIS prototypes to the point where their functionality can be demonstrated and evaluation started.

- design and implementation on the prototypes of two representative OIS applications plus attendant evaluation criteria.
- OIS evaluation proper.

The project should improve the current generation and underpin the new generation of office information storage and retrieval filing tools and systems.

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Start Date: 16-JAN-85

Duration: 60 months

COGNITIVE SIMULATOR FOR USER INTERFACE DESIGN

Project Number : 234

The objectives of the project were:

- The provision of a software package incorporating the principles of cognitive psychology that can be used by the designer of the user-interface as a design aid to assess human-machine cognitive compatibility. This is called the Cognitive Design Aid (CDA).
- The provision of design guidelines derived during the development of the design aid.
- The provision of an assessment of current trends in interface technology.

CDA incorporates modules based on principles extracted from Cognitive Psychology. These modules handle the inputs from designer to CDA. These inputs are a description of the interface and can vary from an abstract to a detailed level, depending on the state of development of the design.

Interfaces which were well tested were used for validating the CDA, their descriptions were input to the CDA, which provided cognitive compatibility indices. Human error performance was also directly measured from use of the interfaces. Four different indices were to be strongly predictive of errors and were used in the CDA.

The existing CDA is thus potentially highly useful for predicting errors. The Final Report also discusses possible future extensions and developments.

The CDA is supplemented with an operational description, and a deliverable which describes the psychological foundations of the project.

The "Design Guidelines" document is intended for both designers and human factors specialists who require a comprehensive and accessible set of cognitive psychology design principles. The principles are presented with examples and areas of application, in a manner which allows the relevant justifying research to be traced. The design principles include those on which the CDA is based, and those for which automatic assessment by a CDA is not yet possible.

The document on "Trends in Human-Computer Interface Technology" describes those developments particularly in electronic office systems which are relevant to cognitive compatibility. This information can be used for further developments of the CDA and the statement of next design principles.

The experience gained during the project and presented in the project

deliverables will have an impact on both academic and industrial practice. The power of the CDA to predict average user error for the interfaces chosen merits further research. If this is shown to be a general result it will be of great importance for cognitive psychology and practical user-interface design.

During the development of the CDA the partners studied topics which will be highly useful to them and others in subsequent projects, for example, methods for interface description and evaluation. The paper-based guidelines, and the Trends in Technology documents are already in use by the partners in their Human Factors work and like all the reports in this project are publicly available.

A subset of the final deliverables is being prepared by the consortium for public circulation.

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Start Date: 01-JAN-85

Duration: 33 months

COMMUNICATIONS SYSTEMS ARCHITECTURE (CSA)

Project Number : 237

The overall objective of this project is to specify, design and produce a prototype communication system architecture that satisfies the requirements of office environments. The architecture will consider the interworking of distributed and heterogeneous resources in an integrated multi-service environment. In traditional architectures such as the OSI Model, communication and resource sharing are explicitly visible at the level of the user. The CSA Architecture makes possible the distribution of applications where these factors are invisible. The project is organised in three major phases:

- Identification of the needs for communication by analysis of user requirements. Development of a logical model of communication. A proposal will be made for the integration of a distributed operating system within the open system structure (years 1 and 2).
- Development of the physical architecture by mapping the logical model from the first phase onto actual communication technology (years 3 and 4).
- Development of the system elements identified in the second phase to achieve a prototype architecture demonstration. This prototype architecture will be used for the demonstration of the features of the architecture and for evaluation of the principles adopted and performance constraints.

The overall strategic architecture was defined in December 1986. It is based on an object oriented approach for structuring the problems associated with an office environment. The architecture provides integrated techniques for managing office resources and handling communications between entities. Such functionality is supported by an Abstract Object Machine. An Abstract Object Machine is designed to solve a particular problem typical within the office environment and the management of this distribution, and finally the external communications to a variety of services operating under different architectural principles.

Industrial implementation is expected to follow rapidly (1990/92) because of the practical nature of the prototype implementation. The project policy of making the strategic architecture independent of technology will allow the early implementation of the architecture using immediately available communications technology.

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Start Date: *29-OCT-84*

Duration: *60 months*

ULTRA WIDEBAND OPTICAL COHERENT LAN (UCOL)

Project Number : 249

The project will investigate the feasibility of utilising coherent optical techniques for very high speed communications in a local area network by addressing both specific technological topics and system integration issues. It will consider new machine architectures to implement high bandwidth transmissions up to 10 Gbits/sec. The technologies to be employed include laser optics, advanced fibre optics and star couplers to serve high numbers of users with reasonable losses. It is expected that during the next decade the results will support the products for multimedia document transmission (including voice, text, image and graphics).

The project is particularly aimed at supporting the critical requirements of very fast response communication (laboratories and industrial control), bulk data transfer (large organisations) and complex applications (multiple TV).

Contact has been made with the "Metropolitan Area Networks" group of ECMA, concerning the potential standardisation of this protocol. The project is looking into the exploitation of future, advanced, critical component technology and in particular spectrum stabilised lasers and wideband optical receivers.

A follow up project would expect to provide a laboratory prototype available by 1990/91. The project addresses large local area networks in which extremely high data rates are required to allow the operation of real time video communication systems. The extension to geographic networks (such as campuses and metropolitan areas) will also be studied.

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Start Date: 01-FEB-85

Duration: 39 months

OFFICE SUPPORT SYSTEMS ANALYSIS AND DESIGN (OSSAD)

Project Number : 285

The overall objective of OSSAD is to develop, implement and validate a problem-oriented office system analysis and design methodology using a formal office language that helps users and manufacturers to specify and implement a computer-based Office Support System (OSS) and to meet the needs of end-users and organisations. More specific objectives are :

- To obtain a description of office work which is as formal and unambiguous as possible. This description should be comprehensible not only to analysts and designers but also to office managers so that they can validate it and suggest modifications and solutions.
- To relate office descriptions to relevant organization performance criteria and to help evaluate office work.
- To validate this description in real office environments; ie to evaluate and improve it on the basis of field studies.
- To specify requirements of office support systems with respect to the user, the organization and the technical solution; these requirements will be based on the empirical findings in existing offices.

Achievements so far:

- Development of different methods for office analyses (eg office functions analysis) based on the OSSAD-Model, which includes an abstract, descriptive and specification model.
- A preliminary glossary of terms to describe office work has been developed and a graphical mapping of formal office language has been specified.
- Field studies to validate the abstract and descriptive model and the related data collection instruments have been started in banks in France, Italy and Germany.
- A preliminary OSSAD manual is available. It consists of a description of models, presentation of the language and covers the whole process of reorganizing an office support system (set contract, analyze situation, design system, implement changes, monitor system performance). This Manual supports "project management" and will be used to tailor data collection instruments to the needs of specific users and organizations
- Field studies have been started to test the Design Methodology. The findings will be included in the final OSSAD Manual.

