TECHNICAL MEMORANDUM

131

Report on 4th Meeting of Member State Computing Representatives, 9-10 October 1986

A. Lea

Operations Department

March 1987

European Centre for Medium-Range Weather Forecasts
Europäisches Zentrum für mittelfristige Wettervorhersage
Centre européen pour les prévisions météorologiques à moyen

INTRODUCTION

The fourth meeting of the Member State Computing Representatives took place at ECMWF from 9-10 October 1986 and was attended by representatives from twelve Member States. Prior to this meeting was the Technical Information meeting (6-9 October) attended by some 37 participants from 14 Member States plus Iceland.

The prime purpose of the Technical Information meeting was to inform all participants on the three major system which had come into use over the 3½ years since the last meeting, namely the MARS data archive and retrieval system, the MAGICS graphics system, and the NTC (New Telecommunication Centre) system. The representatives' meeting covered the service as seen by Member State users, both the day-to-day aspects and the plans for the immediate future. Finally, a presentation was given on the Centre's experience with multi-tasking on the Cray computer system.

The programme of the meeting is attached as Appendix 1, the list of participants as Appendix 2.

SESSION 1: ECMWF Computer Status and Plans - G.-R. Hoffmann

After an overview of the staffing structure of the Centre, including a detailed list of present Computer Division staff, the talk reviewed the substantial computer hardware and software changes which had taken place since the last meeting. Those changes had led to many valuable improvements, including a reduction in the total delay to the forecast over the 3 years 1984 to 1986. Taking all delays of 1 hour or longer, the total delay (summed over the year) has dropped from 152 hours in 1984 to 106 hours (projected) for 1986.

The Cray system has seen two changes since 1983, namely the Cray X-MP/22 replacing the original Cray 1-A, and that in turn being replaced by a Cray X-MP/48. This last machine now has 4 CPUs, 8 Mwords of memory, 32 Mword Solid State Storage Device (SSD), and an Input-Output Subsystem (IOS) handling all disks and front-end links. The throughput of this machine (as measured in units delivered) is almost 10 times that of the original Cray 1-A. Reliability has continued to be good, CPU utilisation averaging around 60% (peaking at well over 90% during the forecast itself). Link traffic is high at a sustained rate of just under 1 Mbit per second averaged throughout the year. All in all the Cray has continued to provide an excellent service.

Since the last meeting the Cyber 175 has been replaced with a Cyber 855 (12 Mbytes memory), a machine of roughly the same power but of much more modern technology. The user throughput of the combined Cyber systems has only risen by a factor 2 since 1980, and in fact this year has decreased compared to 1985. This is because the CRAY link traffic has continued to increase on a saturated system, meaning that the user throughput has to drop as it is of lower priority. The number of tapes mounted on the Cybers has reached virtual saturation at some 450 per day. One disturbing aspect is the number of hardware incidents on the 835 (28 over the past 12 months). Being a modern machine the Centre expected much higher reliability (the IBM for example has had 3 incidents in the same period). One particular incident (failure of a chilling condenser) took the machine down for 3 days while the necessary spares were flown in from Minneapolis.

The IBM 4341 data handling system is fully installed, consisting of an 8 Mbyte machine with 12.5 Gbytes disk storage (IBM 3380), 105 Gbytes capacity cartridge store (IBM 3850), and 6 tape drives (IBM 3420). The availability of the machine has been very high with very few downtime incidents (as already noted above). Some 300 Gbytes of data consisting of 150,000 files are already stored in CFS, the software system from Los Alamos that handles all the data storage. It is currently increasing at approximately 20 Gbytes a month, consisting mainly of the operational forecast archives and of low use Cyber permanent files. Save and retrieve requests are running at approximately 1300 per day, resulting in a link traffic on LCN of some 2 Gbytes/day. The cartridge store is handling some 1300 loads per day, showing the large number of equivalent tape mounts it is saving the Centre. In addition, however, there are approximately 150 actual tape mounts daily on the IBM, making a total of 600 tapes mounted daily by the operators (Cyber and IBM).

The New Telecommunications Centre (NTC) is now operational based on 4 VAX 11/750 machines, linked as a cluster system together with the graphics VAX. Only 3 Member States still have low speed lines, the remainder are on medium speed lines (2400, 4800 or 9600 bps). There is a steady programme of upgrades to higher speeds.

Looking to the future the plans as described in the Centre's "Four Year Plan" were reviewed. For the number crunching system these included

- in early 1987 the replacement of 8 DD 19 disks by 6 DD 29 disks, giving slightly more disk space;

- as part of phase 2 of the data handling system (see below) the installation of Cray's Superlink. This latter change will allow direct access to IBM disks from an executing Cray job;

- in 1988 it is hoped to connect the Cray direct to LCN, rather than through the existing Cyber 825 gateway;

- Cray has indicated its intention in the long term to concentrate on developing the operating system UNICOS (a version of UNIX) across all its machine ranges, and ultimately dropping COS. Perhaps in 1988 or later the Centre may wish to experiment with UNICOS, by running a trial system for stand-alone periods;

- finally the present Four Year Plan looks to a replacement of the Cray X-MP/48 at the end of the period, i.e. in 1990.

For Centre users the next year or two will see the first major change in the Cyber operating system since the Centre was created, namely the introduction of NOS/VE on the Cyber 855, subject to Council approval. A trial has been underway since early 1986 and has shown that NOS/VE solves many of NOS/BE's problems, and provides an excellent interactive service. To provide the hardware facilities required, the Cybers will have memory upgrades plus some changes to the disk subsystem. As Member States will have a full interactive service available to them on the NTC VAXes, there are no plans to provide a NOS/VE service to Member States. However, NOS/BE will continue to run in parallel with NOS/VE for a period to provide services which are very time consuming to move to NOS/VE. This change to NOS/VE is the best the Centre can do in the way of providing a modern interactive service, yet remain within the zero growth budget.

It had always been realised that the IBM 4341 lacked sufficient power to provide a full data handling system for all the Centre's needs. Hence phase 2 of this project, scheduled for 1987, will increase its capacity considerably. The main changes planned are

- increase the processor to roughly 8 MIPS
- increase the disk capacity by 20 Gbytes
- extend the cartridge store with additional read/write stations
- move to the new IBM 3480 cassette tape stations
- allow direct access from the Cray via Superlink.

Once this hardware installation is complete then the Centre will move towards putting all its permanent data (from Cray, Cybers under NOS/VE, and NTC VAXs) on to the data handling system, having cache stores on each "worker" machine holding only the most active files. Users will then be required to transfer files as required to/from the data handling machine via utilities similar to ACQUIRE/ DISPOSE on the Cray. This will result in less disk space and tape units needed on the worker machines, and so a simpler system to operate overall. It is envisaged the enhanced system will be able to handle at least 25000 transfers per day, compared to 1300 being handled now. Also the extra processor power will support various data manipulation functions such as subfield extraction and spectral to grid conversion. Finally, it avoids the necessity to physically increasing the tape storage area to hold the ever increasing archive of 9 inch tape reels. The time table for phase 2 envisages installing the new equipment in the second half of 1987, having it in use by December. Use of Superlink should start early in 1988.

As an initial move to digital communication with Member States, the Centre hopes to install a digital telephone exchange (PABX) in 1987. A link between it and the NTC will allow data to be transferred digitally once the PTTs can provide the necessary services. These will almost certainly be based around ISDN (Integrated Services Digital Network), which the EEC is pushing the PTTs strongly to start in 1988.

Finally, much of the equipment originally installed in 1978 is coming up for refurbishment, an ongoing task over the next few years. Also the Centre will begin shortly to replace its ageing Newbury Labs terminals with PC based ones.

Overall the computer system has changed substantially over that in place when the last Representatives Meeting took place, providing much more computer power to the user community.

After the talk the following questions were asked:

S. Pasquini (Italy): Why is the throughput of LCN so much lower than the nominal 50 Mbits/second cable capacity?

- All networks seem to show a factor 10 between nominal speed and actual user data throughput. This is due to protocol overheads, network computer capacity, etc. LCN is no exception. In practice we see around 5 Mbits/second between the Cybers, less to other machines as they simply are not powerful enough to keep up with the network.

G. Siegwart (Switzerland): When is is planned to replace the Cybers?

- In order to improve the data handling system, and yet remain within the zero growth budget, all the immediate resources are being put into that. Thus it is not envisaged to replace the Cybers until well after phase 2 of the data handling system is complete.

S. Senesi (France): How are the additional costs of NOS/VE to be covered?

- NOS/VE supports more modern disks which are cheaper to maintain. The savings pay for the licence for NOS/VE and the necessary hardware changes. Overall moving to NOS/VE was the only way the Centre could see for providing a modern interactive service (by capitalising on the existing CDC hardware) and yet remain within a zero growth budget.

S. Senesi (France): Will UNICOS/COS sharing a Cray be as disruptive as NOS/VE and NOS/BE sharing a Cyber?

- So far we have no detailed information from Cray on how well UNICOS/COS will run side by side, except that UNICOS requires dedicated storage (memory, SSD & disk). Because we cannot run UNICOS and leave sufficient resources to run a Cray service capable of running the operational model, we will have almost certainly to run UNICOS in stand-alone mode.

S. Senesi (France): Will NOS/VE run on all Cybers eventually?

- The resources left to NOS/BE will depend on the load left on it. The ratio of resources to BE and VE can be altered reasonably quickly as required. Perhaps if the load drops sufficiently we can dispose of the 835 completely. We just have to wait and see.

S. Senesi (France): If the data handling machine goes down, no files will be available and all machines will stop!

- We are assured by vendors that modern machines are very reliable and hence downtime should be far less than with today's machines. Also key storage elements are duplicated to avoid them becoming critical elements. However, the Centre is well aware that on a few occasions there may be situations where indeed files will not be available.

S. Senesi (France): Can LCN cope with the foreseen load after phase 2 has been implemented?

- It is currently believed so. As was stated earlier the main throughput problem is lack of power on the present IBM 4341. The envisaged CPU upgrade should overcome this.

S. Senesi (France): Are there minor upgrades to the NTC disks to be done to cope with the enlarged dissemination load?

- Another system disk is to be purchased shortly to allow new versions of the operating system to be developed in parallel with the daily service.

G. Siegwart (Switzerland): Optical disks are no longer in your plans?

- With Storage Technology going into chapter 11 bankruptcy, our plans to try such a system have stopped. No other vendor we can find is planning to produce a comparable system to that Storage Technology were going to produce. All current offerings are for the PC/micro market and offer only very limited I/O transfer rates. Thus we now propose to go to IBM cassette tapes. However, we still continue to watch market place developments.

SESSION 2: Member States - all Representatives

Each representative spent up to 10 minutes describing his/her Member State's configuration, connection to ECMWF, projects run at the Centre and their experiences with the service, plus their plans for the future. The following notes were taken directly from typed originals provided by each representative.

Meteorological Institute of Belgium

Computer equipment

The computer situated at the Belgian Meteorological Office is shared by 3 scientific governmental institutions :

- Royal Institute of Meteorology,
- Royal Observatory,
- Institute of Space Aeronomy.

The 2 other institutes are connected to the main site by heavy terminals through a telecommunication line.

The main computer is a Sperry 1100/81 :

Processor

- 1 CPU with SAM (Scientific Accelerator Module) - Power : 1.8 Mips
- CM : 1048 kW
- 1 SIU (Storage Interface Unit) : 8 kW
- 1 IOU (I/O Unit)
- 1 SMU (System Maintenance Unit)

Mass memory

2 x 5046 disk controllers -> dual access
6 x 8450 disks (6 x 300 Mbytes)

Other peripherals

- tape drivers : 4 Uniservo's
  1 x U30 : 800 - 1600 bpi
  3 x U36 : 1600 - 6250 bpi
- 1 card reader
- 1 card punch
- 1 printer
- 1 GCS (General Communication Subsystem)

Network

The network is connected to the Sperry through the GCS :
- 2 heavy terminals (UTS 700) are situated in the 2 other institutes sharing the main computer;
- 1 Uniscope terminal reserved to Sperry maintenance;
- 2 multidrop lines with respectively 13 and 14 terminals and PC's;
- 1 Apple II;
- 4 graphic terminals (3 tektronix, 1 televideo 910);

- 2 lines reserved for GTS data (WMO protocol);
- 1 X25 line connected to ECMWF;
- 1 IBM serie I connected via a direct line to the Sperry is used for data acquisition and also as backup for GTS data.

Graphic hardware

2 plotters Versatec (V80, 7224) are connected to a micro V430 of Versatec and work off line.

- Several other microcomputers or PC's exist on our site but are not connected to the Sperry.

Planned configuration

- 2d processor for the Sperry
- 1 DCP 10 (Distributed Communication Processor)
  will progressively replace the GCS
  will first manage - the multidrop lines connected to the GCS
  - a X25 connection to the DCS (belgian public network)
    -> connection to University of Liège, EARN
  - a connection to the Public Works Ministry network.

Projects run at ECMWF

Adaptation of our dynamic meteorology software to the CRAY : some tests were successfully performed.

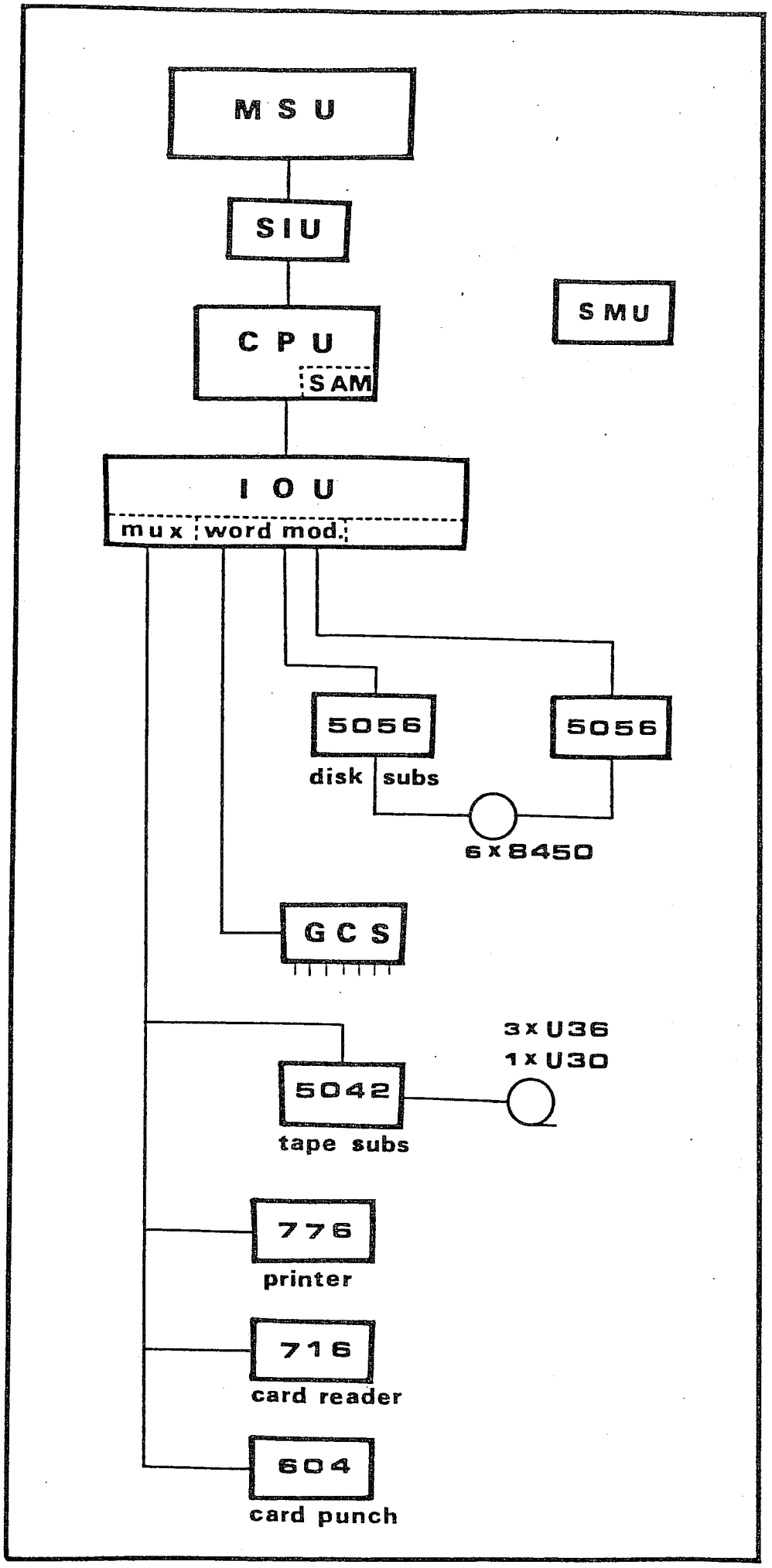
Experience using ECMWF computer

OK.

Plans for next couple of years

- limited area model using an integration method derived from the Lynch analysis method.

- 2 dimensions deep convection model using the finite elements method.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tape subs
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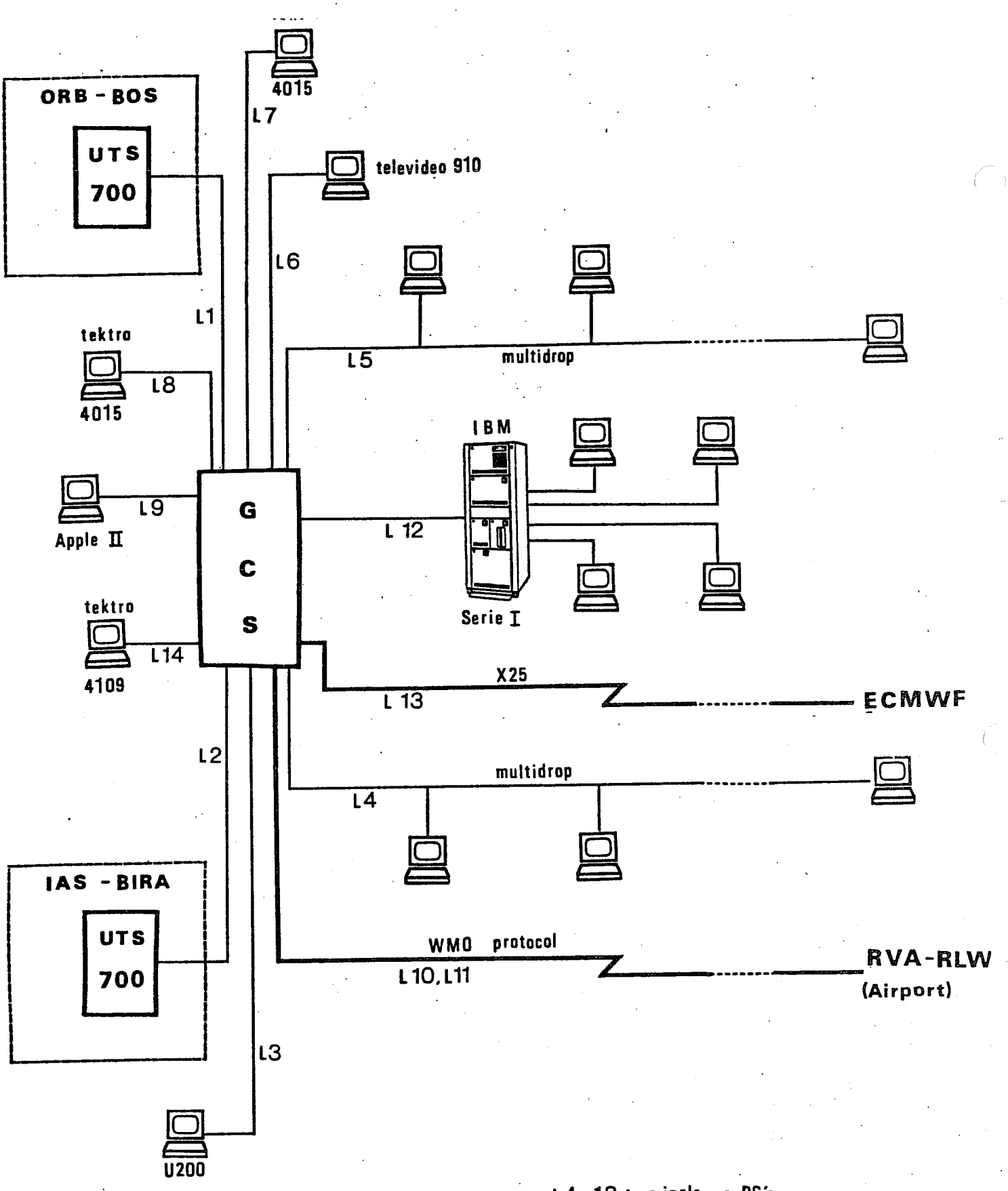
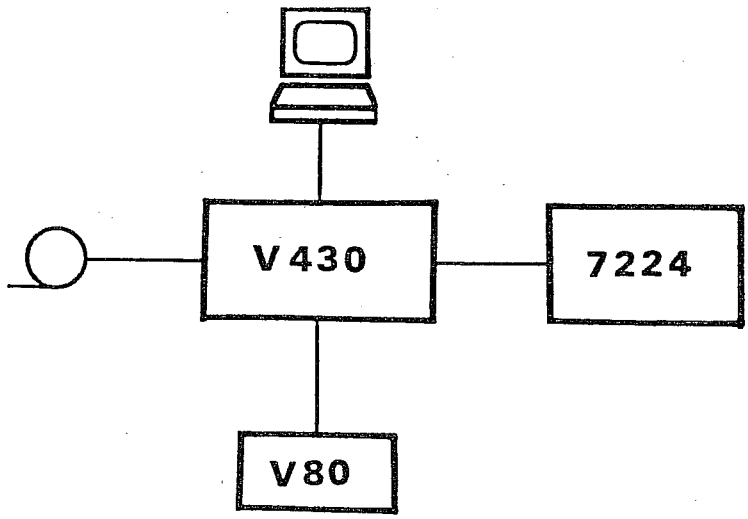
printer
716
card reader
604
card punch

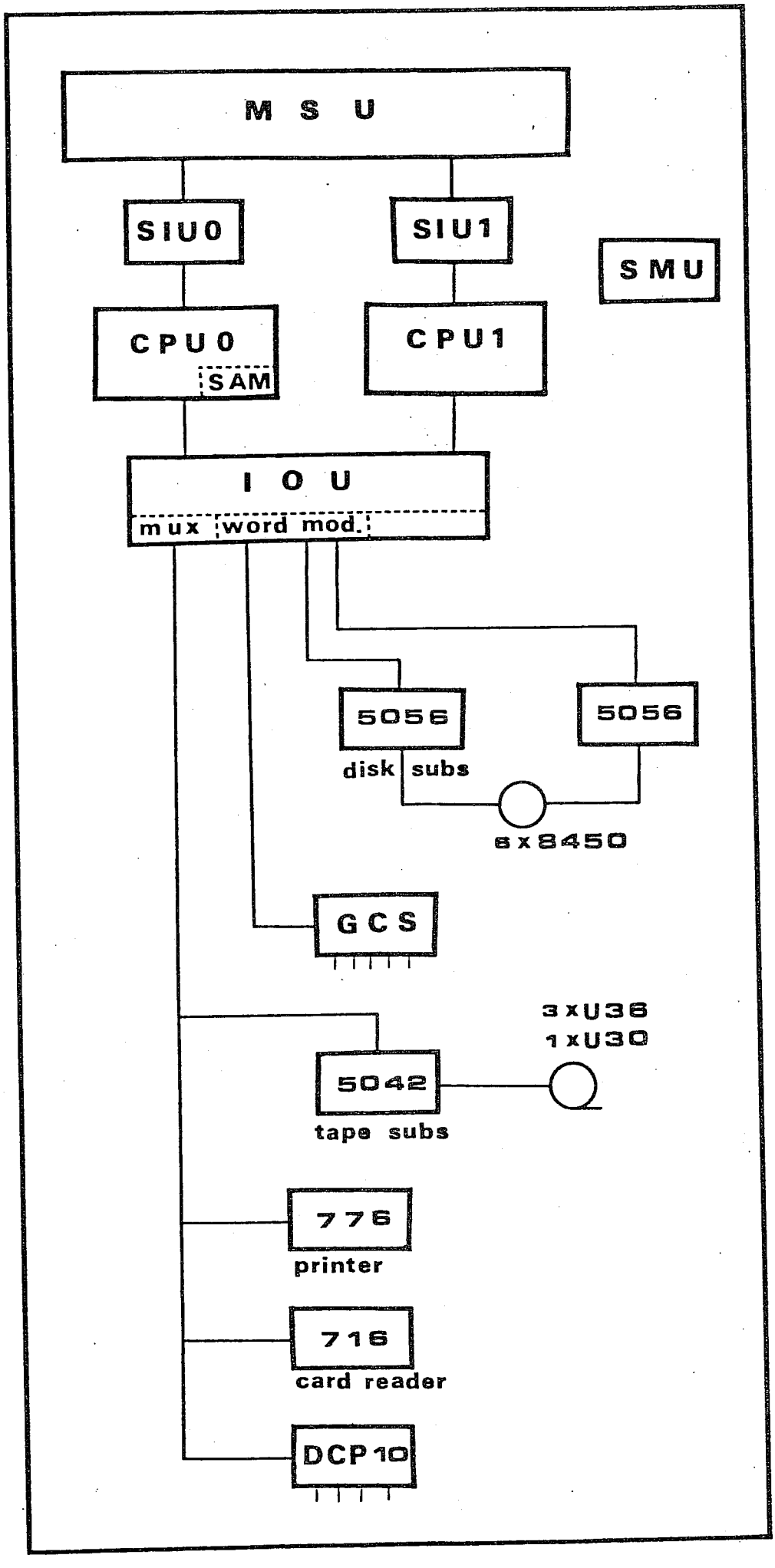


L4 : 13 terminals or PC's
UTS (20,400), Commodore PC 10,
Sperry 20PC, Olivetti M24

L5 : 14 terminals
UTS (20, 30, 40, 400), UDS 2000

GRAPHIC hardware: Versatec




M S U
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GCS
3xU36
1xU30
5042
tape subs
776
printer
716
card reader
DCP10

2.2 Denmark - P. Henning

THE COMPUTER SYSTEM AT THE DANISH METEOROLOGICAL INSTITUTE

In 1987 DMI installed the new Sperry 1100/82 APS computer with an attached vector processor. The configuration can be seen on the diagram.

