European Centre
for Medium Range Weather Forecasts

# TECHNICAL NEWSLETTER

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*Number 4 - August 1979*

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* NOTE : These articles directly concern the computer service, we recommend computer users read them all.

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COVER : HRH The Prince of Wales visiting the ECMWF Computer Hall on the occasion of the Offical Opening Ceremony, 15th June 1979.

This photograph is reproduced by courtesy of the Reading Evening Post.

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This Newsletter is edited and produced by User Support, for the Operations Department of ECMWF.

The next issue will appear in October.

## THE START OF OPERATIONAL FORECASTING AT ECMWF

When, five years ago, the first plans were made regarding the start of the operations of the Centre, the middle of 1979 was given as the target date.

At the time of writing, we have just now reached the middle of 1979 and provided nothing serious happens during the next few weeks, the Centre will start to distribute a basic subset of its numerical products to Member States who have telecommunications links established with the Centre by then. There is still some uncertainty regarding the installation of some of the telecommunications lines by the PTT's but a significant number, if not all, of the seven connections planned by August will be in operation.

The integration of all the individual subsystems making up ECMWF's Meteorological Operational System (EMOS), as described in Technical Newsletter no. 1, is finished and is being tested. The first forecast in real time was produced at the beginning of June and a series of forecasts was available for the official opening of the Centre on 15 June. These forecasts also had the advantage of showing good meteorological quality, predicting a fine spell for the following week which duly occurred! Further details of some of the forecasts which have been made are given elsewhere in this Newsletter. Since this date, tests have continued, various adjustments being made to the analysis and forecast programs as well as to the other subsystems of EMOS, based on the experience obtained during the first half of June.

The telecommunications system is not yet accepted but should be in operation by the middle of this month. The raw observational data is being fed into the CYBER by magnetic tapes until new equipment at the Bracknell RTH is in operation. Needless to say, having this first version of the operational system working or "almost working" does not mean that everything is all right!

There are still a lot of problems to be solved and improvements to be incorporated for the system to be fully and reliably operational. This is the reason why, from the 1st of August, the system will run every day, but staff available will concentrate on producing and making results available for distribution three days a week, Monday, Thursday and Friday. Needless to say, if products are available more often they will be distributed. The forecasts will usually be carried out to 10 days internally in ECMWF but taking into account the present quality only the first seven days will be available operationally.

Everybody is working very hard and the tension is running high! I hope that the next Newsletter in two month's time will confirm the above "prediction", and that we will have kept to our timetable.

I propose that we "meet" again in October to see if we have actually achieved this target date set up 5 years ago.

- