PROGRAMME PROGRESS REPORT

January - June 1982

COMMISSION OF THE EUROPEAN COMMUNITIES
JOINT RESEARCH CENTRE
Ispra Establishment
Italy
Central Bureau for Nuclear Measurements
Geel Establishment
Belgium
Petten Establishment
The Netherlands
European Institute for Transuranium Elements
Karlsruhe Establishment
Federal Republic of Germany

COMMUNICATION

Category **1.0**
Nr **3986**

Specific support for the Commission's sectoral activities

Informatics ◀
Support to safeguards
Support to the Community Bureau of Reference
Training and education
Utilization of research results
Provision of scientific and technical services

Programme Progress Report - JRC Ispra
January - June 1982

Specific Support for the Commission Sectoral Activities INFORMATICS

Abstract

The programme «Informatics» aims at providing a public service in the field of automatic collection, automatic treatment and dissemination of technical-scientific information and the underlying techniques. Three activities are included in the programme, staffed with 34 research men:

a) Contribution to the research in the field of Teleinformatics which include work on a number of the terrestrial networks which are interconnected and linked to a satellite network. In particular in the reporting period work on a fiber optic network started. In addition work is done on protocols to be used in these networks and in particular for problems of burotique. Human and organizational aspects of office automation are as well investigated.
Data Base query language and automatic indexing are also studied for several applications.

b) The European Computer Program Institute (EUROCOPI) with an information service on computer programs and their application.
The new Eurocopi Data Base is now operational and the relevant documentation was published.
Studies on the implementation of engineering packages and on programming for software sharing took place.

c) The European Shielding Information Service (ESIS), a specialized information centre on shielding data and shielding computer and calculation methods. In the reporting period the work concerned mainly the preparation of the new sodium experiment and the completion of iron benchmark experiments.
Methods of calculation for data adjustment were also further developed.

For each of these activities details are given about the progress in the reporting period, the results obtained in selected fields and the planning of the future work.

COMMISSION OF THE EUROPEAN COMMUNITIES
JOINT RESEARCH CENTRE
Ispra Establishment
Italy
Central Bureau for Nuclear Measurements
Geel Establishment
Belgium
Petten Establishment
The Netherlands
European Institute for Transuranium Elements
Karlsruhe Establishment
Federal Republic of Germany

Specific support for the Commission's sectoral activities

Informatics ◀
Support to safeguards
Support to the Community Bureau of Reference
Training and education
Utilization of research results
Provision of scientific and technical services

BEMÆRK

Den viden, som rummes i dette dokument, meddeles som fortrolig fra Kommissionen for de europæiske Fællesskaber til Medlemsstater, personer og virksomheder og må ikke videregives til trediemand. (Euratomtraktatens artikel 13 og Minersterrådets forordning(EØF) N° 2380/74).

Hverken Kommissionen for de Europæiske Fælleskaber eller nogen, som optræder på Kommissionens vegne er ansvarling for den eventuelle brug af information, som er indeholdt i det følgende.

ZUR BEACHTUNG

Die in diesem Dokument enthaltenen Kenntnisse werden von der Kommission der Europäischen Gemeinschaften den Mitgliedstaaten, Personen und Unternehmen der Gemeinschaft vertraulich mitgeteilt und dürfen nicht an Dritte weitergegeben werden. (Euratom-Vertrag, Artikel 13, und Beschluss des Ministerrates (EWG) Nr. 2380/74).

Weder die Kommission der Europäischen Gemeinschaften noch Personen, die im Namen dieser Kommission handeln, sind für die etwaige Verwendung der nachstehenden Informationen verantwortlich.

NOTICE

The information contained in this document is communicated confidentially by the Commission of the European Communities to Member States, persons and undertakings and should not be passed on to third parties. (Euratom-Treaty, Article 13, and Regulation (EEC) No. 2380/74 of the Council of Ministers).

Neither the Commission of the European Communities nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information.

AVERTISSEMENT

Les connaissances contenues dans le présent document sont communiquées confidentiellement par la Commission des Communautées européennes aux Etats membres, personnes et entreprises et ne peuvent être transmises à des tiers. (Traité Euratom, article 13, et règlement (CEE) N° 2380/74 du Conseil de Ministres).

Ni la Commission des Communautés européennes, ni aucune personne agissant au nom de la Commission, n'est responsable de l'usage qui pourrait être fait des informations ci-après.

AVVERTIMENTO

Le cognizioni contenute nel presente documento sono comunicate confidenzialmente dalla Commissione delle Comunità europee agli Stati membri, persone ed imprese e non debbono essere trasmesse a terzi. (Trattato Euratom, articolo 13, e regolamento (CCE) N° 2380/74 del Consiglio dei Ministri).

Né la Commissione delle Comunità europee, né alcuna persona che agisca per suo conto, è responsabile dell'uso che dovesse essere fatto delle informazioni che seguono.

OPMERKING

De kennis, die in dit document is vervat, wordt door de Commissie van de Europese Gemeenschappen vertrouwelijk aan de Lid-Staten, personen en ondernemingen medegedeeld en mag niet aan derden worden doorgegeven. (Euratom-Verdrag, artikel 13, en het besluit van de Ministerraad (EEG) No. 2380/74).

Noch de Commissie van de Europese Gemeenschappen, noch de personen die namens haar optreden, zijn verantwoordelijk voor het gebruik, dat eventueel van de hiernavolgende informaties wordt gemaakt.

CONTENTS

INTRODUCTION

The programme «Informatics» includes those activities in which efforts have to be concentrated in order to make contributions to the Commission policy in this field and to promote the use of advanced and efficient systems for the automatic collection, analysis, automatic treatment and dissemination of information and the underlying techniques. Three main items make up the programme, selected out of the public service activities, that can be expected to be performed by the JRC and on the basis of the specific experience available:

— contribution to the research work in the field of Teleinformatics which shall lead to extend and improve the communication between geographically disseminated computers. The research is centered on the two subjects of «network» (language, operation, protocol) and «data» (data-banks, standards, processing).

— management of the EUROpean COmputer Programme Institute (EUROCOPI), with the aim to integrate closely the research and service activities in software evaluation and dissemination. The research is oriented on programming techniques and software information transfer problems; the information service is pursued by setting-up a computerized data base on program information and by the organization of a program distribution and program information service.

— running the European Shielding Information Service (ESIS), which in a specific field, where very relevant experience has been accumulated at Ispra, fulfills the task of analysing, evaluating and synthetizing information on shielding data and calculation methods, as well as performing a shielding benchmark experiment. This information is exchanged with the interested organizations and firms in the European Community.

The work is in general pursued in collaboration with a range of bodies in the Community countries and in close contact with the relevant Commission services.

The total number of research-men attributed to the programme «Informatics» is 34.

EXECUTIVE SUMMARY

1. TELEINFORMATICS

The research activities which are undertaken in the framework of the «Teleinformatics» project are intended to represent an original contribution to the international research effort in the field. Due to the accumulated experience in contributing to such projects as EIN-COST 11 and EURONET/DIANE, the JRC is now asked to actively participate to more ambitious projects which have been promoted by the Commission in the framework of her major «Telematics» plan as discussed by the Parliament and by the Council.
In particular, two projects have a direct influence on our work i.e.:

— the COST 11 bis research project which is intended to offer the working scenario for joint European research ventures in the field of teleinformatics;

— the INSIS (INterinStitutional Information Service) project which is aimed at providing the European Institutions and the National Administrations with the appropriate teleinformatics services which allow the exchange of the information in its various forms (voice, image, text).

The two projects mentioned above have at least one important objective in common in the sense that they both represent significant contributions to the overall process towards standardization. To this respect our work is also deeply influenced by the emerging recommendations as produced by the competent standardization bodies ECMA, ISO, CEPT, CCITT and the Commission supported Working Group on Standards.
The stimuli originating from this rather complex external scenario lead us to concentrate our efforts on the problem of integrating existing and emerging network technologies with the view, on one hand to support new types of distributed services and on the other hand to contribute to the overall process towards standardization. In this spirit four major axes of research are followed:

— terrestrial networks
— satellite networks
— information networks (burotique)
— standardization of protocols and services.

As far as the **terrestial networks** are concerned, the internal network project has reached a satisfactory level of assessment as regards the interconnection of seven Solar 16 minicomputer, one of which is in the process of being installed at our headquarters in Bruxelles.
The network of Solar systems represent an unique example of an X25 private network which extends over an X25 public service (EURONET) and offers gateway functions to other public and local X25 networks. Indeed in order to reach the wide public in the buildings and the offices we are installing a number of X25 concentrators, which are based on microtechnology, which appear to the major network of Solars as a multitude of private X25 networks.

Other technologies for local internetworking are under investigation: the Cambridge ring, the Mininet and our Hermes ring based on fiber optics.

The Cambridge ring approach has temporarily been abandoned because the systems which are available on the market present limitations as regards their capability to cover long distances as required by the topology of the Ispra Establishment.

The Mininet system, which is the result of a joint research and development effort by Italian and British universities, could represent an acceptable solution for the interconnection of process control devices. We are looking forward to participate to the demonstration of the new version of the system that is expected to work at remarkable speeds.

The fiber optics approach is also an interesting solution for local networks. In this field we have identified two items of research: the design of the channel access scheme and the design of a transport protocol which best utilises the intrinsic broadcasting capability of the transmitting media. The idea is to create a prototype working system with multicasting capabilities which are best suited to support two large classes of applications: real time control and computerized message broadcasting.
This project represents one of our most ambitious research initiatives, since speculation is undertaken in the rather unexplored field of broadcast protocols and services. A study contract has been finalized for the realization of a prototype ring network, based on micros, which takes the form of a joint R/D effort between the JRC and an industrial company.
The broadcast protocols and services have been specified and a further contract will be finalized for the development of the software, after the prototype firmware has been proven satisfactory.

This initiative constitutes our original contribution to a major project called «High Speed Local Area Network, Design and Services» which is carried out in collaboration with the Technical University of Denmark, CNUCE Pisa and «J. Stefan» Institute Ljubljana in the framework of COST 11 bis.

As regards the **satellite networks**, the idea to install an earth station at Ispra pointing to the OTS satellite was given up because of the major uncertainity about the lifetime of the satellite itself. We are looking forward for the provision of the adequate service by the European PTTs (the announced Telecom or ECS satellites).
In the meantime we are developing the necessary protocols using a twin Link Driving Computer to the one installed at CNUCE, which is connected to the OTS earth station in Pisa.

The «Interconnection of Local Area Networks using satellite links and X25 public services» project aims at the definition of the appropriate internetworking protocols which make it possible for different types of terrestrial networks to interwork by sharing the use of satellite links.

In the framework of COST 11 bis our collaboration with CNUCE has been extended to other partners: CENTERNET (DK), CERN (Genève), INRIA (F) and Rutherford Lab. (UK).

Under the term «**information networks**» we group the activities which are related to the automation of the communication between human partners (message exchange systems, mail, facsimile, teletex). In this framework, the

SCRIBA project plans for the integration of three types of technologies i.e.: distributed data bases, digital networks and office automation in order to offer a prototype text and facsimile communication system.

Four classes of problems have been identified:

— the data base function
— the transport function
— the postman
— the word processors and facsimile devices.

Distributed data bases are used to collect and manipulate the information about access rights, distribution lists, conference structures, address maps, etc. They play the role of a system of interconnected «post offices» which supervise the overall routing and broadcasting services as required by the end users.

The prototype data base function has recently been demonstrated. It offers a good example of the «intelligence» required by a computerized message distribution service. The data base function also provides a «quick service» for users who want to directly access their mailboxes or archives using simple terminals via the internal network, via Euronet or dial up lines.
The «delivery» of the messages to the destination printers or desk terminals is performed according to the Teletex CCITT recommendations.
The delivery function is currently under development. In the future another function called «postman» has to be added in order to complete the automatic delivery function. The postman is charged to interpret the envelopes of the messages and to drive the teletex transport service in such a way that the users can receive their mail without any intervention from their part.
The market of word processors and facsimile devices is constantly investigated with a view to indentifying those products whose data communication interfaces best conform to current recommendations for advanced internetworking. In the meantime we have developed an adaptation software for the existing set of word processors.