The RC8000 computer is still functioning, but gradually more and more activities will be transferred to the Sperry system.

From this summer the communication to ECMWF runs entirely on the Sperry system.

We receive a great amount of disseminated products from the Centre. The main user of these products is of course the forecasting department of our institute, where the prognosis are represented partly as isolines on maps, partly as meteograms and partly as pseudosynops, that is: at some gridpoints on a map the forecasted weather elements are plotted in a synoplike fashion. We think that this will give a good overall view of the weather situation in a very condensed manner.

The Centre's products are also used for preparing wind prognosis in different levels of the atmosphere for use in the military weather service at Karup.

Every 6 hours we run a LAM-model. The model computes prognosis until 36 hours from the analysis hour. We take the boundary values for the LAM-prognosis from the disseminated ECMWF prognosis.

The model has 9 layers. Every layer consists of about 4000 gridpoints with a distance of about 100 km. The products from the LAM are presented to the forecaster as isolines and pseudosynops.

To run these prognosis it is necessary to have a large computing power, which is accomplished by our APS. Software is made on the Sperry to decode the disseminated files as well as to send remote jobs to the Centre and to receive the results. At present, the results from remote jobs can only be received in character format.

Several projects are run at ECMWF by employees at DMI, the University of Copenhagen and the Danish Air Pollution Laboratory.

In our department we have developed a system for requests of global data in order to be able to draw meteograms for arbitrary locations in the world.

The forecasting department runs different projects. For the use in a MOS programme, data are required at ECMWF.

An investigation into polar lows is under development and is going to be run in the near future.

The Geophysical Department of the University of Copenhagen runs a simulation of ultra long waves.

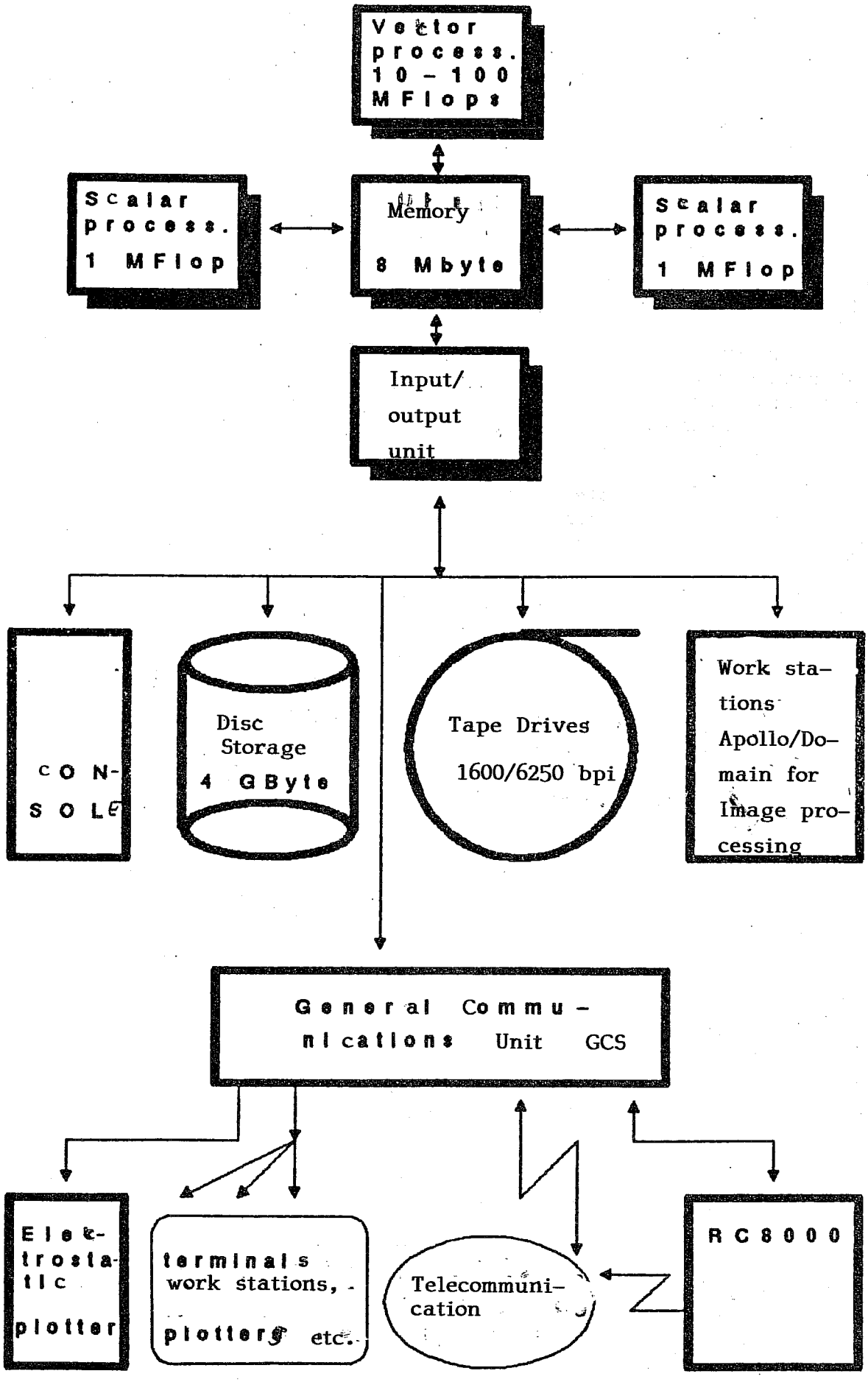
The Air Pollution Laboratory makes computation of long range transport of air pollution.

A group of meteorologists from the Nordic countries with headquarter at DMI is preparing a HIRLAM model and it is expected that they will run quite a lot of jobs at the Centre.

We plan a system for requests of weather reports in order to get the data which will be missing in case of a breakdown of our system. We would like very much to be able to request reports for a given area.

In general, the use of ECMWF computers functions well, the disseminated products are received in due time, especially after the upgrading of the line to 4800 bauds. Also the remote jobs seem to run well, although Cyber units and PF seem to be scarce resources.

SPERRY 1100/82 APS



2.3 Spain - M. Hortal

MEMBER STATES COPMPUTING REPRESENTATIVES MEETING

ECMWF 9-10 OCTOBER 1986

REPORT FROM SPAIN

Since February 1985 the Spanish National Meteorological Institute (I.N.M.) has been running a new central computer which substituted the old IBM 360/40.

The new computer is a FUJITSU FACOM M-382 having 2 CPU's of 12 MIP's each and 16 Mbytes of real memory associated to each of the CPU's. The system is configured such that the whole 32 bytes of real memory is treated as a unit and can be accessed by any of the CPU's. Also the CPU's are not distinguishable from the user's point of view.

The operating system is the OS-IV/F4 (E 20) which defines the user area of the real memory for programs with a maximum of 7 Mbytes. The address extension option of the compiler allows variables in COMMON blocks not initialized by means of BLOCKDATA subprograms to occupy a region of the memory outside the user area thus making full use of the 32 Mbytes (excluding the area used by the operating system) of real memory. This feature has been taken profit of by the forecast model to store the whole fields into memory thus avoiding input/output. The existence of two CPU's has also been considered in the operating forecast suite by the forecast model submitting the postprocessing as soon as a history file is ready to be processed, and runs in parallel with the forecast model itself which uses some 90% of one of the CPU's.

At about the same time as the central computer, the old telecommunications computer of I.N.M. (a pair of IBM's S/7) was replaced by a new system based in two DATA GENERAL ECLIPSE MV-4000 computers which handle two medium speed lines to the GTS, a high speed link to the FUJITSU and the national dissemination lines.

The link to ECMWF is handled directly by the FUJITSU computer which, since december 1985 decodes the bit-oriented code of ECMWF therefore allowing to receive a full set of fields to be used as boundary conditions for our LAM as well as the previous dissemination products to be plotted on the electrostatic on-line plotter.

- The jobs run at present at the ECMWF computers are mainly of two kinds.

  a) Developement of MOS equations using the ECMWF statistical forecast programs.

  b) Retrieval of observations and fields from the archives. They are terefore run on the CYBER's.

  The roject on a limited area model using finite elements which was begun two years ago on the CRAY had to be discontinued due to lack of manpower at I.N.M. and the need to start an operational suite at our own computer.

  During the present year, therefore only the trials of MARS have been submitted to the CRAY.

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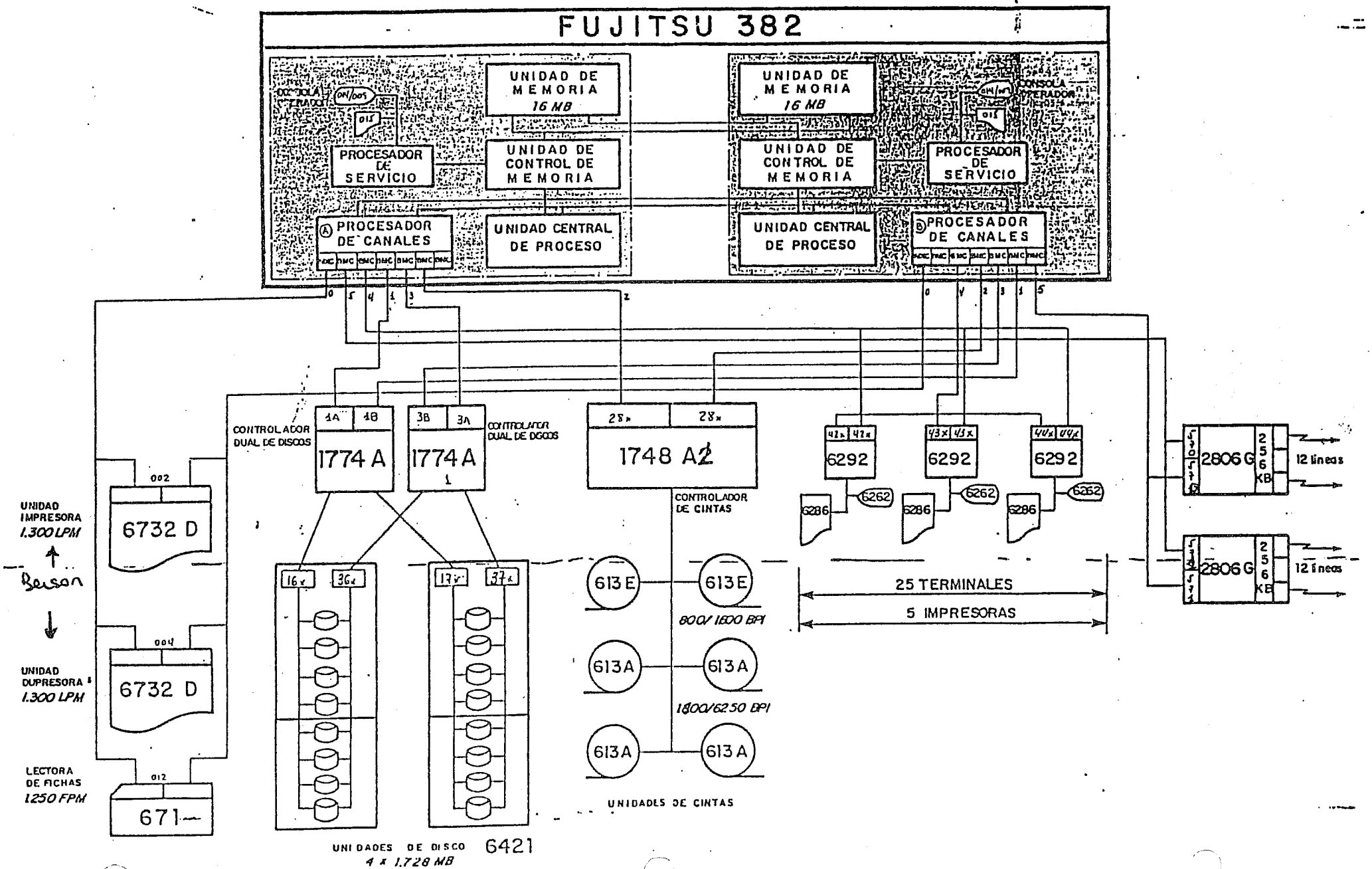
- Jobs submitted to the CYBER's have been found from our point of view to have a very long waiting time at the input queue, which is not surprising and therefore : we look forward to the possibility of accessing the archives through the CRAY interface of MARS which is tried at present without success.

  An undesirable procedure for us is to take as the name of a job submitted from an RJE link, the name of the RJE file and not the one of the JOB card as is at present implemented because many procedures at ECMWF take as ouwner identifier for a file to be catalogued the first characters of the job name which does not coincide with the user identifier as we had our RJE files defined when the communications were based on the old NFEP. Of course we could redefine our files with a different name but the possibilities are then severely limited.

OFERTA "A"

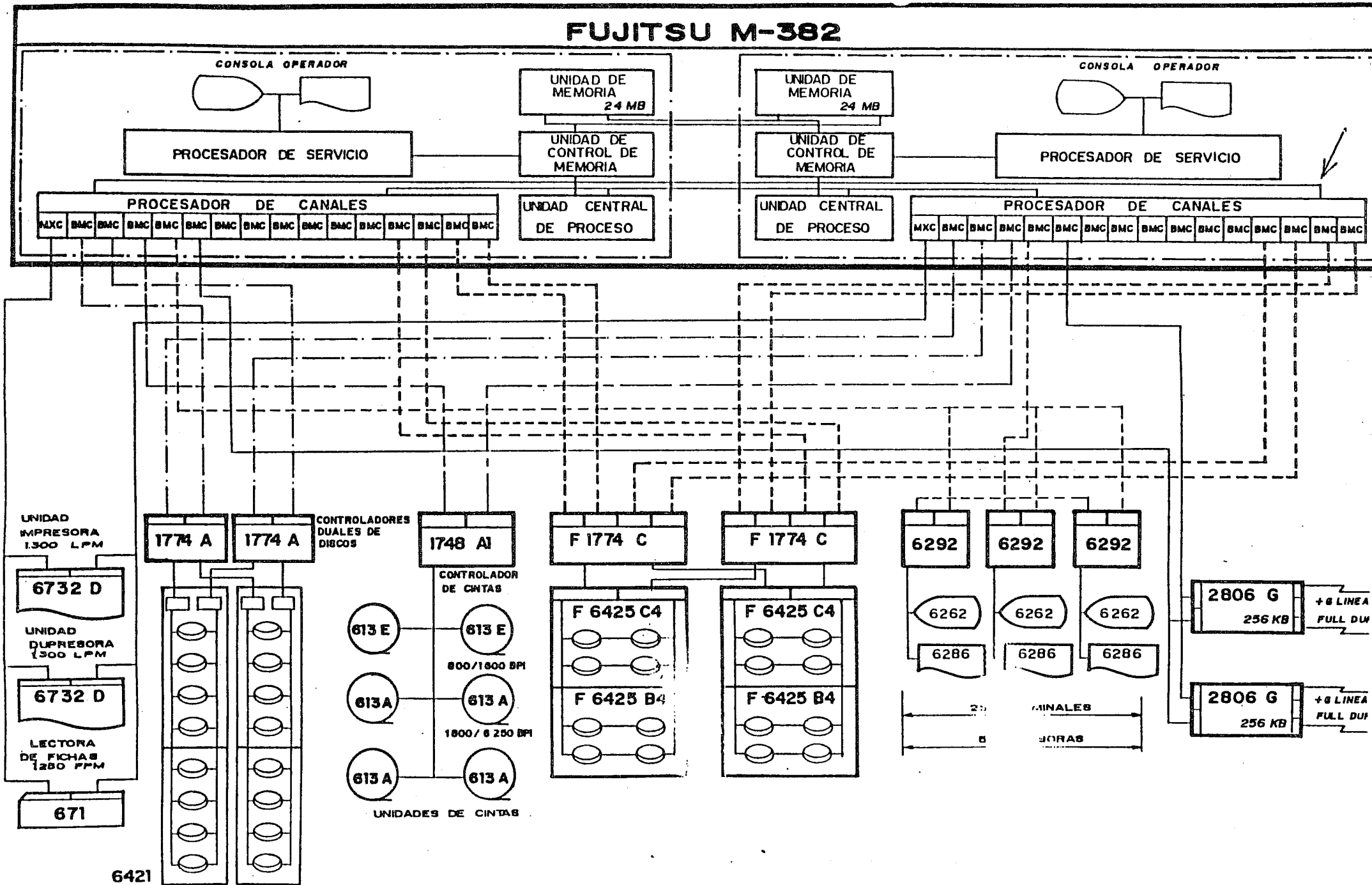
INSTITUTO NACIONAL DE METEOROLOGIA

ORDENADOR FUJITSU M-382

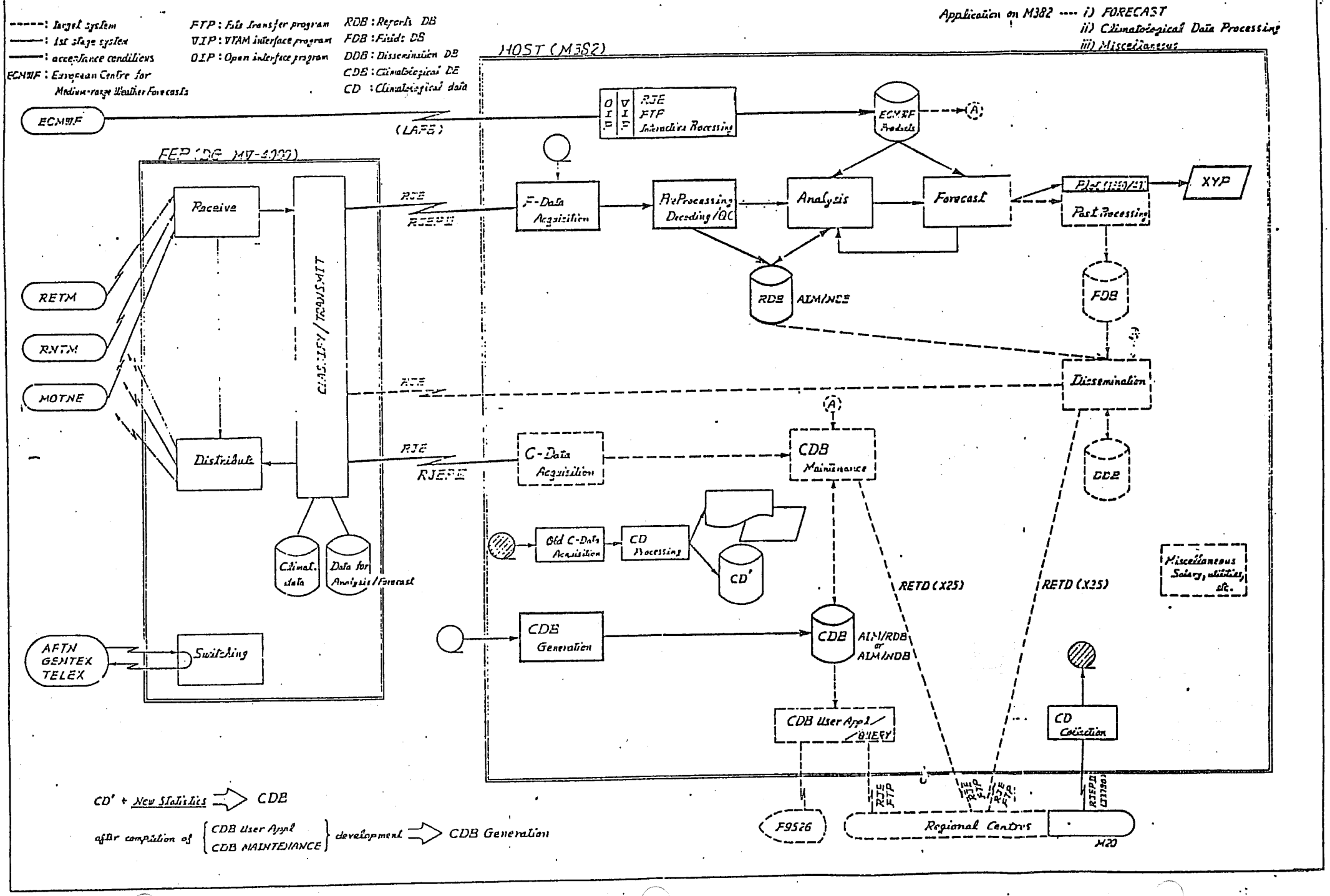


INSTITUTO NACIONAL DE METEOROLOGIA — ARCHIVO

—ORDENADOR FUJITSU M-382—



1. Overview of the ENFI System



2.4 France - S. Senesi

French Contribution to the Computer Representative Meeting 9-10 October 1986

1. Computer equipment

The main computing centre, located in Paris, includes:

- one Cyber 180/835 from CDC (with 1 Megaword of memory, 2.5 mips, 0.47 Megaflop on Linpack) that deals with pre- and post-processing of data, and every operational tasks including graphics and excluding model running. It runs under NOS 2.3.