The ability to derive better user requirement specifications will have a very positive impact on information system application and on the rapid acceptance of future IT products. The developed office language "OSSADIC" can be used to specify technology/human behaviour interfaces and supports common efforts to integrate different kinds of office support systems from several European manufacturers.

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Start Date: 01-JAN-85

Duration: 48 months

LINGUISTIC ANALYSIS OF THE EUROPEAN LANGUAGES

Project Number : 291

The objective of the project is to produce the software necessary to perform grapheme-to-phoneme and phoneme-to-grapheme conversion at word level. This involves the conversions between the textual and the acoustical representation of words and the acquisition of the knowledge required to include speech in the man-machine interface. A linguistic model, based on typical syntactic patterns extracted from texts by statistical analyses, will also be developed to deal with an ambiguous solution. The project covers the following languages : Dutch, English, French, German, Greek, Italian and Spanish. The first step has been the development of a common methodology among the different languages in order to provide coherent and comparable results. Hardware and software tools have been standardised. Reference corpora of about 100000 words, dictionaries and lists of ambiguities (omographs and omophones) are available. They have all been extracted from common European Community texts, except for Spanish and Greek, where newspaper texts have been chosen. Statistical analysis on the reference corpus is in progress, along with the definition and development of a linguistic model for semi-automatic labelling of new text corpora and for phoneme-to-grapheme conversion on the basis of a contextual analysis.

The following results are now available for the different languages:

- Grapheme-to-phoneme conversion rules.
- Frequency of occurrence of the graphemic representation and of the phonemic representation of word forms (frequency-sorted dictionaries of several thousand words are available).
- Frequency of occurrence in the dictionary and in the texts of phoneme and grapheme clusters (frequency-sorted clusters lists are generated).
- Word length distribution and coverage graphs showing, as a function of "n", the percentage of texts which can be covered by the "n" most frequent words.

Grapheme-to-phoneme rules, already developed for all the languages using a unified phonetical alphabet, and statistical information extracted from the data bases can now be used to develop multilingual text-to-speech synthesis systems, excluding phonological phenomena at word boundaries.

All these rules developed in this project are being implemented in one software package.

Full industrial exploitation of the results is expected by the end of the 1980's in speech processing based systems. Target application areas are unrestricted texts, speech synthesis and large vocabulary speech

recognition. The acquired knowledge and the results obtained will also be useful for applications to other domains, such as optical reading, word processing and automatic translation.

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Start Date: *01-FEB-85*

Duration: *48 months*

THE PAPER INTERFACE

Project Number : 295

This project deals with techniques for automatic transfer of information between electronic systems and paper documents. Three major categories of paper interface systems are identified:

From Paper: Scanning of composed paper documents. Separation into the parts "image", "graphics", and "text". Recognising and encoding of text and graphics for further processing to generate an electronic document.

To Paper : The generation of a paper document from electronically filed information.

With Paper: Recognizing and encoding of typical text and graphical information in real time as it is produced by the human hand.

These components will be integrated into one system, with particular emphasis on aspects such as the human interface, editing and document architectures. The project objectives include for each task : specification of requirements, technology study, system and functional specifications, development of algorithm.

The project has developed a broad set of sub-systems, currently under test are:

- multicolour scanner.
- page printer sub-system.
- graphics analyser.
- image analysis.
- text recognition module.
- sub-system for on-line handwriting recognition.
- document rendition software for united text and graphics.

Integration of each sub-system is tested in the preliminary demonstrator. The preliminary demonstrator system is now in operation, integrating the three project components (scanner, analysis software, printer) for evaluation and demonstration. The design of this preliminary demonstrator system is completed.

The results are expected to be integrated in office products in 1990. They will contribute to establish a link between the paperless parts of the office of the future and those domains where paper will remain an indispensable element. The provision of this link will meet a growing need to avoid incompatibility between paperless and paper-bound tasks.

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Start Date: 01-SEP-84

Duration: 60 months

SECURE, OPEN, MULTIMEDIA, INTEGRATED WORKSTATION (SOMIW)

Project Number : 367

The SOMIW-Project aims to build an advanced multi-media workstation for office workers. The project focuses on the following main topics :

- Communications : The user will be able to communicate through different types of network and in particular ISDN. Communication can be protected against intrusion by a cryptosystem based on public keys.
- Multi-media input/output components: Different I/O components will be integrated in the workstations. These will include classical devices like the mouse and the keyboard and "intelligent" ones like an OCR (Optical Character Recognition) module, a voice recognition and synthesis component, an image processor allowing acquisition and display of animated colour images for transmission or archiving purposes, and a voice processor for coding voice at different rates.
- User Interface Management System : A new activity, User Interface Management System (UIMS) has been added to the project for managing the interaction with the user. Separating application development and user interface development allows the splitting of responsibilities. A specialist handles the difficult task of designing and implementing a dialogue structure, including the command syntax.
- Integrated applications: For preparing and handling documents, a multi-media WYSIWYG (What You See Is What You Get) editor, formatter, printer server and a filing and retrieval system will be developed. The object oriented operating system and the user interface management system will facilitate the integration between all the software components (editor, formatter-printer server, filing, retrieval and screen management).

A workstation design, called "Metaviseur", was adopted to permit the integration of the proposed devices, thereby defining a standard reference architecture.

For the integration of software an object-oriented operating system was adopted and extended for distribution. The SOMIW Operating System (SOS) eases the final integration of the different applications and modularises the services offered by the operating system by basing them on a minimal kernel. SOS is UNIX compatible. Colour was added and will support all the sub-tasks of the project. Window management, screen and screen management, multiplexing of video images and the integration of these different functionalities are available as services of the operating system.

A common document architecture based on the ODA standard has been adopted. A document interchange format (ODIF) has been used for a first integration

step. The document handling applications have been integrated into a common object-oriented document architecture offered by the filing and retrieval module.

A first non-integrated version of the different SOMIW components was demonstrated at the Hannover Fair in April 1987 and at the Esprit Conference Week in October 1987 . The main goal is to obtain the first completely debugged SOMIW prototype (mostly integrated under UNIX) by the end of 1988.

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Start Date: 01-JAN-85

Duration: 48 months

HUMAN FACTORS LABORATORIES IN INFORMATION TECHNOLOGIES (HUFIT)

Project Number : 385

The methods and tools under development are:

- An integrated set of methods and tools for the design of easily usable software (ISMED).
- A prototype multimedia adaptable integrated interface with appropriate tools to develop it efficiently. (MAITRE)
- A dialogue management tool to develop efficiently integrated graphical interfaces. (DIAMANT)
- A support system for the designer to assist in the human factors oriented design of usable software. (INTUIT)

The tools will exist in a variety of forms, from simple paper based ones, to an IT based decision support system providing advice and tools which contain a large amount of human factors knowledge. These tools are being developed with the help of designers in the companies, so that they will be practical and useful aids to such staff at their work bench.

