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Management Information Systems at CERN

J. Ferguson

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1. Introduction

1.1 Mandate

On August 1, 1986, I commenced activity on a mandate from the Director General:

> "to carry out an overall study of management informatics at CENR. In particular, I should like to ask you (i) to carry out a detailed technical and financial audit of the present situation of all aspects of management informatics; (ii) identify current limitations and wished for developments; and (iii) elaborate a detailed programme for future action including resources needed, time scale and possible administrative structure. The outcome of the study and the resultant proposal should be ready for consideration by the Management Board by the end of the year, so that the new structure for Management Informatics within the Organization could be effective as from 1 January 1987."

The specific areas addressed in the study were

1. Management decision support (data presentation, data base management systems – DBMS, modeling)
2. Text processing,
3. Electronic communication for management purposes,
4. Office automation,
5. Administrative use of Management Information Systems (MIS) and in particular Administrative Data Processing (ADP).

It is extremely important to note that as I reported to SCAIP on 11/06/86 and repeated in MIS01 distributed to the Management Board on August 15, **and audit of the laboratory's administrative procedural practices should be carried out with a view to increasing efficiency and the introduction of automation. This will require external expertise in order to perform a comprehensive study**. As it was impossible to arrange this on the proposed timescale it was decided to leave this as a high priority item for the 1987 programme of work.

1.2 Task Force Activities

The technical work involved in this study began in August and was carried out by a task force whose composition and terms of reference are given in MIS01. The work of the task force has been:

1. To identify, in detail, the topics to be audited and the persons involved in the audit process.
2. To coordinate the information collection on a divisional basis, ensuring consultations with end-users, in particular with divisional administrative/planning officers and secretariats
3. To review and analyse audit documentation collectively at weekly plenary meetings
4. To synthesize the audit information by topic and review and analyse this collectively with invited specialists at topical meetings
5. To document the audit in machine-readable format in a simple classification scheme
6. To increase divisional awareness of the overall CERN problems in these areas and to publicise the currently available facilities. In particular to identify local solutions that can be more generally used.

The task force has met 16 times since the inaugural meeting of August 13. In addition there have been 10 topical meetings of the task force with invited specialists on

- NOTIS, and the DG services upgrade proposal
- AES, and the TH, DD, EF upgrade proposals

- Data Base Management Systems
- Text Processing
- Communications
- ADP present/future
- Personal computers: administrative uses
- Central computers: administrative uses
- General information audits (including requirements for future systems)
- Programme of work review

In addition to many personal contacts and discussions there have specifically been direct discussions with the DAO/DPOs in each division.

There have been open meetings with the secretaries and secretariat staff of all divisions.

The document MIS-100 contains the individual audit reports as described in the index[1]. The document MIS-99 contains the review documents by topic and the corresponding summaries and conclusions of the topical analysis meetings. This provides the reference summary material for the reviews in chapter 2. Where an additional level of detail has been considered necessary as supporting material for a proposal made in this paper a corresponding technical justification has been contributed to MIS-99.

1.3 Current Resources Used

There exists a central service in ADP which aims mainly at present at satisfying the needs of Finance and Personnel Divisions with respect to major data base applications for accounting, salaries and personnel management. This provides also the basic divisional accounting information. In the past this was accessed via the S lists. A considerable effort has been invested recently in the on-line provision of this data to a wider user community. Some central support is also provided by DD, for DBMS primarily to the LEP project, and for text processing aimed at scientific and technical staff.

Divisional activities include administrative secretarial text processing, data base definitions and applications, and project management tools. There is also a major effort going into applications development in a highly distributed environment which makes it difficult to assess the true manpower investment. In table 1 those people who have administrative computing functions as a primary activity are listed. There are **53.5 staff members and 6 fellows/students/associates/consultants** in this category. It is clear that, **in addition** to this there is a large number of people involved a small percentage of their time. The integral of this is estimated to be **at least of the same order as the direct support staff**.

[1] A VM/CMS userid MISSEC has been created to hold the working papers of the task force. The disk, where the documents are stored, can be accessed by issuing the following command:
GIME MISSEC 192.
For each document a file of type MEMO contains a version of the document that is suitable for viewing on a terminal. Assuming you wish to read the document MIS1 you could issue the following command:
BROWSE MIS1 MEMO
The file INDEX MEMO contains an index to the documents. This contains the filenames or an indication that the document only exists on paper.

Table 1: Current Human Resources MIS activities

Staff directly involved a significant percentage of their time in administrative computing functions. N.B. data entry staff are not included.

Division	Function	Total Staff	Others
ADP	operations	5	
	programming	10	2
PE	informatics	1	
	decision support	0.5	
EF	Macintosh support	1	
EP	informatics	0.5	
	Macintosh support	2	
	decision support	1	
TH	library support	1	
ST	stores	3	
	All in One	1	1
	ICL	1	1
	applications	0.5	
TIS	system supervision, DBMS, applications	2	
LEP	DBMS applications	2	
FI	Nixdorf ops, decision support	2	
PS	informatics, decision support	2	
SPS	informatics, DBMS, text processing support	2.5	
DD	text processing	1.5	
	DBMS	5	2
	Modelling	1	
	PC support	3	
DA	text processing	3	
DR	decision support	1	
pension fund	decision support	1	
Total		53.5	6

N.B. Distributed staff, of the same order, in Divisions not counted.