- one Cyber 175 from CDC (with 256 Kilo words of memory, 8 Mips, 2.1 Megaflops on Linpack) for research purposes and climatology. It communicates with the 835 by shared disks. It supports the ECMWF link.

- 6 Mitra 225 from Bull-Sems, dealing with the regional centre and the national centre functions on GTS. They are connected to the 835 by X.25 links.

- One Micromega 32 supporting the Videotex server (up to 50 simultaneous access via PPSN, plans to an upgrade to 150).

The numerical models are run on a Cray 1.5 which is owned by a group of 8 institutions, including the Ministry of Research, of Defense, of Education, Spatial Research Office, CNES, and located 20 km south of Paris. We use 25% of the processor time by dedicated sessions (4 hours at night, 1 at day time) for operations and as batch user for research, for the remaining resources. The Cray is linked to the Cybers by a Network System Corporation Hyperchannel at 50 Mbits per second, which trunk is carried via a leased line at 512 Kilobits per second.

This Cray 1 will be replaced by a Cray 2 delivered mid-November 86, running the Unix-like UNICOS operating system. The Cray 2 has 4 processors, 2 Gigabytes of memory and a clock period of 4 nanoseconds, leading to a peak power of 1 Gigaflop.

The link to ECMWF is supported by the Cyber 175 and one of its Network Processing Unit 2550. The first two layers of protocol (HDLC) are supported by this NPU: this is a site-modified version of the CDC CCP software (taking off the X.25 level 3 layer), that is difficult to maintain. EEP and FTP layers run on the host; they have been written in a CDC language (SYMPL) in collaboration with CDC France. Every user can submit a job included in a NOS file by a single command. A file image of the batch output is routed on a user basis after the jobname to a "wait queue", even to our remote sites (Toulouse, Lannion ..) and can be displayed at any screen. This avoids the printing and dispatching delays. This software also runs at Austria, Finland and Portugal.

2. Projects run at ECMWF

They are 21 account numbers at ECMWF, including 60 registered users. The projects related are:

- meso-scale modelling
- physical parameterisation
- boundary layer studies
- simulations
- three-dimensional convection modelling
- climate simulation
- model output statistic
- objective analysis
- transport and trajectories calculations
- stratosphere circulation
- access to archives.

Most users are located in Paris and in Toulouse (at the National Meteorological Research Centre CNRM). They use Cybers mainly as Cray support.

3. Experience using ECMWF computers

Because of the large percentage of the Cray 1-S used for operation purposes, most of the research jobs had to be done on the ECMWF Cray. The pressure is thus high on the link to Reading and we had hard time with the NFEP and the 4800 b/s link.

The introduction of the NTC leads to a decisive improvement, together with the upgrade of the line.

The initial problems of the NTC experienced are:

- response time of the status command
- RHF bugs leading to misrouting of outputs (corrected)
- ignorance of the whole set of mail commands (e.g. to purge the messages)
- the internal network links in force with the NTC that gives the same name to a Cyber job and the Cray job launched by it. This implied that we modify our software to allow non-uniqueness of file identification, which is not a reliable feature.

Permanent file space allocation is ever too small for any user in every system. This is particularly true at ECMWF. The missing of an automatic repressive or preventive mechanism leads to "manual" intervention involving the user support and the computer representative to contact the users in fault and make them spend too much time on the phone.

Documenting a system is a hard job. The user support performs valuable efforts by releasing the Member State literature set. Nevertheless, some mechanism allowing a user to get an updated copy of every manual would be useful. Newssheets and possibly newsletters should also be accessed that way.

The perfect solution would be to use the future interactive access to NTC to let on-line manuals available, or at least short sets of informations like news sheets.

4. Plans

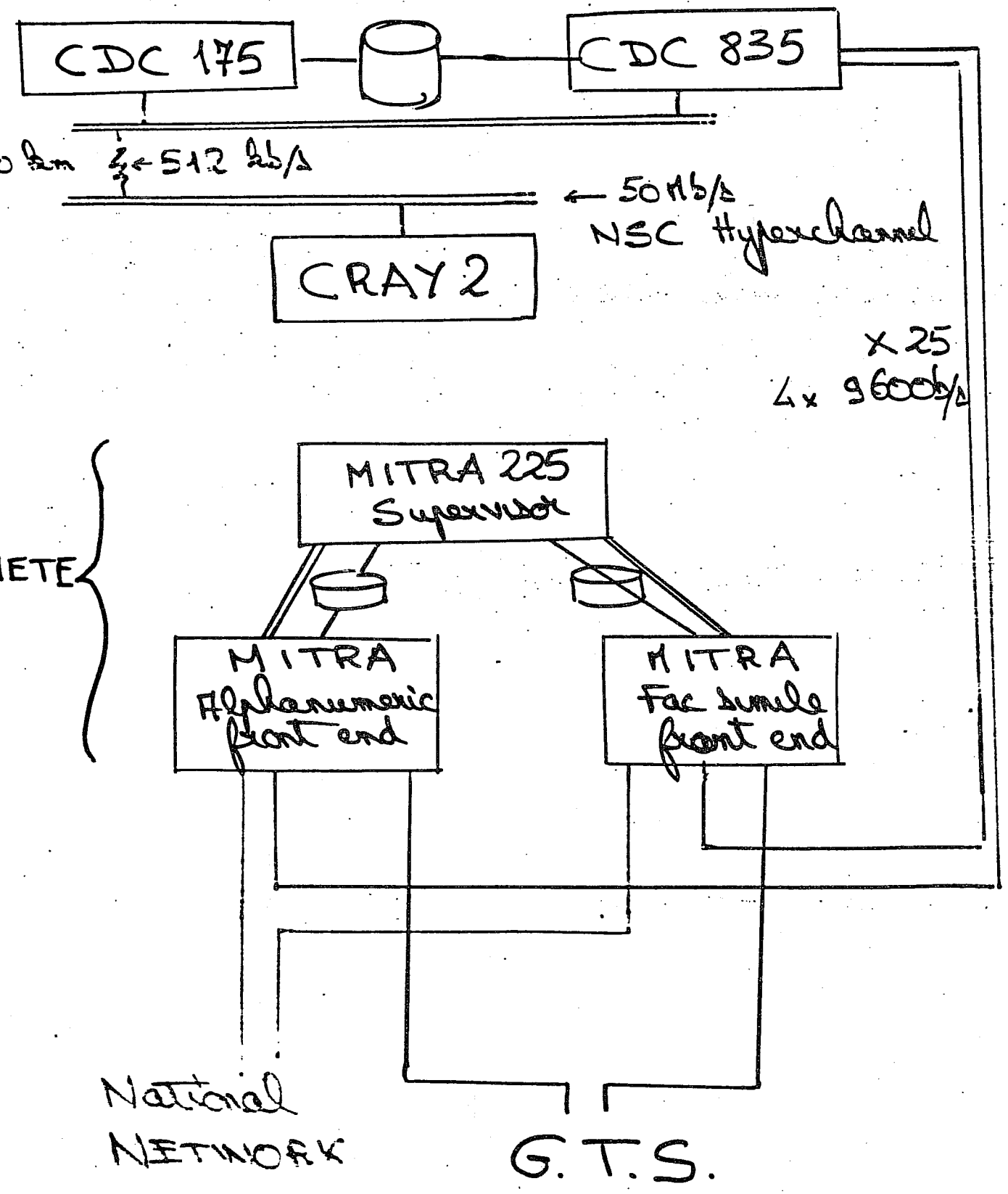
- In the short term, modellers will use the Cray X-MP to investigate the multi-tasking facilities of Cray, in order to tune the first Cray-2 tuned model.

- We intend to implement the interactive facility as soon as possible.

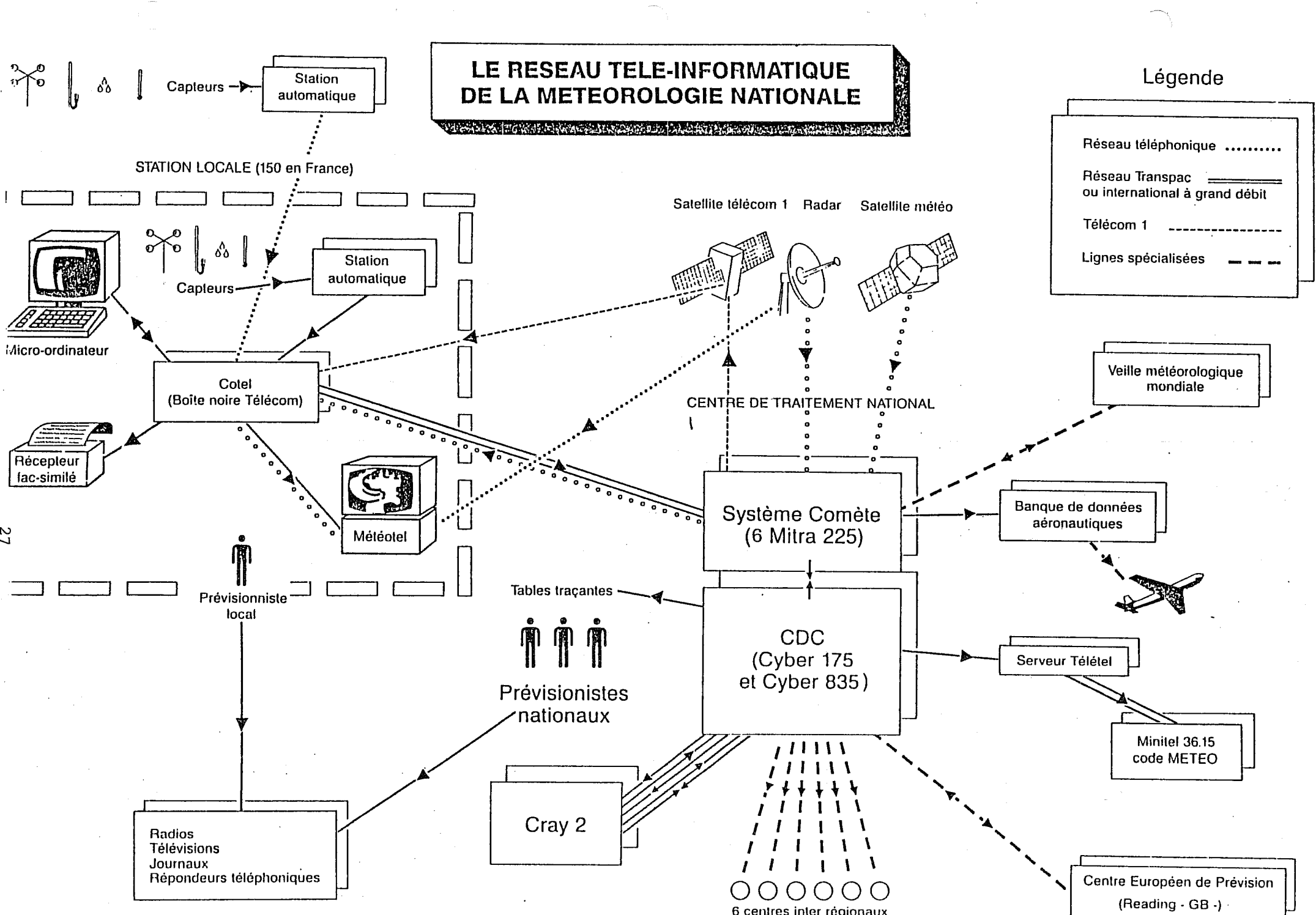
- An increase of the line speed should become useful in 87 or 88.

- An Invitation to Tender is in progress concerning the replacement of the two CDC machines. Whatever solution comes out, the advantages of a Unix-like operating system have been considered, and thus also the facilities it could provide to have this system available at the Centre. This could be on the Cyber with NOS/VE and VX/VE and on the Cray with UNICOS, which is the emerging operating system for Cray and can be a guest operating system of COS as an interim solution.

FRENCH METEOROLOGICAL COMPUTING CENTRE



LE RESEAU TELE-INFORMATIQUE DE LA METEOROLOGIE NATIONALE



2.5 Ireland - J.V. Ryder

IRISH METEOROLOGICAL SERVICE.

COMPUTER LINK TO ECMWF.

At present the link to ECMWF is via a 2400 bps synchronous line to the Service's PDP 11/40 communications computers. A COMIOP-DUP interface together with additional software on the 11/40's handle the protocols.

The data are transferred from the 11/40's to the 2050 mainframe using Magnetic Tape. After decoding and processing there, the data are used for plotting on the Calcomp plotters and for display on the Dec GIGI graphics terminals at the Airports and the Central Forecast Office at Glasnevin. First Guess and Boundary Values are extracted for use in the Service's NWP model.

When the 11/40's are replaced by the VAX 11/780's (not earlier than the spring of 1987), the KMS11 acting as an X25 gateway together with DECNET will handle all levels of protocol. The Service will at this stage participate in the N.T.S. project organised by ECMWF for member states using VAX computers.

It is envisaged that the present line speed of 2400 bps will be upgraded to 4800 and eventually to 9600.

CURRENT PROJECTS.

1. Post Analysis of case studies e.g. August storms, using MARS to access ECMWF archives.

2. Retrieval of forecast from experimental midnight run.

EXPERIENCE WITH PRESENT SERVICE.

1. The Cyber JCL in its present form is cumbersome, and a more simplified user-friendly interface would be of benefit if such were feasible. It would be interesting to know if any member state considered or indeed developed a type of Emulator or Preprocessor to alleviate this problem.

2. The use of MARS for retrieving the midnight data has posed a number of problems for Peter Lynch of our Research Division. He has listed these and indeed has received a lot of help on the subject from Norbert Kritz.

PLANNED PROJECTS.

1. Theoretical Model of Baroclinic Instability of Planetary Waves.

2. Assessment of Variational Initialisation Technique.

3. General NWP research.

Finally it is fair to say that more use would be made of the ECMWF facility but for constraints imposed at present by our own equipment, but this problem should be overcome to a great extent with the introduction of our new VAX system in the near future.

J.V. Ryder.

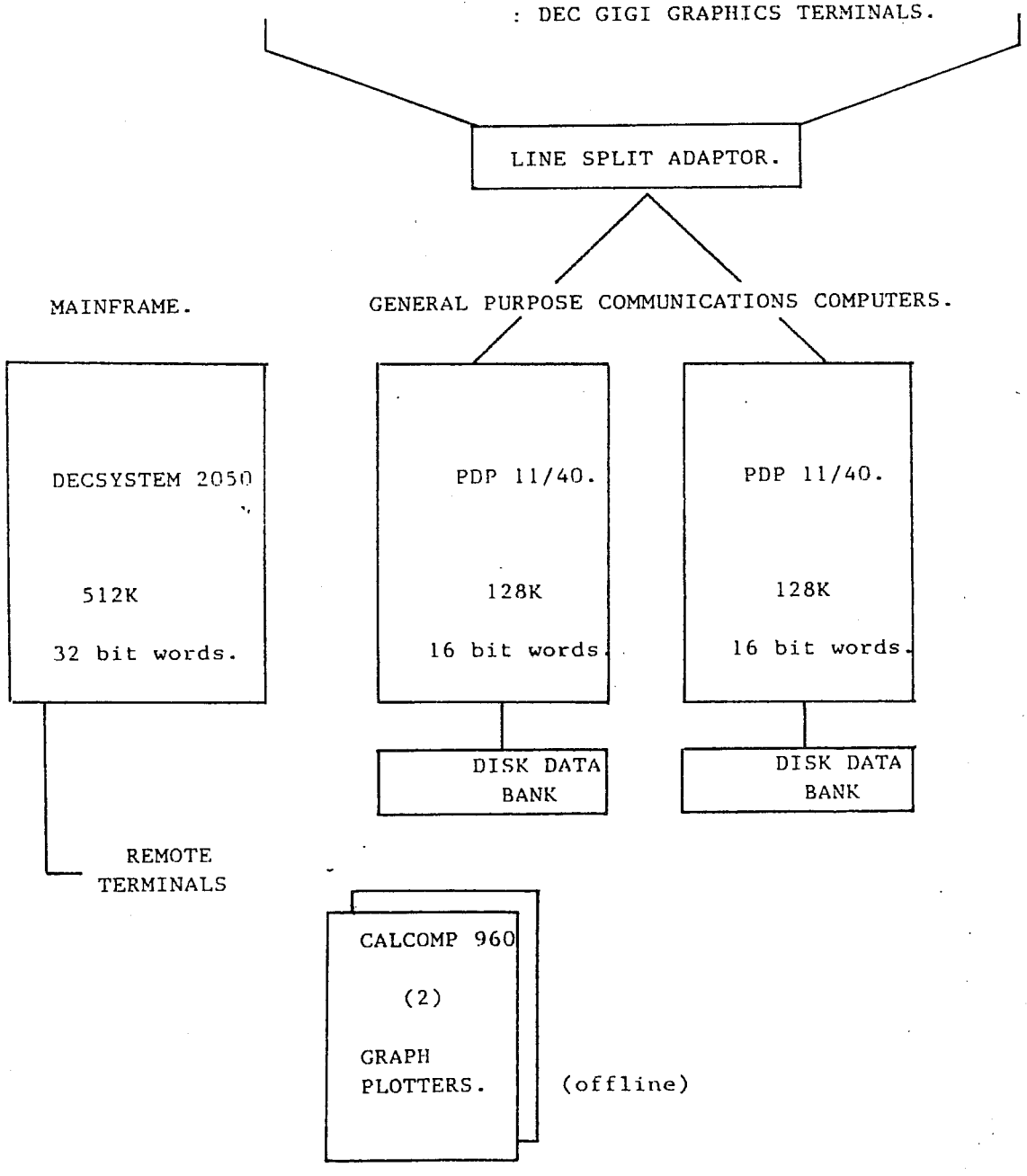
IRISH METEOROLOGICAL SERVICE COMPUTER COMPLEX.

Communication Lines.

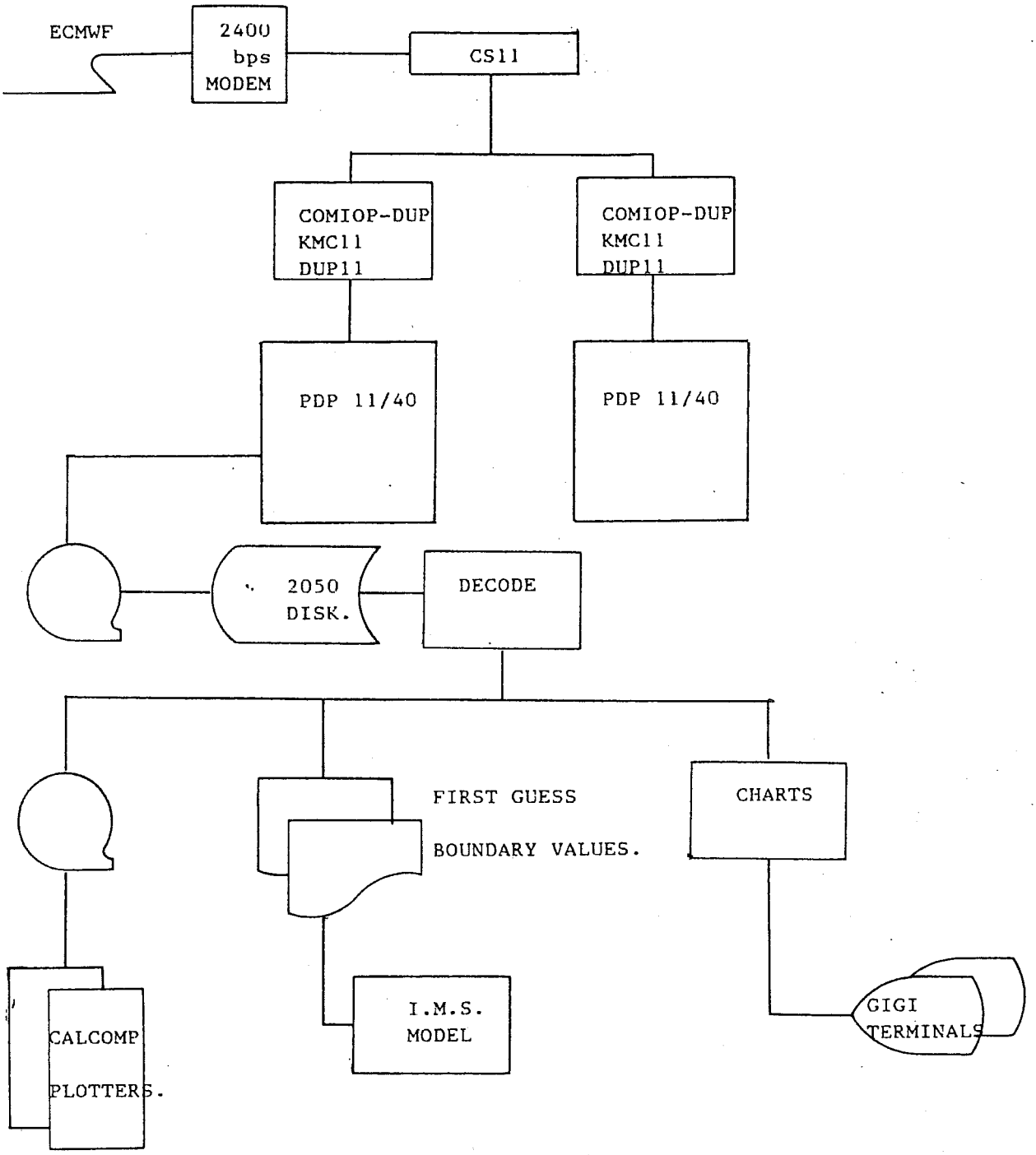
3 Synchronous : ECMWF, BRACKNELL RTH, AER LINGUS.