Over its first two years the project has been concerned with a worldwide appraisal of the state-of-the-art in human factors and developing work programmes based on this knowledge. A report detailing the study has been produced.

To date, the project has achieved the following results:

- OLIWRITER: An Olivetti product has been evaluated and improved by means of a first version of ISMED.
- DIAMANT: A dialogue management tool for the efficient implementation of advanced integrated graphical interfaces is currently in use in 7 European IT companies for rapid prototyping. Three products have been implemented so far by using this tool.
- The project has generated advances in voice interaction, direct manipulation and hybrid dialogue styles and the development of tools for user and task analysis, usability evaluation.
- A service has been set up for the transfer of human factor knowledge to the industry.

The project is strongly influencing the national (DIN, BSI) and international (ISO, CEN) standard organisations in the field of usability and computer interaction.

Furthermore, the industrial partners within the project are creating human factors laboratories at their sites and are sharing the resources with each other.

As the results of the research undertaken within the project to-date, a number of the project members have been persuaded of the need to modify their design processes in order to take proper account of the human factors issues, and of the need for tools for the design of the human-machine interface.

Before 1990, the project's knowledge and many of its deliverables, including the human factors tools will be made available to the ESPRIT projects and the wider European IT community. Consequently, any impact will not be confined to the partners, but will be wide ranging.

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Start Date: 01-DEC-84

Duration: 60 months

AN INTEGRATED NETWORK ARCHITECTURE FOR OFFICE COMMUNICATIONS (INCA)

Project Number : 395

The objective is to define and design an architecture for office communications and to demonstrate a pilot implementation. The architecture will be capable of including most types of local and wide area networks, such as optical LANs, CATV broadband networks, FDDI metropolitan area networks, packet switched networks and the emerging integrated services digital network (ISDN). Components of the integrated architecture will be demonstrated in a pilot integrated network, including a variety of available local and wide area networks and linking the project partners' sites. The demonstrated applications will include an enhanced version of the document-handling environment, electronic mail and directory services. Network management will be incorporated into the demonstrator. It is planned to provide a complete interworking environment.

The project incorporates the results of the one year pilot project P95 (Broadband Office Communication). This activity has been developed further, and a broadband LAN has been demonstrated. A number of important decisions were made in the design of that LAN. These include the data rate of 2 Mbps/channel for the 15 channels, the modem agility and a number of other communications parameters.

A further activity is an advanced document handling environment. The components that have been developed and demonstrated include a high performance workstation, a multimedia editor, an interface to a filing system for document components and operation of the whole system in a distributed local area network.

The project is fully aligned with the OSI standards and there is active interaction between the project and the standards bodies.

The communications components required for the demonstrator have been specified, some have been completed and others are under development. These include the OSI infrastructure, relays between the network technologies involved and network management facilities. Directory services and electronic mail have been demonstrated. An industrial version of an advanced document handling system will be available by 1989. Decisions on the industrialisation of the local area network will be made during 1988. Industrialisation of the relays, directory services and network management is expected to follow during 1989 and 1990.

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Start Date: 01-SEP-84

Duration: 48 months

INVESTIGATION INTO THE EFFECTIVE USE OF SPEECH AT THE HUMAN-MACHINE INTERFACE

Project Number : 449

This project which is now completed, addressed voice applications in a wide range of environments. The objectives were:

- To determine the current state-of-the-art (hardware & software) and the current areas of actual and imminent application.
- To explore the potential for future applications.
- To determine the additional new requirements for hardware and software to allow the potential application areas to be realised.
- To forecast the likely development of speech technology over the next 5 years, with specific reference to application areas.

The effective use of speech can be seen as a major enabling tool in the wider use of information technology. Yet there are conflicting reports as to its successful use, and a general lack of understanding of the technology.

A comprehensive Final Report is publicly available, which includes a list of conclusions and recommendations. These are the most important considerations for the development of a successful system:

- Isolated word recognition systems perform satisfactorily, connected speech is possible with good equipment and good design. continuous speech recognition is unreliable or extremely specialised and expensive.
- There are several reliable speech synthesis systems that can be used alone, with speech recognition systems or for example with touch-tone telephones for dial-in enquiry systems, to give a completely hands free environment.
- Speech should be part of the overall design of a system, success is less likely when speech is added to a current package.
- Successful implementation requires more knowledge than the average potential system designer has available. The suppliers supporting software, technical descriptions and documentation tend to be poor.
- The greatest expenses do not relate to the cost of the voice equipment but the cost of thorough system design and integration.

There were several significant findings:

- The effectiveness of an application is often governed by the appropriateness of the microphones and other ancillary equipment.
- With properly calibrated equipment, consistent high background noise (90 dBA) did not detract from recognition.
- A well designed vocabulary on a low quality recogniser could out perform a badly designed vocabulary on superior equipment.
- Many of the current successful applications used small vocabularies organised into context selected sets. Large vocabularies tend to encourage the notion that unrestricted language can be used, which is not yet possible.

The major considerations for future developments are:

- Continuous speech systems require research into and analysis of phonetic and linguistic factors and are to be implemented via knowledge based interpretation on faster and cheaper processors. This is unlikely in the next 10 years.
- Speech synthesis applications are the most likely for early widespread development, especially by telephone companies (PTT's).
- The industrial area is the most amenable to speech recognition applications with current equipment. Further exploitation in the office environment can only come from speech synthesis and with better continuous speech recognition.
- The next generation of systems will analyse and store speech based on phonemes which will cut down storage requirements, but will result in language and dialect dependencies.
- The concept of true speaker independent recognition, thus saving the current 'enrolment' or 'voice training' for each new speaker, will be highly dependant upon the outcome of current IKBS and algorithm research and is definitely well into the future.

Speech technology is already being used successfully, and provided the current limitations are observed and taken account of in the design, there are good prospects for increased use of the technology in selected and restricted situations. Unrealistic expectations of the customer and over-selling by the suppliers, coupled with poor documentation are producing a large number of failed projects and causing prospective beneficiaries to delay their commitment. Improvements in the base technology are continuing. Continuous speech recognition is not available commercially, but neither are the systems ideas/designs which could make effective use of it. It has become clear from limited experimentation that considerable complexity in software may be necessary to deal with quite limited vocabularies, and restricted syntax, where interpretation is called for.

On the other hand the benefits of simple speech input coupled with synthesised voice prompting has been demonstrated publicly by the Project Team. They have shown the benefit of totally hands free control and the value of a well-designed, simple command syntax.