Table 2: Current Financial Resources in MIS activities

Division	Minimum Lifetime to year	Activity	MIS ref. number	Date of inst.	Purchase KFRS	Recurring KFRS / year
DD	90	AES	44	85	94	13
SPS	90	WANG	21,22,23	82-85	601	70
PS	90	NOTIS	20,41	82-86	470	47
LEP	90	VAX DBMS	21	82 / 85	2800	290
LEP	88	Philips	45	79 / 86	727	59
EF	90	AES	40	83	113	15
EF	90	WANG	39	80 / 85	498	57
EP	92	PC's	25	86	187	-
EP	88	WANG	26	80 / 82	436	59
TH	90	AES	43	83 / 84	189	24
ST	88	ICL	27	83	550	40
ST / LEP	89	VAX	36	84	630	12
ST	OBS	PC / Microfilm	37	75 / 86	230	14
ST	OBS	Stores IBM	50	78	110	10
ST	OBS	Stores HP	50	78	368	42
ST / TIS	90+	NOTIS	28	82	372	38
DA	90+	NOTIS	34	80 / 86	1200	130
ADP	87	IBM	31	84 / 86	2000	950
FI	90	NIXDORF	58	83	253	54
PE	OBS	NOTIS	15	82	140	30
DR	89	Various	18	83	96	-
Totals					12064	1924

N.B.

Equipment already written off in the last five years is not included
Several systems (including LEP VAX for DBMS, and ST / LEP VAX) are also used for technical purposes
Communication facilities, terminals not usually accounted for
PC's not included in general
Use of central computers not included
Only one NIXDORF included
The capital spent by ADP includes minor expenditure from the operating budget. The recurring figure is an operating budget which includes of the order of 200 KSFR for investment each year.

The financial investment, see table 2, is of the order of 12 million SFR with a recurring annual expenditure of the order of 2 million SFR. These figures do not include use of central computer facilities, communications equipment, PCs, consumables, and other mini-computers primarily used for other purposes.

In the longer term, a more coherent approach should lead to increased efficiency and improvement with respect to the current situation, without increasing the total annual expenditure in money or human resources. In future years, resources liberated by increased efficiency could either be used to further the automation process or reallocated to other activities. However the transition phase will require an additional level of expenditure.

2. Review by Topic

2.1. Decision Support

Data Base Management Systems (DBMS)

Current situation

Support is provided in the DBMS area by two central units. ADP offers major data base services in the fields of accounting, salaries, personnel and purchasing. These have been primarily aimed at meeting the needs of the central administration. The recent investment in widening the on-line access to the accounting information has been extended to provide more easily accessed summary records of personnel information.

The DBMS section in the software group in DD provides support essentially for administrative uses of DBMS, since they support 130 registered data bases across a wide range of activities of which approximately only 30 could be considered scientific or technical. The principal customer of this section is the LEP project and most of their activities are aimed at supporting the ORACLE services on DEC and IBM computer systems.

At present there is no definition of a universally agreed, desired set of the organisation's administrative data needed to meet the divisional needs. It is therefore unsurprising that many applications which could most effectively be provided via central support on data available at a Laboratory-level do not exist. There is inadequate centrally provided applications support, or even consultancy service available for divisional activities in provision of data base systems due to the level of human resources invested.

Due to the lack of clear definition of the administrative data base needs of the Laboratory and the insufficient investment in central provision of DBMS support, the divisions have justifiably implemented solutions for their own specific needs. Although, in general, these are coherent at divisional level they are piecemeal and inefficient from a global standpoint. Of course the divisional needs, viewed globally, do not differ dramatically. Thus there are numerous examples of applications developed by different people, using different data structures, programming techniques and computer systems to solve similar, or in some case, identical problems e.g. inventory systems, personnel lists, telephone lists. This is evidently an extremely inefficient use of human resources.

Aims

It is recommended to create unique centrally maintained data bases of information considered to be a common requirement by virtually all divisions (i.e. corporate data). This generates the related issues of who should be responsible for various aspects of these data bases, e.g. data base software choice, resource provision, maintenance of the system, data

security, provision of tools, data entry, data validation/authorization, report generation, access authorization.

Actions

A definition of the sets of data by topic required must be made. Examples are of the type:

- Accounting information (status of payments, contracts, commitments)
- Purchasing information (including on-line status information of any order / contract)
- Budget planning / management / information
  This must in some way closely integrate with accounting information. It has to include all known financial planning information to the group / project level. Recent historical data is also required.
- Telephone list
- Personnel list
- List of all persons having access to site
- Stores catalogues
- Suppliers
- Wiring of site
- Administrative computer facilities available
- Space inventory and administration

It is noted that whilst data entry should be distributed fro most of the central data bases there is also a need for central validation of some information e.g. change of home address could be updated by the persons secretariat, but validated centrally by PE and any action required taken (say in the case of moving from Switzerland to France).

There is also a clear need to provide data base services to the divisions, including user consultancy, provision of tools and applications, such as inventory management, list processing, document handling.