The SCRIBA project is being developed as an original contribution to work carried out within INSIS.

The JRC staff is involved in INSIS at the level of the Steering Committee and at the level of two working groups: technologies and human/organizatorial aspects.

This latter acticity has as its primary goal the identification of and response to human and organizational constraints likely to impede the large-scale introduction of high-technology office systems in Community institutions and national administrations.

The first year of the activity coincided with the planning and design phase of INSIS. During this phase much of the activity related to organization.
INSIS has an inter-service steering group, with the actual ground-work being performed by an inter-service working group. The activity involves participation in this working group, chairing one of the sub-groups (Sub-Group IV: «Human and Organizational Aspects»), and liasing with other sub-groups. (These are concerned with «User Requirements», «Technical Options and Standards», «Economic and Financial Aspects» and «Data Base Policy»).

As a final remark it should be stressed that the JRC is actively contributing to the general process towards **standardization.**
The Reference and Test Centre for higher level protocols is now a continuous service, accessible via Euronet by the implementors of terminal stations or network software for host computers. In particular the remote printing stations of the Telesystems and Sit-Intel manufacturers have been properly checked against our reference protocol and a UNIVAC version of it currently under test.
Similar test will be operated with ICL, Siemens and CII-HB which are at present planning for the installation in their systems of a file transfer capability according to the NIFTP recommendations.
The Reference and Test Centre services might be expanded in order to cover the interworking of message exchange systems and office equipment. A technical proposal has been submitted to INSIS and is currently being considered by our management.

The JRC leads the COST 11 bis Working Group on transport layer which has produced the final report. «Basic specification of the transport service and protocols» which is supposed to be a reference document for the implementation of the emerging recommendations by ISO.

As a further example of our involvement in the field of standardization the JRC acts as the technical leader of a joint research effort between GMD (D), Adl (F), NPL (UK) and supported by DG III on the methodologies for the certification of protocols.

Finally it has to be mentioned that regular progress of the work on Data Base Query Language took place and that the collaboration with the GID-Frankfurt and the University of Linz went on in the field of Automatic Indexing.

2. EUROCOPI

The main objective of the EUROCOPI project is to provide EC users of scientific/technical computer programs with a program information and program distribution service. These services and additional development activities, including the related research activities, are the following:

— Computer program information service
— Computer program library techniques
— Practical programming and documentation techniques for the development of computer programs which are structured, flexible, and portable.

During the last half year there has been an emphasis on the function extension of the data base as well as the program library and on two topics in applied research and technical development. This means in detail:

— Adaptation of the data base to the ADABAS version 4
— Critical review of necessary future data base improvements
— First practical experience with efficient data sources
— Adaptation of the program library to new user requirements
— Production of the new user manual «The ICES System»
— Completion of the study «FORTRAN IV Dialect Conversion, A case study: CDC to IBM» (end of the first study performance status)
— Technical editing of text for a book on «Programming for Software Sharing»

The adaptation of the DB to the DBMS ADABAS version 4 has been successfully finished, so that the DB can be considered as fully operational in this new improved version.
Further technical and functional improvements have been considered according to the first practical experience gained and will be achieved in relation to practical necessities.
Concerning data input further efficient data sources have been located and the first practical cooperation in data transfer has already taken place.

As far as applied research and technical development are concerned there was a steady emphasis on implementation,

use, and maintenance of engineering packages (see ref. 1) and the study on FORTRAN dialect conversion has been completed (see ref. 2). Furthermore the preparation of the publication of the Ispra Courses on «Programming for Software Sharing» has been started.

The work planned for the next half year period is:

a) Data base
   - — Operation of the DB under the public experimental test phase
   - — Realization of the first planned phase of improvements (general data converter, general data update program)
   - — Data conversion and input from computer program libraries and documentation centres.

b) Program Library
   - — Last phase of reorganization:
     Creation of effective procedures for storage, retrieval, updates, and distribution of programs and data files as well as printed materials
   - — Compatibility between the program library and the DB

c) Applied Research and Technical Developments
   - — Practical realization in software quality control and studies about the characteristics of the software for vector computers
   - — Evaluation of the reactions to the study on FORTRAN dialect conversion.

References

1. A. INZAGHI: «Il Sistema ICES», Commission of the EC, JRC Ispra, Dept. A, Div. 1, EUROCOPI, Jan 1982.
2. A. A. POLLICINI: «Converting CDC FTN4 to IBM FORTRAN IV», Commission of the EC, JRC Ispra, Dept. A, Div. 1, Computing Centre Newsletter, Handbook Series, May 1982.

3. ESIS

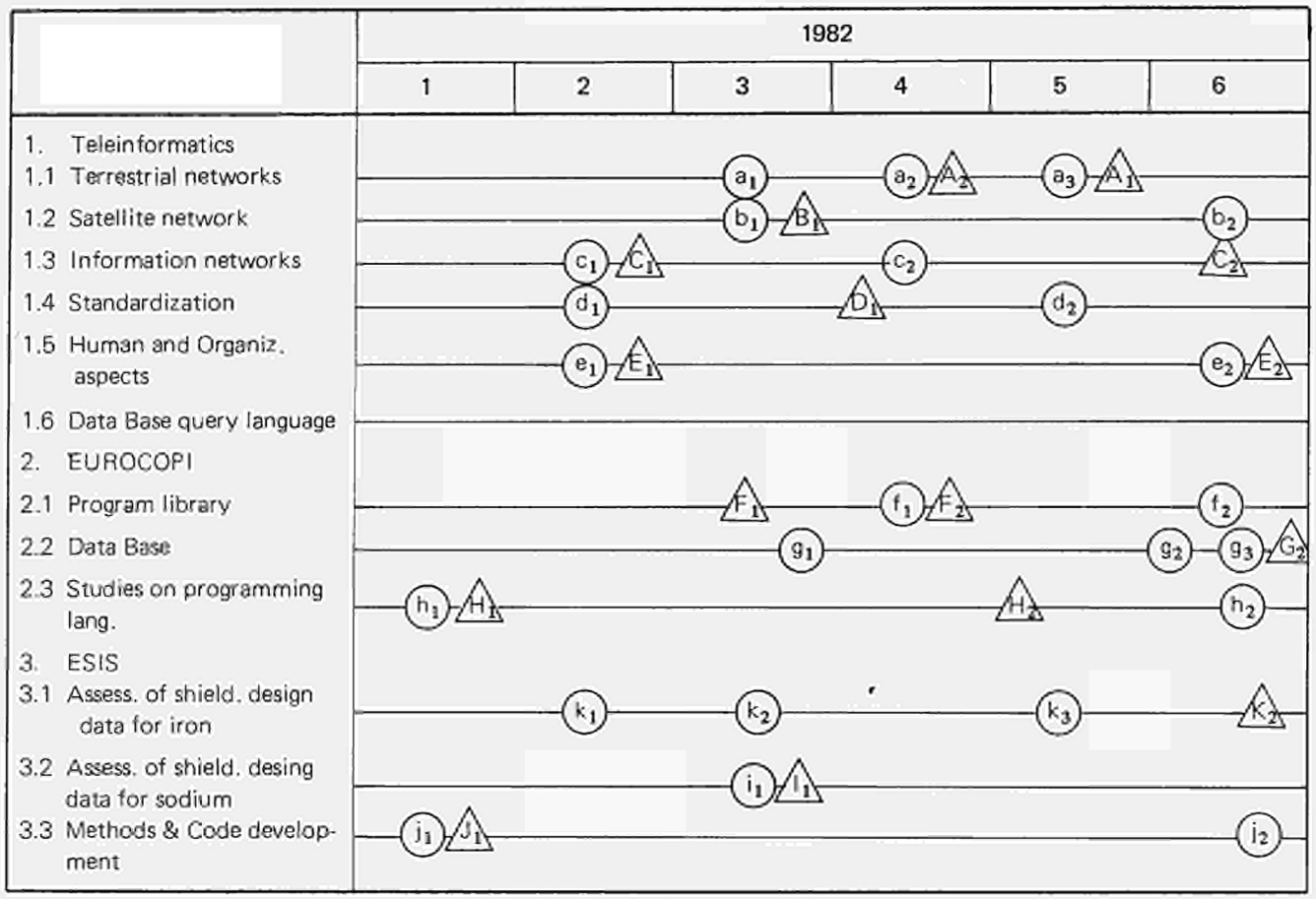
As already reported, R & D in ESIS is focussed on integral deep penetration neutron shielding benchmarks and simplified gamma ray attenuation algorithms in multilayered shields. From time to time the methods under development are applied to prototypical shielding problems.
In this reporting period neutron streaming in ducts of a PWR and the experimental facilities of an accelerator were analyzed.

In the iron benchmark experiment, which is being completed, a series of calibration measurements have been carried out. Parallel to this measuring campaign, the preparatory work for a similar deep penetration sodium experiment has reached the following achievements: completion of the safety report including detailed 3-D activation calculations, planning, construction and mechanical tests of the sodium containers and preparation of the sodium melting procedure.

The newly developed data adjustment code ADJUST-EUR has - after improvements and careful tests - been applied to the ASPIS experiment.

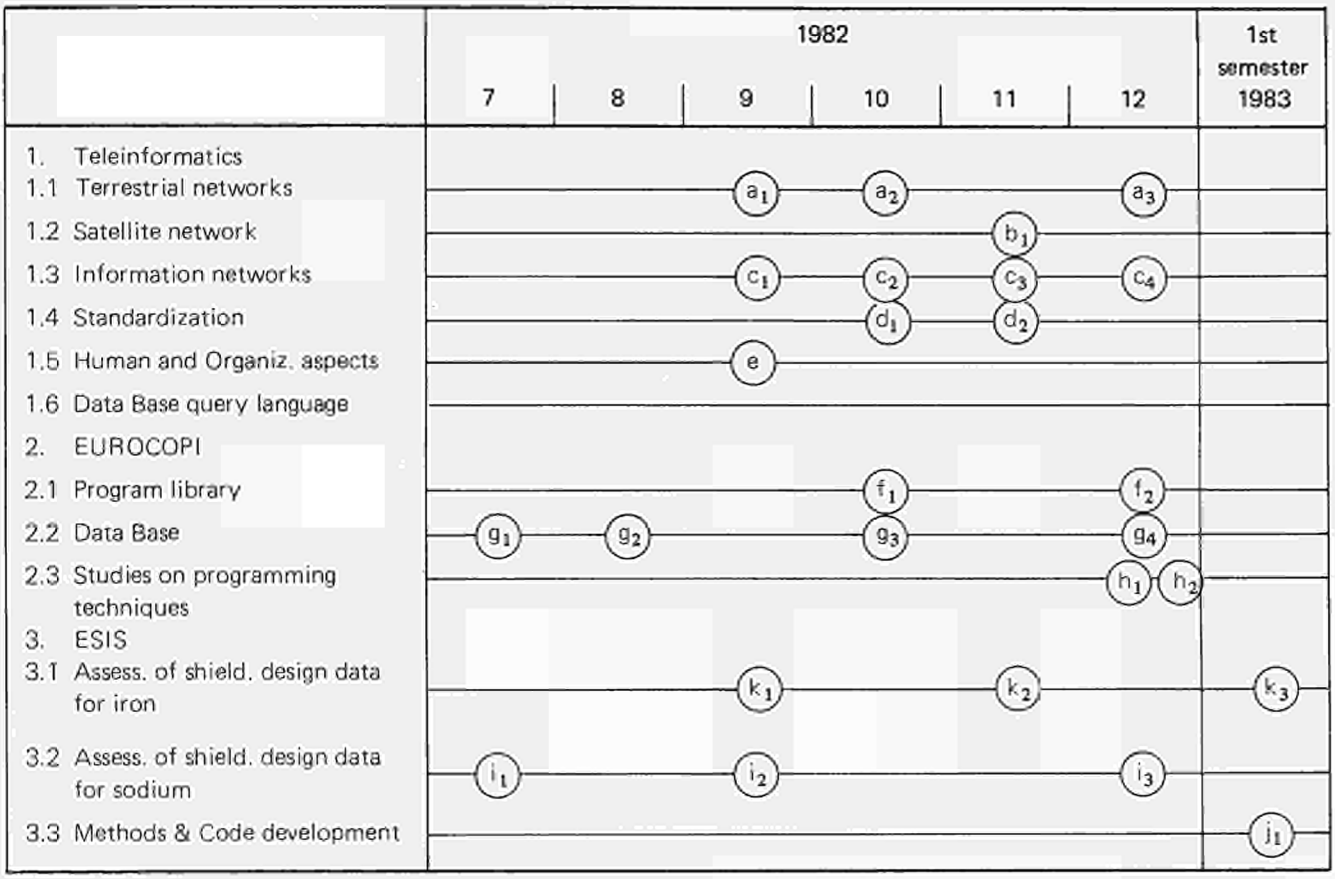
In this first application the global detector method was used to fit the sulphur activation measurements. It showed a perfect convergency for the new group data in EURLIB structure with locally dependent resonance weighting.

Table I. Significant achievements compared to planning



a_1 Final assessment of the X25 network of micros (delivery of some components delayed)
a_2 Preliminary specifications of the fiber optic ring hardware and software
a_3 Possible installation of a Cambridge ring (temporarily abandoned)
b_1 Internet protocol using satellite link first version
b_2 Preliminary packet exchange on satellite (waiting for CNUCE being connected to EURONET)
c_1 Integration of word processors into the SCRIBA system
c_2 Preliminary operation of SCRIBA
d_1 Transport layer basic specification classes 0 and 2 final report
d_2 Transport layer specification classes 1 and 3 (COST 11 bis management decision)
e_1 Finalised ergonomic check-list available
e_2 Workshop
f_1 Manuals on Engineering packages, printed version
f_2 Preliminary status on library automation
g_1 Draft of DB operation manual, ready
g_2 Program for DB data input and updating, ready
g_3 First results on experimental external test phase
h_1 Guide on Fortran dialect conversion, start
h_2 Guide on Fortran dialect conversion, ready
k_1 Completion of the adjustment of ASPIS by the use of ADJUST-EUR
k_2 Completion of the EURACOS iron benchmark experiment
k_3 First data adjustment results from EURACOS
l_1 3D flux and sensitivity analysis of the sodium experiment (for the safety report)
j_1 Completion of incorporating ADJUST into RSYST
j_2 Distribution of the TIMOC perturbation & sensitivity version (including code manual)

Table II. Planned activities and important milestones



a_1 Final specifications HERMES broadcast protocols and service
a_2 INET extention to Bruxelles with job inout and delivery
a_3 HERMES ring prototype evaluation
b_1 Preliminary version of internetworking protocol via satellite
c_1 Feasibility of integration of facsimile
c_2 Acceptance of the SCRIBA data base function
c_3 Tests of TEXIS
c_4 Specifications for POSTMAN
d_1 Start of basic specifications for transport class 1 and 3
d_2 First results on certification methodologies
e Book text finalised
f_1 Last phase of organisation
f_2 Compatibility between Progral Library - DB
g_1 Operation of the DB under the public experimental test phase
g_2 First phase of improvements: due to converter
g_3 First phase of improvements: updating program
g_4 Data conversion + input from libraries: two applications
h_1 Software quality control + vector computers, practical realizations
h_2 Study on FORTRAN dialect conversion, evaluation of user's reactions
k_1 Completion of the adjustment of the ASPIS experiment
k_2 First iron adjustment results from EURACOS
k_3 Completion of the iron adjustment based on EURACOS measurements
i_1 Completion of the assembly of the sodium benchmark experiment at the EURACOS facility
i_2 Begin of the measuring compaign in sodium
i_3 Conclusion of the first series of measurements in sodium
j_1 Distribution of the TIMOC perturbation & sensitivity version (including code manual)

PROJECTS

1. TELEINFORMATICS

Current trends in teleinformatics research show that the interest is rapidly moving from the area of low speed to high speed networks such as local area and satellite networks. In parallel, new types of informatics services are conceived which best exploit the capabilities of the new network technologies.
A large and dispersed community of users of conventional informatics services, such as timesharing infomation retrieval and remote job entry, can already benefit from the services offered by the public networks which allow the access to the hosts offering those services. The challenges for research activities arise now in the fields of message exchange systems, office automation and distributed control of physical and social processes.
Some systems, which provide those advanced services, do already exist as prototype realizations or even in the market: the problem is rather their integration into coherent and possibly heterogeneous systems and their accessability via public network services. In this sense a remarkable effort in terms of standardization is needed.
In accordance with the above remarks, our activities can be classified in the following way:

— terrestrial networks (SOLAR net, X25 network of micros, HERMES fiber optics project, other Local Area Networks),
— satellite networks (contribution to the COST 11 bis project),
— information networks (burotique, SCRIBA),
— standardization (transport layer, RTC, certification methodologies).

In addition, work progressed on Data Base Query Language.

TERRESTRIAL NETWORKS

Following the satisfactory assessment of our internal X25 network based on SOLAR 16 mini-computers, we are now proceeding in the installation of new types of networks. Those networks offer some remarkable peculiarities in terms of serviceability and capacity. The already developed network of SOLAR constitutes the flexible kernel around which a mesh of networks of distinct characteristics can be build.

Access to Data Base from Euronet

A certain amount of effort has been spent in tidying up the access mechanism, as the sudden appearance of about 80 external users for the ECDIN data base (which is now in its experimental phase) has spotlighted certain problem areas which had not shown up previously. This has happened mainly because the external users are unaccustomed to our particular system and do not always do what is expected of them. The major cause of problems has been users disconnecting during a session, thus leaving a time-sharing session in course on the mainframe computer. The Solar computer now attempts to close the TSO session in this situation, although it is not always possible.

A second modification has been to add a third data base to those for which access is given from Euronet, although the access is restricted at the present time to those developing it. This new data base is SHIPY, and is intended to provide information about the shipyard industries.

On-Line Information Service

With being a host of Euronet/Diane, the Ispra computing centre has been overwhelmed by requests for information about the services provided. In order to answer all these requests, it has been decided to implement an «On-Line Information Service», which is currently available on Euronet and can be interrogated by prospective users of our various services.
The aim of this system is to provide at least a first level of information about the computing facilities available at Ispra to Euronet users. This «first level» of information is equivalent to the information already contained in the various brochures describing some of the services and should be sufficient to allow potential users to identify services that are useful to them.

X25 Network of Micros

This technology is particularly suited for interconnecting a dispersed population of computers and terminals.

A prototype configuration, manufactured by a French company, has been installed and tested. Its compatibility with the Euronet standards has been proven. Such a network might represent a solution to the low-medium traffic requirements of INSIS. Indeed with a comparable cost to that of the required modems, terminal concentrators can be installed almost anywhere in the buildings. These concentrators offer up to four X25 ports and up to fifteen X28 asynchronous ports.

A network of eight such units has been installed. This network supports a population of terminals and offers ports to the mainframe computer and, via the SOLAR network, to Euronet.

HERMES: Fiber Optics Ring

The fiber optics approach represents some undoubtful advantages as compared to coaxial cables and in particular it is characterized by low attenuation and low sensitivity to external sources of electromagnetic noise. With the adoption of fiber optic trunks, the ring networks can be extended up to remarkable distances (several Kms).
We are currently developing the prototype firmware of the Link Access Module for such network.
The link access scheme has been designed taking into consideration the functions required by the higher level broadcast and synchronization services. The adopted solution shows, even at the theoretical level, some remarkable advantages as compared to other link access schemes (CSMA/CD, token passing).
By the end of the year, we plan to offer a demonstration based on a network of three nodes with trunks of 1 Km each and working at 10Mb/s.

The top down approach required that the overal network services be defined before the basic services.
In this sense we have found the technical solution for the following classes of network services:

— free broadcasting
— broadcasting with reservation
— multisender-multireceiver transmission
— X25 virtual circuits
— n to m transmission with error and flow control.

The implied protocols have been specified. The details of the realization on cheap microcomputers will be considered after the satisfactory evaluation of the prototype ring.

As a general remark we believe that this project, if successful, is going to provide us with an extremely flexible test bed for proving the validity of new services and applications in the field of teleinformatics. Indeed the conceived services cover all conventional data transmission features (point to point liaisons with or without error/flow control) and in addition they provide multicast data transmission functions and synchronization primitives for distributed processes.
The qualifying difference to what has been realized so far is that the «communication scenario» can be defined, for all foreseen services, by the communicating partners as well as by any third «intelligence» which can act as the «operator» of the communication. In this sense the notion of «monitor» is introduced in the data transmission protocols.
The «monitor» concept has proved to be extremely powerful in the definition of the existing «operating systems» of the data processing systems. An analogous impact is expected to be implied by the concept of «monitor» as applied to data transmissions networks.

Other Local Area Networks

The installation of a «Cambridge ring» system as proposed in the framework of the COST 11 bis project has been postponed. We are looking forward for a system which can support longer distances between nodes as required by the topology of the JRC Ispra Establishment. In the meantime our interest is focused on the announced new version of «Mininet» which is expected to provide fast, reliable transportation of short packets between data collection and data analysis systems. We believe that this system can properly solve data communication problems in the areas of real time and process control.

Satellite Networks

A DEC systems has been installed and equipped with the required features (high level language compilers and data communication interfaces) for running all the sofware produced in the framework of the COST 11 bis joint venture on «Interconnection of local area networks using satellite links and X25 public services».

A 1Mb/s link between our Satellite Link Driving Computer and the Teledetection laboratory has been satisfactory testes.
This link allows the access to all software development facilities which are available in other DEC installations from our relatively small system.
The same link is going to be used in case large amounts of data (ex. satellite images) are to be transferred to/from the teledetection laboratory. In the future the proprietary «Decnet» services will also be accessible through our LDC. The LDC is connected to our SOLAR network by means of an X25 gateway. A virtual connection is prolonged over Euronet to the twin LDC computer installed at CNUCE (Pisa) which in turn drives the earth station to the OTS satellite. In this way we can communicate via the satellite with the other partners of the COST 11 bis project.
In collaboration with those partners we are at present concerned with the development of the commonly agreed internetworking protocol.
We hope that by the end of next year an experiment on internetworking via satellite can be set up with the aim at demonstrating the result of this collaborative effort.

INFORMATION NETWORKS

This project is intended to demonstrate the feasibility of an advanced information distribution service based on the latest developments in three relatively unrelated fields i.e.: data base management, network services and equipment for office automation.
The project takes into consideration recent announcements concerning new services offered by the European PTTs (ex. Teletex, Telemail) and the preliminary studies which are carried out in the framework of INSIS.
We recall that the INterinStitutional Information Service project is a Commission action aimed at the realization of a teleinformatics system which allows the exchange of information in its various form (voice, text, image) between the European Institution and the National Administrations.
The JRC actively contributes to the technical working groups of INSIS.
We are also designing some prototypes systems which can be considered as test beds for the major project.

Burotique

Two actions have been undertaken in this field: the definition of a compatible Teletex private network and the adaptation to it of some existing word processors.

As soon as Teletex terminals with an X25 interface will be available on the market, they will be connected to our system of X25 networks and therefore the point to point transmission of documents will be supported.

Teletex Network and «Postman» Function

The TEXIS software package provides a «value added» service which consists of «storing and forwarding» teletex documents and facsimile files in order to decouple the physical resources (the terminal devices) from the bursts of traffic.

TEXIS primitives will also be used by the «postman» function which is charged to best exploit the network and the terminal resources for driving an automatic mail delivery service without any human intervention.

The technical specification of the software for a fully compatible teletex network has been the subject of a call for tender addressed to European software houses. The idea is to build, on top of our basic X25 network kernel, a teletex service which offers the document transfer function for the submittal and the delivery of the computerised mail.
The system (called TEXIS) will be accessible by teletex compatible terminals connected to either our internal network or to the emerging teletex public services.
The basic store and forward capability of TEXIS will mainly be driven by the «postman».
The postman software function will take decisions on how, when and where the messages can be delivered to the destination print out stations, on the basis of the current traffic and the availability of the terminals.
We believe that the postman function represents a considerable improvement when compared to the existing computerized message exchange systems which require the (human) intervention by the communicating partners. Indeed

even the conventional mail service «delivers» the mail to destinations without the addressees being obliged to repetetively ask the service provider if there is any mail for them.
TEXIS is under development and the specifications for POSTMAN will be ready within this year.

Word Processors

Taking into account that the X25 compatible teletex terminals are not yet available on the market and that a reasonable population of Olivetti word processors are already installed at the JRC, we have developed a proper interface that makes those word processors appear as standard teletex stations.
Like many other mapping modules, this software runs on the SOLARs which act as the collectors of all letters to be mailed and originated from the Olivetti's.

SCRIBA

SCRIBA is the name of our prototype information distribution system which integrates the services offered by the word processors, the printing stations, the network data transfer capabilities and the data bases which support the overall distribution service.
The data base function of SCRIBA is currently in the implementation phase and some preliminary demonstration have already shown some good results.
The data base is supported by the ADABAS Data Base Management System which is available on our mainframe computer and on some other mainframes (DEC, Siemens). In addition ADABAS has demonstrated full compatibility with the CODASYL recommendations and, consequently, the SCRIBA implementation is considered to be portable to other computer systems with a relatively small effort.
SCRIBA has been conceived as a distributed computerized message exchange system. A number of SCRIBA systems will cooperate exactly in the same way as regional post offices cooperate for performing the overall distribution function, each of them taking care of its local subscribers.
In addition SCRIBA holds the data structures describing conference memberships, personal access rights, public and private archives, routing criteria as defined by its end users and mailboxes.
By means of an adequate interface to the POSTMAN function, the SCRIBA systems are capable of best exploiting the available multicasting capabilities of the underlying network services (see our **HERMES** research project).
As a final remark we stress that the nature of the message plays no role within the overall architecture of the system: the contents of a message can be voice, text, facsimile or graphic.

Human and Organizational Aspects of Office Automation

Two activities are at the moment under way under this heading which forms part of the general EC project known as INSIS, the first aiming to gain experience of using the new technology under discussion, the second concerning the organization of a major expert workshop on this subject. Work has also been done on provision of ergonomic guidelines.

In this field an inquiry of the «European Communittee for Standardisation (CEN)» among its members, the national standard institutes of 16 European states, has been evaluated. The evaluation showed that a rather large number of standards for «Office furniture and the work place» and for «The office environment: lighting, climate, noise» exist in some member states. Very few standards, even in the form of draft or pre-standards, exist for «The visual display unit (VDU) work station» which is specific to information technology.

The initial idea to compile an ergonomic check list for VDU-work stations was given up in favour of charging specialists with writing a small brochure about ergonomic considerations for VDU use. At present we are looking for groups with suitable experience in this field.

STANDARDIZATION

The JRC is actively contributing to the overall process of standardization. The implied activities are carried out at various levels of technicalities and in the framework of various contextes.

Reference and Test Centre

This service is offered by the JRC to the implementors of the EURONET higher level protocols. Our debug and certification facility for the Remote Printing Protocol has helped the Sit-Intel and Telesystems companies in the tuning of their realizations of the Euronet printing station. At present a UNIVAC implementation of the remote printing protocol is under test.
Similar help is now offered to ICL, Siemens and CII-HB mainframe manufacturers in the development of their File Transfer Protocol service (NIFTP version 81).
In order to offer a better user-friendly interface to the NIFTP testing tool, a text editor for describing the test scenarios has been added to the system.
We have plans to extend the service to the fields of message exchange systems and the interfaces to office automation equipment. The idea is currently under discussion within INSIS.

Transport Layer

The Transport layer is likely to be the first issue for standardization within the ISO Open Systems Interconnection reference model. Current work carried out by ISO experts shows that at least classes 0 and 2 or the transport service are to be considered as stabilized.
The COST 11 bis project has activated an action titled «Basic specifications of the transport Service and Protocols» which is meant to offer an unambiguous, implementation oriented interpretation of the recent recommendations by ISO.
The JRC leads the COST 11 bis working group which has undertaken this analysis which has recently produced its final document on classes 0 and 2.
An analogous study contract is now proposed for covering classes 1 and 3 too.

European Collaboration on Protocol Testing Techniques

The JRC is participating in a European collaborative project which is a «Pre-development study of testing techniques for implementations of High Level Protocols».

As well as the JRC, the participants are:

— National Physical Laboratory, Teddington
— Agence d'Informatique, Paris
— Gesellschaft fuer Mathematik und Datenverarbeitung, Darmstadt

who are being partly financed by the Commission for the execution of this work.

The intention is that these centres will develop their techniques and tests, each concentrating on a particular protocol, for an initial period of 9 months. At the end of this time, a common architecture and a common set of techniques will be defined, which will then be applied to developing tests for

the emerging ISO standards for Network Service, Transport Service, and Session Service.

As these techniques are based on original techniques developed and used at Ispra, the JRC was invited to participate in a technical advisory capacity, not having the resources available for a greater participation at the present time. However, suggestions made by the JRC have already been accepted by the other participants, and in particular, an initial phase of collaboration has been agreed, during which a common set of terms, protocol primitives etc. will be defined, and then used in the remainder of the project. This is seen as an important first step in the convergence towards a final common solution.

DATA BASE QUERY LANGUAGE

The more significant contributions to the development of a generalized query language based on the ADABAS DBMS and oriented towards bibliographic and factual data bases are, in the reporting period, the following:

1. The macroprocessor which had been set up last year has been enhanced and new programming modules have been added.
2. New facilities have been programmed to improve the ADAGF capability. They are:
   a) extension of the proximity searching in free-text abstracts feature to any possible series of words, situated at any place in a sentence (interrupted sequence).
   b) display of histogrammes related to a relevant part of the data base and not only to the whole.
   c) display of data stored in a network structure of files.

In order to upgrade our Data Base and, obviously, the actual generalized query language, the migration of ADABAS from the current version 3 to the version 4 has been performed.

In the frame of the Automatic Indexing activity, the contract on the dictionary construction to be used in the Automatic Indexing System (SLC II) has been successfully terminated.

Some Indexing runs were performed on Food Science & Technology material using this new dictionary with promising results.

The collaboration between University of Linz, G.I.D. Frankfurt and Ispra will go on for further development of the system.

COLLABORATION WITH EXTERNAL ORGANIZATIONS

It has been pointed out in the above description that our activities are closely related to current R & D efforts carried out by other research laboratories, manufacturers, PTTs and standardization bodies.
In particular, our participation to the COST 11 bis research project and our active role in the INSIS project, offer us several opportunities for adjusting our own research activities to common objectives of widely recognized interest.

Examples of some joint research ventures are the satellite, local area networks, transport protocol and certification methodologies projects mentioned above.
We feel that our technical expertise is complementary to the organizatorial effort performed by other Commission services in orientating the European R & D ventures in teleinformatics.

REFERENCES

G. DE GRANDI, A. ENDRIZZI
- HERMES: fiber optics ring network
  Protocols and Services specifications.

J. C. REY
- Automatic Job Input and Listing Delivery for INET
- RTCFT-Ispra File Transfer Protocol Test Facility Reference Manual

COST 11 bis
- Basic Transport Service, Transport Protocol for ISO class 0 and 2 and associated Network Service.
  Final Report
- Need for continued concerted teleinformatics research in Europe.

J. LOCQUET
- INET interconnection to STELLA.

2. EUROCOPI

The results achieved during the first half year period are reported under the following main headings:

— Activities in Applied Research and Technical Development

— Computer Program Information and Distribution Service

In addition, a more detailed report is given on the structure use and application of the ICES System (engineering package).

a. Activities in Applied Research and Technical Developments

a1. Engineering Packages

Taking into account the long and wide experience with the ICES System in theory and practice, a gap of the ICES system documentation has been filled by writting a user oriented system description, which facilitates the access to a comprehensive understanding and to a first use and application of this large engineering package. This description shows the basic philosophy, structure and range of applications and save the engineer from the necessity of reading some extensive volumes.
The draft version of this manual «The ICES System» was presented and discussed during the last session of the IUG Directory Board, where it was judged to be a very useful complementary element to the already existing ICES documentation.

Concerning all implemented engineering packages (BERSAFE, NASTRAN, ICES) the support in system and informatics related aspects (introduction, use, application) continued as well as the new implementations and daily maintenance.

Calculations in natural sciences and enginnering are now more oriented towards the use of vector and matrix operations. Actual computer architecture developments consider these types of data processing requirements.

Modifications and implementations of existing software however require special training for vector computing. For this purpose two members of EUROCOPI participated in a 3 day seminar on «Parallel computers and scientific calculation» organised by IBM Italy.

a2. Practical approach to portability

The preceeding report contained a special introduction to the study «FORTRAN IV Dialect Conversion, a case study: CDC to IBM». This subproject advanced and the following additional steps were completed:

- After the successful user's review the final version of the conversion check list is available.
- A set of library routines has been produced (6 for character handling and 3 for octal to decimal conversion).
- The conversion guide and the questionnaire are ready for publication. They will be published as a handbook issue of the JRC Ispra Computing Centre Newsletter.
- A two day training course has been announced on the subject.

a3. Utility tools for data base operation

Remembering that this program information service should run for some years under the present technical conditions and respecting the experience gained from recent use of the data base we considered in a technical study all topics still to be improved concerning the overall data base operation, i.e. informatics and data aspects.
Considering that the manpower allocation for the data base is very limited we planned that this improvement work should take place over two years and this time has been subdivided into 3 priority sections.
Concerning the technical aspects we also considered 3 sections which are: data input, data base operations, and DB use. Further technical details will be reported when important achievements will be completed.

a4. Publication of research and technical development results

Publication of the lectures prepared for the Ispra Courses on «Programming for Software Sharing» is envisaged. The supervision of the technical editing for this book will be performed under contract by a member of the University of Edinburg, UK.

The main subjects treated are:

- Software Development Methodology
- Flexibility
- Transfer/Sharing
- General.

b. Program Information and Distribution Service

b1. Technical maintenance of the data base

a) Data base operation

Concerning the data base operation we now have a pool of about 160 modules containing programs, data sets of different data types, and procedures handling the DB, moving and checking data, executing programs, etc.
We have recently adapted, implemented, and tested again the total set of procedures according to changes in the computer system organization and according to changes of the DBMS ADABAS (we used the ADABAS version 4). All these tests have been finished.
Providing that there will not be additional major modification of the DB operation, the number of operational modules can be reduced to a figure which allows us to operate the DB in a simple and elegant way.

b) Authorized files

Concerning the thesauri we again updated the subject classification file EPOS (reduction of records together with a structure compression) and the computer system file COMP (extension to 1600 descriptive records). These updates make the code assignment operations much easier.
To perform fast updates of files, some sets of macros have been developed which can adapt information online in a more sophisticated way.

c) Data sources

Our first cooperation efforts for acquiring new data sources were successful. We achieved practical agreements and procedures to transfer the total data collection of the «CPC Program Library» at the Queen's University of Belfast and of the «Informationszentrum Sozialwissenschaften (IZ)» at Bonn. The IZ is regularly in contact with software documentation centres and software producers in the member countries of the EC and the USA. The subject fields covered are statistics, linguistics, graphics, information retrieval, network analysis, and simulation.

d) Data security

As well as backups regularly performed for all ADABAS files we created a raw data archive so that we can restart the DB from zero in the case of very severe breakdowns.

b2. Program Library

During the last half year the following phases of the reorganization of the EPDA (European Program Distribution Agency) were achieved:

- Disk units have been replaced and new peripheral system software has been implemented. Consequently all libraries, programs, and data files of different types had to be transferred.
- The total material check of the computer programs has been finished and the check of the software itself is in progress.
- An inventory of all remaining printed documentation has been drawn up including the reclassification of this material.
- Concerning the inventory and reclassification of documents the same actions have been applied to all tapes, on-line and archived files. This phase is still under way.
- For the remaining programs, the abstract production from the available documentation has been started. Furthermore all program descriptions of the EPDA library have been converted from SIMAS to ADABAS format and structure and updated in the content.
- Finally the last phase of the reorganization has been started, namely to create effective procedures for the storage, retrieval, update and distribution of programs and data files as well as printed materials.
- We received five new programs which have been tested and made available for distribution.