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Start Date: 01-DEC-84

Duration: 12 months

A HIGH COMPRESSION PICTURE CODING ALGORITHM FOR PHOTOGRAPHIC VIDEOTEK (PICA)

Project Number : 563

The objective of the project is to produce an efficient compression scheme for photographic images. The algorithm is to be capable of compressing a colour picture to 1 bit/pel or less while retaining good quality. This will allow a full frame videotex picture to be stored in only 32 Kbytes of memory and transmitted in 4 seconds on the Integrated Services Digital Network (ISDN). The final goal of the project will be to gain acceptance of the algorithm as a standard.

The results can be used for many videotex application areas that would benefit from the inclusion of a photographic insert in the text, such as travel brochures, mail order catalogues and property literature.

Innovative compression algorithms have been developed and tested and then compared with known ones. Good results have been achieved with compression values meeting, and in some cases exceeding, the target of 1 bit/pel.

Following the first years work a patent application has been made on a new technique for Vector Quantisation by CSELT. BT has been developing a new technique, known as Recursive Binary Nesting, and a patent was filed during the second year.

PICA has submitted two compression algorithms to the ISO/CCITT Joint Photographic Experts Group (JPEG) for standardisation and one of them was ranked first out of 12 during the first evaluation exercise. The final decision by the JPEG is expected by January, 1988.

Excellent results in terms of image quality have been achieved using compression ratios of 21:1 and at 16:1 the decoded image is indistinguishable from the original except for a trained eye. At 64:1 the image can still be recognised and can for example be used for the quick scanning of photographic archives.

The agreed high compression technique should stimulate the market for photovideotex services in the late 1980's.

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<i>Start Date: 01-JAN-85</i>	<i>Duration:</i>	<i>39 months</i>

MODELLING AND SIMULATION OF THE VISUAL CHARACTERISTICS OF MODERN DISPLAY TECHNOLOGIES UNDER OFFICE WORK CONDITIONS

Project Number : 612

The project aims at designing, engineering and building a hardware device able to simulate, in real time, a broad range of flat panel displays. These include Electro Luminescent (EL), thin film EL, memory EL, active matrix Liquid Crystal (LC) ferroelectric LC and supertwisted LC. This device will be used by office automation manufacturers as well as display manufacturers, to test properties of new technologies and interactively optimise display parameters to obtain good image quality and maximal comfort.

Specific objectives are :

- Comparison between various simulated display technologies and technical solutions according to user acceptability criteria.
- Ergonomic experiments under prolonged office work conditions, to find relations between technology-dependent display properties, visual discomfort and image quality.

The simulator facility will support display designers and display users (Office Automation Manufacturers, user organisations, etc.) in the definition of new products and applications.

Achievements so far are:

- Top level design of the simulation software required for real time simulation of display technologies.
- Implementation and demonstration of a first version of an electro luminescence display model.
- Architectural design of the simulator machine.
- Design of the high resolution digitally controlled colour-monitor required to visualise the simulated displays.
- Design of a shading correction technique for CRT.
- Construction of a functional model of visual perception.

After 1989 the simulator facility will be in full operation, as a useful aid in reducing the design cycle of user-acceptable displays, for both display manufacturers and office automation manufacturers.

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Start Date: 01-OCT-84

Duration: 60 months

TOOLS FOR DESIGNING OFFICE SYSTEMS (TODOS)

Project Number : 813

The objective of the TODOS project is the development of tools to support office systems design. These tools will cover all phases from the planning stage to the proposal of an architecture of office systems. The tools developed will be used by the system designer and will support the phases of requirements collection and analysis, logical design, the rapid prototyping of office systems to validate requirements, and architecture design.

The programme of work is as follows:

- The investigation of models for office systems design from a feasibility analysis to an implementation specification.
- The provision of a design support environment based on graphical interfaces and using expert techniques to guide the design and identify problems and incorrect specifications.
- The provision of tools for the evaluation of the proposed office models during the different development phases.
- The provision of tools for the design of an architecture for the office system.
- The provision of tools for office prototyping from the specification of the conceptual model.

Achievements are:

- A state-of-the-art report on office characteristics, office models, design methodologies, design support tools and system development methodologies and environments has been produced.
- Existing multi-media data bases have been investigated.
- A TODOS conceptual model and a specification language have been specified.
- A rapid prototyping model has been developed.
- Tools have been developed for practical proof of the researched methods and concepts.
- Links to project 56 (FAOR) are established.

This project will provide methodologies and support tools for office systems design which will enable more effective and efficient introduction

of IT technologies in the office .

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Start Date: *01-JAN-86*

Duration: *36 months*

**ADVANCED AND INTEGRATED OFFICE SYSTEMS PROTOTYPES FOR EUROPEAN
PUBLIC ADMINISTRATIONS (ASTRA)**

Project Number : 831

The main objectives of the project are to contribute to common understanding of the office automation problems of public administrations in different European Countries and the integration of the state-of-the-art technology, concepts and results derived from ESPRIT projects. It will also contribute, at application level, to the implementation of international standards.

ASTRA will provide facilities for testing and evaluating office information systems. The project consists of two phases :

- An analysis of very large public administrations in four participating countries with regard to information handling.
- The development of two prototype systems. These differ in size, complexity, system architecture and costs and can be described as:
 - A high level prototype, which deals with large amounts of data.
 - A low level prototype, which deals with the multifunctional aspects of office automation.

These prototypes will make use of advanced storage and retrieval systems based on optical discs. They will be evaluated through test implementations in two different countries. The results of the project are targeted at the public administrations of European member states.

Standards and management guidelines have been defined by the consortium. The methodology has been defined for the analysis of user requirements in the four partner states. The user requirements analysis has been completed in the selected public administrations and a synthesis of requirements achieved. The technological environment base for the prototypes has also been established.

Procedures, standards and techniques for public administration information systems will be derived from this project. The primary target is the large scale information handling integration within national bodies.

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**CONSTRUCTION AND MANAGEMENT OF DISTRIBUTED OFFICE SYSTEMS
(COMANDOS)**

Project Number : 834

The primary objective of the project is the creation of a flexible, reliable and easy-to-use environment for the development and management of distributed applications in the office context. In order to create this type of environment, a range of tools must be designed and implemented. These can be functionally divided into:

- tools supporting the development of distributed applications.
- tools supporting the execution of distributed applications.
- tools supporting the user activities.

An important objective of the project is to combine and advance the state-of-the-art of different technologies such as distributed databases, languages, software technology and communications into innovative and generalised tools for different application environments. These cover:

- The definition of an architecture for workable distributed office systems (1988).
- The implementation of a low level kernel shell providing the infrastructure for integrating a number of system services (1989).
- The implementation of linguistic object-oriented support ensuring widespread acceptance of the shell (1989).
- The implementation of a multi-database system (1989).
- The implementation of a multi-file server system with a high degree of integration between application sites (1989).

The global architecture has been established using the object oriented approach. The architecture encompasses the operating system, the data management systems as well as an integration approach for pre-existing applications (the COMANDOS Integration System (CIS)). Functional specification of kernel and system services has also been established. Interfaces and language requirements have been defined.