The issue of coherence and integration of all data base services is of critical importance in facilitating access, data entry, easy and efficient use of the information stored, e.g. data from several data bases should be easily accessed by the user and subsequently easily merged, processed, and / or included in reports. The appropriate experts should critically examine the services and applications under DL1, IDMS, GIP and ORACLE systems and make a proposal on the possibility for future integration of these services.

It is recommended that the user interface to the different DBMS applications should be made as uniform as possible, especially within the framework of specific DBMS systems and their associated hardware; e.g. ORACLE on IBM, ORACLE on VAX. One should clearly create guidelines for e.g. menu structure to be used for new applications. To make everything uniform, including all existing applications is however a very resource consuming task.

It is noted that LEP have implemented many applications, where central data bases should be created, on their own system. It is thus a very good case study for a Laboratory wide service.

It is recommended that a central organizational unit be made responsible for the Laboratory's general administrative data. A full definition of the data to be treated must be made and publicized. It is proposed that the responsibility for data entry be left at the point of origin of the data. This must nevertheless be clearly and uniquely defined, and publicized.

A code of working practices for people who wish to restrict access to sensitive material should be established including recommendations on where and how to create and store the data and how to transmit it to those concerned.

Policies

A policy must be elaborated on what administrative information is considered to be confidential or requiring access control. This requires corresponding definition of which sets of staff members should have access to which data. There is a related issue of ensuring easy access to data for these people who have the right and need to use it.

Analysis/Presentation Techniques

Current Situation

Very little coordinated activity or user support exists in the use of software packages for extraction of data, manipulation and subsequent convenient presentation for management purposes. This is typically performed on personal computers switching between local and terminal emulation modes. Experience and knowledge of the field is to be found in the DR unit primarily although contributions are made by applications programmers in a few divisions.

There is very little activity to provide and use modeling tools for administrative purposes. Known exceptions are the personnel budget, personnel planning, and the pension fund. These activities need coordination to avoid incoherence and duplication.

Aims

In order to enable more efficient use to be made of managerial manpower it is recommended that at least a minimum level decision support facility be established. This should particularly aim at providing integrated, user-friendly, environments meeting the needs of defined sets of personnel e.g. Director / Division Leaders, Divisional Administrative / Planning Officers, Group and Project Leaders, Secretaries. It should, additionally, provide user support functions and recommendations for software selection and utilization.

Actions

- Define support level
- Transfer staff
- Define programme of work, including software advice, modeling consultancy, user support, and definition of user environments.

2.2 Text Processing

Current Situation

The situation observed is one with a high multiplicity of incoherent solutions which are of varying degrees of acceptability for their particular aims. The different systems have limited, or in some cases non existent, communication capabilities for exchanging information amongst themselves, and with the ADP system or the central computers. This results in the same information being typed many times by different people around the Laboratory. This can also lead to the need for use of multiple terminals for the secretary who requires access to ADP data or to the central computers communications facilities.

While no consensus is reached on what is the “best system” it is clear that had the Laboratory chosen **any one** of the existing systems and restricted its investment and development of facilities to that one system then the overall situation would be significantly better today.

Aims

The Laboratory should aim at a situation where it supports a smaller number of fully integrated, compatible text-processing systems (with preferably one data interchange format). It is generally agreed that the future direction in distributed text processing systems will be towards highly distributed intelligence to the end-users via personal computers. These may be of standard flavours or perhaps in some cases packaged by manufacturers with more sophisticated screens and keyboards for the professional typist. It is clear that current manufacturers and software developers are actively pursuing this line and that many such flavours will be available in the next one to two years which meet the demands of all sectors of the user community. The flexibility of this approach, particularly with reference to communications possibilities and multiple function workstations is extremely attractive.

An important long-term aim, with widespread implications on procedures is that documents should be typed at their point of creation once only, transmitted electronically and thereafter be edited, abstracted, commented, corrected, etc. with a trace of actions being retained.

During 1987 it is proposed to consult the various sectors of the user community, defining clearly their requirements, while consulting suppliers of equipment and software in this field. It is thought reasonable to select a future recommended 'standard' for equipment / software purchase to satisfy text-processing needs in the Laboratory, probably based on a personal computer / workstation concept by end 1987.

In parallel with this activity effort should be put into defining a standard interchange format covering both character coding for special characters and the logical structure of the document. Such an interchange format will enable easy communication of text between user systems – locally, centrally and the publications department. This format should be based on international standards. A standard, ISO 8879, came into existence recently and it is expected that the first text processing systems designed specifically for this will be available during 1987; the first being scheduled for release in the first quarter.

The communications infrastructure must be strengthened based on international standards (OSI) and non-proprietary protocols. Where possible commercially available solutions should be used. Sufficient data rates for comfortable transfer of sizable files (e.g. graphics) must be available.

The recommended solutions must include simple communication of text between systems used by secretaries and also technical / scientific staff. This communication is not restricted to text, but must include material from data bases, spread sheets, graphics, etc. It is thought that high quality laser or LED printing facilities should be available to the professional users of such systems at least at the corridor level. The specific needs for dedicated printing capabilities for secretaries should be satisfied. Thus, where justifiable, printers could be located in individual offices.

The centrally provided text processing service should be of the 'public transport' type for those who will not have the workstation capability (could eventually be a small number in view of the evolution of 'PC' prices). The integration of this with the distributed system is essential.

In the next one to two years it will be essential to implement interim solutions to increase the efficiency of the users of the current systems. Such solutions e.g. in the area of file transfer, are likely to be technically unsatisfactory and consume large amounts of resources in development, but are nevertheless expedient.

While it is felt necessary to have a central support unit for this activity it is clear that a very strong first level support must exist in the user community.

Actions

- A specific proposal has been considered for the upgrading of the facilities available to the DG services. Analysis (MIS-59) suggests that it is reasonable to upgrade the NORD hardware to a level consistent with an acceptable level of resources per user on the understanding that no decision on a 'future' recommended system (or approach) was likely before the end of 1987. The lifetime of the upgrade would be a minimum of three years. The additional peripheral equipment proposed is consistent with this approach. The cost per user of the upgraded NORD, based on a 3-year lifetime, is of the order of 1 KSFR / per year. The cost of the additional peripheral equipment is of the order of 200 KSFR.
- A similar proposal was considered for the upgrading of the text processing facilities using AES equipment in DD, TH, EF. Analysis (MIS-60) suggests that expenditure should be made in this area to make the existing systems uniform, to avoid operational difficulties, providing improved communication facilities specifically to ADP and the central computers, while minimizing maintenance costs.
- It is proposed to implement simple file transfer mechanisms, where currently unavailable, (capturing most of the text, but no formatting information) between Notis, Wang, AES, Philips and the central computers, provided that the manpower required is not prohibitive.
- It is proposed to install the appropriate hardware and software to permit systems to communicate adequately with ADP and the central computers
- It is proposed to provide electronic mail facilities or systems to permit the use of electronic mail from within the systems themselves, where possible (i.e. without logging in to another system in terminal emulation). For PCs, and some stand alone systems terminal emulation packaged adequately is considered acceptable, considering the cost and technical difficulties for small systems. The implementation of software following the X.400 CCITT recommendation should be carried out when available from the manufacturers.

Policies

- The criteria for selection of suppliers of hardware / software should be stated e.g. member state, lowest cost, best performance, most user friendly, etc.
- The method of enforcement of recommendations should be elaborated e.g. control of funding, authorization of purchase, support policy, etc.
- The resources to be invested on current systems must be decided e.g. freeze systems at which point, what types of expenditure on systems justifiable.

2.3 Communications

Current situation

- Electronic Mail Services

  A comprehensive set of electronic mail services is offered on all central computers and NORSK systems permitting access to all associated users on the CERN site and to a large number of external institutes spread around Europe and North America. Unfortunately many users at CERN have no connection capability to the central computers. Several systems which have the hardware connectivity do not provide standard software for interfacing to the CERN electronic mail systems (as on personal computers).

  A major use is being made of electronic mail by the scientific and technical community. In

the area of administrative support functions, however there is little or no use of electronic mail in a coherent fashion due to the lack of tools, knowledge, incoherent non-communicating systems, available to the end users.

- Telex

  A package for mail access to the telex system was evaluated in IBM/VM. A list of bugs and missing features has been provided to the implementers. This project has not been completed.

- Hardcopy Mail

  A project is underway at the University of Geneva to provide an X400 print server which will allow mail delivery on paper via the internal courier. The system will be evaluated for use at CERN on completion.

- Telephones (digital telephone status)

  There will be 650 telephones and 230 data connections installed and in operation by 1987.

  On the status of cabling of the CERN site for data communications facilities it is estimated that of the order of 50% of the offices are currently wired for data communications.

  The cost of wiring an office today is between 4 and 5 KSFR by means of Index, including the cost of the blue box, 1 to 2KSFR by means of a recommended LAN type connection and 2 to 4 KSFR via digital telephone exchange. The cost of a 'terminal' can vary from a few hundred francs for the simplest terminal, a few thousand francs for a PC, to tens of thousands francs for a powerful workstation.

Aims

The Laboratory should have generally available electronic mail facilities which permit communication with every office and laboratory. Each office should be equipped with a data communications facility at the lowest possible costs consistent with the data rates required and have an installed 'terminal' meeting the needs of the occupants. This should conform to the recommendation on terminal access from the CS group in DD. It is clear that this will be a mixture of index, LANs, and telephone connections. The general, long term, philosophy remains, however, local LANs interconnected by a backbone.

The use of electronic mail should be encouraged to eliminate as much paper movement as possible, provide corresponding savings in paper utilization. The productivity of the staff can be greatly enhanced in this way. A two-way telex service should be made readily available.

Actions

- Define and implement the two-way telex service
- Specify sets of information which will be made generally available electronically and publicise (e.g. minutes of certain meetings)
- Promote the use of electronic mail where possible in restricted communities for meetings/minutes
- Decide which systems will have electronic mail software installed and implement this on agreed timescale
- Allocate resources, identify the effort for the stop-gap solutions to be implemented. This includes definition of personal computer environments for use of electronic mail.

- It is proposed to implement simple file transfer mechanisms, where currently unavailable, (capturing most of the text, but no formatting information) between Notis, Wang, AES, Philips and the central computers, provided that the manpower required is not prohibitive.
- It is proposed to install the appropriate hardware and software to permit systems to communicate adequately with ADP and the central computers
- It is proposed to provide electronic mail facilities or systems to permit the use of electronic mail from within the systems themselves, where possible (i.e. without logging in to another system in terminal emulation). For PCs, and some stand alone systems terminal emulation packaged adequately is considered acceptable, considering the cost and technical difficulties for small systems.

Policies

The DD communications group will issue recommendations on data communication facilities (and wiring mechanisms) in the coming months. It is urged that a policy be agreed, leading to the availability of data communications facilities in every office of the laboratory. This should be implemented with high priority.

2.4 Office automation

Current situation

This area is generally defined as the integration of management information tools and associated services. It normally includes printing, document handling, text processing, agendas, calendars, meeting scheduling, electronic communication.

At present there is no use of computerized agendas, calendars, and meeting scheduling. There is little use of automated document handling and electronic communication in the administration although significant use is made of these in the scientific/technical community. There are however certain items which are well used in some divisions and even some small pockets of activity across the entire range (e.g. ADP-PROFS usage).

It is virtually impossible to generalize the use sensibly until a critical user mass is reached. Electronic mail is all very well, but if it cannot reach the segments of the population you wish… Meeting scheduling is very useful but requires all potential attendees to be users of the same system, or to be able to communicate with it.

At present there is not this critical mass either using the same system on which one could implement office automation tools (other than the central computers) or using systems which can communicate at a level of information exchange which permits the integration of such facilities. The current variety of installed computer systems and software, allied with the lack of defined standards for information exchange has precluded any coherent use of office automation tools until the present.

Aims

There should be a well defined set of office automation facilities required by the divisions with relative priorities given. This should aim at providing acceptable facilities across the above mentioned areas to increase efficiency in the office environment.

Actions

- Identify divisional requirements
- Identify the current systems where attempts will be made to implement certain facilities (identify those where zero effort will be invested)

- Specify a Programme of Work for implementation
- Allocate staff necessary

Policy

- Top down approach is essential in this activity to promote utilization. The Rutherford use of PROFS is a good illustration of this approach.

2.5 ADP, PCs, Central Computers, and Miscellaneous Systems

At present administrative use of MIS is spread across the use of a) ADP, b)Personal Computers, c) Central Computers, and d) Miscellaneous Systems

ADP

Current situation

The ADP unit is comprised of 15 staff, of which 5 are operations personnel, 8 applications analysts, one junior programmer and one group leader. VM system support is provided by an external consultant. They have their own computer centre in the basement of building 5, with an IBM 4361 and a moderate tape and disk configuration. Access is provided for up to approximately 90 327X like terminals and 56 index connections. The total investment in the last five years is of the order of 2 MSFR, with an annual operations cost of 950 KSFR.

The services provided by the unit have been primarily aimed at PE and FI divisions although effort has been invested recently in extending the on-line services to a wider community. The services can be classified as follows:

- Data base applications and support for major packages in accounting, salaries, personnel purchasing
- Provision of computer resources to run theses packages and providing access via recommended terminals
- Operation of computer facilities
- Basic software (operating system) support
- User support functions

The unit is understaffed to accomplish its current narrow mandate and is at risk in the support of its applications. Basic systems support is provided by an external consultant. There is no serious investment in automating administrative procedures, particularly in the interface between the Divisions and the central administration.

Aims

The resources of the ADP unit should, as soon as possible, be integrated into the computer centre to optimize use of operations staff and make use of existing infrastructure and thus reduce costs.

The ADP services and central computer services should be based on one version of the VM operating system to provide a coherent interface to users.

The role of this unit in providing MIS services for the laboratory should be extended.

Typical examples of additional services requested by the users are:

- Easy user-friendly access to the various packages

- An integrated budget management capability, in addition to the current accounting one, allowing 'provisional' data entries, divisional and group data entries, historical data, with an improved presentation of results and interfacing to end user applications e.g. spreadsheet.
- Easily accessed data being extracted from personnel data base e.g. telephone list, access lits.
- Data base consultancy and applications support across a wider range of subjects e.g. stores catalogue.
- Provision of central data bases and application tools for the Laboratory defined data needs
- Integration and consistent user-friendly presentation of the various administrative outputs and lists currently used e.g. S lists, stores withdrawals, TIDs.
- The simplification and automation of virtually all interface functions and procedures between divisional secretariats and the central administration e.g. claims, vacation, purchasing.
- On-line purchasing system with data entry distributed to the point of order.
- The ability to trace where and administrative transaction has been and where it currently resides e.g. an external order.
- Increased level of user support

Actions

A detailed mandate for the unit must be established and the necessary resources made available. A Programme of Work for 1987 should be produced, including a detailed service definition. An organizational structure should be created with a central role in the provision and coordination of all MIS activities of the Laboratory. The current unit should be moved to DD as soon as possible.

Following a review of the administrative procedures of the Laboratory a Programme of Work of automation in this area should be defined and implemented according to agreed priority.

The implications of the elimination of the ADP 4361 system should be studied, in conjunction with a possible transfer of applications to the central computers. The past justification of a separate system on security grounds must be fully explored.

The present ADP computer resources should be integrated into building 513. the operations and system support functions should be transferred to the appropriate computer centre groups as quickly as feasible. The costs of such a removal, particularly of communications facilities, will influence the timescale.