External Cooperation

In this connection the following may be mentioned:

a) IUG (ICES User Group)

Participation in the IUG Directory Board meetings at Delft Technical University and Bologna: this board manages all matters related to the maintenance development, and application of the basic system and of the different subsystems.

b) Computer program documentation centres

Agreements on a regular data transfer to EUROCOPI has been set up with:

- CPC (Computer Physics Communications) Program Library, Dept. of Applied Mathematics, Queen's University of Belfast, Ireland.
- Informationszentrum Sozialwissenschaften (IZ), Bonn, Germany.

In the following a somewhat detailed presentation of the ICES system is given.

Main features of the ICES system

(A. Inzaghi)

INTRODUCTION

A group of researchers from the Department of Civil Engineering at M.I.T. (Massachusetts Institute of Technology) dedicated itself in 1964 to the examination of engineering programmes and the languages used in their creation in order to find any gaps, in respect of the possible user requirements.

Some of the negative characteristics which emerged were: rigid formats for input and output, preset dimensions of the variables and structure of the data, inflexible solution processes, technical difficulties of access to computer use by those without a computer background and poor use of the memory.

To eliminate the inconveniences listed above and to fulfil other needs M.I.T. invented the ICES (Integrated Civil Engineering System). Prestigious firms and private and public American organizations took part in the expensive project.

For several years a world organization - IUG (ICES USERS' GROUP) - has promoted the ICES philosophy everywhere and helps the many users (about 800).

The two main characteristics of the ICES system are as follows:

a) Software development tool

b) A tool for the analysis and solution of problems.

At present ICES can operate on the following computers: IBM 360/370, UNIVAC 70/1100, CDC CYBER 70/170/700, Philips, Siemens and Vax.

The ICES system

ICES is a integrated system used in the various engineering fields. It is made up of the Base System and the applied Subsystems. There is a heirarchical relationship between these as the Subsystems are run under the control of the Base System. ICES is controlled by the Operating System of the computer, from which it calls for suitable services: space allocation, loading of the modules etc.

The Subsystems are developed with special programs included in the ICES Base System.

Each Subsystem is associated with an area of application. In other words, a Subsystem can only treat a previously defined «class of problems». The engineer (user) communicates with the Subsystem using a language oriented towards the problem (POL) also previously defined using the CDL language.

The use of the (POL) language makes the engineer-computer contact much easier.
The applied programs written in ICETRAN, once supplied as «input» to the ICETRAN Precompiler, become Fortran programs with special characteristics. A Fortran compiler produces the corresponding object programs with which, using the ICES «Link-edit» procedures, one obtains the modules which can be executed by an ICES Subsystem.

Some Programs of the Base System

Externally, each ICES Subsystem is made up of a set of commands (POL) which the engineer can use to communicate a problem to the computer. Internally each Subsystem is made up of a series of modules which are capable of considering the data of the problems and the various requests for analyses and of supplying the results. The programs of the ICES Base System and their characteristics make it

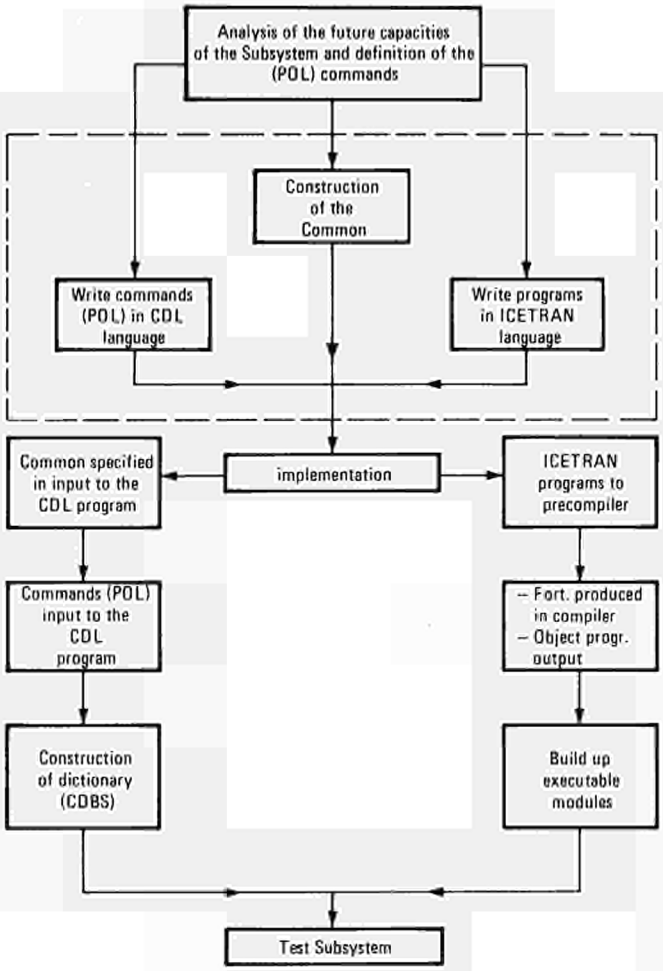


Fig. 1. Scheme of Development of an ICES Subsystem

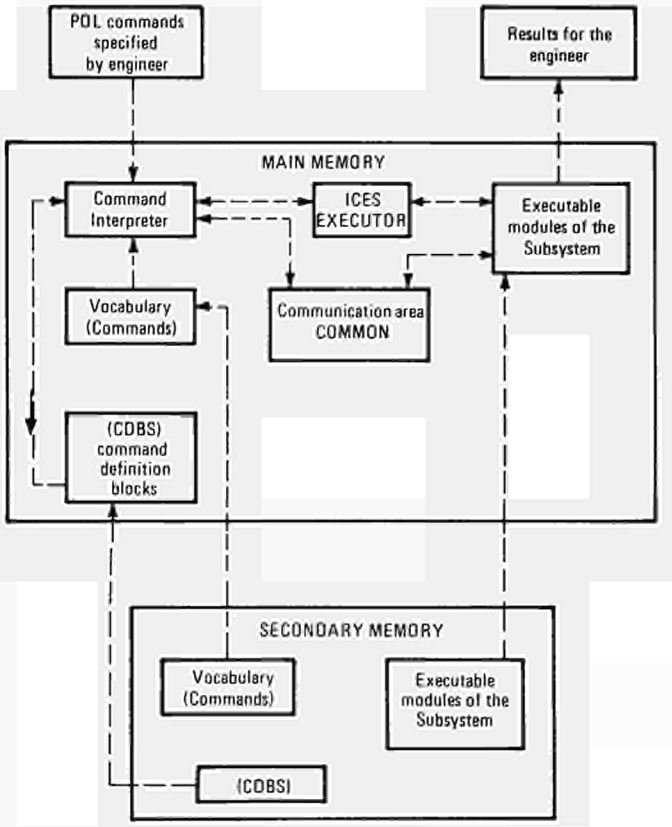


Fig. 2. Scheme of execution of a POL command

possible to achieve dynamic linking between external information, programs and data.

— CDL - Command Definition Language. Is the language (program) of the Base System which allows the programmer to create the commands which make up the (POL) of a hypothetical new Sybsystem and to construct the vocabulary.

— ICETRAN - (ICES-Fortran). Is the language (program) available to the programmer to write the programs which will supply the Subsystem.

— CI - (Command Interpreter). Recognises the (POL) commands which the engineer uses during the analyses and arranges the appropriate services.

— EXECUTOR - Is the heart of the Base System. It manages the «control» during a run. It governs the flow of information recognised by the CI, the Subsystem modules, the «Management Programs» and as a function of the dynamic needs, calls up the services as required from the Operation System.

Problem Oriented Language (POL)

In ICES the Command Definition Language (CDL) and the Command Interpreter (CI) are the programs available for writing and using a Problem Oriented Language (POL). Each ICES Subsystem solves problems which belong to a certain discipline; it has an appropriate (POL) which the engineer uses. (See fig. 2).

The Strudl Subsystem has its own (POL) for problems of structural analysis, the Project Subsystem has its own (POL) to deal with working activities in time; the STATS Subsystem has its own (POL) for problems of mathematics and statistics, and so on.

The languages (POL) are created with words (Commands) which are very similar to the natural language which an engineer normally uses. For example, if it necessary to deal with a problem of structural analysis, the ICES applicative Subsystem available is Strudl (Structural Design Language). Its (POL) used for describing a problem is made up of Commands (Words) such as UNIT, JOINT, MEMBER, LOAD, FORCE, MOMENT, etc., familiar to a structural analyst, and taken from English.

It is possible to define a (POL) with words taken from other languages.

The Programs

A Subsystem is usually made up of several modules, the sum of their dimensions often being considerably larger than the dimensions of the primary memory of any computer.
During the execution of a problem however only some of them are used and this not simultaneously. The selecting is done indirectly by the user by means of the commands (POL) used to describe a problem.

The Data

The data of the problem in ICES have a flexibility and a structure which is adequate to the needs of the user.
These characteristics are contained in the structure of the commands, and in the definition and structure of the variables contained in the programs which make up the modules.

A communication area «COMMON AREA» acts as a bridge by which all the information and data pass from the commands to the executable modules and vice versa.

The dynamic structure of the data and their size are considered during the execution of a program. The space

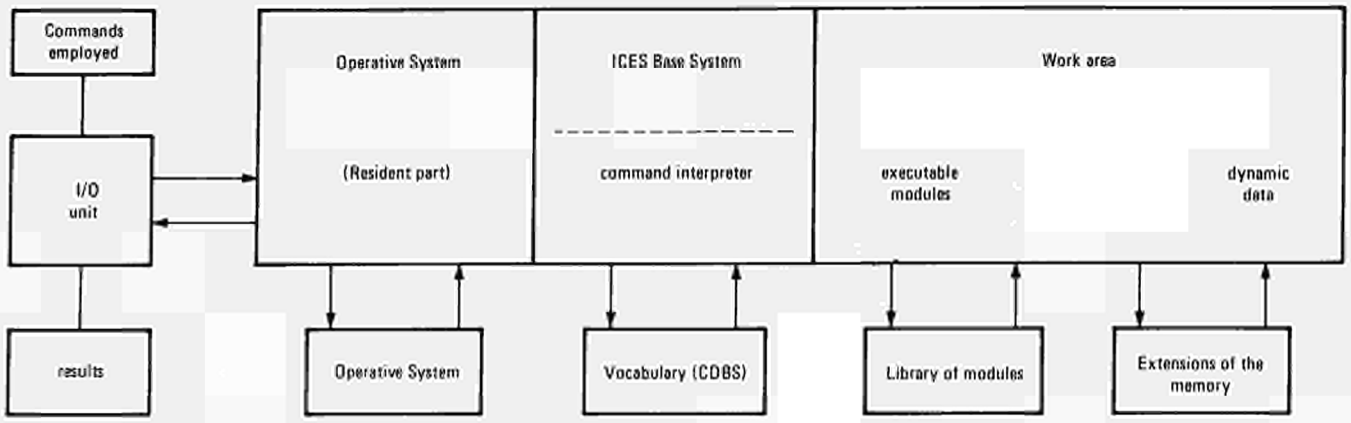


Fig. 3. Execution of an ICES Subsystem and dynamic memory allocation

necessary for a variable is allocated only when it is required.

The dynamic variables are defined by the appropriate use of «sentences» contained in ICETRAN. The morphology of the ICETRAN sentences is similar to Fortran.

The maximum size of a problem depends only on the computer used.

Example of an Application

Strudl (STRUctural Design Language) is the best-know, most important and most used of the ICES Applicative Subsystems. It is capable of mechanical, thermal and dynamic analyses of complex structures. The continuous structures can be discretized with finite elements of various types and geometries (plane and threedimensional elements etc.). Strudl also deals with structures of trusses and mixed structures. It communicates with the Subsystem using the appropriate commands (POL) required by the problem. (See Fig. 3).

Example - Vibrations

Continuous structures discretized with 2 BPR type finite elements. Nodes 1 and 4 are supported.

Our example shows how one may describe the problem of finding the natural frequencies (eigen frequencies) of the structure in the figure, discretised with BPR (Plate Bending Rectangular) elements. The characteristics of each finite element are stored on a permanent file during the installation of Strudl.

```
INTEGRATED CIVIL ENGINEERING SYSTEM - IUG VERSION V2M1, MAY 1977
                        – ICES –
DEC 16, 1981                              TIME = 13.27.37

STRUDL "EX. 2" "NATURAL VIBRATION OF PLATES"

                    ICES STRUDL-II
                THE STRUCTURAL DESIGN LANGUAGE

                IUG VERSION V3M1, MAY 1977
                SIZE OF POOL 8K BYTES
                  13:28:01      12/16/81

GRID DEFIN X 1 AT 15. Y 2 AT 15.
WALL Z 1 T 1. ELE TYP "BPR"
END OF DEFIN
TYPE PLATE BENDING
CONST E 7.2E5     ALL
DENSITY 0.000108 ALL
INERTIA LUMPED
NORMALIZE EIGENVE
DYN ANA EIG 3
LIST DYN EIGENVA 3
```

RESULTS OF LATEST ANALYSES

JOB ID -- EX. 2 JOB TITLE – NATURAL VIBRATION OF PLATES

ACTIVE UNITS – LENGTH FORCE ANGLE TEMPERATURE TIME
INCH LB RAD DEGF SEC

ACTIVE STRUCTURE TYPE – PLATE BENDING

ACTIVE COORDINATES AXES X Y

EIGENVALUES

MODE	EIGENVALUE	FREQUENCY	PERIOD	RADIANS
1	0.263781D 07	0.258489D 03	0.386863D–02	0.162414D 04
2	0.251446D 08	0.798073D 03	0.125302D–02	0.501444D 04
3	0.699913D 08	0.133150D 04	0.751031D–03	0.836608D 04

LIST DYN EIGENVE 3

RESULTS OF LATEST ANALYSES

JOB ID – EX. 2 JOB TITLE -- NATURAL VIBRATION OF PLATES

ACTIVE UNITS – LENGTH FORCE ANGLE TEMPERATURE TIME
INCH LB RAD DEGF SEC

ACTIVE STRUCTURE TYPE – PLATE BENDING

ACTIVE COORDINATES AXES X Y

EIGENVECTORS

MODE 1

JOINT		DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
2	GLOBAL			0.3273615	0.0379246	0.0000000	
3	GLOBAL			0.9999995	0.0483015	0.0000000	
5	GLOBAL			0.3273615	0.0379246	0.0000000	
6	GLOBAL			0.9999995	0.0483015	0.0000000	

MODE 2

JOINT		DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
2	GLOBAL			0.5884114	0.0367314	0.0784549	
3	GLOBAL			0.9999996	0.0258905	0.1333333	
5	GLOBAL			–0.5884114	–0.0367314	0.0784549	
6	GLOBAL			–0.9999996	–0.0258905	0.1333333	

MODE 3

JOINT		DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
2	GLOBAL			0.9999999	0.0098651	–0.0000000	
3	GLOBAL			–0.6547225	–0.1704050	0.0000000	
5	GLOBAL			0.9999999	0.0098651	–0.0000000	
6	GLOBAL			–0.6547225	–0.1704050	–0.0000000	

FINISH

Description	Comment
STRUDL «EX. 2» «NAT. VIBRAT. OF PLATES»	- call to subsystem
GRID DEFIN X 1 AT 15. Y 2 AT 15. WALL Z 1 T 1. ELE TYP «BPR» END OF DEFIN	- automatic generation of the structure
TYPE PLATE BENDING	- type of geometry
CONST E 7.2E5 ALL DENSITY 0.000108 ALL	- Young's module and density
INERTIA LUMPED	- inertia concentrated at the nodes
NORMALIZE EIGENVE	- Nomalisation
PRINT STR DATA	- Output of structural data
DYN ANA EIG 3	- Type of dynamic analysis and number of eigenvalues requested
LIST DYN EIGENVA 3	- Results requested
FINISH	- End of problem described

CONCLUSIONS

This paper describes ICES, shows the «development» (scheme only, see Fig. 1) and «application» aspects of the System with an example.

Its purpose (see ref.) is to inform and assist the potential user and to clarify certain concepts concerning the architecture of ICES to the reader including those who in the Centre or elsewhere regularly use the existing application Subsystems.

REFERENCES

1. A. INZAGHI
The ICES System
To be publisher, Jan. 1982

3. ESIS

In this section of the report a somewhat detailed account is given of the recent work performed on the analysis of iron benchmark experiments executed in ASPIS, on some simple gamma shielding estimates and on a practical accelerator shielding problem.

SELECTED TOPICS

Analysis of Iron Benchmark Experiments

W. Matthes in collaboration with R. D. Baechle and G. Hehn from IKE-Stuttgart

ABSTRACT

The «global detector version» of the code ADJUST-EUR has been tested, improved and applied to the ASPIS experiment. Since the S_N-code ANISN needed more than 90% of the total CP time and practically no advantage was taken from a previous run in the iterative procedure, we improved the flux guess and gained 40% in machine time.

The first application of the global detector method to fit the sulphur measurements of ASPIS revealed, that the method converges perfectly.

For proper solution of the neutron transport in large iron blocks like ASPIS and EURACOS the resonance weighting of the EURLIB group data has to be improved depending on the penetration depth in iron.

Accelerated Convergence of Transport Calculations

The first test runs of the global detector version of the data adjustment code ADJUST-EUR showed, that the onedimensional transport code ANISN needed the same calculation time for each run of the iteration process and there was no advantage from any previous calculation. The reason was, that the flux guess option in operation allowed only the input of the integral fluxes from a similar previous calculation but no angular fluxes. This procedure was practically worthless in the forward as well as in the adjoint mode of the code ANISN. For multigroup data adjustment this bad convergence in the transport calculation had to be solved primarily. A progress was needed for the global detector version of ADJUST-EUR but even more for the Newton iteration version with multiple adjoint runs in each iteration step.

We studied an acceleration principle for S_N-programmes by taking the angular flux guess of all groups from a previous run of a similar problem.

This principle of improving the flux guess is very effective in reducing the number of inner iterations, if we have identical geometry and only small changes of source data and group cross sections in two successive runs. These small changes are facilitated by proper choice of the damping factor in the iteration procedure.

In ANISN the angular flux guess is needed as flux moments separately for the zero flux moment and the higher moments. We supplied the module SN1D, which represents ANISN in the code system RSYST /1/ with the new input option. With the flux guess improvement according to the principle mentioned above we achieved a reduction of the total number of inner iterations by 40%, which corresponds to a reduction of the calculation time of the same order. By optimizing the value of the damping factor, we are sure, that a further decrease of the inner iteration number will be possible. Fast convergence of the transport calculations is essentially necessary for multigroup data adjustment.

It should be mentioned, that ANISN has only restricted input possibilities for the buckling factor, and therefore any variation of the buckling factor with energy group and penetration depth can be introduced only with the cross section input. In our first results of group data adjustment with the global detector method only a constant buckling factor has been applied.

First Results of Cross Section Adjustment with the Global Detector Method

With the global detector version of ADJUST-EUR the inelastic group cross section of natural iron have been adjusted to the sulphur detector measurements of the ASPIS experiment. The original iron cross sections were taken from EURLIB-4 /3/ with $1/\Sigma_T \cdot E$ - weighted group data based on ENDF/B-4. The error correlation information stems from the 30 group COVFILS data /4/, which had been interpolated to 100 EURLIB groups as reported previously. The uncertainty of the measurements was taken to be 5%. The first data adjustments have been performed by least square fitting the measured values. In this case we get an adjustment to the detectors at a depth of 5 and 10 cm in iron and almost no effect of the other detectors at deeper positions can be seen.

The final results are shown in Fig. 1, when all changes are confined to the total inelastic cross section. The convergence of the iteration procedure is perfect. Therefore the damping factor is set equal to one. The strong reduction of the inelastic cross section can be explained and is in good agreement with the results of Table 2 in the 2. progress report /2/. For the first sulphur detector at 5.08 cm depth the measured activation rate is 20% higher than the calculated value in slab geometry with a constant buckling correction and the next detector at 10.18 cm is 10% higher. For larger penetration depth the agreement becomes better.

Comparing the calculated activation rate of sulphur in twodimensional representation with the buckling corrected onedimensional case, it is clear that a constant buckling factor cannot be sufficient to cover all twodimensional effects correctly. It is further clear, that the $1/\Sigma_T \cdot E$ - resonance weighting applied for the EURLIB group data cannot be the right one for all penetration depth in iron. Accordingly the group cross sections of iron should vary between 3 MeV and 20 keV with the penetration depth. From our first results we conclude:

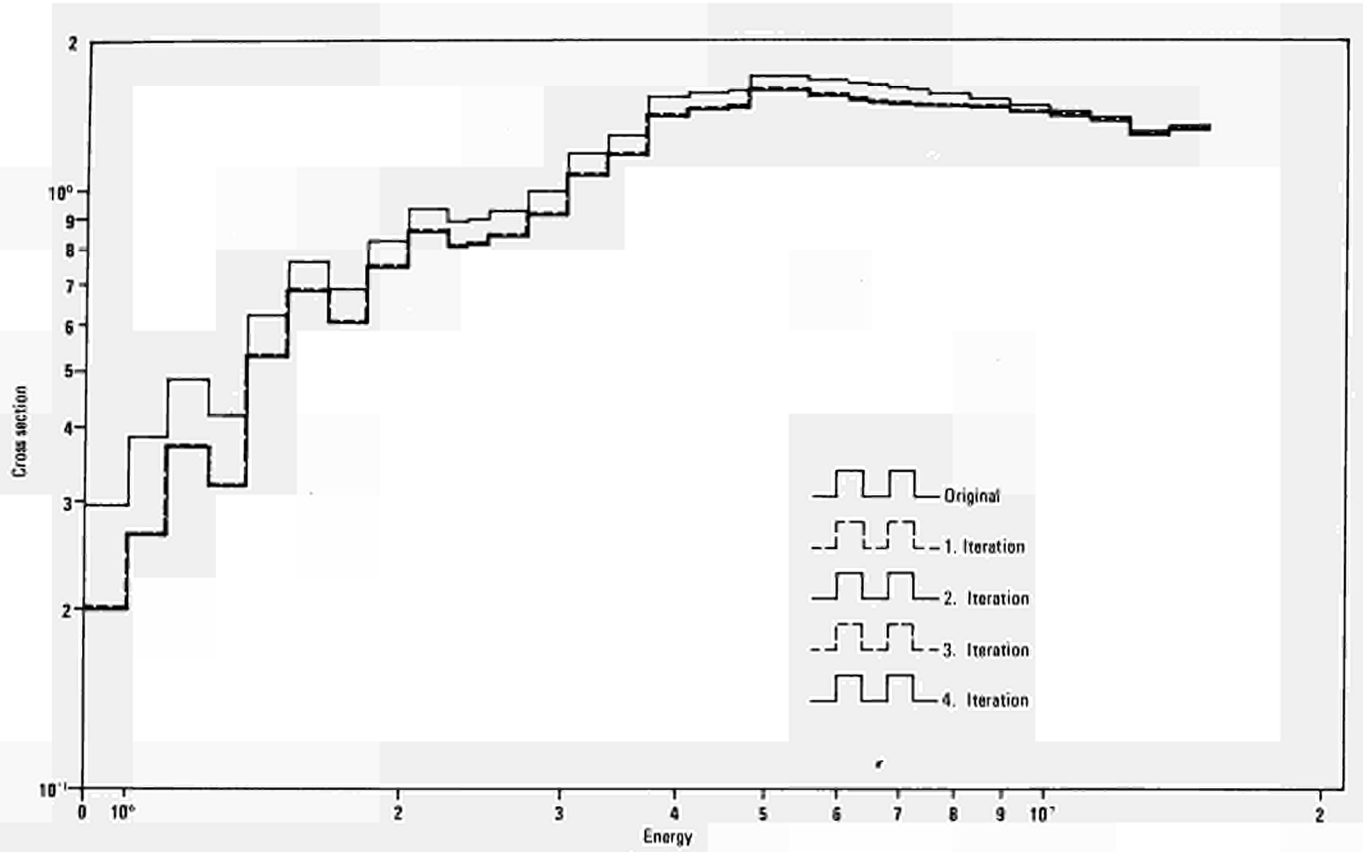


Fig. 1. Adjustment of inelastic iron cross section after various iterations

1. The buckling correction should be determined for each energy group in several zones of penetration, to avoid any adjustment from geometry effects.
2. For group data in the resonance region we should allow the adjustment procedure to recognize local changes of the weighting flux in several zones of penetration.

Reduction of the Iron Group Cross Sections with Penetration Depth in ASPIS

In deep penetration iron experiments like ASPIS and EURACOS fission neutrons propagate predominantly in the resonance region between 3 MeV and 20 keV. In this energy range the cross section minima between the large resonances are filled up with neutrons gradually with increasing depth. Due to this filter effect the resulting group cross sections decrease with penetration depth, because the importance of the minima is raised. If the fine structure of the neutron flux becomes proportional to $1/\Sigma_T$, the relative decrease of the group cross sections is appreciable compared to a flat 1/E weighting of the resonances as shown in Fig. 2 for the total cross section of iron in the VITAMIN-C group structure /5/.
Such group cross sections, weighted in accordance with the narrow resonance concept, are applied as local averages to calculate neutron penetration through iron layers. But the detectors, deposited over a wide range of penetration depth, give measured values, which cannot be calculated properly with a mean set of group cross sections in the resonance region below 3 MeV. Of course, there is no weighting problem above this energy limit, as can be seen quite well from Fig. 2.

To get a first indication of the reduction of group data with penetration depth, we made a calculation of the ASPIS experiment with the 171 VITAMIN-C groups and condensed the results to the 100 groups of EURLIB. The relative decrease of the group data compared to the innermost iron interval at 0,91 cm is shown for example in Fig. 3 and Fig. 4 for different depths in iron.

To clarify the local effects of the resonance range a special superfine group structure will be designed for this energy region and applied to determine proper weighting functions for several zones of penetration. There will be no problem for the one- and twodimensional transport calculations to use various zone averaged group cross sections of iron.

The super-fine group cross-section set only will eventually be «put under adjustment».

Before each iteration (in the adjustment procedure) zone averaged group cross sections will be evaluated (from the updated super fine group cross sections) for following transport calculations.

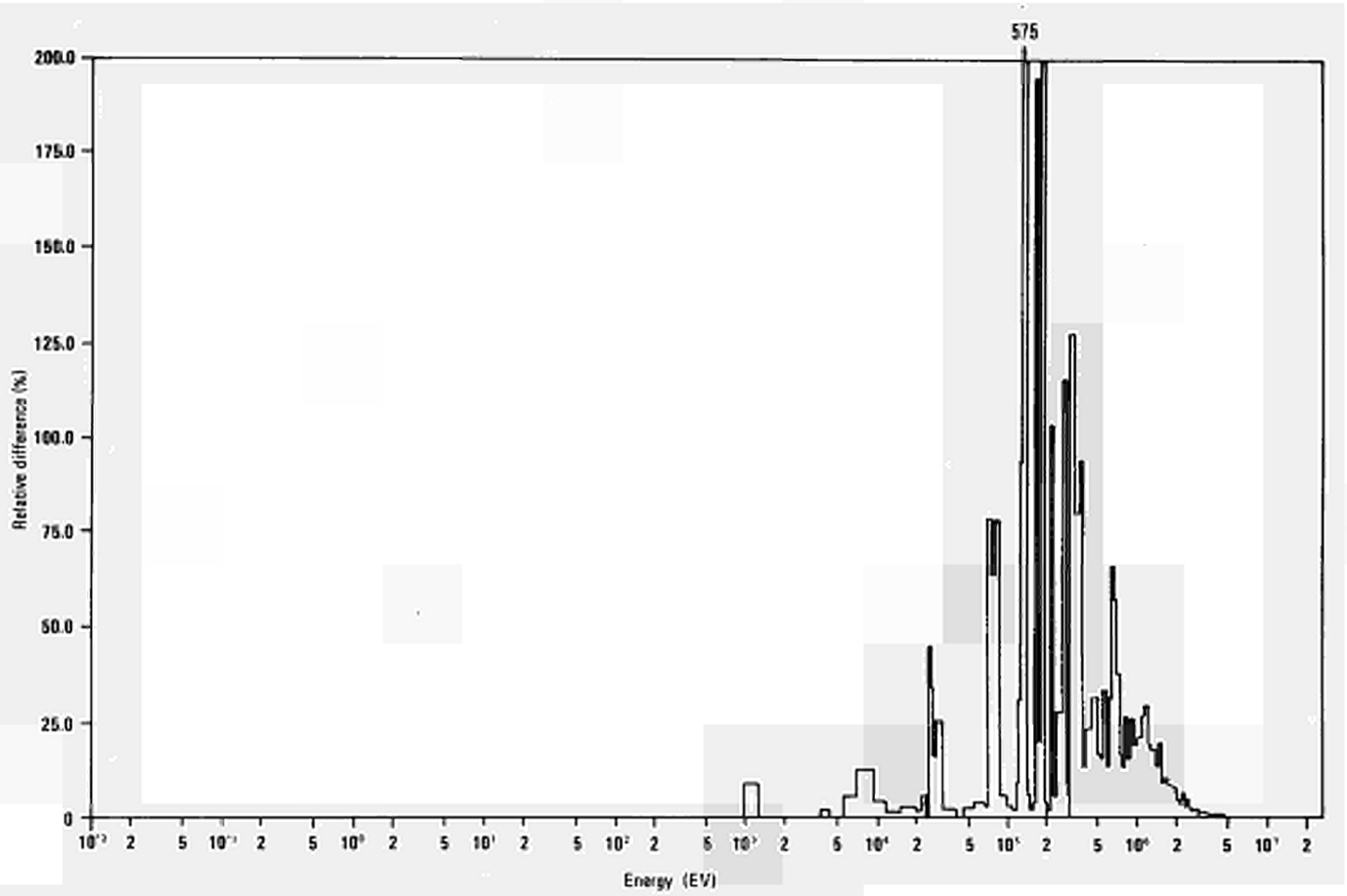


Fig. 2. Iron ENDF/B-IV/1192 total XS rel. diff. of W(E): ((1/E) - (1/SIGT))/(1/SIGT)