The developed software is expected to be used as individual tools or as a complete package. It will be rapidly introduced after the research and development phase. Indirect advantages can also be derived for the fast development and efficient management of distributed systems.

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Start Date: 01-MAR-86

Duration: 60 months

ACQUISITION, COMPRESSION & REPRODUCTION OF TRUE-COLOUR IMAGE DOCUMENTS

Project Number : 853

The project has three main objectives:

- Development of highly sophisticated colour image acquisition (prototype already realised), processing and enhancement systems.
- Definition and development of colour image coding and compression algorithms, using techniques which take into account human perception features.
- Development of an advanced non-impact printing technique for colour images with fine tone definition (intensity modulation).

An integrated prototype will be developed to demonstrate the result of the research.

At present, the high feature colour scanner and the true colour printer are in the preprototype testing phase. Results on picture compression are now available .

Studies and experiments have been carried out on colour image acquisition and enhancement using the first simulator. Software architecture has been defined, and some parts are already implemented.

The research will promote use of colour documents in the office environment by developing new, advanced methods for colour image reproduction, storage and transmission. The consortium will industrially exploit the project results by 1990 in electronic colour processing systems and colour image reproduction peripherals.

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Start Date: 21-APR-86

Duration: 36 months

EUROPEAN TYPEWRITERS AND OTHER WORKSTATION INTEGRATION

Project Number : 855

The project will investigate the role of typewriters in a future office automation environment where communicating typewriters, word processors, personal computers and PBX will interwork in distributed systems. The programme of work is as follows:

First phase (1986)

- Analysis of technological and market trends for typewriters and workstations.
- Investigation of functional integration between typewriters and other office automation devices.

Second phase (1987)

- Specification of a common code for all the European languages and editing functions commands for exchanging information between European typewriters.
- Proposing of protocols for communications (PBX's or LAN's).
- Proposing of a general architecture for inter-connection between European typewriters and workstation via PBX or the LAN.

A number of areas where the evolution of the technology is to be investigated have been identified. The areas are processing facilities, printing, storage, the user interface, display systems and communications. These investigations have been extended to cover functional user requirements for low cost and high cost office workstations, integration of text and graphics, graphics software environments and the use of existing standards. The first results are as follows:

- A proposal for a framework for handling mixed mode communication has been submitted.
- Cost trends of base technologies for typewriters and PCs have been analysed.
- A report containing standard primitives for a new intergraphics system has been produced.

The project supports the integration of typewriters and low cost workstation units in the office information system domain. The results are expected to be transferred to the new products. The development of standards supported by the European market leaders in this field will have a major strategic impact.

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Start Date: 01-MAR-86

Duration: 24 months

TESTING AND ANALYSIS OF LOCAL AREA OPTICAL NETWORKS (TALON)

Project Number : 870

The TALON project is aimed at providing methods and instruments for testing complex optical LAN's. It supports and complements communications system design activities. Many of the currently established methods for testing point-to-point optical fibre links are ineffective when applied to complex optical topologies. The project will build demonstrators and evaluate their effectiveness in different environments.

Development of complex networks will be facilitated by the results of this project in the next two years.

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Start Date: 01-JUL-86

Duration: 36 months

EXTENDED OFFICE PROCESS MIGRATION WITH INTERACTIVE PANEL DISPLAYS (PROMINAND)

Project Number : 878

In this project a prototype system will be developed which, in order to automate office activities, combines the concept of controlled flow of information (comprising data and tasks to be performed) with a novel panel display device.

Typical office activities consist of tasks which are performed in parallel or sequentially. These activities must be described formally in order to automate them. This can be done by having a process migrate automatically to the station where the single tasks are to be performed. However, with the involvement of human beings, non-deterministic elements emerge caused by personal judgements and individual working styles. The extended office process migration covers both the formally described flow of work and the handling of exceptions.

On the basis of office process migration a prototype of an office system will be developed as a tool for design, optimization and demonstration of office activities. This will be supported by prototypes of novel interactive display devices. They can serve as flat panel workstations or as special planning panels that can be used for the specification and control of process migration.

The user friendliness and acceptance of extended process migration with the new user interface system are to be guided by human factor analysis.

The specifications for the basic prototype have been established. They include the design of formalisms for migration and office process operations as well as the design of a migration server with interpreter. For the Interactive Panel Display the design of the block elements, board module and controller have been completed.

The office worker requirements have been analysed and documented. Requirements for the migration process and for the panel display have been identified. The envisaged user interface has been defined together with the project scenarios.

Successful completion of this project will result in software products supporting automatic flow, control and processing of information in the office environment of the late 1980's.

Possible spin-offs could result in the validation of novel display technology and application. New cost effective complex office system applications can be supported by the results of this project.

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Start Date: 20-DEC-85

Duration: 48 months

**PARALLEL ARCHITECTURE FOR NETWORKING GATEWAYS LINKING OSI
SYSTEMS (PANGLOSS)**

Project Number : 890

This project will build a prototype high-performance networking gateway using a highly-parallel architecture in order to meet the anticipated demand for linking OSI systems and networks. To achieve this, the project is to study the following areas :

- Overall architecture characteristics of a networking gateway.
- The functional definition of a networking gateway (including performance and connectivity goals), and a formalised approach to design an architecture for such a gateway.
- Implementation-oriented issues (e. g. hardware/software split, suitable technologies), and a formalised approach to the transformation of specifications into implementations and onto parallel hardware.
- Performance analysis of proposed architectures, specifications and implementations.
- Rapid prototyping of designs using hardware/software trade-offs as appropriate.

The project has successfully completed its initial studies. This includes the definition of the requirements of a gateway, appropriate formal specification techniques, transparation techniques, parallel machine architectures, appropriate performance analysis and simulation techniques and implementation languages for parallel hardware.

The prototype can be rapidly transformed into an industrial product of high commercial interest. This product is in fact indispensable to the creation of large networks linking major organisations (corporate networks in large enterprises, public administrations, hospitals), and to support the expansion of Value Added Networks (VANs).

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Start Date: 01-JAN-86

Duration: 36 months

AN INTELLIGENT GENERAL PUBLIC DATA, VOICE AND PICTURE STORAGE RETRIEVAL SYSTEM

Project Number : 901

This project offers a range of research and development activities in the field of intelligent data, voice and picture storage retrieval system. It covers the development of a compact electronic storage system capable of providing rapid random access to very large volumes of multi-media information such as maps, photographs and other analogue-stored pictures with digitally held text and data. Moving video and sound are incorporated in the base. Particular emphasis is given to a very user-friendly user-interface which implements knowledge engineering techniques. The project aims at improving the acceptability of these systems and making them complementary to current systems through the prototyping of the Laser Vision technology combined with new advanced user interfaces based on high-level expert systems.

Design of the system will be targeted to widely available, low cost workstations.