Personal Computers

Current situation

There are, at present, of the order of 250 IBM, 510 Macintosh and 80 Olivetti personal computers in use at CERN. There is a degree of uncertainty in these numbers as there is no unique place in which this information is readily available. These are being added to at the rate of 5 IBM, 25 Macintosh and 5 Olivetti per month. This is likely to increase significantly with the availability of the Amstrad systems and their impact on market prices.

It is estimated that 40% of the utilization of these systems is for 'administrative' purposes. There is a considerable lack of knowledge about the current situation. The replies to our questionnaire have added to the centrally available information within the personal computer project. It should be remembered that PCs used for technical purposes by scientists/engineers require significantly less support than the administrative systems.

It is clear that the Laboratory has been in a phase of uncontrolled, exponential growth in the acquisition and utilization of these systems. This has however been relatively positive, as the utilizations observed are efficient, cost effective and providing user satisfaction.

Negative points however are as follows:

- The PC support project is not satisfying user expectations, given the explosive growth in PCs used by non-technical staff
- Central user support, in all its aspects, is ill-defined and at a low-level
- The process for selecting, ordering, installing and using the systems is not well publicized
- The commercial terms obtained from the suppliers could be improved by higher level negotiation.
- The software situation is confused. There are few recommendations for which packages to be used. The licensing position is not always clear and in many cases site licenses should be purchased.
- There is no clear maintenance strategy at the user level
- The diversity of solutions currently used for interconnecting Personal Computers and connecting them to host systems, many of which are inconsistent with the future laboratory communication strategy.

Aims

The growth in this area should be encouraged, but constrained by a policy of offering support to only two types of system i.e. Macintosh and 'IBM + compatible". There should be one office in CERN (Finance) in which every order for this type of equipment is processed. A detailed inventory of what exists in the Laboratory should be maintained.

The software acquisition / licensing issue should be well defined, clearly legal and conform to Laboratory policy.

Central user support should exist to provide consultancy on software equipment / availability, selection, installation, use, and maintenance strategy.

Actions

- Establish a general support structure for all aspects of 'PC support' including the use of packages in the 'Management Decision Support' category. This would aim at providing support to the administration, but some services would be made generally available.
- Offer defined support for 2 systems: Macintosh, IBM + compatibles
- Negotiate site licensing agreements for the commonly used software packages. Agree a licensing process for all other software
- Nominate one purchasing officer to coordinate all purchases in this field
- Establish and maintain an inventory of the equipment installed and on order
- Investigate the policy of the establishment of a 'PC' shop in collaboration with manufacturers and commercial suppliers
- Provide recommendations on hardware / software selection. (Support will be provided only for recommended solutions)
- Provide recommendations on interconnection of PCs and connection to central host
- Provide maintenance / backup advice based on estimated minimum life of Personal computers in specialized applications (3 to 5 years)
- Investigate the possibility of selective backup of data to the central computers
- Provide software distribution by down-line loading, where possible

Policies (Questions)

- Member state purchasing

- Blanket ordering –FC
- Negotiations (who does them)
- Software licensing (involve legal service)

Central Computers

Current situation

Administrative use of central computers consist of text processing, document handling, electronic mail, DBMS applications and miscellaneous applications. The host computer systems are IBM and DEC hardware with VM, MVS, VMS and UNIX operating systems. The user community is large and primarily scientific or technical.

There is widespread use of text processing systems including SCRIPT, RUNOFF, xROFF, TeX. These are in general considered overcomplex and clumsy by the professional typist users of specialist systems, but offer facilities required for the complex texts not available on the secretarial type word-processors. There are about 100,000 formatted pages of output produced on IBM systems each month.

The use of these systems and their associated user interfaces (SGML, CERNPAPER, etc.) gives access to the specialized output capabilities in the Centre (APA 6670, XEROX 8700, IBM 3800, IBM 3812).

The major problems in this area are, interchange of text between central computers and specialist systems (i.e. between scientist and secretary), multiplicity of systems, difficulty of use for the non-sophisticated user, the lack of easy typing of mathematical formulae in SCRIPT (which will soon be supplied by the supplier of SCRIPT).

It is clear that extensive use is made of electronic mail facilities by scientific staff and this is treated in MIS-53, and MIS-75.

There is no generally available, recommended document handling system supported by the Computer Centre. Thus there are numerous private or semi public schemes which give more or less satisfaction.

A recommended standard system is being implemented in the DD/US Group at present and is likely to be available during 1987.

DBMS utilization on the central machines consists of applications using Oracle, KAPACK, ISIS, INFOL and execs on Wylbur VM and VMS.

Aims

The central systems should provide ‘public-transport’ type services to those people who have no alternative facility. Specifically it should provide supplementary ‘administrative’ services to the scientific and technical community.

The infrastructure should be used to provide operational, software systems, communications support to ‘glue’ together distributed disjoint systems. They should be the primary location of communication bridges, access to special purpose high cost peripherals, bulk data storage and secure back-up facilities.

Actions/Policies/Questions

- What level of resources on these systems should be made available for MIS activities.
- What activities should be encouraged on these systems and which excluded.

- Should all applications on the current ADP system be moved to the central systems and if so what are the implications for both services.

Miscellaneous Systems

The remaining activities in MIS utilization, not covered by the previous three areas, consist of a variety of distributed systems and applications. These are well documented in MIS-100. Particularly good illustrations of this type of system are accounting done on Nixdorf systems, maintenance management on an ICL system, civil engineering communications on the DEC VAX (All In One) system, and the stores stock control on a very old HP system.

Aims

The provision of this type of service in future should be integrated, where possible, into standard facilities permitting a more efficient use of resources. A specific aim should be to liberate some of the staff currently supporting these systems for re-allocation to other activities.

Action

At the appropriate time, i.e. when upgrading or replacing these systems, an attempt should be made to integrate these applications into standard systems.

3. Service Requirements, Resources and Organizational Framework

3.1 General Overview

It is observed that there has been neither a general laboratory policy on MIS activities nor a suitable forum for their discussion and coordination at laboratory level. In the past various organizational units have existed with a mandate and resources aimed at meeting the administration's needs in MIS rather than the more general needs of the entire Laboratory. Additionally the current ADP unit is staffed at a very low level and has by necessity a narrowly defined mandate. The effect of these three points is unsurprisingly that the overall state of MIS in the Laboratory is inadequate, unintegrated, lacks coordination and contains a wide diversity of solutions e.g. text processing performed on IBM, DEC, UNIX central systems, WANG, AES, Philips, Nixdorf, Norsk, ICL, DEC distributed systems, IBM PCs, Macintosh, Olivetti. Faced with the unavailability of centrally provided services, divisions have analysed their own needs and implemented their own solutions (with varying levels of manpower investment) in their own style. This was a predictable and natural result of the absence of policy and an organizational structure with a laboratory-wide mandate for providing such services and for their coordination and implementation. A typical example of Divisional activity is that of TIS where having requested in vain resources and services from both ADP and subsequently the DD SW / DBMS section they implemented the film badge data base on a NORD 100 using the SIBAS DBMS system. **Despite many of the Divisional solutions to specific problems being efficient and well implemented, in isolation, the multiplicity of solutions developed for solving identical or very similar applications is clearly an inefficient utilization of human resources and often adds to the incoherence of our MIS approach. Particularly clear illustration of this are a) the number of different inventory systems developed and in use around the Divisions and b) the variety of text processing systems and associated applications.**

3.2 Service Requirements

Analysis of chapter 2 provides the following common minimum sub-set of the requirements expressed by the Divisions, in addition to the currently supplied services:

- Central DBMS support, definitions of data bases of interest to the entire organization, provision of advice and tools for creation, abstraction, updating and interrogating of data bases, provision of applications and support
- Centrally coordinated text processing support
- Comprehensive document storage / retrieval system
- Generally available, user-friendly, communications capabilities between users, ADP and the central computers
- Simplified, fully automated, administrative procedures
- System analysis support in the definition of end-user needs / solutions
- Integrated budget management tools, not just accounting information
- Personal Computer support, ranging from product availability advice to installation of hardware / software and maintenance service
- Significantly extended user support for ADP services
- A forum for discussion and coordination of MIS activities at a laboratory level
- It is desirable that the user interface to MIS applications packages / services must be as well structured as the typical Macintosh packages. [N.B. It is evident that general availability of Macintosh personal computers and associated software has created a de facto standard for the judgment of the human interface in computer applications. It is clear that almost all suppliers of hardware and software are moving rapidly in this direction.]

It is a clear conclusion of the task force's activities that a coordinated, integrated approach to the provision of Management Information Systems in the Laboratory is needed. This could lead to a considerable increase in the efficiency of the administration.

3.3 Human Resources

In order to fulfill the service requirement detailed in chapter 2 it is estimated that there is a need for 57 direct support staff providing services and centralized user support (Table 1, MIS-99) working closely with the divisional representatives and the divisional support staff providing distributed services.

It is more difficult to asses the level of end-user support in the Divisions, as this would naturally be spread over a large number of people a small percentage of their time. There is a requirement for one informatics specialist per division and an average division could easily require an integral of one man / year for each of text processing, data bases, PC support, decision support / ADP usage. This would suggest a total requirement across all divisions of a further 50 man years.

This is, in total, roughly the same effort which is at present spent providing inadequate services due to lack of coordination, incoherence, and duplication.

3.4 Organizational Framework

1. **A policy should be elaborated for the provision of integrated MIS services for the entire laboratory.**
2. **A central unit should be given the overall responsibility for MIS services.**
3. **It is specifically proposed that the historical role of DD for providing services to the research community only be extended to include overall responsibility for MIS. [This supports the SCAIP proposal made to the Management Board in May 1986].**
4. **A structure should be created within DD with a mandate to provide integrated MIS services for the entire laboratory. This should include data base services, office automation, the interface between divisions and the central administration,**

modernization of the administration's uses of MIS, text processing, communications facilities, decision support systems, integration of services. The use of the computer centre infrastructure and associated services should be exploited to maximize cost effective utilization of resources.