27 Asynchronous : AIRPORTS, CAFO, TELEX, MOTNE, AFTN,

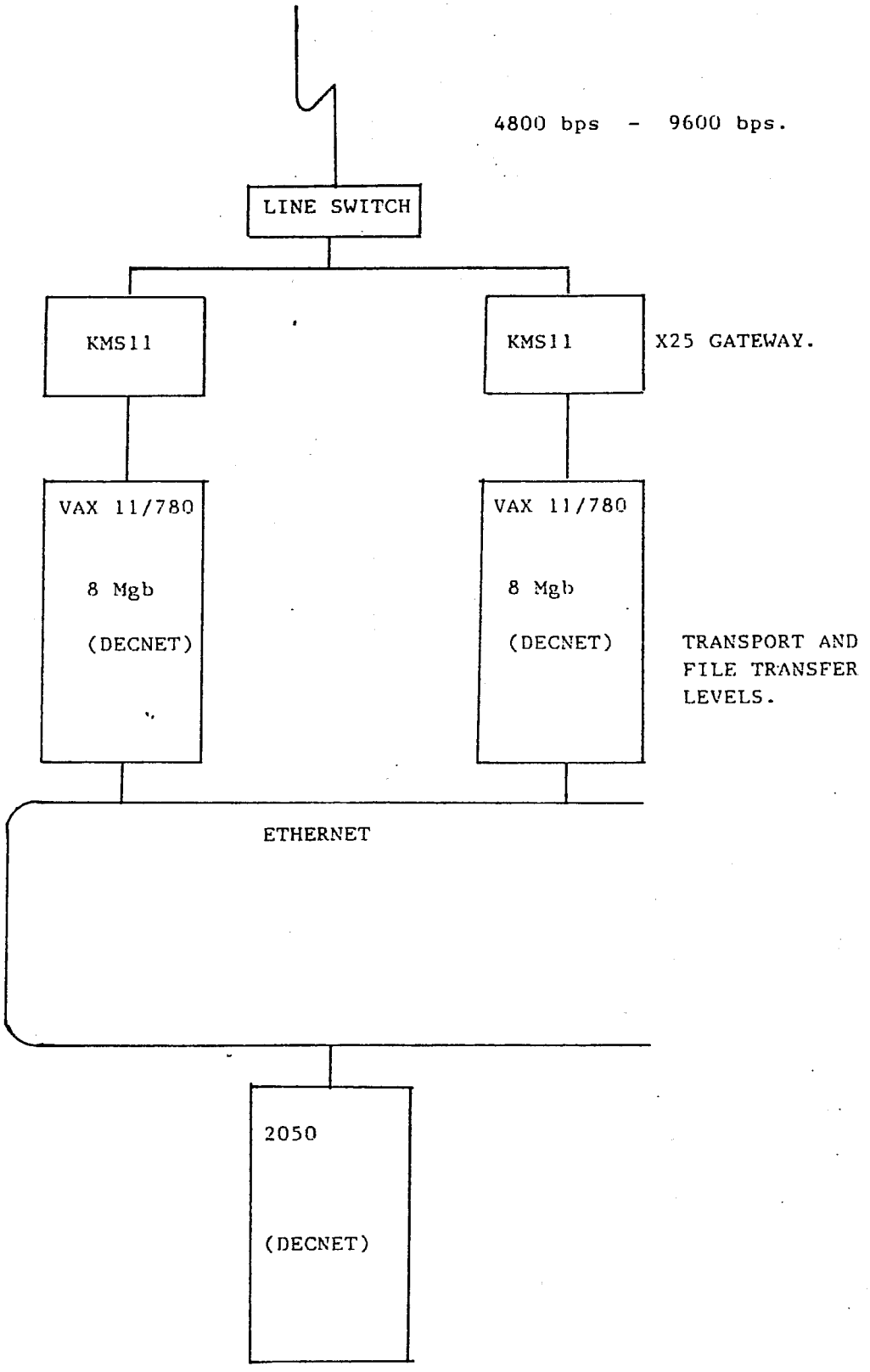
: DEC GIGI GRAPHICS TERMINALS.



ECMWF DATA FLOW.



NEW I.M.S. COMPUTER COMPLEX. (ECMWF).



2.6 Italy - S. Pasquini

CNMCA computer environment is illustrated in Fig.1 and is based on two IBM 4341 M02 mainframes.The operational machine, running under DOS/VSE and using CICS as TP monitor, performs three basic functions:

1. message switching
2. VSAM database
3. forecast model.

The other 4341, running under VM, is used for software development and as back-up when the operational machine is down. The two machines do not share the database.

The two IBM S/7 are used to receive and transmit data from/to GTS, the national network (low speed lines) and ECMWF (data acquisition only).

Three IBM 3705 M80 control unit are used to disseminate meteorological data to State Agencies such as television, energy, telephone, etc...

RJE equipment (PC emulating an asincronus terminal) is not shown in the figure because is attached to another low speed line and is logically connected to the Cybers.

The Italian projects running at ECMWF are:

- Statistical post-processing
- Numerical weather prediction
- Diagnostics on predictability in the tropics
- Cyclogenesis in the Mediterranean area
- Long-distance transport of pollutants
- Turbulence modelling on planetary scale.

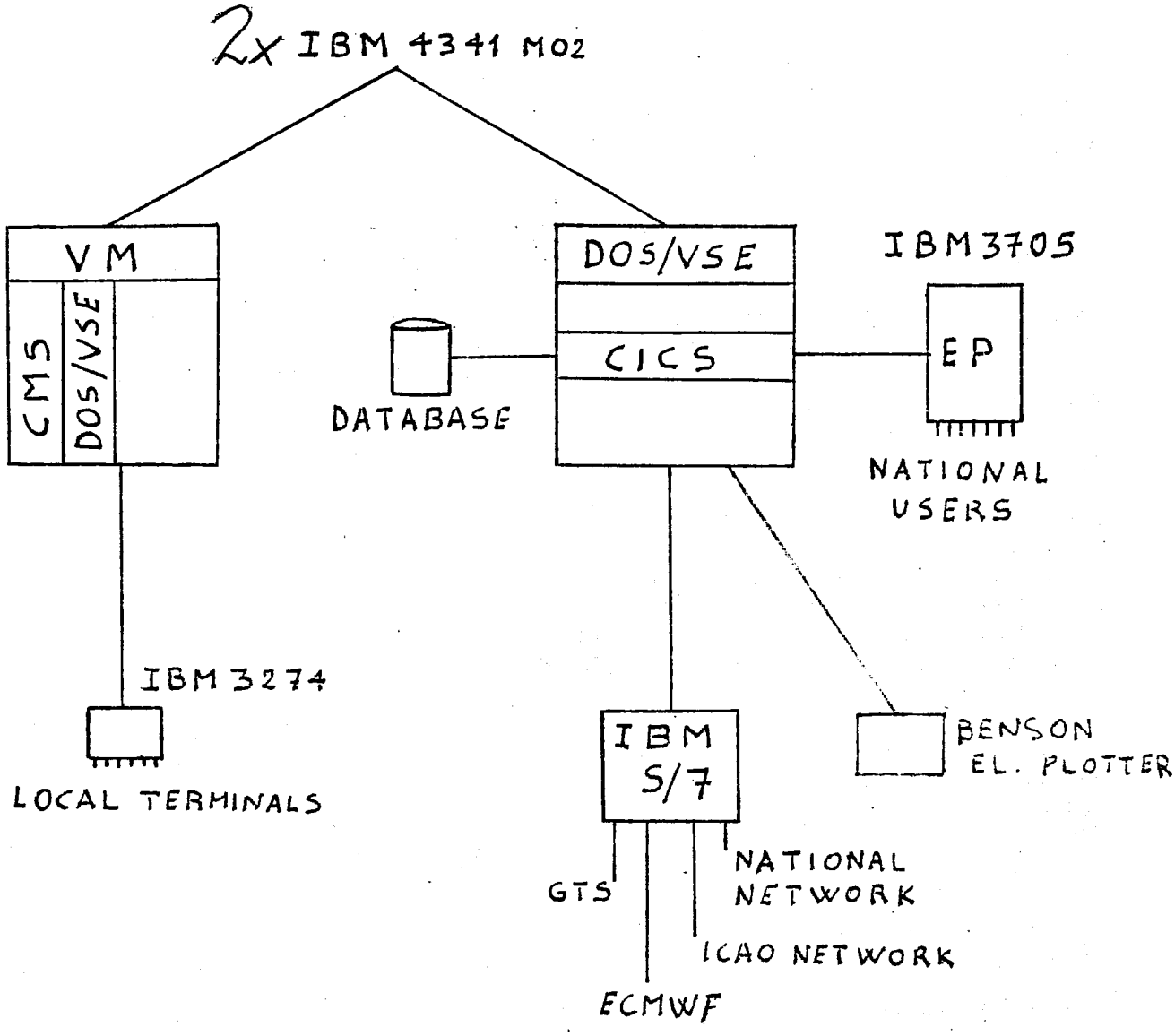
The Italian experience, using ECMWF computers, has been very satisfactory and, because of the low speed line, the Italian users often come to the ECMWF where they find appreciated user support. They report two problems:

a. Cyber bottleneck
b. decrease of perfomances when the operational model is running.

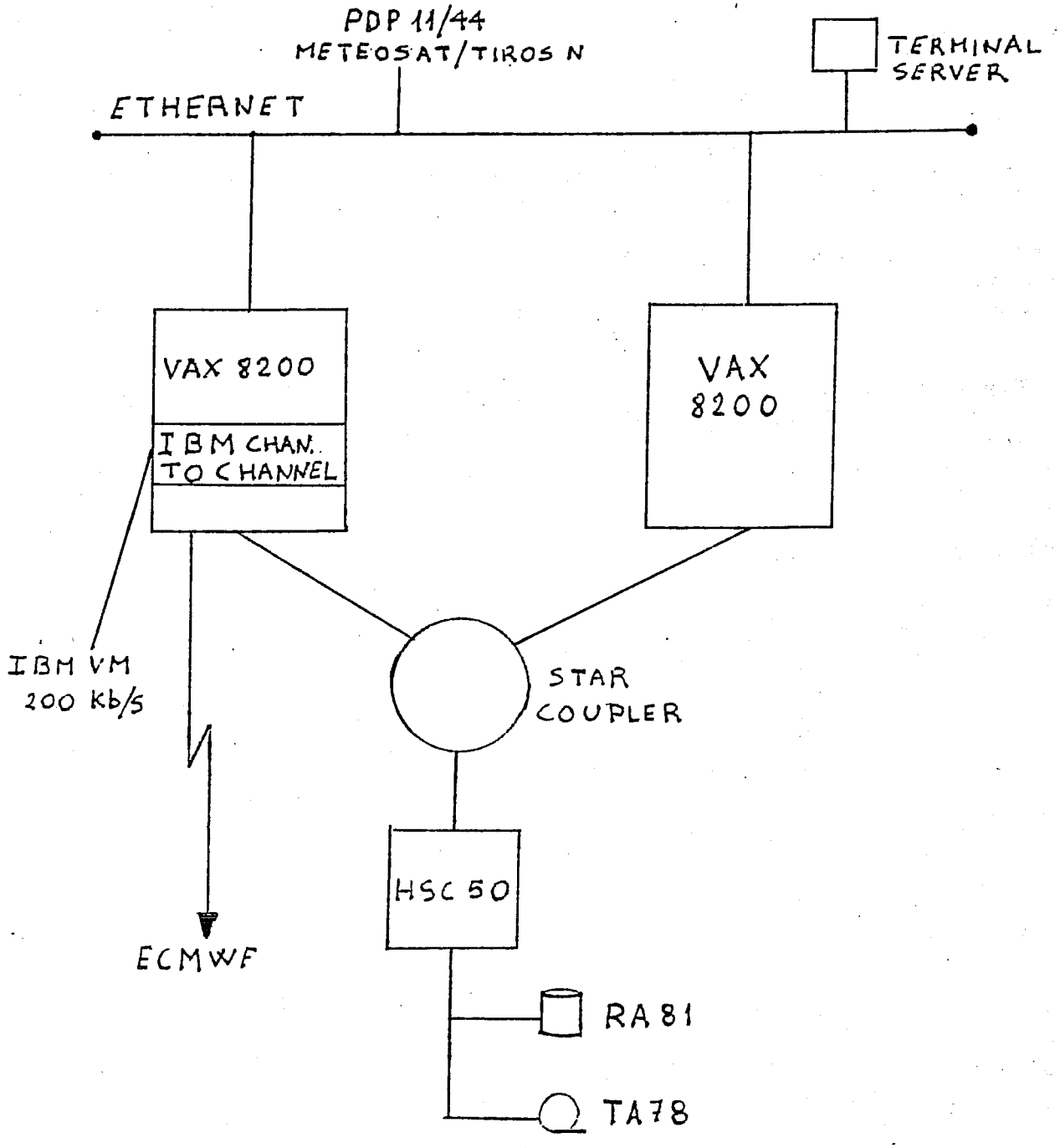
The latter is very important now, because of starting of the 00Z forecast.

The Italian Met Service is going to acquire a computer system (Fig.2), which will enable connection with the ECMWF, via Decnet, at high speed. This system will be based upon the two VAX 8200 computers, sharing disk storage and connected by an Ethernet local area network to local terminal server and to the two PDP 11/44 of the Meteosat and Tiros N receiving stations. This front-end system will be connected to the IBM mainframes via channel to channel interface, emulating an IBM tape to the VM operating system.

As an interim solution the Italian Met Service is going to borrow VAX 730 for connection with the ECMWF, and emulating an IBM 3780 terminal to exchange the data with the IBM mainframes.


2x IBM 4341 M02
VM
CMS
DOS/VSE
DOS/VSE
CICS
DATABASE
IBM3705
EP
NATIONAL USERS
IBM 3274
LOCAL TERMINALS
IBM S/7
BENSON EL. PLOTTER
GTS
NATIONAL NETWORK
ICAO NETWORK
ECMWF

- Fig. 1 -


PDP 11/44
METEOSAT/TIROS N
TERMINAL SERVER
ETHERNET
VAX 8200
IBM CHAN. TO CHANNEL
VAX 8200
IBM VM
200 Kb/s
STAR COUPLER
HSC 50
ECMWF
RA 81
TA78

- Fig. 2 -

KNMI computer configuration

Mainframe

The KNMI uses as mainframe two Burroughs A9 (version D) computers with each 6 mb internal memory. One computer is used for production , the other for backup and development. In total is available 3.3 gb online diskstorage, 3 magtape units (1600/6250 BPI) and 2 central printers.

Operating system : MCP
Database : DMSII
Compilers : BEA (Burroughs extended algol)
Fortran

The ECMWF line is switchable to both A9 mainframes. Operational products are directly processed in the production A9 , other products are send over a double BNA link to the development computer. (BNA = Burroughs Network Architecture)

Dedicated mini's

VAX 730/750/8300
- Handling plotter information to several devices. Seven HP7585 plotters and a 4107 color display are now operational. Two Versatecs (22 inch) will be connected in the next future.
- A VAX 8300 is used for Airflight (met.) data distribution (Amsterdam Airport)

PDP11/34
- Datacommunication , mainly telex
- Observationsystem (Amsterdam Airport)

micro VAX
- Meteosat

Main projects using the ECMWF computers

- LAM Limited Area Model
- WAM Wave modelling
- Climate model

Experience

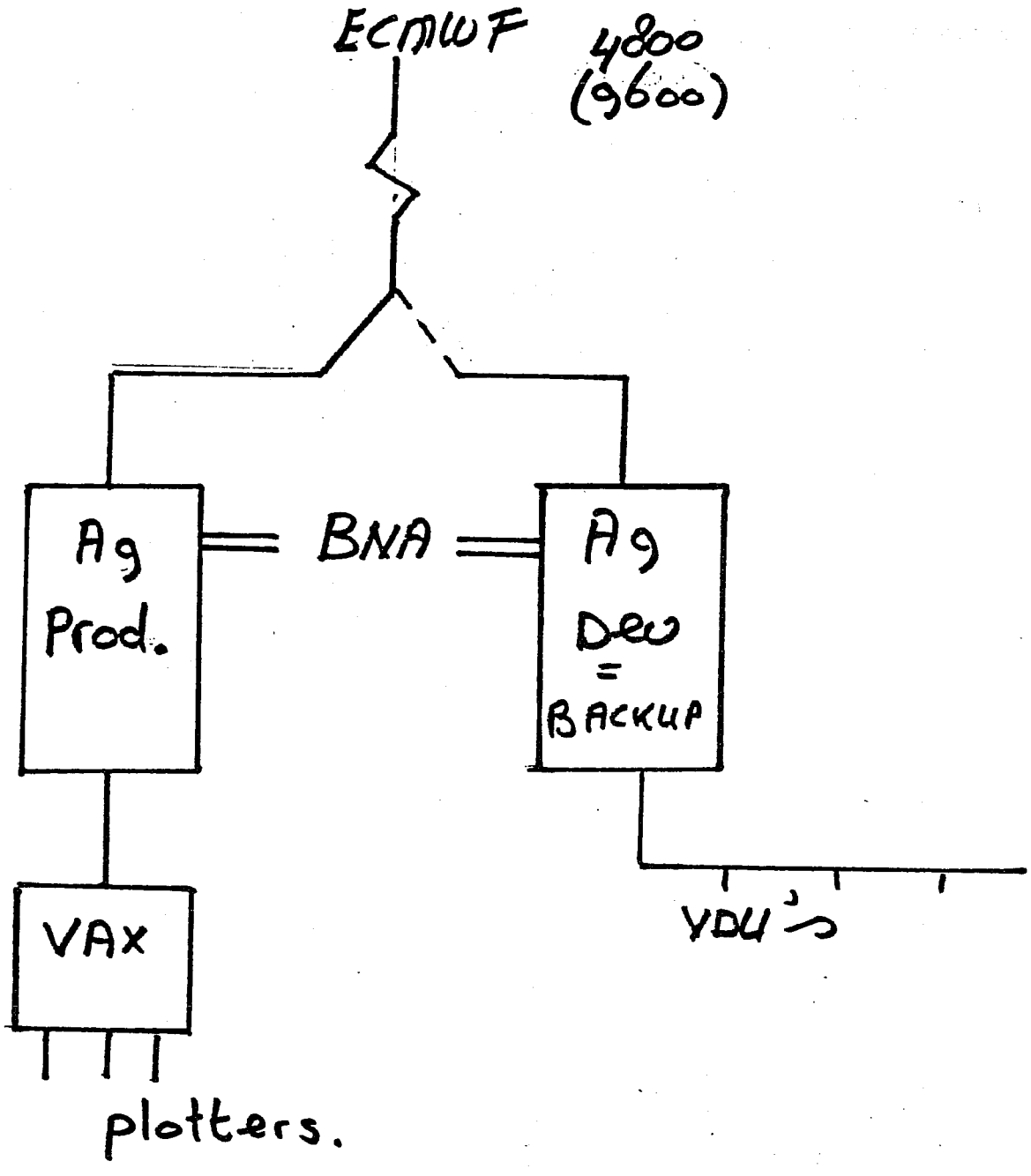
- There were several problems due to the new communication systems of the ECMWF and the KNMI
- Very good service during a Trans Atlantic Ballon flight

Suggestions

- Can the ECMWF develop an overall catastrophe-program? Remember the overlowded systems during the Tsjernobyl case.

Plans

- In 1987 the KNMI plans to have his own small number cruncher (0.05*Cray) for LAM and WAM models. The development of these products will be done at the ECMWF.
- Next to the development of the several projects will more post-production being run at the computers.


ECMWF
4800
(9600)
Ag
Prod.
BNA
Ag
Dev
=
BACKUP
VAx
VDU's
plotters.

OVERVIEW CIVIL METEOROLOGICAL SERVICES

Ministry of Science	Transport	Agriculture
		• Hydrographical Central Office (Hydrograph.Zentralbüro)
Central Institute of Meteorology and Geodynamics (Zentralanstalt für Meteorologie und Geodynamik)	Federal Office of Civil Aviation (Bundesamt für Zivilluftfahrt)	
	• Meteor. Dept.	
ZA f. M.u.G.	BAZ	-
WMO NMC	NTH/RTH	-
ECMWF YES	NO	-
EDP-EQU. Cyber 171 CDC Sy.18-20M	2 x CDC Sy.17	
SW NOS 2.2 MSOS 2 Fortran 77	MSOS 2	
Appl. MSS X.25/EEP/FTP Frontal Par. Trajectories	MSS	

ORGANISATION of ZAfMuG

Director

2 Vice Directors

Departments:

Synoptic

Climatology

Environment

Geophysics

Technics

EDP

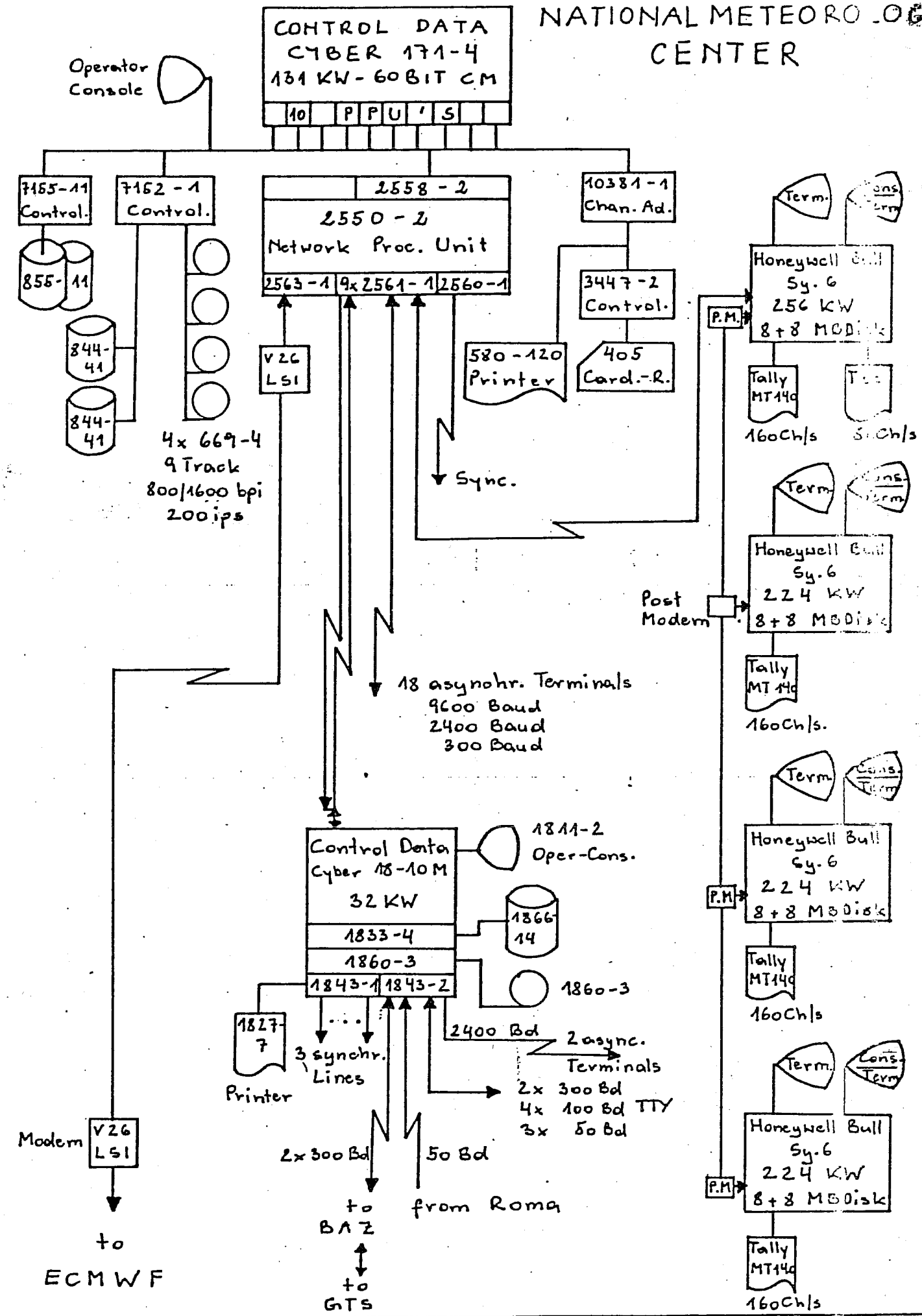
Regional Dept. Innsbruck

Regional Dept. Klagenfurt

Regional Dept. Salzburg

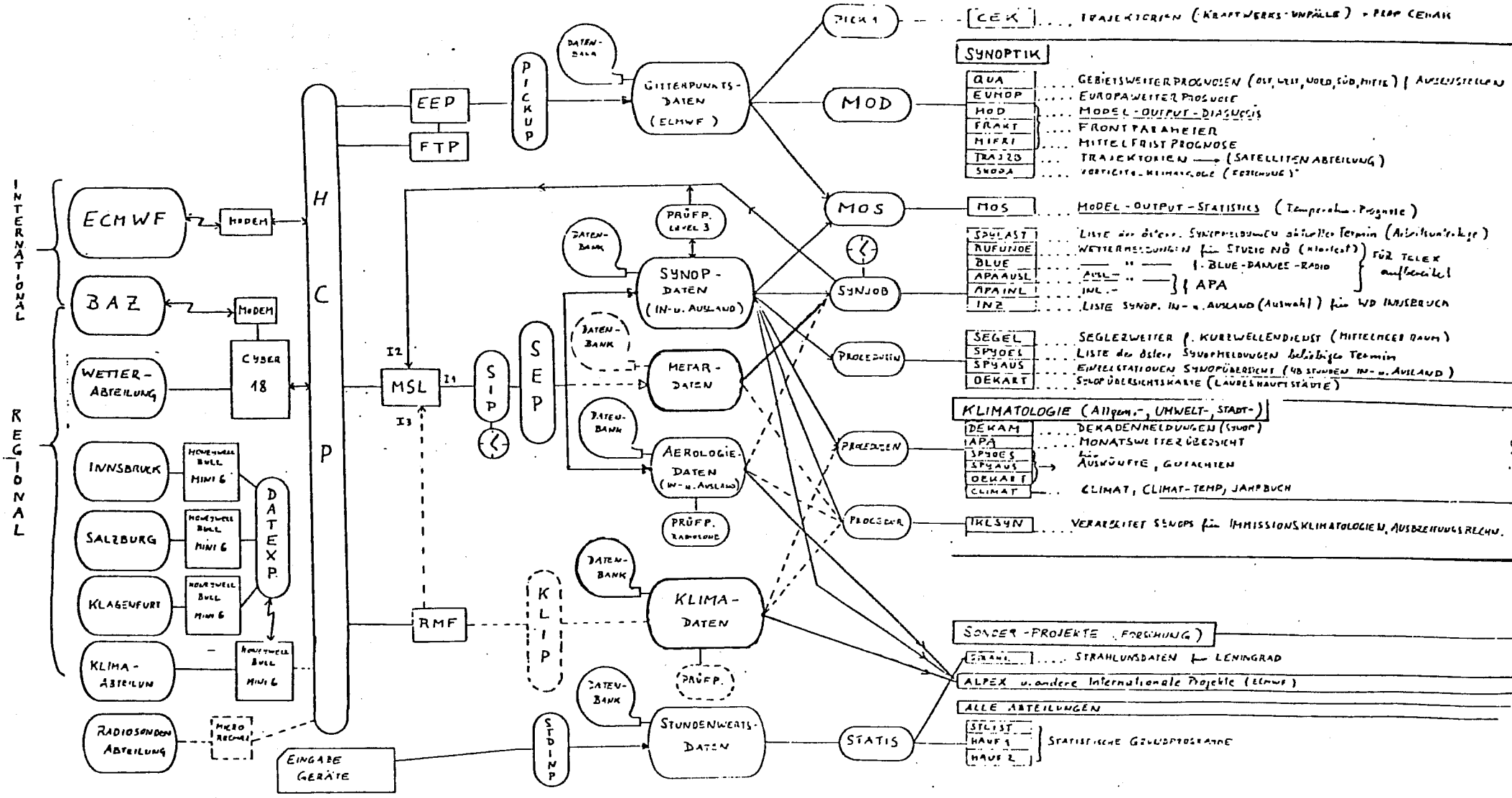
Administration

NATIONAL METEORO .OG CENTER



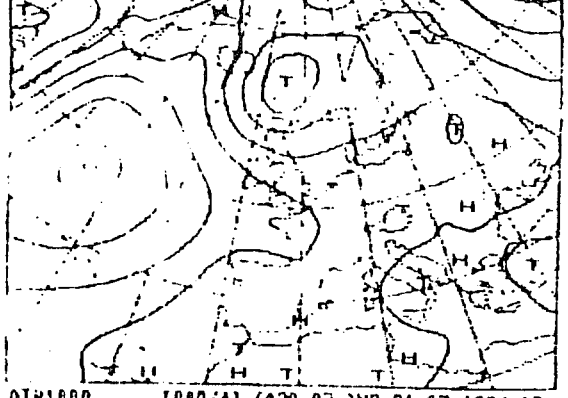
Synoptic		Climatology
international	national	

ÜBERSICHT DATENFLUSS APPLIKAT. / "EUROPÄISCHER WETTERDIENST"

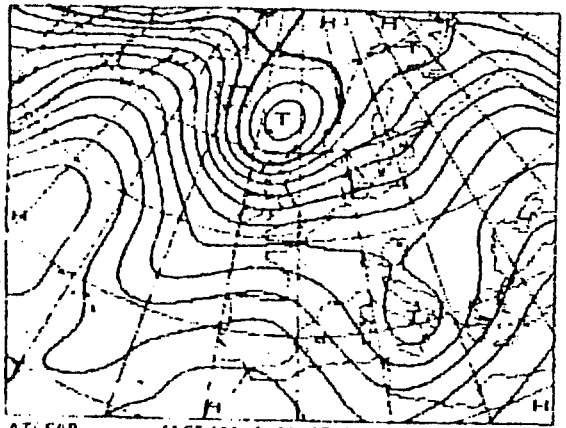


DATEN LIEFERNDE INSTITUTIONEN	HARDWARE	SOFTWARE (auf CYBER 171)	METEOROLOGISCHE ANWENDUNG

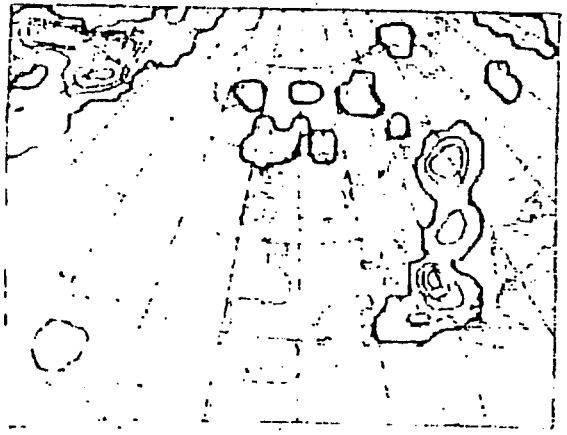
ABKÜRZUNGEN:
BAZ ... Zentralanstalt f. Zivilluftfahrt
BIO ... Batch Input/Output
MSL ... Message Switch Linking system
RMF ... Remote Micro Facility
HCP ... Host Communication Processor
MOS ... Model Output Statistics
SEP ... Synop Extraction Program System
SIP ... Synop Input Program System
EEP ... End to End Protoko
FTP ... File Transfer Protoko
MOD ... Model Output Diagn

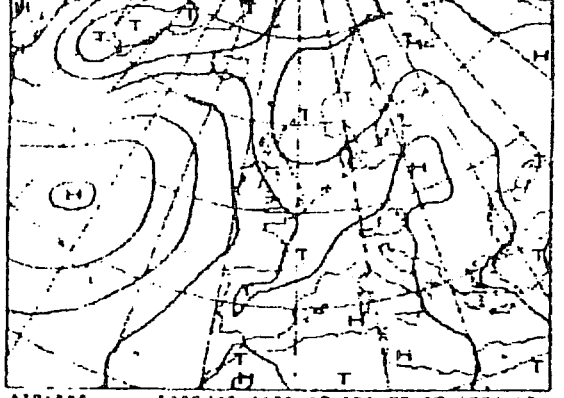


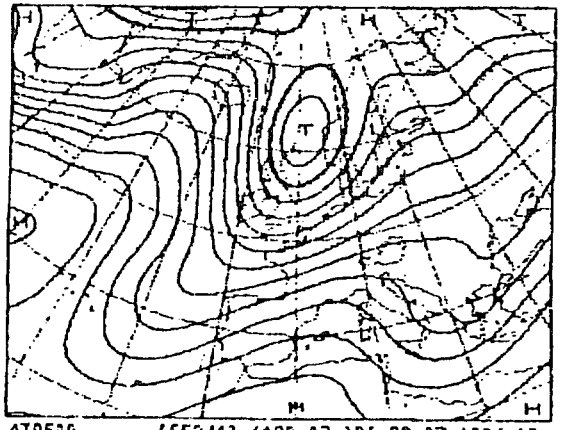
Absolute Topogr. 1000 hPa

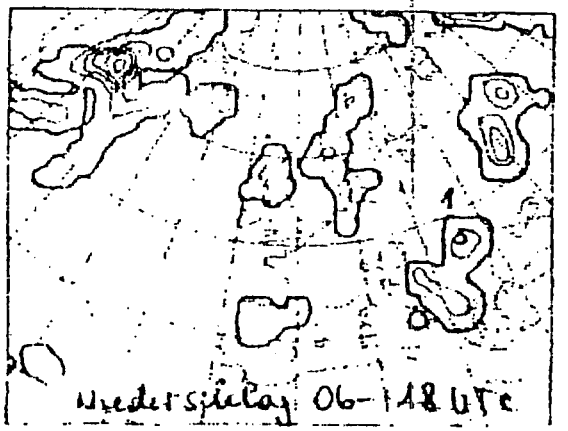


Absolute Topographie 500 hPa

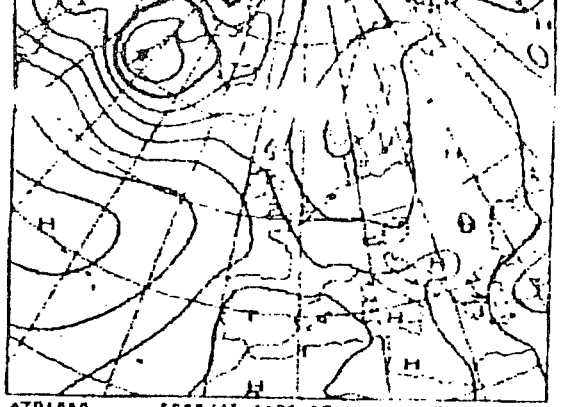


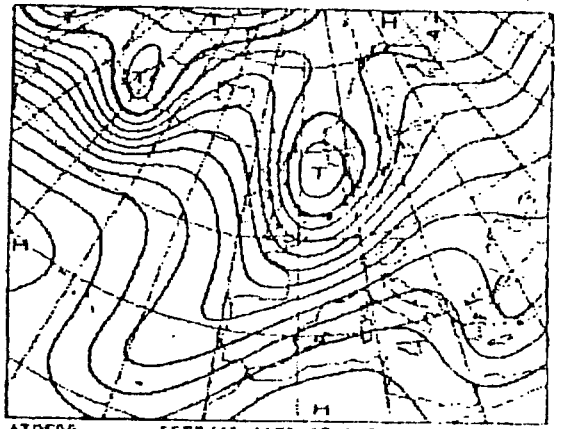


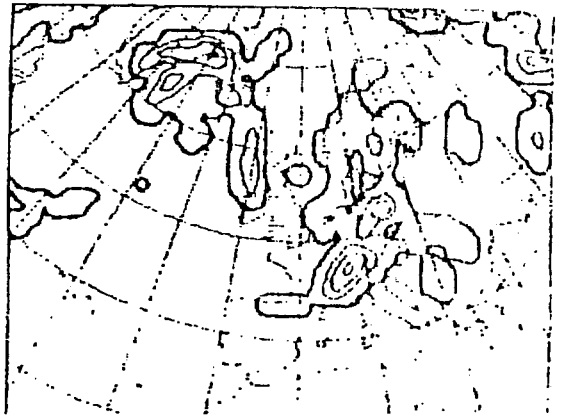




Niederschlag 06-18 UTC







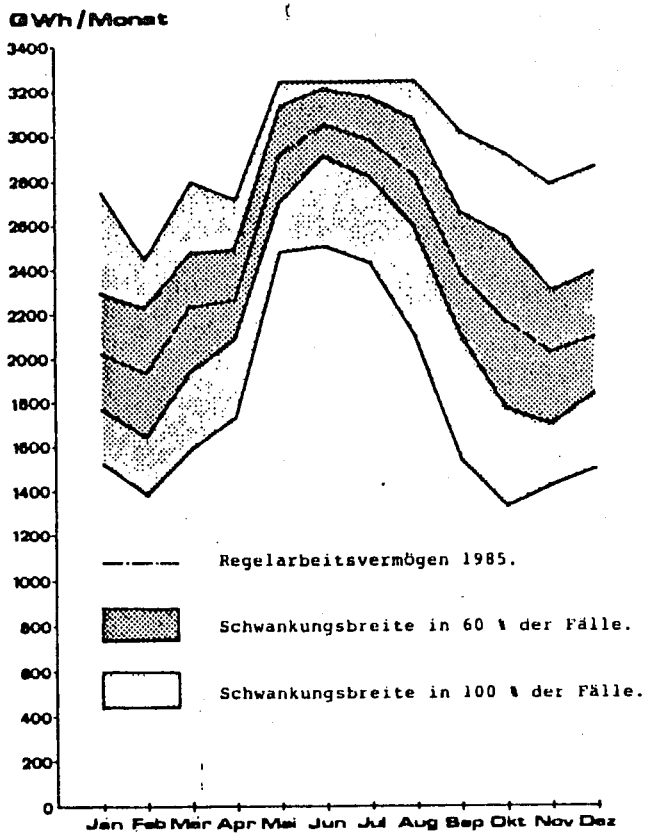


Abb. 4. Schwankungsbreite der Wasserkrafterzeugung in Österreich, öffentliche Elektrizitätsversorgung

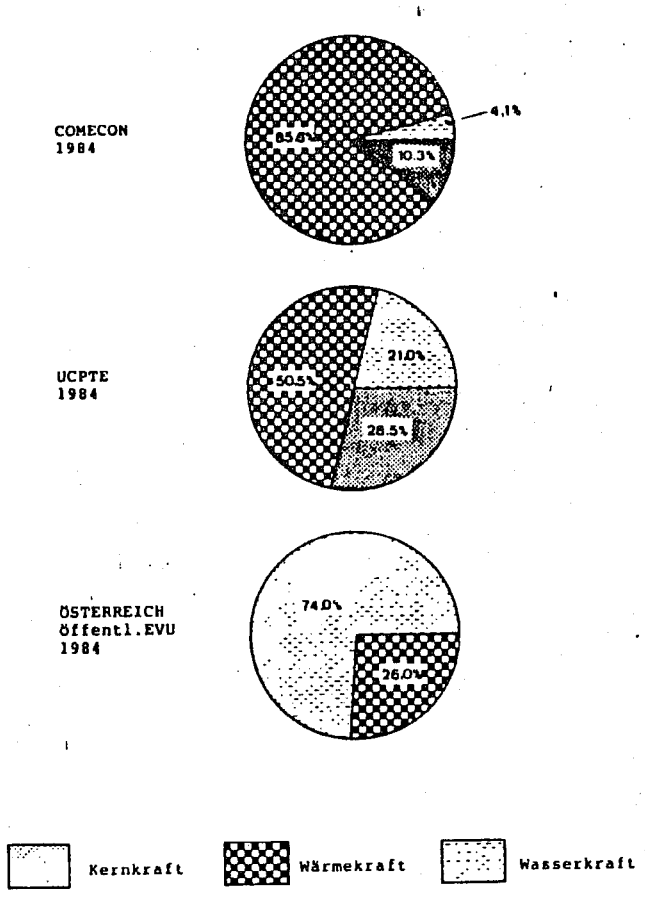
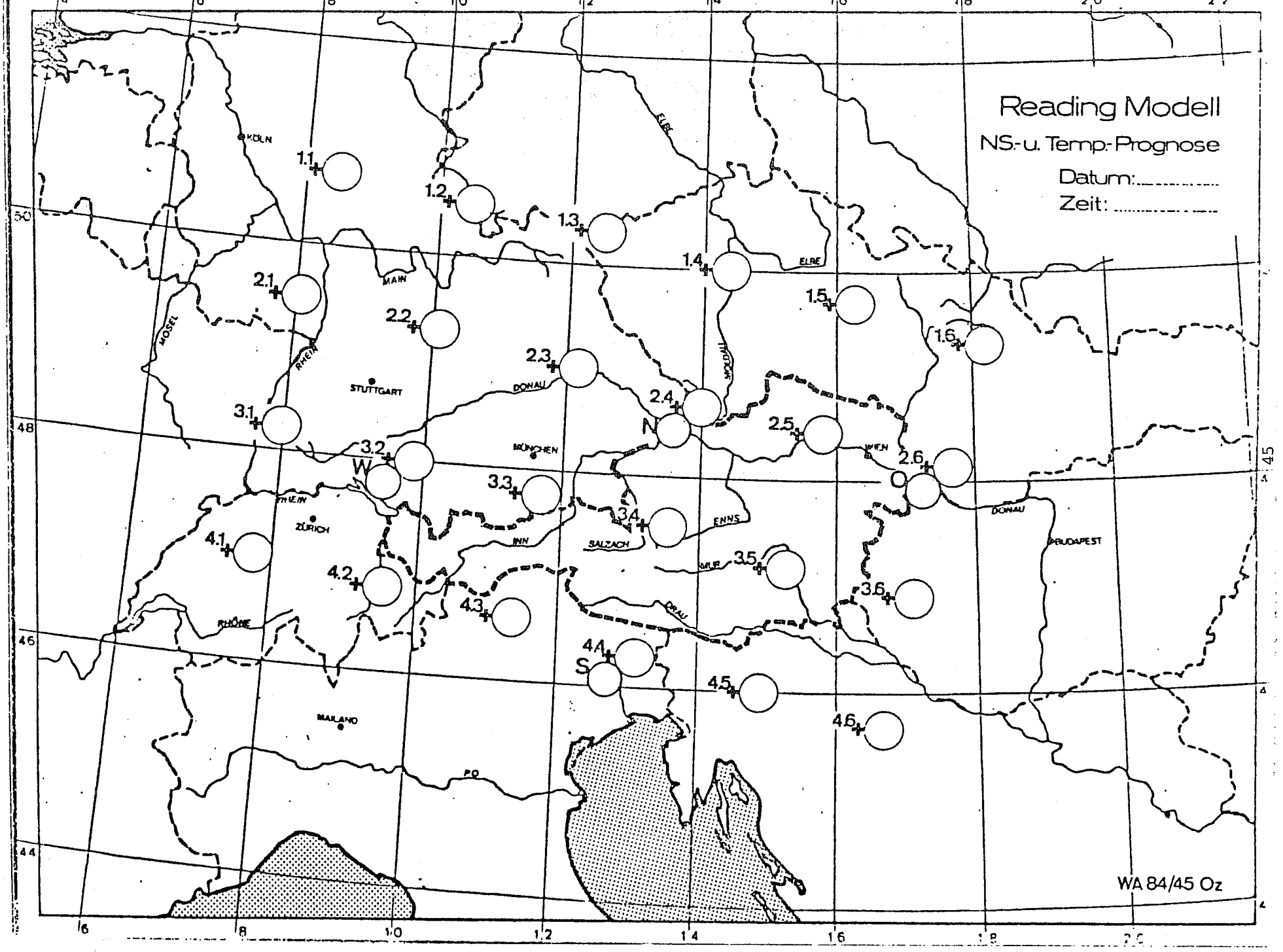
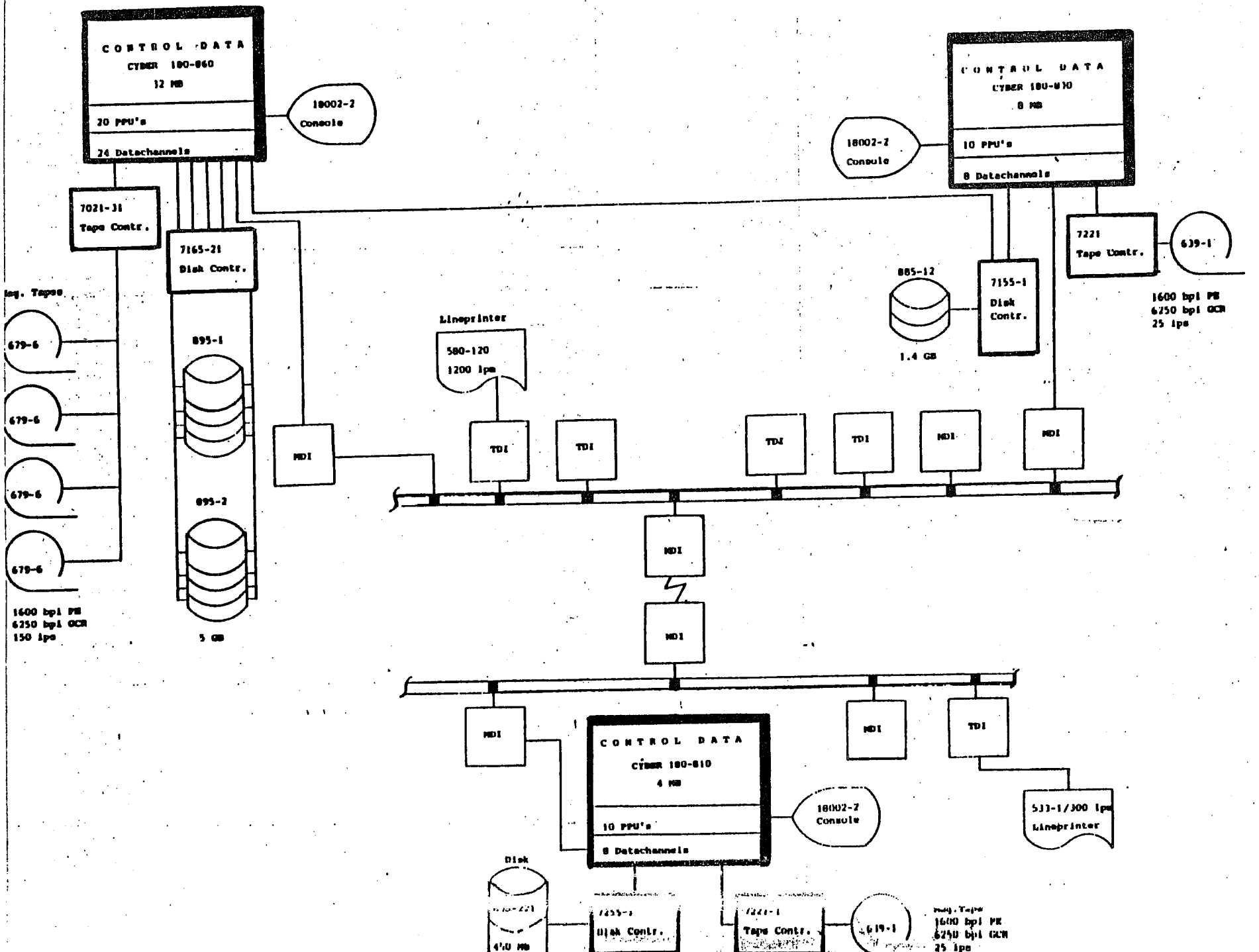