A Laser Vision-ROM based system with a working semi-expert retrieval system is now available with a massive amount of information in the form of maps, pictures, data sets and text on the demonstrator called The Domesday System . A study of the state-of-the-art and the specifications of an intelligent image databank management system is underway. The key requirements are for an interactive and user-friendly image databank. Analysis of hardware architecture for a future system is supported by the Imageur Documentaire. This is an image-based databank management system built around the Laser Vision-ROM disc drive.

The results are expected to have a direct impact on multi-media storage and retrieval systems for education, domestic use, and several applications in the service and trade industries. The hardware will make image and data bases available with fast sophisticated retrieval facilities. The demonstrator, the Domesday System is a unique archive for the future. The Domesday discs have enormous potential as a public source of information for use in schools, colleges, universities, libraries and government offices. It is marketed in some member states and is the basis of a popular television quiz programme using its encyclopaedic knowledge. Applications can also be identified in many areas of industry and commerce such as advertising, market research, tourism, town planning, marketing and distribution.

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Start Date: 18-DEC-85

Duration: 28 months

CODING FOR MOVING PICTURE & STILL PICTURE AT 256 KBITS/S AND 64 KBITS/S

Project Number : 925

The project addresses advanced compression techniques for both moving video and still picture coding, for tele-conferencing applications. After reviewing state-of-the-art techniques and requirements, the project aims at:

- Achieving very high compression rates for video-conference grade image motion with good resolution and quality. Advanced intraframe and interframe compression techniques are being investigated, including orthogonal transform coding algorithms.
- Achieving high picture quality and resolution for still picture coding in order to reproduce business graphs, technical drawings, photographs.
- Defining a proposal for a standard for moving image codecs.

Advanced algorithms have been selected and defined. They have been tested by computer simulation. Impressive simulation results have been shown of real-time transmission of moving images over a 64 Kbit/s link. This technique, fully implemented, would allow the use of ISDN as a carrier for the setting up of video-conferences.

The results will have a significant effect on the ability of the European industry to develop video-conferencing products operating on the 64 Kbit/s ISDN. A direct influence on the development of video-conferencing applications by the supply of compatible and internationally standardised products is also foreseen.

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Start Date: 02-JAN-86

Duration: 18 months

INTELLIGENCE AND KNOWLEDGE AIDED RECOGNITION OF SPEECH (IKAROS)

Project Number : 954

The aim of the project is to evaluate the AI techniques for speaker independence and understanding of continuous speech. This project is complementary to project 64 (SPIN). An initial test of feasibility will be achieved through the implementation of a system for recognising and understanding continuous speech.

This final demonstrator should operate in real time and should be speaker independent, insofar as it should not depend on receiving input from previously sampled speakers. In order to achieve this, it will be restricted to a single application and will cover a limited subset of natural language compatible with that application. In this project, models will be developed and implemented which perform an integration of prosodic, syntactic, semantic and pragmatic knowledge. The system will be based on a blackboard architecture. This structure allows the use of independent knowledge sources which communicate through a global database. It will be able to cope with uncertain data and can manage conflicting hypotheses. A demonstration of an application of a speech understanding system and a demonstrator of tools for pragmatic knowledge representation are due at the end of year five (1990). A limited functional demonstration is due at mid-term.

The project has concentrated its first work on the system architecture and on the possible applications. The abstract model of blackboard has been studied and its structure has been implemented. The syntax and the semantics appropriate for the chosen language coverage in the application area have been formalised. The syntactic and semantic representation of the user query will be mapped onto a formal query to a relational database. The railway enquiry service has been chosen as an application. This decision is based on a documented general analysis which includes ergonomic considerations. Extensive studies on language coverage requirements have been completed. A corresponding vocabulary and the anticipated sentence patterns have been defined.

A considerable impact on systems based on speech understanding is expected in the early 1990s. Domains involved could include workstations, intelligent PABXs, database queries and updates, Value Added Systems (VAS) and management information systems.

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Start Date: 01-JAN-86

Duration: 60 months

COMPONENTS FOR FUTURE COMPUTING SYSTEMS (COCOS)

Project Number : 956

The main objective of this project is the provision of a set of common tools for building future information systems. Hardware and software issues will be combined in an unique design that is based on a top-down approach :

- At the application level, the user will be provided with a dynamic environment to create and define his own application, through a man-machine interface (MMI). The environment will include tools for viewing different tasks simultaneously (multi-windowing), switching between these tasks very quickly and invoking actions with natural commands eg graphical symbols.
- The middle layer will be a self contained environment acting as the conduit between the applications layer and the lowest layer. It will provide :
 - Support for programming language interfaces to services and functions commonly provided by operating systems.
 - An underlying homogeneous object model with a fine level of granularity.
- The lowest layer contains the hardware circuitry that best supports the application language. RISC CPUs and dedicated VLSIs will be investigated, network and disk interfaces and memory management will be studied along with the selected CPU.

After one year of work, a state-of-the-art report on all relevant technologies which will be involved in the project has been produced. This report covers areas such as hardware, standard CPU chips, RISC chips, internal and external bus architecture and interconnection schemes in multiprocessor systems. It also covers software, for example operating systems, distributed systems, programming languages, object oriented environments, and the man-machine interface.

Currently proposed scenarios include a typed object-oriented language (LE_TOOL) and a system based on PARLOG (a parallel logic programming language). PARLOG will be used to implement the formalisms required by chosen applications as well as the man-machine interface. Tools for the compiler generation will yield both PARLOG compilers and compilers for other high level languages.

Current work on the hardware level includes the use of a RISC chip and of a micro-programmable symbolic co-processor , both of which have been developed by the partners.

A new area of research has emerged within the framework of the project. In order to integrate many of the concepts that have been studied within the project, several partners have decided to focus on tasks relating to multi-media workstations. These tasks range from studying the human-factors of the new multi-media input and output devices, to the specification of an appropriate architecture using 2nd generation RISC chips.

The anticipated date of completion for the project is the end of 1988, with working demonstrations of both LE_TOOL and the system based on PARLOG.

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Start Date: *01-JAN-86*

Duration: *36 months*

**HIGHLY SECURE OFFICE INFORMATION SYSTEMS - DEFINITION PHASE
(MARS)**

Project Number : 998

This project studies the current state-of-the-art in the areas of physical and logical security and integrity of office systems, to develop a model, and to add substantial new and innovative propositions to deal with the needs of future office systems. They also include the specification of a trusted Key Management Center and a number of trusted end-user security facilities which together provide the facilities of secure communications via an insecure network. The result of the project will be a set of reports which can provide input to European standards work for secure office systems and development of guidelines for the assessment of existing and planned systems.