5. **A horizontal-interdivisional structure should be created for coordination of all MIS activities of the laboratory, by means of a MIS board. It will be essential in the long term to continue applications development in a highly distributed environment at divisional level. It is thus critical to have excellent coordination between any central support units and their divisional collaborators.**
6. **A senior Directorate level body (i.e. SCAIP) must exist for important policy questions and conflict resolution.**

It is proposed that Divisions appoint representatives to a MIS board. This would not necessarily be a full time activity but is likely in most cases.

These representatives would coordinate the activities of their divisions in this field, promote the use of the available facilities, spread computer literacy, vet applications, and manage their divisions' activities in this respect.

It is suggested that following the audit in 1987 of the administrative procedures of the laboratory the divisions should be responsible for implementing the modernized procedures which will be the basis of joint activity, with the MIS unit, for the introduction of automation.

The mandate of the MIS Board should be to coordinate all aspects of MIS implementation within the highly distributed divisional environment, and to permit a forum for the discussion of the programme of work of the central unit and the relative priorities. Requests form utilization of the available resources (human / financial) and applications provision would be discussed by the Board.

4. Pragmatic Implementation Proposal

It is assumed that the integrated personnel need (section 3.3) is unattainable at present both for central and distributed functions.

It is nevertheless considered essential for the laboratory not to lose this opportunity to take a first step towards integration of MIS services. This must include:

- Provision of a wider range of services in the area of automated procedures,
- Enhanced user support for the administration,
- Extension of the current ADP services and resources,
- Increased security and back-up for applications support,
- General DBMS support including the establishment of the corporate data bases required by the divisions,
- Central coordination of text processing (including support for the administration's use of NOTIS),
- Decision support aimed at the Personal Computer user,
- Personal Computer support.

It is suggested that in order to permit the first step to be taken it would be acceptable to:

- Phase activities over a longer time-scale,
- Handle user support with increased emphasis on end-user support in the divisions,
- Give lower priority to interim solutions to ease the use of current systems that will be phased out.

It is considered essential that the organizational framework defined in section 3.4 be implemented.

4.1 Human Resources

In view of the above it is proposed to group together in DD a number of staff continuing their present activities within a new organizational structure. This would provide a nucleus of 25 staff including the current ADP unit, and entails no real loss of posts to the divisions. In the course of the audits, and in view of the programme of activity proposed, a small number of (5) specialists have been identified who could significantly contribute to the MIS activities. It is suggested that they also be transferred to the new structure. This causes a loss of 5 posts to the divisions. This would be partly compensated by central service provision. In order to provide the necessary **minimum resources** consistent with the **reduced programme of activity defined above** (chapter 4) it would be necessary to find a further 10 posts to reach a complement of **40 staff**. It is proposed to obtain these posts by a mixture of internal and external recruitment, phased over the next year. The recruiting of young staff with an industrial background in the field is highly desirable.

The staff who should be included in the transfer have clearly been identified, but little consultation with them has taken place at this stage.

In addition to the above it is suggested that extensive use should be made, as at present, of:

- Collaboration with industry
- Divisional collaboration
- Fellows / visitors / students

It is suggested that each division appoint an informatics officer (cf. PS and PE situation). In addition the local support roles should be clarified in each division. This may require a re-allocation of priorities and staff to this activity within the divisional structure. In some divisions the currently available support level is totally inadequate.

Posts should, on the longer term, be liberated as some of the current isolated systems are replaced in the confines of an integrated approach. Additionally as the MIS unit takes advantage of the DD infrastructure posts could be made available for re-assignment in future (e.g. from operations functions). Overall this could liberate in excess of 10 posts. As centrally coordinated services become available, particularly in the DBMS and decision support activities, effort in the divisions could be liberated from isolated applications development. The effect of this and increased administrative efficiency will provide manpower savings, but these are more difficult to quantify.

It is extremely important in this attempt to provide **integrated coherent solutions** for MIS in the Laboratory that a **credible central unit** should be created which can also coordinate the work done in a highly distributed environment in the divisions. It is suggested that the **pragmatic approach proposed is the minimum threshold level** for a mandate which aims at integrated MIS for the 1990's in the laboratory.

4.2 Financial Resources

It is presumed that divisions would retain in their budgets the responsibility for communications infrastructure and terminal / PC purchase.

It is equally proposed that they retain responsibility for the recurring expenditure for maintenance and consumables of existing systems. All proposals for divisional purchase of hardware and software in the field should in any case be coordinated through the MIS Board. If the purchase is not of a recommended and supported type a strong case should be made

and prior approval must be obtained. This is equally true for manpower investments in applications at the significant man-month level.

Major investments, of the type replacement of the ADP computer, or enhancement of the central computer facilities, system replacements, could be financed as now, by requests to the DG fund. It is already clear that ADP needs a major system upgrade, which should also cater for the increased corporate data DBMS services that must be provided. This should be done no later than 1988 and could either consist of the acquisition o a new, more powerful, system or a configuration upgrade to the central computers. The nature of the system / upgrade and its cost will depend directly on the MIS mandate and the associated services.

Naturally the transferred units would have their budgets moved into DD. It is estimated that this would result in the central unit(s) having a budget for 1987 of the order of 2 MSFR for operations, current activities, basic facilities, and minor investment. This is likely to increase substantially in 1988 to 1990 when the detailed plans and strategy for the future system have become clerarer.