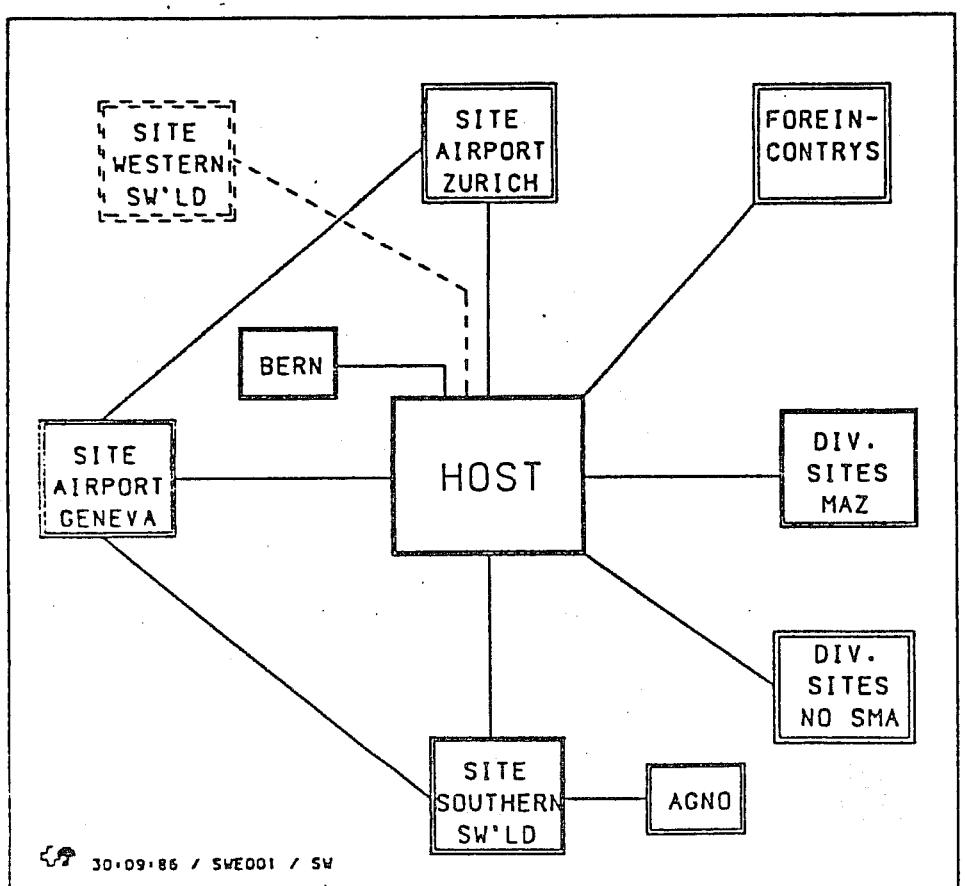
Abb. 5. Aufteilung der Jahreserzeugung auf Kraftwerkstypen im europäischen Vergleich


Reading Modell
NS.-u. Temp.-Prognose
Datum:.....
Zeit: .....
1.1
1.2
1.3
1.4
1.5
1.6
2.1
2.2
2.3
2.4
2.5
2.6
3.1
3.2
3.3
3.4
3.5
3.6
4.1
4.2
4.3
4.4
4.5
4.6
W
N
O
S
KÖLN
STUTTGART
MÜNCHEN
WIEN
ZÜRICH
MAILAND
BUDAPEST
ELBE
MAIN
MOSEL
RHEIN
DONAU
ENNS
INN
SALZACH
DRAU
RHÔNE
PO
50
48
46
44
45
16
18
20
WA 84/45 Oz

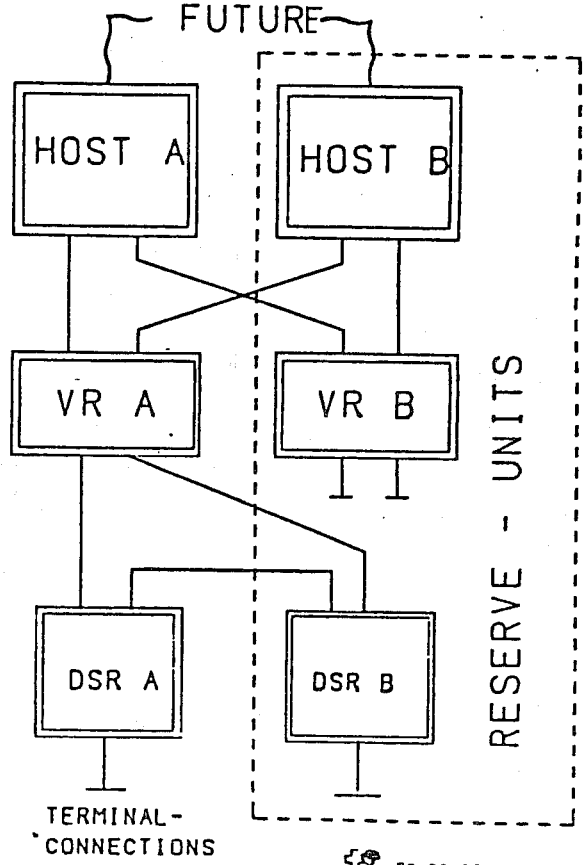

CONTROL DATA
CYBER 180-860
32 MB
20 PPU's
24 Datachannels
18002-2
Console
7021-31
Tape Contr.
7165-21
Disk Contr.
Seq. Tapes
679-6
679-6
679-6
679-6
1600 bpi PE
6250 bpi GCR
150 ips
895-1
895-2
5 GB
MDI
Lineprinter
580-120
1200 lpm
TDI
TDI
CONTROL DATA
CYBER 180-830
8 MB
10 PPU's
8 Datachannels
18002-2
Console
885-12
1.4 GB
7155-1
Disk
Contr.
7221
Tape Contr.
639-1
1600 bpi PE
6250 bpi GCR
25 ips
TDI
TDI
MDI
MDI
MDI
MDI
MDI
MDI
TDI
CONTROL DATA
CYBER 180-810
4 MB
10 PPU's
8 Datachannels
18002-2
Console
533-1/300 lpm
Lineprinter
Disk
Disk Contr.
Tape Contr.
639-1
1600 bpi PE
6250 bpi GCR
25 ips

SWISS METEOROLOGICAL INSTITUT

METEOR -PRINCIPLES



COMMUNICATION - LEVELS



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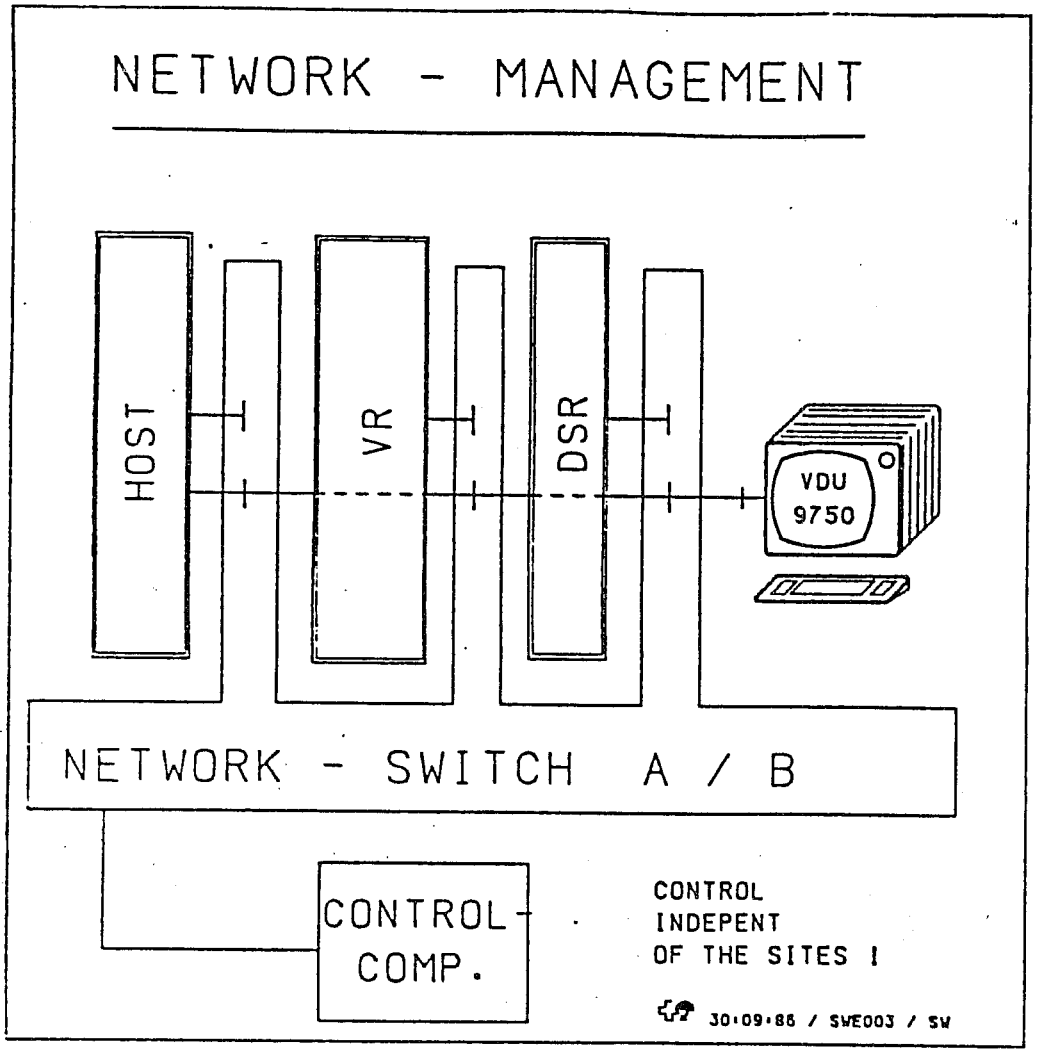

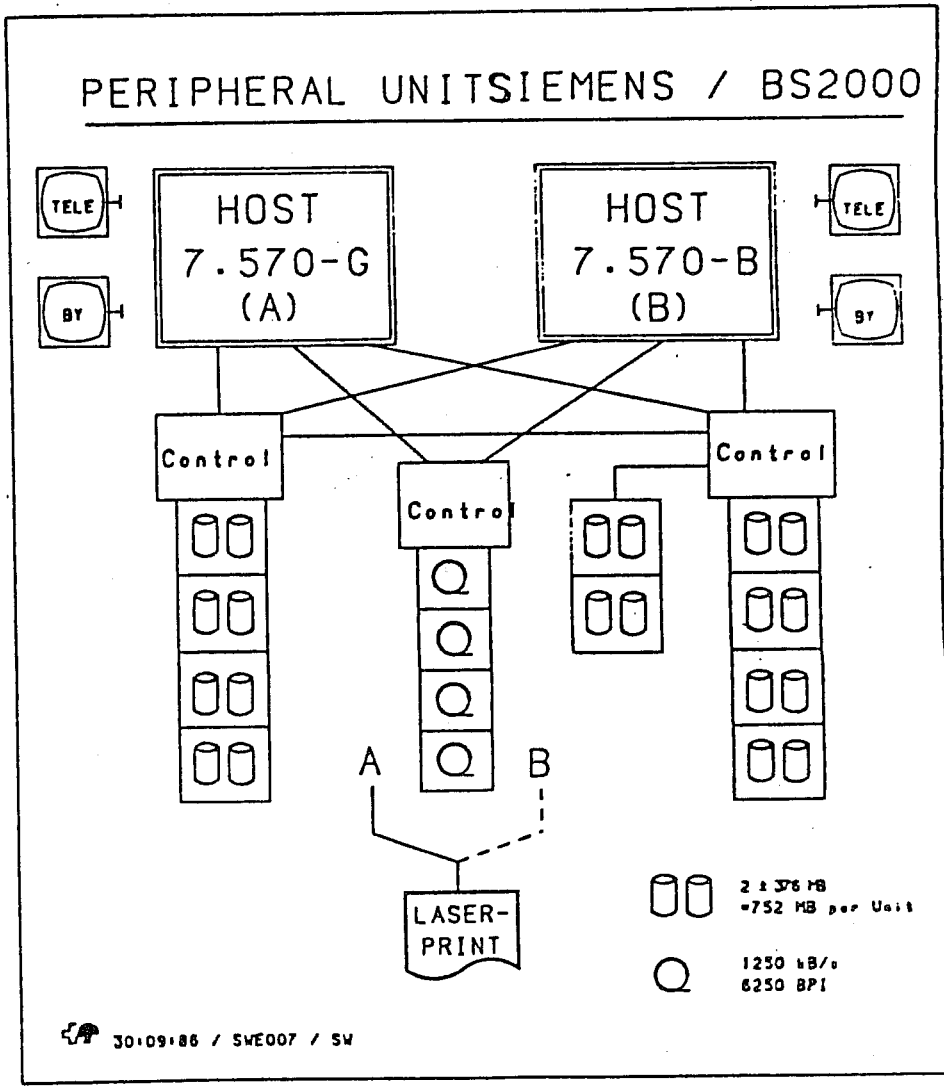

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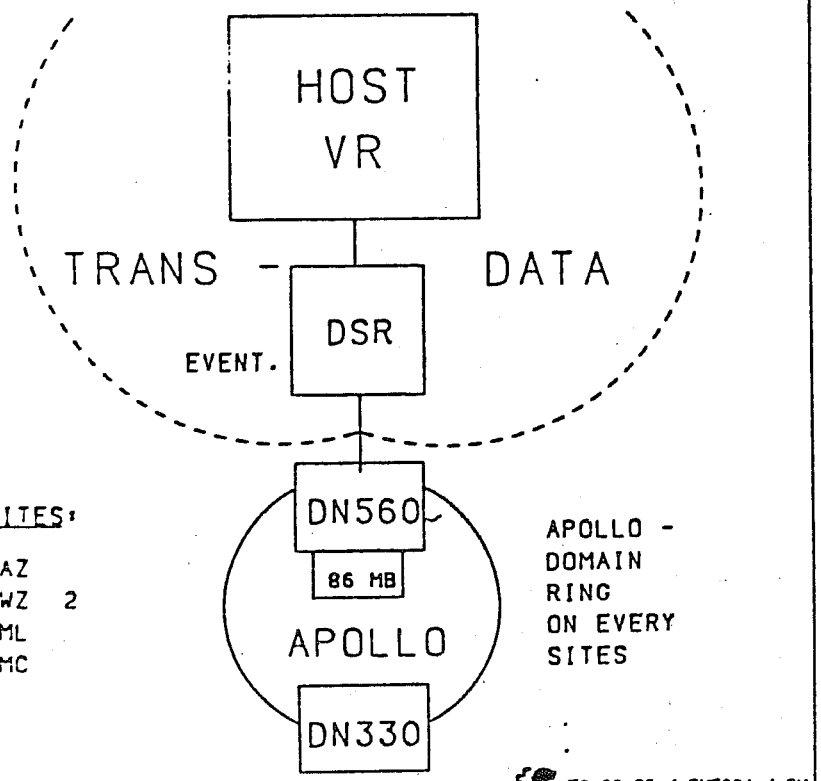
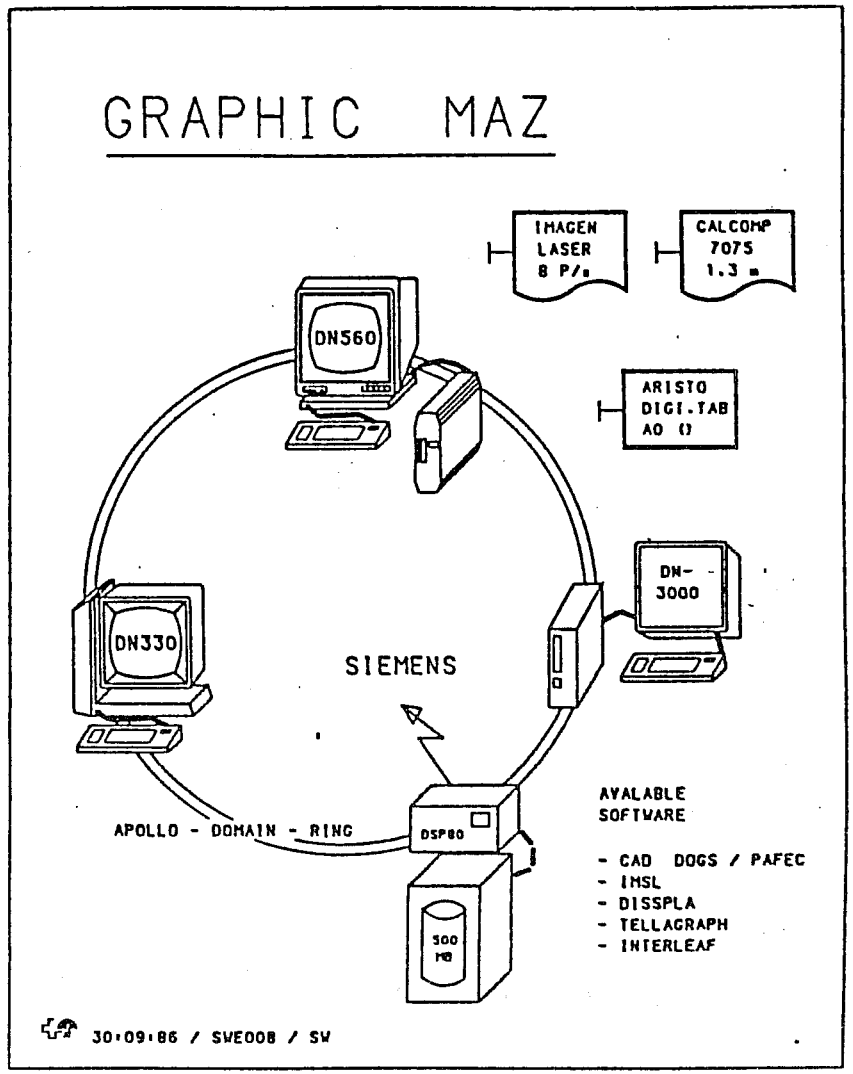
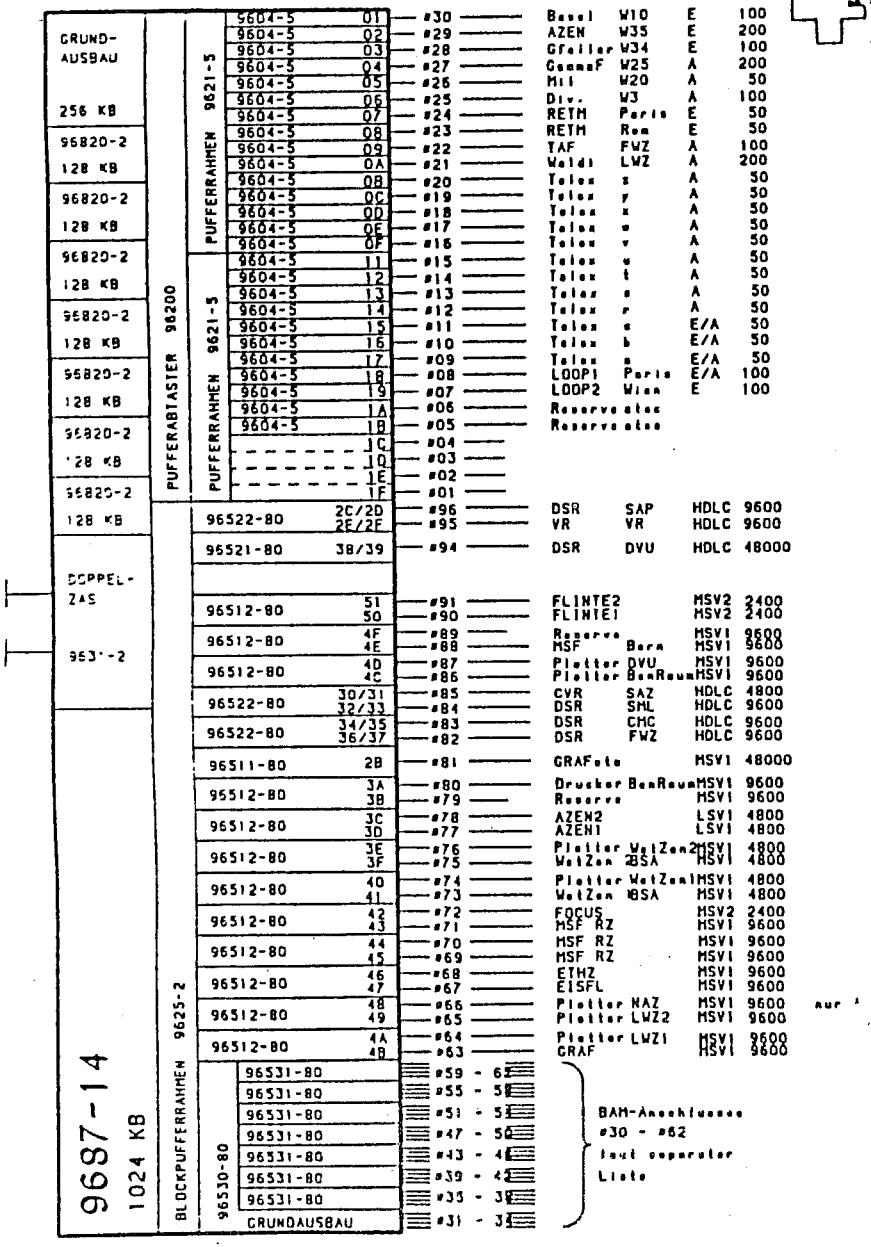
GRAFIK - CONCEPTION