The project is divided into five phases based on the three main aspects which are office system elements, threats and security means. The programme is as follows:

- Study of the state-of-the-art in the field.
- Development of a model for secure office systems in banking environments.
- Synthesis of security recommendations and guidelines based on the state-of-the-art study and model development. The report concluding this phase summarizes the recommendations for data security in banking office environments.
- Specification of the requirements for a key management center and end-user security facilities. Emphasis will be placed upon the requirements of users of banking networks.
- Specification of the design of the key management center and the end-user security facilities. This will include operational specification of the cryptosystem(s) to be used, and also the means of authentication of end-users. This phase will further specify protocols for establishing secure communication channels, and it will recommend areas suitable for future standardisation taking ISO's work on OSI security services into account. The resulting report should provide input for a possible later phase of detailed design.

The first phase of the project has been completed with a comprehensive report describing the state-of-the-art in security. The report covers essential areas such as:

- user requirements, auditability requirements and legal aspects.
- threat and risk analysis.

- different formal modelling approaches.
- security measures related to operating systems.
- enciphering algorithms and methods.
- security mechanisms related to the OSI architecture.
- terminal access control and identification procedures.

The second phase of the project, the development of security model, has been finalised. The increasing interest in areas like privacy, integrity and high reliability/availability which has become evident in the last ten years, is reflected in the report.

The work performed in the MARS project could form the basis for system security improvements and standardisations within office automation systems, especially in the banking environment. The state-of-the-art report completed provides a solid basis for further work in this area, and will increase the general interest in security.

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<i>D</i>	<i>S</i>

Start Date: 18-DEC-85

Duration: 36 months

PILOTING OF THE OFFICE DOCUMENT ARCHITECTURE (PODA)

Project Number : 1024

The goal of this project is to evaluate and to advance the ISO and CCITT standards on Office Document Architecture (ODA) and to accelerate the exploitation of ODA. The programme includes:

- Demonstration of the interchange of documents between commercially available office equipment from different manufacturers.
- Identification of the interest in ODA and the Office Document Interchange Format (ODIF).
- Verification of the suitability of ODA as a basis for office systems by the construction of an industrial prototype of a Portable European Document Handler, a Document Class Definition Editor, and an ODA Imager with font support.

The construction of the components is essential for the useful implementation and acceptance of the ODA/ODIF standard in European office document handling systems, which are competing with the IBM DCA/DIA standard. The ODA standard will be advanced by providing the standardisation bodies with contributions for enhancements based on research and prototyping work in the project.

The project has produced the global specification (first version) including :

- Multi Vendor Document Interchange with definitions of conformance levels for the first demonstration.
- Specification of final form Imager for document printing facilities based on ODA.
- Specification of font support including a standard description of fonts.
- Initial design of Data Content Editor, for computed information in documents.
- User requirements for document security.

A first demonstration of multi-vendor document interchange via ODA was demonstrated at the Hannover Fair 1987 and at the ESPRIT Conference Week 1987.

The editors and standards developed in this project and project 121 (Herode), will be basic components in products commercially available in the 1990's

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Start Date: 19-DEC-85

Duration: 48 months

HUMAN AND ECONOMIC FACTORS IN IT UPTAKE PROCESSES (IT-UPTAKE)

Project Number : 1030

The project focuses upon the role of human, organisational and economic (HOE) factors in the effective and productive uptake of information technology (IT) application systems in complex work environments (CWEs). The project explicitly addresses IT-uptake in more traditionally organised work environments and in new forms of work organisation made possible by teleworking. While office systems are the major focus of concern, the project also addresses developments in Computer Integrated Manufacturing (CIM).

The major outputs will be a generic model of (HOE) factors in IT UPTAKE processes, an instrument for the collection of information concerning these HOE factors in working environments, field trials of the generic model and instrument in working environments, and guidelines concerning the management of HOE factors in the UPTAKE of IT and Telework in working environments. The project is complementary to ESPRIT Project 56:FAOR and liaises and exchanges information with that project.

A third version of the model and instrument has been developed and subsequently refined through field testing in a wide range of user environments (CWEs). This version of the model and instrument integrates expertise and perspectives from four areas: human and organisational factors in IT/Telework uptake processes; traditional business systems analysis techniques; vendors' perspectives on IT/Telework uptake processes; and expertise concerning the diffusion potential and uptake dynamics of Telework. This extended and refined version of the model provides a comprehensive framework for conceptualising, understanding and investigating or intervening in IT/Telework uptake processes in user environments.

An analysis of the potential and the uptake dynamics of telework has been conducted through large scale empirical surveys and refinement of their indications through detailed field trials undertaken in a range of user environments. On the basis of this work and previously described modelling work, the refined extended model provides an integrated framework where IT and Telework uptake processes are conceptualised as being embedded in broader organisational change processes.

A test bed investigation has been undertaken using traditional business systems analysis techniques and an IT system has been proposed which would support and improve the functioning of the test bed site. Significant features of this proposed systems design concern the systematic incorporation of human, organisational and teleworking perspectives into the final specification for the design of the proposed IT application system.

Currently, a Guidelines Package for managing IT/Teleworking uptake processes in user environments is in preparation. This will emphasis the management of human, organisational and economic factors, and will be initially targeted at managing IT/Telework uptake in user environments, but will also be of considerable benefit to suppliers of IT products and services and to IT manufacturers.

The packaged guidelines for use in the management of HOE factors in IT/Telework uptake processes in user environments are expected in 1988.

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Start Date: 07-APR-86

Duration: 24 months

AN OFFICE SYSTEMS RESEARCH WORKSTATION FOR EUROPE (ERM)

Project Number : 1032

The overall objective of this project was a hardware configuration and software environment suitable for research and prototyping advanced integrated office systems. This will strengthen the European computer industry and reduce its dependence on costly foreign products. Specific technical objectives included the development within 3 years of an advanced prototype with:

- Very high performance at a low cost.
- Hardware design to exploit VLSI manufacture and RISC architecture in the processor design.
- Open architecture so that resources elsewhere on the network can be substituted for local resources.
- Tools for language development for generating RISC code to interpret a virtual-machine instruction set.
- Programming environments for several languages.

The project was terminated in October 1986.

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Start Date: 01-JAN-86

Duration: 48 months

AMORPHOUS SILICON CONTACT IMAGER FOR OFFICE AND GRAPHIC APPLICATIONS

Project Number : 1051

There are three main objectives for the project, containing both short and medium term goals, they are

- Prototyping of a very compact contact imager with amorphous silicon sensor elements, creating a linear scanning array with better opto-electronic properties than those currently available . The contact imager will be packaged and incorporated and evaluated in a system. A market study will determine the quantitative targets.
- Investigation of alternative deposition techniques for amorphous silicon (homocvd, photocvd) aiming at an increase in the stability of the deposited films.
- Study on integration of thin film switches and shift registers on the same substrate. This will avoid cumbersome and expensive hybrid interconnections.