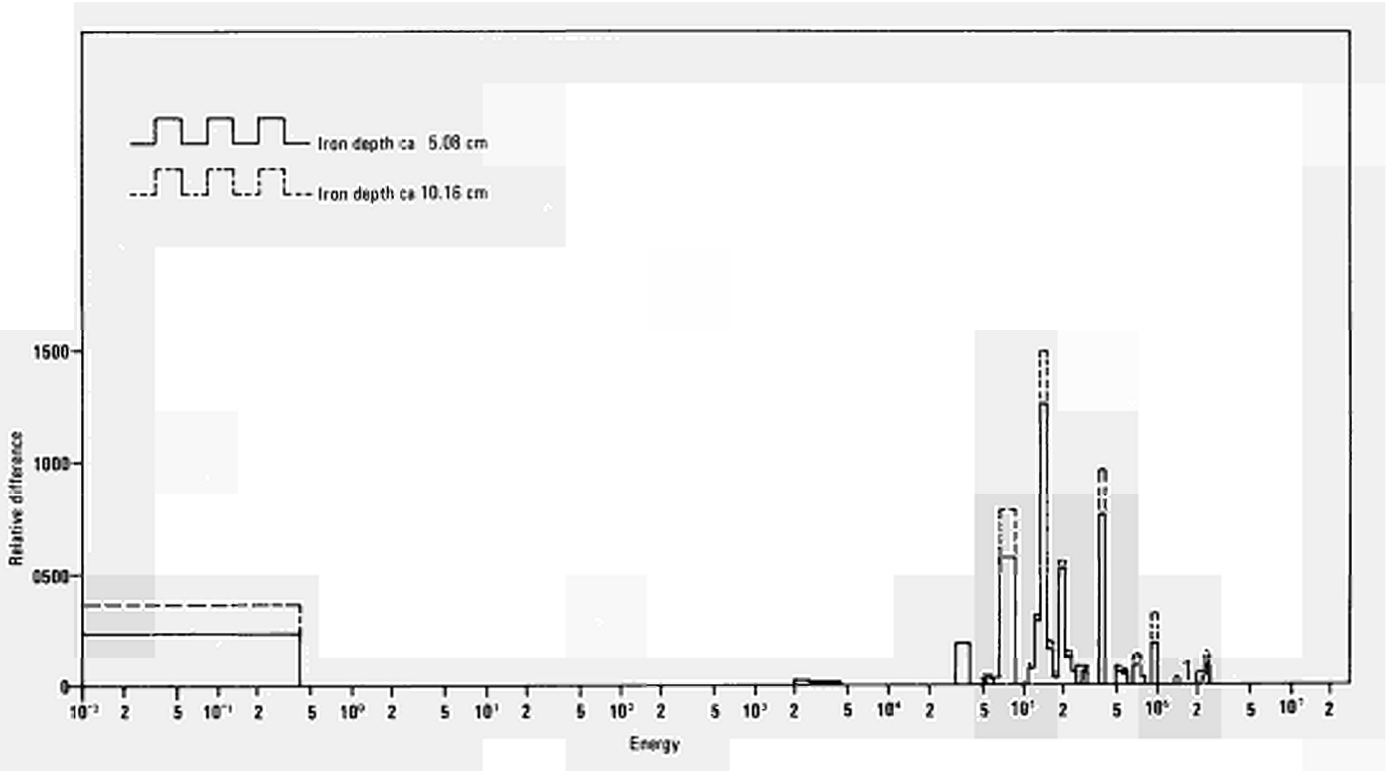


Fig. 3. Relative difference according 0.91 cm

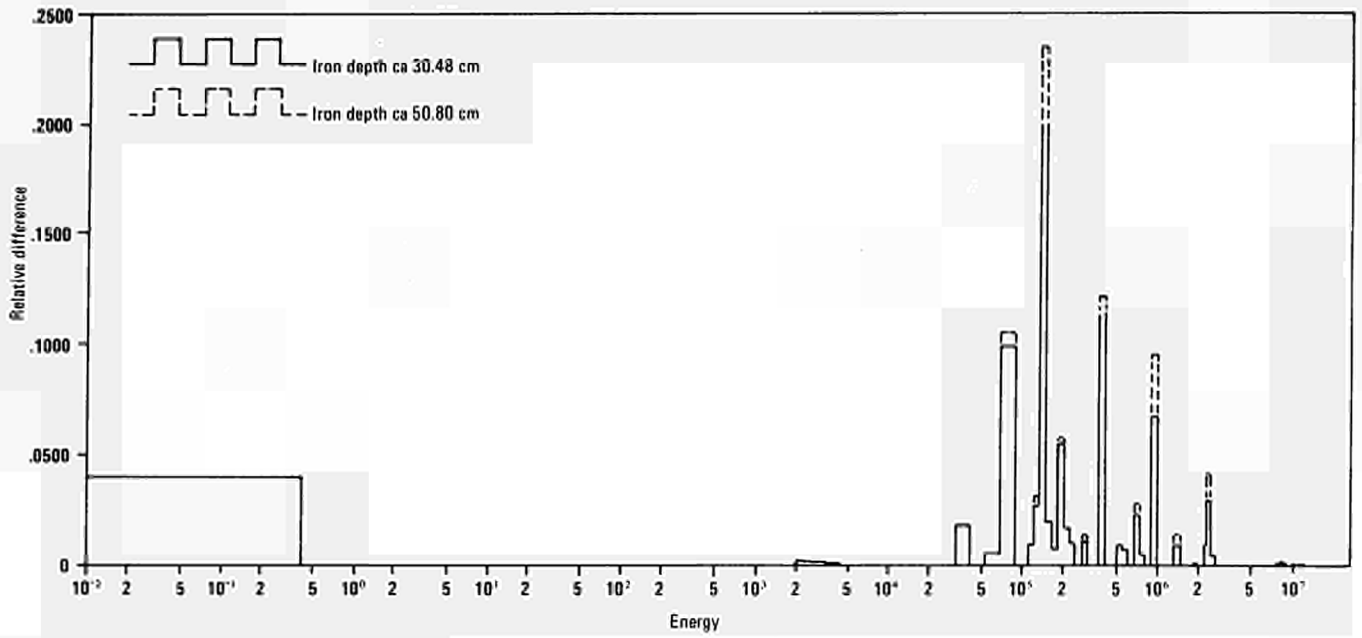


Fig. 4. Relative difference according 0.91 cm

REFERENCES

1. R. RÜHLE
   RSYST-I-III Experience and Further Development, ATKE 26, p. 185, 1975
2. R. D. BÄCHLE, G. HEHN, G. PFISTER
   EURLIB Data Adjustment to Integral Experiments, 2. Progress Report, IKE 6 EUR, 1981
3. G. HEHN, M. MATTES, K. AL MALAH, G. KICHERER
   Checking and Improvements of the Multigroup Data Library EURLIB-4, Proc. Spec. Meeting on Nuclear Data and Benchmarks, OECD, Paris 1980
4. D. MUIR, R. LA BAUVE
   COVFILS, a 30 group covariance library based on ENDF/B-5, LA-8733-MS, 1981
5. R. W. ROUSSIN ET AL.
   VITAMIN-C: The CTR Processed Multigroup Cross Section Library for Neutronic Studies, ORNL/RSIC-37 (ENDF-296), 1980

How to fit the Gamma Ray Buildup Factors in Two-Layer Shield

H. Penkuhn in collaboration with Prof. H. Schultz, T. H. Hannover

Since nearly 3 decades, the B-factors (= buildup factors) in homogeneous media are known, in large part due to moments method (Goldstein and Wilkins 1954). But simple and well working rules for the B-factors in the second slab of a two-layer shield were not found. Often the assumption was made that the transient from $B_1(Z)$ to $B_2(Z)$ behaves exponentially (Kitzume 1964) - $B_1(Z)$ is the B-factor of the first, $B_2(Z)$ that of the second medium, and Z the total distance in mfp (= mean free path) source plane - detector point. But Kitazume's hypothesis did not yield good results.

We here try another approach: let Z_1 and Z_2 be the penetrations in mfp in the first and second slab, $Z = Z_1 + Z_2$. For large Z_2, $B_2(Z_2)$ is proportional to a power of Z_2, say Z_2. (This follows from asymptotic solutions of the Bolzmann transport equation using the Laplace transform). Now substitute the first Z_1 mfp of the second medium by the first medium. This is equivalent to adding or subtracting fictitious sources. Their emission spectrum should be similar to that of the scattered spectrum in its high-energy range, slightly below the source energy E_0. Therefore they will penetrate with an exponential very similar to that of the unscattered quanta at E_0, but the spectrum change will result in a changed exponent of Z_2, say Z^C for $\Delta B(Z_1, Z_2)$ which is the «perturbation» B-factor. Let $B(Z_1, Z_2)$ be the heterogeneous B-factor with

$$B(Z_1, Z_2) = B_2(Z_1 + Z_2) + \Delta B(Z_1, Z_2) =$$

$$= B_2(Z_1 + Z_2) \cdot \left(1 + \frac{\Delta B(Z_1, Z_2)}{B_2(Z_1 + Z_2)}\right),$$

then the quotient $\Delta B/B_2$ should, for large Z_2 be itself proportional to a power of Z_2, or

$$\frac{\Delta B(Z_1 Z_2)}{B_2(Z_1 + Z_2)} \sim \frac{a}{Z_2{}^b}$$

In order to avoid a divergence at $Z_2 = 0$, we assume a proportionality to $a/(a + Z_2{}^b)$. Then we require that ΔB vanishes if first and second material are identical, independent on the choice of a and b. This is possible with the assumption that $\Delta B(Z_1, Z_2)$ is proportional to $B_1(Z_1) - B_2(Z_1)$. Finally we normalize the remaining third factor contained in $\Delta B(Z_1, Z_2)$ by the requirement

$$B(Z_1, 0) = B_1(Z_1)$$

(At the interface, with $Z_2 = 0$, the backscatter change due to the second medium is ignored, and the heterogeneous $B(Z_1, 0)$ is assumed to be equal to the B-factor at Z_1 in the homogeneous first medium). This last assumption lead to the final equation

$$B(Z_1, Z_2) = B_2(Z_1 + Z_2)\left(1 + \frac{B_1(Z_1) - B_2(Z_1)}{B_2(Z_1)} \cdot \frac{a}{a + Z_2^{\,b}}\right)$$

The correction term now depends only on the ratio of $B_1(Z_1)$ and $B_2(Z_1)$, not on their difference; this seems more realistic than those hypotheses made before which assume a dependence on the difference only.

The fitting equation was tested for those transport calculations published in EUR(ESIS) 6381 EN. There the first material is RS 253, a radiation shielding glass of density 2.53 g/cm³ and the second medium is RS 520, a lead glass of density 5.20 g/cm³. The source energies E_0 from 0.5 to 4 MeV were treated, the considered thicknesses of the first slab range from 15 cm to 90 cm, the thickness of the second slab was 60 cm or more. The table gives the values for a and b; the highest deviation of the fit from the transport solution was 12%, for $Z_2 \geq 0.3$.

The fitting parameters a and b as functions of E_0 in the sequence RS 253 - RS 520

E_0	0. 5	0.66	1.25	2	3	4
a	0.26	0.35	0.55	0.45	0.6	1.05
b	0.75	0.78	0.75	0. 5	0.3	0.07

Some irregularities in the table seem due to the fact that some evaluations were made by hand and other by a computer research.

Whether the same fitting formula works also for the sequence heavy-light shielding materials (e.g. lead-aluminium) is not yet clear. Further evaluations will be necessary for other pairs of materials.

A paper describing the first fits of this kind will be published in ESIS Newsletter 41, in the colums «ESIS Forum».

Calculation of Neutron Streaming through the Access Ways of the CERN Experimental Halls of SPS and LEP

C. Ponti

This study has been performed in collaboration between the ESIS group at JRC-Ispra and the Radiation Protection Group at CERN-Geneva.

The object of the study is the analysis of the radiation streaming in a specific experimental area, which is one of six similar access ways to the underground ring tunnel.

The neutron source produces a dose rate distribution in the hall, in the pits and at the ground surface. This quantity is in general estimated with the help of semi-empirical formulae.

The purpose of the study which has been concluded is:

- to calculate the penetration of neutrons with an accurate method (the Monte Carlo method)
- to provide accurate results with which to compare previous ones, in order to check the validity of the semi-empirical formulae
- to assess a calculation method suitable to the solution of similar problems.

The data base which has been specifically developed to solve this problem consists of a 10-group neutron cross section library for concrete and air in P3 angular approximation, and a 10-group albedo data library for concrete.

To perform the Monte Carlo calculations, the code MORSE-E was applied, in conjunction with the combinational geometry. Albedo surfaces have been located 25 cm beyond the air-concrete interfaces. The problem has been solved in a mixed transport-albedo mode that minimizes the product of variance times computing time.

The calculation method which was developed can be applied to analyse radiation protection problems of the other experimental areas present along the SPS and the LEP ring tunnel.

JRC PUBLICATIONS

E. R. REICHL
Creation of a food science dictionary for use in SLC II
Final Report for Contract N° 1639-81 10 EP ISP A, March 1982

Y. YEIVIN
The Euracos Activation Experiments: Preliminary Uncertainty Analysis
EUR Report (to be published), September-October 1981

A. DUBI, H. RIEF
Track Length Estimation Applied to Point Detector
Submitted for publication to the «Nucl. Sci. & Eng.»

W. MATTHES
Monte Carlo Calculations of Perturbations
To be published on Nucl. Sci. & Eng.

W. MATTHES
A Simple Theory for the Analysis of Pulse Trains from Neutron Counters
To be published on Journ. of Nucl. Sci. & Eng.

B. WYNNE, H. J. OTWAY
Information Technology, Power and Managers
April 1982 To be published

ESIS Mewsletter
N° 38-39 July/October 1981

ESIS Newsletter
N° 40 January 1982

GLOSSARY

ANSI	American National Standards Institute
ASPIS	Integral Iron Shielding Experiment (Winfrith)
BPR	Plate bending rectangualar
CCITT	Comité Consultatif International Téléphone et Télégraphe
CCL	Common Command Language
CEGB	Central Electricity Generating Board-U.K.
CEN	European Committee for Standardization
CENTERNET	Danish projet for computer networks
CEPT	Comité Européen de Postes et Télécommunications
CERN	Organisation Européenne pour la recherche Nucléaire, Genève
CI	Command Interpreter
CNUCE	Centro Nazionale Universitario di Calcolo, Pisa
COST	Committee for Scientific and Technical Cooperation
DB	Data Base
DBMS	Data Base Management System
DEC	Digital Equipment Corporation
EC	European Community
ECMA	European Computer Manufacturer Ass.
ECS	European Consortium for Software
EIN	European Informatics Network
ENDF	Evaluated Nuclear Data File
EDPA	European Program Distribution Agency
EURACOS	Experimental shielding facility
EURLIB	JRC Neutron Shielding Library
EUROCOPI	European Computer Program Institute
EURONET	European Network for Scientific and Technical Information
ESIS	European Scientific Information Service
GID	Gesallschaft fuer Information und Dokumentation, Frankfurt
ISES	Integrated Civil Engineering System
INET	Internal Network
INRIA	Institut National de Recherche Informatique Automatisme
INSIS	Interistitutional Information System project
ISO	International Standard Organization
IUG	ICES Users Group
JRC	Joint Research Centre
LEP	Large Electron Position storage ring
MIT	Massachusetts Institute of Technology
OTS	Orbital Test Satellite
PAD	Packet Assembler/Disassembler
POL	Problem Oriented Language
PPR	Programme Progress Report
QL	Query Language
R & D	Research and Development
RTC	Reference and Test Centre of EURONET
SCRIBA	Prototype Information distribution system
SPS	Super Proton Synchrotron
TEXIS	A Teletex service
VDU	Visual Display Unit

LIST OF AUTHORS

Programme Manager: C. RINALDINI

D. Bain, W. Boettcher, H. W. Braun, E. Caglioti, U. Canali, S. Capobianchi, H. I. De Wolde, A. Endrizzi, H. Fangmeyer, G. Fattori, G. Gonano, A. Inzaghi, W. Izzo, V. Lamareille, H. Lauer, T. Leo Menardi, J. Locquet, R. Misenta, W. Matthes, H. Neu, H. Otway, H. Penkuhn, G. Perlini, A. A. Pollicini, J . R. Rey, H. Rief, S. Riva, U. Spieker, K. Weaving.