GRAPHIC MAZ



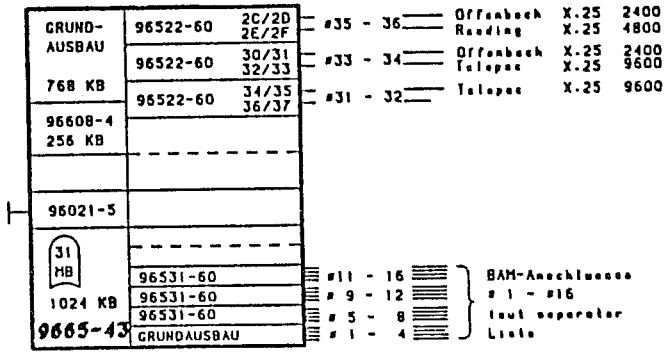
DETAILS of the VR



01.10.86 / SW013 / SV

SWISS METEOROLOGICAL INSTITUT

DETAILS of a DSR

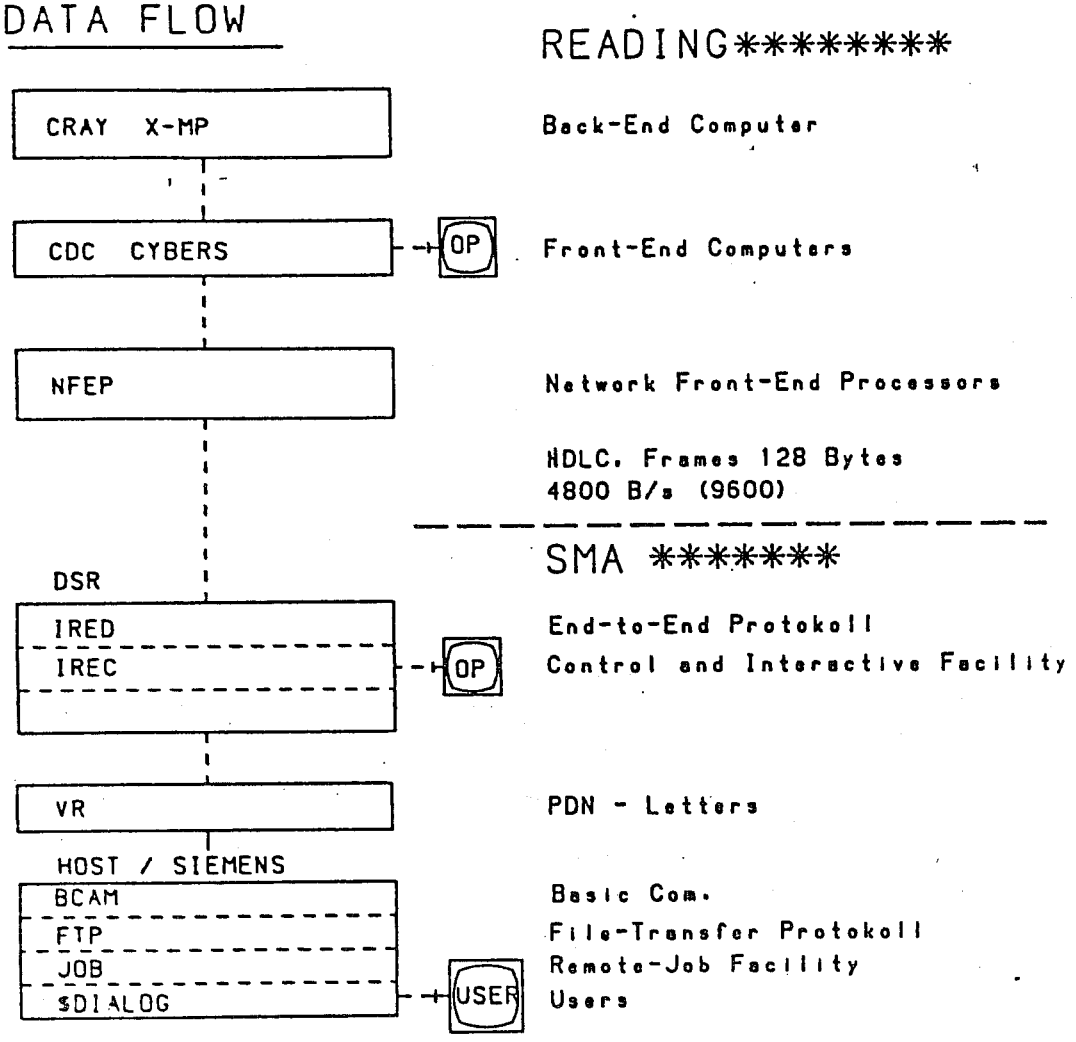


DSR DVU

01.10.86 / SW016 / SV

SWISS METEOROLOGICAL INSTITU

DATA FLOW



Main computer

Cyber 170/730 with dual CPU

- numerical weather prediction
- climatological database

- communication with ECMWF

Communications & graphics computer

2 x Cyber 18/20

- communications with GTS
- operational graphics

Videotex computer

PDP 11/34 (will be replaced by VAX 8200)

- distribution of products to special users (agriculture, police, road weather service, construction industry etc.)

Meteosat receiving system

DEC MicroPDP 11/73

NOAA satellite receiving system

2 x MicroVAX II

Radar computers

VAX 11/730

2 Projects run at ECMWF

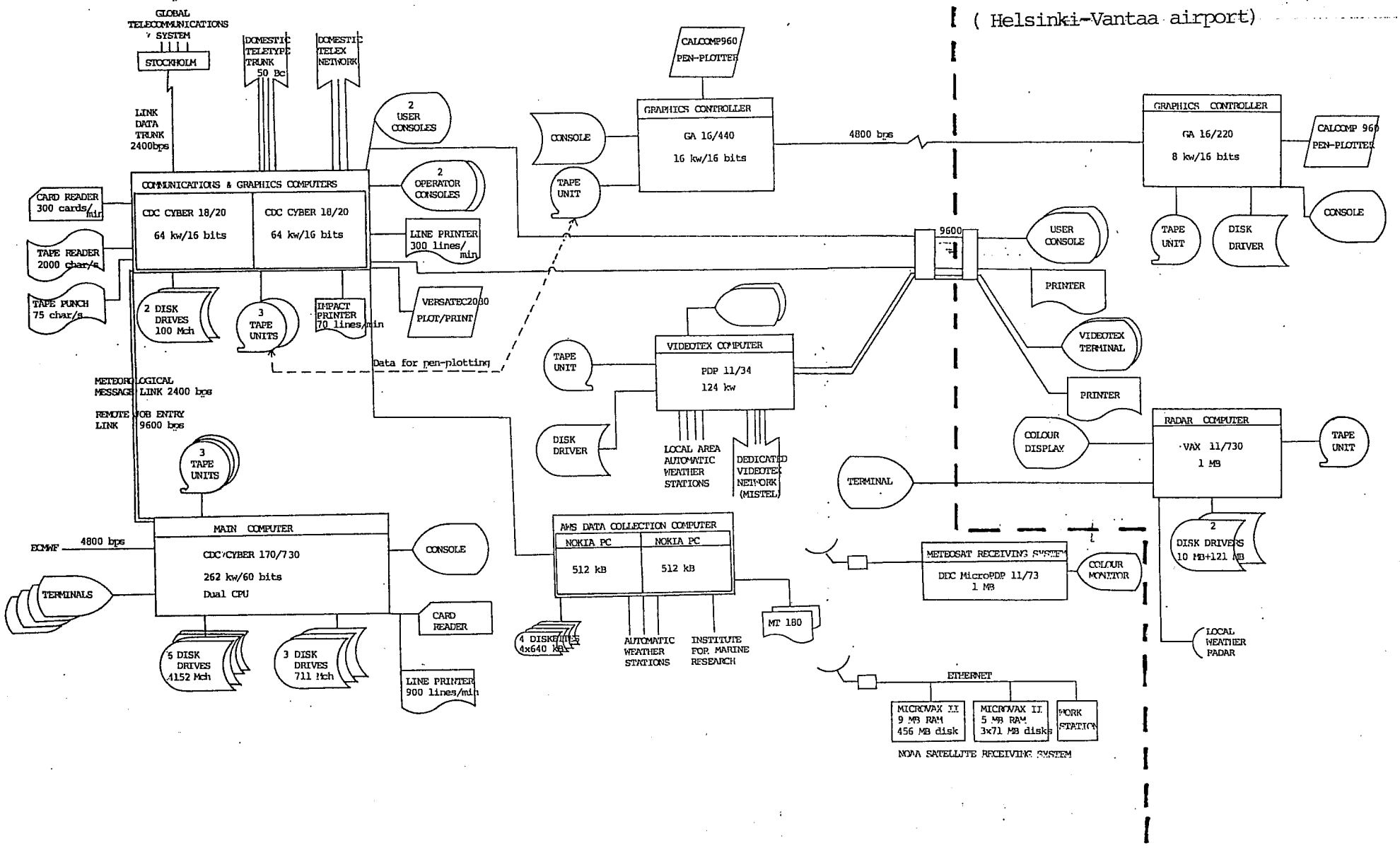
- development of a numerical mesoscale model
- development of a high-resolution limited area model
- research of air control and spread of pollutants
- development of a sea-breeze model
- research of empirical orthogonal functions
- retrieval of meteorological data from ECMWF archives for various purposes

3 Future plans

- telecommunications computer will be replaced 1988
- main computer will be replaced about 1989

Main attention will be given to development of data processing activities at regional weather centres.

1 COMPUTER CONFIGURATION RELATED TO WEATHER SERVICE AT FMI



2.11 Sweden - S. Orrhagen

The SMHI (Swedish Meteorological and Hydrological Institute) computing facilities with relation to ECMWF

Present computer configuration

SMHI has acquired a new computer system to replace the very old Sperry 1100/22 that had been in use since the very late seventies. The new system is a powerful and flexible system which is meant to meet our requirements for the foreseeable future, say eight years.

The system is delivered by Digital Equipment Co. and consists of two VAX 8600, one VAX 750 and a microvax II. For further details see the computer configuration diagram.

The DEC equipment was installed during the spring/summer and the power of the Sperry system was switched off late September only three weeks later than originally planned. One VAX 8600 is meant to be used as the main computer for the analysis and the forecast suite. The other to cover various needs from different users and two major projects, one being the satellite data processing system (PROSAT) the other the project of a pilot station for the future weather service in Sweden (PROMIS).

The VAX 750 is the local weather radar processor and supports reception, processing and display of radar imagery. Also it has a DECNET link to the newly installed weather radar system at Arlanda airport outside Stockholm.

As far as the communication with ECMWF is concerned it will be handled by the microvax and the software will be the NTS supported by PSI (a Digital product). See diagram.

Projects run at ECMWF

NORDIC HIRLAM

Nordic HIRLAM (HIgh Resolution Limited Area Model) is a joint Nordic (Denmark-Finland-Iceland-Norway-Sweden) development project , aiming at an analysis-forecast system with a resolution of the order 30-50km. The system is intended to form the basis for operational short-range numerical forecasting in the Nordic countries in the beginning of the 1990s. Through a special agreement, the Netherlands is an associated participant in the development work.

The project requires large computer facilities and the CRAY X-MP/48 will be used for much of the development. At the time of writing (1.10.86), an existing analysis- initialisation-forecast system, presently operational in lower resolutions at DMI and SMHI, has been installed on the CRAY in a version with 9 levels and a horizontal resolution of 0.5*0.5 degrees in a transformed lat-long grid. Interfaces to ECMWF GETDATA facilities make it possible to use ECMWF operational and FGGE data as lateral boundary forcing, and as observational database. An archive system has been designed and implemented, and a graphics package allows us to plot (using DISSPLA) maps locally at the Centre. Remaining work before the system is fully usable as a remote batch (from Denmark/Finland/Sweden) test-bench, is a de-bugging of the semi-implicit part of model time integration, and the finishing of a file transfer system using GRIB coded data for display and evaluation on local computers.

We expect to use the X-MP for a major part of our high resolution assimilation and forecasting experimentation, since our local computer resources are insufficient for these purposes. Allocations of computer time for 1986 will not be fully used, due to a heavy workload for a small group of people; however, we expect to be quite busy on the CRAY for the rest of 1986. In 1987 we expect to need about the same amount of CRAY resources as those allocated for 1986. Our demand for Cyber time will probably be reduced.

The very small allocation of permanent disk space, and the impossibility to use so-called 'pool-tapes' for local archiving of results at the Centre is a severe limitation. Until external Member States batch users can archive their own data, in their own (GRIB) format on the MARS, the Centre's decision not to allocate pool-tapes to these users is unfortunate. We realise that limitations, even severe limitations, are necessary, but work with a high resolution model is very difficult when you cannot keep more than one or two model datasets permanently at the Centre.

Project for Aerodynamic and Air Pollution Modelling

In this project different numerical models are used to simulate three-dimensional processes in the atmosphere. This includes air flow around buildings with different shapes. Such studies are of great importance in building climatology, Other application concerns transport and deposition or air pollution studies.

Other Projects

PHOENICS MODEL:

This model is used to study general hydrodynamical problems. It is preferably used to look upon flows on a smaller scale. For instance circulations around and inside buildings.

MESOSCALE MODEL (Pielkes model):

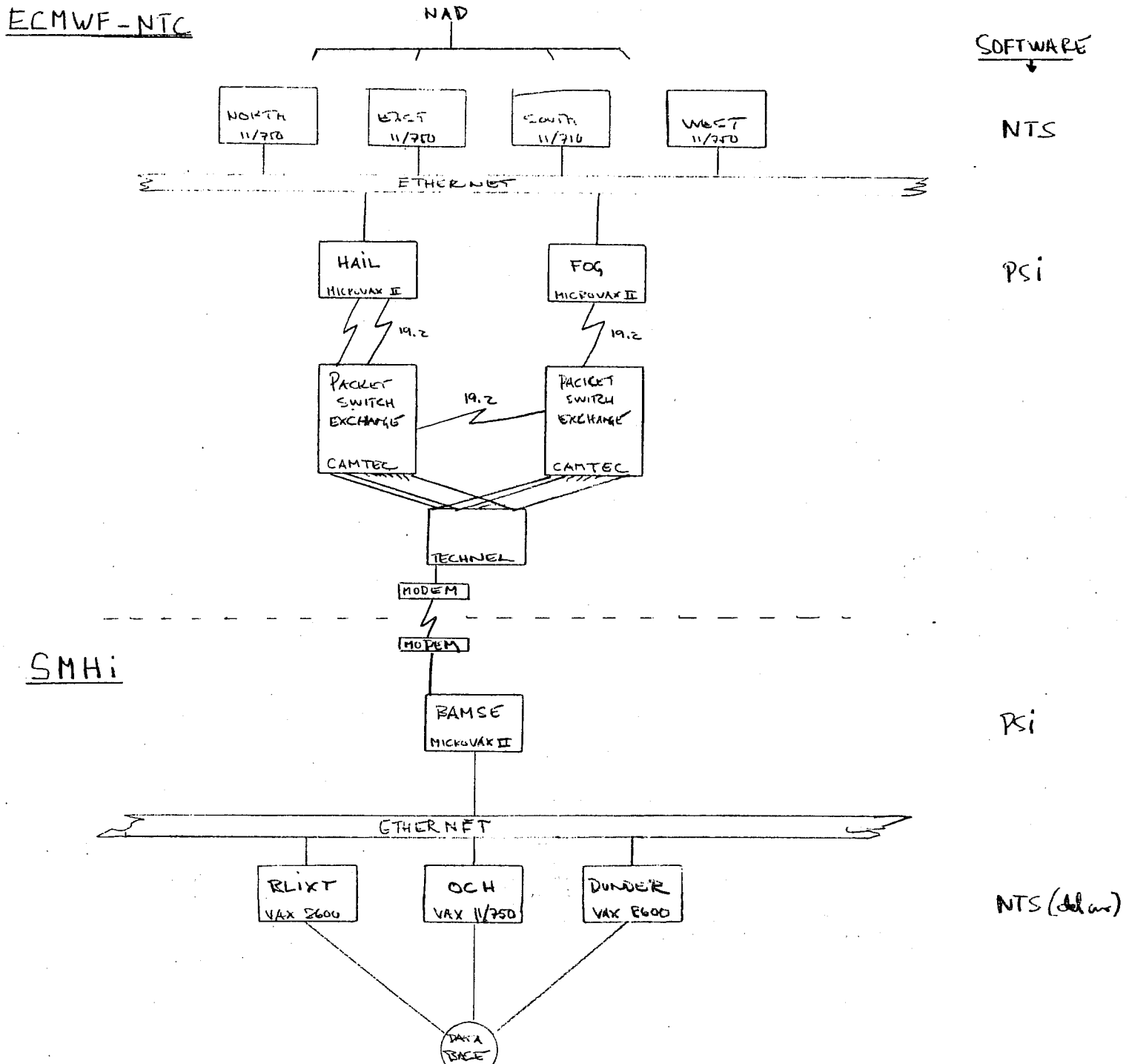
We use this sophisticated model for different mesoscale applications:

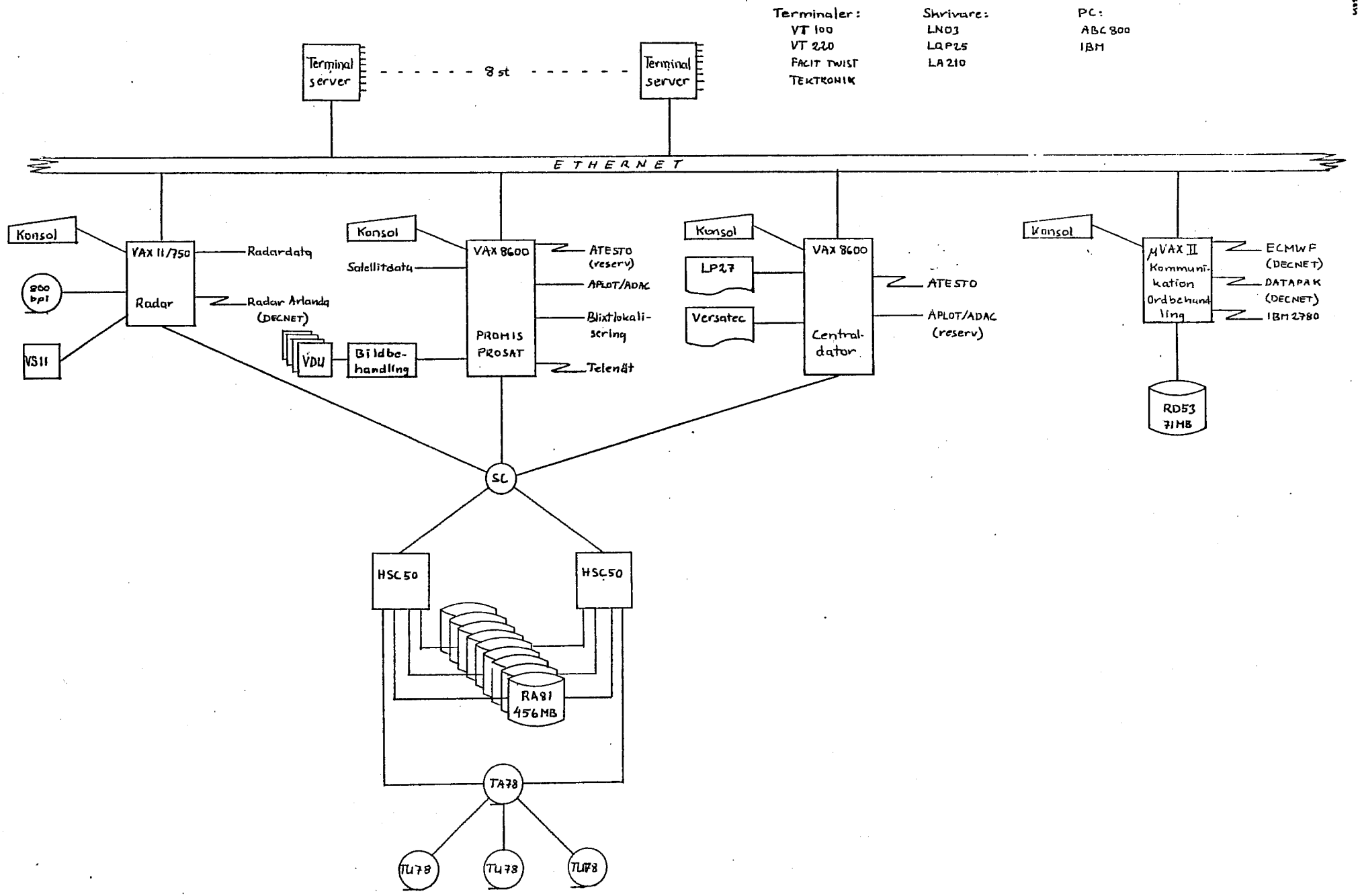
i) sea breeze simulations
ii) wind energy simulations
iii) case studies

Modelling horizontal spread at the bottom boundary layer.

The forecasting section of SMHI has used the ECMWF computers for some data extraction and plan to use some resources also for statistical interpretation, using the ECMWF MOS-package (Cyber CDC only).

When the link is up we intend to extract 00z test output from MARS for evaluation purposes.


ECMWF - NTC
NAD
SOFTWARE
NORTH 11/750
EAST 11/750
SOUTH 11/750
WEST 11/750
NTS
ETHERNET
HAIL MICROVAX II
FOG MICROVAX II
Psi
19.2
19.2
PACKET SWITCH EXCHANGE CAMTEC
19.2
PACKET SWITCH EXCHANGE CAMTEC
TECHNEL
MODEM
MODEM
SMHi
RAMSE MICROVAX II
Psi
ETHERNET
RLIXT VAX 8600
OCH VAX 11/750
DUNDER VAX 8600
NTS (delvis)
DATA BASE



SMHI:s VAX-SYSTEM

SMHI/Td
Ake Larsson

1986-04-15

UK METEOROLOGICAL OFFICE

Computing representative: A. Dickinson

1. Computer equipment and RJE connection.

The main components of our central computer installation are shown in Figure 1. The heart of the system is a CDC Cyber 205 supercomputer purchased in 1981. When using 32-bit precision, this system has a maximum performance of 400 million floating point operations per second. All operational work and major research projects are run on this system. Two general purpose dual processor IBM 3081's host the Cyber 205, supporting an interactive terminal system and links to remotely sited minicomputers, as well as line printers, plotters, film and fiche units. Most of the work on the IBM computers consists of post processing model runs, graphical applications and accessing meteorological databases.

The telecommunications computer system is shown in Figure 2. The link to ECMWF goes through the TPU (telecommunications processing unit) which consists of three Ferranti Argus 700G minicomputers. Two of these are on line, whilst the third acts as backup. All protocol conversion is carried out by these computers. Along with Offenbach, the UK link provides the connection between ECMWF and the GTS.

For the last two years the link between the UK and ECMWF has supported an RJE facility. Prior to 1984 all our programming was done on site at the Centre. Jobs may now be submitted from the terminal system connected to the IBM mainframes and output directed to either hardcopy or disk file. The link software only supports character transfer, but we are able to transfer enough formatted data to support a reasonable amount of graphical output on 35mm film.

Looking to the future, we are currently awaiting financial approval for replacement of the Cyber 205 by early 1988. This system is now saturated and new requirements such as an operational mesoscale forecasting system suggest that even in the short term we require an increase of up to 5 times the throughput of the Cyber 205.

2. Projects, experience and plans.

One of the main obstacles we encounter in fully utilising the ECMWF computer system is that most of the code developed on our Cyber 205 is written using non-standard extensions to FORTRAN. It is therefore difficult for projects to migrate from one system to the other The projects that we do run on the Cray are either ones which have historically been assigned to the system or new projects which do not require the use of existing Met Office resources. A list of our current projects is given in Table 1. It is envisaged that these projects will continue over the next few years.

The introduction of the NTC has unfortunately led to problems with the reliability of the ECMWF/UK link, which were not identified during testing. The problems seem to affect the transmission of files from ECMWF to the UK, so that the main sufferers have been UK users

with lost or corrupted output. During one week in September there was little or no output percolating back from the Centre. The link is now being run at a reduced speed which has led to a more stable system, although the mean time between link failures is approximately 2 hours. The cause of the problem is still being investigated.