A maskset and external package for the first type of scanner have been completed. The technological implementation is anticipated soon. A market study of the application fields and requirements has been carried out. The study concludes that to cover all market demands, several types of sensors and read-out techniques will have to be developed. The realistic goals of the report after the study are to implement sensors with a resolution of 200 dots per inch (DPI) and two read-out speeds : 10 ms/line and 2ms/line.

The sensor arrays are being implemented and tested. The problem of the integration of the switching circuitry on the same substrate as the sensors is being tackled. The method of mounting the sensor array and the circuitry within the FAX-machine (the packaging) has been carefully designed.

A theoretical study of the advantages of integration of switches and shift registers is outlined and two process flow charts have been proposed.

The project is expected to have an effect on the market of digital scanning and printing systems. This project is expected to have an effect on the market of digital scanning and printing systems.

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<i>Start Date: 01-JAN-86</i>	<i>Duration:</i>	<i>24 months</i>

MULTIPOINT INTERACTIVE AUDIO-VISUAL COMMUNICATION (MIAC)

Project Number : 1057

The objective of this project is to develop a system for the simultaneous communication of speech, pictures and data forms of information between persons at two, three or more widely separated locations, using ISDN and other 64 Kbit/s networks.

A demonstrator will be developed in a real environment. It will be a multipoint international audio-conference system with visual and office-system aids, but the signal and protocol infrastructure developed will be applicable to a wide range of other audio-visual services. The conferencing system in presentation point mode was demonstrated in September 1987. The demonstration included the meeting room, the audio-sub-system and the meeting aids (Fox, SPTV, Telewriter). The experts defined the audio quality is "excellent".

The prototype terminals are likely to form the basis for the industrial development of complete communication systems and not only audio-conferencing systems. They will be available at the end of the project. The development of such terminals for use on ISDN and other emerging digital networks will strongly support the widening of the installed base and the firm establishment of such services.

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Start Date: 07-JAN-86

Duration: 27 months

DYNAMICALLY ADAPTABLE MULTI-SERVICE SWITCH (DAMS)

Project Number : 1059

The objective of the project is to identify and exploit the relative advantages of a switch-oriented communication architecture with respect to the wide variety of traffic and services required in the office. Dynamic allocation of the bandwidth according to the varying needs of the users will be investigated in order to manage the available bandwidth in the most efficient way.

A "system external specifications" study has been produced, which lists the external requirements of an advanced PABX (e. g. services to be produced, time response). In addition, an architecture based on an optical ring has been outlined.

Industrially exploitable results are expected by early 1991. These will be based on R & D to be carried out following the study phase.

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Start Date: 03-FEB-86

Duration: 30 months

MULTILINGUAL INFORMATION SYSTEM (MIS)

Project Number : 1533

The MIS project is based on the hypothesis that a semantic (deep) representation of natural language sentences which may be effectively used to query and manipulate a multi-lingual structured document database. The intention is to develop the deep representation of English, French, German and Italian but every effort will be made to include the other European languages.

Although natural language will be the query language for most users, a user interface will also be provided for expert users, such as the database administrator, which combines graphic interaction techniques with natural language. Interaction between these and an underlying generalised database will be via a knowledge management system (KMS). This will provide both with a more intelligent access to documents and a support for the linguistic knowledge which must be accessed in the course of the interpretation of the natural query language .

The generalised database, which should contain not only structured text but also graphics, pictures and voice, will present an entity-relationship to the KMS.

The major goal of the study phase of the MIS project is to evaluate the feasibility of a MIS system. Products with the results of this research embedded in them may be expected to merge some time after the end of the project. Products employing the results of this research may be expected to emerge some time after the end of the project.

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Start Date: 01-JAN-87

Duration: 18 months

MULTI-LINGUAL SPEECH INPUT-OUTPUT ASSESSMENT, METHODOLOGY & STANDARDISATION

Project Number : 1541

The objective of the project is to provide a pan-European basis for the assessment of speech technology devices

The definition phase is allied to the existing SPIN programme (Esprit project 64). It involves recogniser and synthesiser assessment in each of the participating countries, and is necessarily founded on the utilisation and systematic archiving of available databases of words and sounds for general use within the Community. The collation of material coming from the UK, France, Holland, Denmark, Italy and North America is being undertaken as a first step.

Within the Definition Phase tentative uniform protocols are being established at the technical level in respect to media and recording conditions. In the Full Project, levels of phonetic, linguistic and cognitive difficulty of test materials will also be taken into account. This will enable cross-language work to be properly founded. The partners in the project will work towards the establishment of these protocols and their progressive refinement by experiment and test. Broadly acceptable cross-language standards will be defined in this way. These will provide the foundation for a progressively more rigorous intercomparison of existing devices, and contribute to the development of new speech I/O processors. The initial requirements will be met in a very straightforward fashion by establishing commonly accepted and produced databases. The project will also provide the means for the assessment of the next generation of speech I/O devices.

The first phases of the multi-lingual work are directed towards the establishment of a set of strictly practical tools for everyday use in laboratories and industrial settings in the Community. The work also aims to establish the basis for future development in the field of language-independent assessment techniques, for both speech recognition and speech synthesis.

Parallel work is taking place in the different member countries, to establish normative databases for the purposes of referencing and test construction, this will be the basis of the cross-European developments in respect of format and structure. The cross-comparison of this corpus of EEC speech data provides a specification of normal speech which is vital to both new product design and its evaluation. In the context of the EEC, its availability will assist in the development and application of products both internally and externally.

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Start Date: 01-JAN-87

Duration: 36 months

INTELLIGENT BUSINESS APPLICATION SUPPORT SYSTEM (IBASS)

Project Number : 1573

The aim of the project is to develop tools and techniques which allow the end user to create and maintain an office application without the need for direct help from a professional systems analyst/designer. The intention is to develop a system in which the user is supported by knowledge based help systems (both individualised and organisational), which work in an object-oriented (real world) environment by means of adaptable human-machine and machine-machine interfaces.

The project will develop a comprehensive user interface for the information system designer and the end-user, a organisation modelling system and a design manager. The first part of the project (Phase 1) is an in-depth study of the feasibility of specifying prototype demonstrator systems. An extension of the project (Phase 2) will then further investigate and develop a powerful set of tools and designs to be tested in various business and organisation domains. These tools and designs are intended to provide systems which are much more flexible and user-friendly information in an integrated environment than are currently available. The integration of the tools proposed in this project should lead to a faster rapid development of new types of applications with more user sensitivity for Integrated Information Systems (IIS) by manufactures and software. The effects of such development would :

- address the problem of a shortage of skilled analyst/designers and ultimately reduce the backlog of office application development requests which is stifling the efficiency of European industry;
- provide job enrichment to office staff by giving them more control over and responsibility for the automation of their systems;
- produce reliable and cost-effective integration of subsystems into a comprehensive IIS for an organisation.

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<i>UK</i>	<i>P</i>

DATAMONT SPA

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Start Date: 01-JAN-87

Duration: 15 months

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