Several of our projects make extensive use of ECMWF's meteorological archives. It has been noticeable that access via the FINDATA utility has slowed down considerably during the year. However, we have recently switched some of our work to use MARS. Access via this system is much faster as can be illustrated by the following example: accessing 30 consecutive daily analyses using FINDATA took almost one week to complete, while the same job via MARS was completed in one afternoon.

UK PROJECTS

1. FORECASTING RESEARCH 38%
   - Development of new integration schemes

2. LONG RANGE FORECASTING 27%
   - Using a global model to look at prediction on the timescale of a month

3. STRATOSPHERIC MODELLING 26%
   - Modelling the dynamics of the midddle and upper atmosphere

4. DIAGNOSTIC STUDIES 7%
   - Accessing ECMWF's meteorological archives for diagnostic purposes

Table 1

UK METEOROLOGICAL OFFICE

CENTRAL COMPUTER INSTALLATION

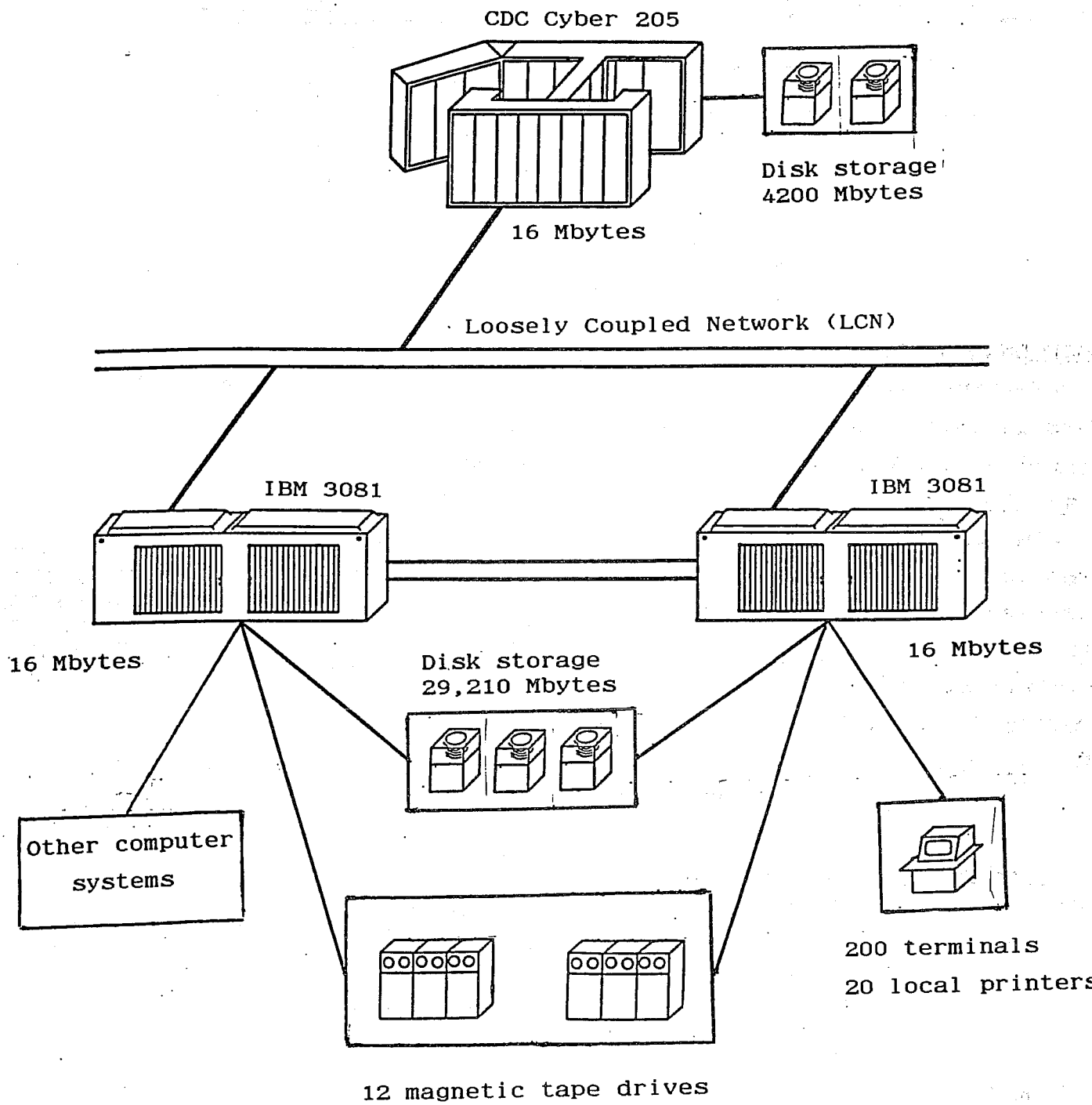
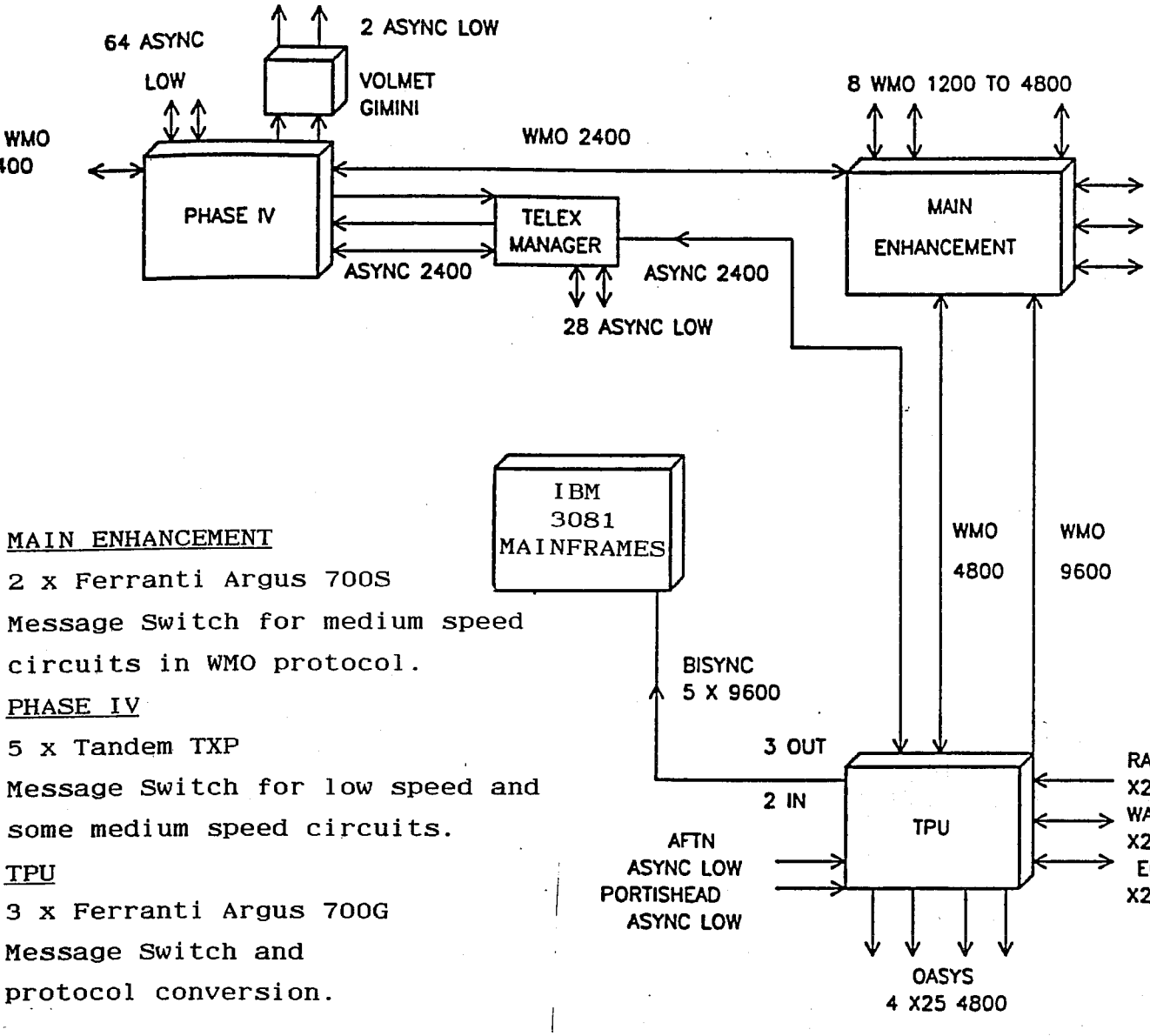


Figure 1

UK METEOROLOGICAL OFFICE

TELECOMMUNICATIONS COMPUTER SYSTEM



MAIN ENHANCEMENT

2 x Ferranti Argus 700S

Message Switch for medium speed circuits in WMO protocol.

PHASE IV

5 x Tandem TXP

Message Switch for low speed and some medium speed circuits.

TPU

3 x Ferranti Argus 700G

Message Switch and protocol conversion.

OTE :

INDICATES A FULL DEDICATED BACKUP SYSTEM.
THE MAIN ENHANCEMENT HAS AUTOMATIC SWITCHOVER TO A HOT STANDBY.
PHASE IV HAS FULLY AUTOMATIC TASK TRANSFER FACILITIES IN MULTIPROCESSOR ENVIRONMENT.
OTHER SYSTEMS HAVE MANUALLY SWITCHED OR PATCHED BACKUP

: OASYS LINES TO LAP, HQSTC,LWC & NORTHWOOD

Figure 2

SESSION 3: User Support Service - Andrew Lea

Out of a total of 7 staff in the section two are currently on secondment to other areas within the Computer Division, thus there are 5 staff on current User Support activities.

Allocations and accounts

The enhanced user registration procedure adopted for 1986 will continue for the foreseeable future. For 1987 Member States will be requested to register for the VAX interactive service in addition to the normal Cray and Cyber registrations.

Because we account an exact number (52) of weeks per year, the beginning of the accounting year slowly creeps forward year by year into December. To correct this, 1987 will be a 53 week year for accounting purposes.

One problem seen with the switch to the NTC is that some Member State implementations of our protocols differentiate between the job name and file name of a RJE job. This has the effect that it can be difficult identifying the returning job, or that sometimes two returning jobs have the same name. Spain is suffering the first problem, France the latter one. No other Member States present reported problems of this nature.

S. Senesi (France): Will Member States be charged for VAX usage?

- The service offered to Member States on the NTC VAXes will be an interactive job preparation, batch submission to the mainframes, and output retrieval. There will be no batch or interactive execution of jobs allowed on the VAXes. Thus at this stage there are no plans to allocate resources and charge usage as is done on the Cyber and Cray services.

R. Hoogendoorn (Netherlands): Whenever the permanent file (PF) allocation on the Cyber is exceeded is it not possible to automatically warn, and then guillotine further usage, until the usage is below allocation again?

- NOS/BE is an old system and does not contain any such controls (as an aside both VAX VMS and Cyber NOS/VE do). It would take a lot of effort to build such controls in. With the move of files to CFS in the long term it is hoped that PF space control will not be necessary eventually. Otherwise the present manual warning/control system is the best we can do.

G. Siegwart (Switzerland): Why is Switzerland restricted to beginning its user identifiers with the two characters CH?

S. Pasquini (Italy): How many section identifiers are allowed?

- All groups of users of the Centre's systems are asked to register a two character (section) identifier with User Support. These two characters can be any combination (provided no one else is using it), they need not be related to the country (e.g. CH was Switzerlands initial choice,it could have been any other combination). Within a Member State several section identifiers can be used, for example France uses about 6 related to various internal divisions within their user community. The reason for registration, and then subsequent use in the job name, is so that any job in the system that has a problem (or is causing problems) can be quickly identified as to its place of origin, and then to the individual user. This system has worked very well up to now. If anyone wishes to register new section identifiers then contact User Support in the first instance.

Advising & tuition

COMFILE is still the most popular form of communication, and Representatives were reminded that when anyone sends a technical query it helps a great deal this end if the maximum amount of information about the failing job(s) can be sent by COMFILE before any telephone contact is made. As a minimum always quote job name plus time/date of execution and on which machine.

Now that the NTC is operational the opportunity exists to communicate via VAX MAIL. The problems are that

(i) often the RJE console in the Member State is not accessible to the general user;

(ii) some Member States will not be using the VAX interactive service for sometime to come;

(iii) the user has to logon to retrieve his mail, whereas COMFILE sends a printed message which automatically appears in the user pigeon hole.

Thus the general conclusion was that COMFILE will still be heavily used for some time to come, with only a slow switch over to VAX MAIL. If COMFILE is unavailable e.g. because the Cyber service is down, then the representatives felt the best form of immediate communication would be telex rather than VAX MAIL for the moment.

P. Henning (Denmark): When will Member States be able to have multiple terminal access to the VAX interactive service?

- Not until the formal acceptance period for the NTC has been completed, currently that would be February 1987. However, it does also require some work by the Member State to change their link software to handle such multiple links. This could delay it further for specific Member States.

The Centre proposes to offer one set of computer training courses per year as at present. The only change to come is the replacement of Cyber interactive access with VAX interactive access. It is not clear whether this change should be made in spring 1987 when only one or two Member States may be using the VAX interactively or perhaps wait until 1988. After some discussion it was suggested that for 1987 (at least) the Centre would offer two parallel sessions for the interactive service tuition, one for those who wish to use the VAX service, the other for Cyber access as in the past. This parallel session would be approximately half a day.

Contact Points

The system of having Contact Points within User Support seems to be working very well. The load on these Contacts is increasing steadily as remote users become more active. It seems to be valuable both for the Centre and the users that the Contact Points meet their corresponding users on occasions, however, from the Centre's point of view there is always difficulty in funding such visits on a regular basis.

One problem Member States have always had is to know what the status of the Centre's computers is at any one time, e.g. short term schedule, problems of the moment, etc. The NTC now offers a chance to alleviate this problem and the Centre therefore proposes to implement the following scheme. A VAX file will be created holding such information as

- schedule for today and tomorrow;
- any message of the moment;
- events of the past 24 hours;
- possibly some dissemination timing information.

This file will be updated daily and once every 24 hours a copy would be sent to each Member State to be printed. It would also go into the VAX MAIL box of each Member State so that copies can be taken should the original be missed for any reason. This scheme was widely welcomed by all Representatives.

P. Henning (Denmark): Can information be added on dissemination delays?

- Yes, if it is so wished. However, this scheme would not replace the telexes now sent overnight whenever a delay occurs. Telexes would still be sent as before.

S. Orrhagen (Sweden): Can the reasons for such delays also be added?

- This request will be passed on to those who will look after the updating of the file. The contents of that file have not been decided fully, the Centre first of all wants to get the mechanism working.

R. Hoogendoorn (Netherlands): Can the printed output be identified by a special heading?

G. Wihl (Austria): In Austria the file must be stored rather than printed automatically, as overnight the printer is not switched on.

- Both these points will be passed on to the implementors.

Documentation

This is one area where reduced manpower within User Support has meant that updating and maintenance of the bulletin set has not been kept up to date sufficiently. User Support apologise for this.

Currently work is proceeding on 6 bulletins:

METGRAM Users Guide
FORMAL Users Guide
Introduction to VAX usage
CUECHART Users Guide
TELL-A-GRAF Users Guide
Useful Cyber utilities.

It is hoped to issue them over the next 6 months.

One Member State (France) has asked if it is possible to have the bulletins in computer held form so that they can be printed remotely. It is possible to set up such a system, initially on the Cybers because Member States cannot, as yet, print off a file held on the NTC. Most present thought this was a good start, but stressed they would eventually like to see them held on the VAX because from there they will be able to both print and access them interactively. It was noted that problems may arise in some Member States where it might not be possible to print an upper/lower case ASCII file.

G. Siegwart (Switzerland): Is it possible to have the manufacturers' manuals on-line as well?

- Neither Cray nor CDC (at least for NOS/BE) provide manuals in machine held form so there is nothing we can do there. For the VAX system there is an extensive HELP facility that goes a long way towards providing the equivalent of on-line manuals.

S. Orrhagen (Sweden): Could news sheets, once published, be held in VAX MAIL, so that a Member State that misses the initial distribution can get a copy later?

- This is a good idea that we shall investigate.

S. Pasquini (Italy): It is difficult sometimes to know that the Centre is holding a training course, as the necessary information is sent only to Directors and TAC Representatives. Others in the organisation only get to know much later when they read about it in the ECMWF Newsletter.

- It should be possible for the Centre to send a copy to the Computing Representatives as well.

A discussion at this point revealed that Computing Representatives are often unaware of computer related general correspondence, questionnaires, etc., sent to Member State meteorological services. They asked if it might be possible for the Centre to send copies of all such material (a copy of the covering letter would usually be sufficient) to them so they would be aware in future something had been sent to their senior management.

Libraries

Again the reduced manpower has meant that only bug fixing has taken place recently. ECLIB is virtually frozen as a lot of its functions have been taken over by other libraries, e.g. $SCILIB from Cray.

Within User Support Dimitris Maretis is undertaking a review of the libraries and their contents. To gather the necessary feedback from Member States a questionnaire will probably be issued shortly.

Two specific problems have emerged recently that may affect Member State users. The first is the proposed change of the random I/O package within ECLIB to that provided by Cray. Although the features provided will remain the same the underlying file format will change. France asked that such a change be delayed for 6 months so that their users could phase out use of the existing package before the change takes place. No other users seem to be affected as most use it for temporary files only.

The second problem was the discovery, by a user from Germany, that a file sent down the link that had an odd number of words per record lost the last 4 bits of the last word of each record. A fix has been put in which now restores those missing 4 bits, but now provides an additional 4 extra (unused) bits as well. A temporary patch has been put into ROUTEDF for them. No other Member State reported being affected by this problem.

M. Hortal (Spain): Does the Centre plan to keep ECLIB frozen for the foreseeable future?

- The Centre has no plans for major enhancements. There are one or two items known to be coming from Meteorological Applications Section but that is all.

Visiting the Centre

There has always been a problem at the Centre of a lack of accommodation for visitors who come to use the computer system. There were never any spare offices available in the original plans of the Centre, hence visitors have always had to make do with the User Area, and more recently the classroom. In order that too many visitors do not attempt to come at the same time and so overload the available resources, the Centre has always tried to control the number of such visitors. The previous control schemes have not worked too well, especially when subjected to a lot of local visitors. Thus a new policy is about to be introduced, it will be sent shortly to all Member States by the Director. In outline the new policy will be:

(i) there will be a maximum number of visitors accepted at any one time, a booking scheme will operate to ensure that the maximum is adhered to;

and then by using a series of locks ensure it cannot occur in practice. When one task reaches a point where it needs to know if a certain data element has been set by another task then there exists the need for task to task communication, and task waiting. Sharing data between tasks is achieved via COMMON. Data private to a Task may be put into TASK COMMON. Data in TASK COMMON is available to all subroutines called by a single task but not to other tasks in the system.

Several methods exist for multi-tasking. For example entirely separate functions can run in parallel (functional multi-tasking). Alternatively, a given function can be split (by the user) into a specific number of parts which it is known can be scheduled to execute in parallel (pre-scheduled multi-tasking), the Centre's model is of this form. As always whenever one splits a program into several parallel streams the extra overheads (at least) will mean that the sum of the times of all the parallel streams will exceed that for a single CPU version of the program. However, the big benefit is that elapsed times can be dramatically reduced.

The Centre has multi-tasked its spectral model based initially on a north-south split of the global calculation. For details of this see references 1 & 2. The 4 CPU version of the model has continued this approach, with 2 CPUs working on one north-south pair of lines of latitude, and the other 2 CPUs working on a second pair of lines. The results have been a great reduction in elapsed times per model time step, as shown in Table 2 below. For the future the present scheme can easily be extended to any even number of CPUs. However, the gains start to fall off reasonably fast, for example it is estimated that a speed up factor of only 11 would be obtained on a 16 CPU machine. Other strategies could change this so one has to consider carefully how to use each multi-processor machine as it becomes available. In December of this year the Centre will host a second workshop on this topic, namely how meteorological models can best be run on multi-processor machines of varying complexity and architecture. Invitations to this workshop have been extended to all Member State meteorological services.

Table 2: Multi-tasking timings CRAY-X48

No. of processors	1	2	4
seconds/time step	19.3	10.3	5.5
speedup ratio		1.87	3.5

References and further reading

1. ECMWF Workshop on "Using multi-processors in meteorological models", 3-6 December 1984

2. "Multi-tasking the weather" by D. Dent in the 16th Cray User Group Proceedings (Fall 1985).

3. Cray Programmers Library Reference manual, chapter 14 (SR-0113) for release 1.15 and beyond.

4. "Tutorial on parallel processing" by R. Kuhn and D. Padua (IEEE publication).

5. "Parallel Computing 83", Conference Proceedings (Berlin September 1983), edited by M. Feilmeier et al.

6. "Vector and parallel processors in computational science", Conference Proceedings (Oxford August 1984), edited by I. Duft and J. Reid.

7. Journal "Parallel Computing", published by North Holland.

APPENDIX 1

Member States Computing Representatives' Meeting 9-10 October 1986

PROGRAMME

Thursday 9 October

SESSION 1:

14.00	Welcome	Geerd Hoffmann
	ECMWF's computer status and plans	Geerd Hoffmann

SESSION 2:

15.30 Member States
Each representative will be asked to speak for a maximum of 10 minutes outlining their Member State's involvement (actual or planned) in the computer service at ECMWF. This should include:

- diagram of own computer equipment, and of RJE equipment connected to ECMWF
- projects run at ECMWF
- experience using ECMWF computers, including suggestions and queries regarding the present service
- plans (involving ECMWF usage over next couple of years)

17.30 Finish

Friday 10 October

09.00 Member State presentations (continued)

SESSION 3:

09.45 User Support Service — Andrew Lea
- allocations and accounts
- advisory
- contact points
- documentation
- libraries
- visiting the Centre

SESSION 4:

10.45	Operational Service	Graham Holt
	- schedules	
	- Member State services: tapes, lineprinter and COM, plots, postal services	
	- network: practical problems, future development	
	- message (console, NTC, mail, telex, phone)	

SESSION 5:

13.00	Systems plans	Claus Hilberg
	- Cray software (COS, CFT, CFT77, micro-tasking in Fortran)	
	- Cyber software (NOS/BE, FTN4, FTN5)	

SESSION 6:

13.45	Multi-tasking experience at ECMWF	
	- Cray multi-tasking in outline	Dave Snelling
	- multi-tasking the Centre's model	David Dent
15.00	Finish	

APPENDIX 2

Member State Computing Representatives' Meeting 9-10 October 1986

PARTICIPANTS

MEMBER STATE	
BELGIUM	Mrs. L. Frappez
DENMARK	Mr. P. Henning
SPAIN	Dr. M. Hortal
FRANCE	Mr. S. Senesi
IRELAND	Mr. J.V. Ryder
ITALY	Dr. S. Pasquini
NETHERLANDS	Mr. R.J. Hoogendoorn
AUSTRIA	Dr. G. Wihl
SWITZERLAND	Mr. G. Siegwart
FINLAND	Mr. T. Hopeakoski
SWEDEN	Mr. S. Orrhagen
UNITED KINGDOM	Dr. A. Dickinson
ECMWF	G.-R. Hoffmann C. Hilberg G. Holt A. Lea J. Greenaway N. Kreitz D. Maretis P. Prior D. Dent D. Snelling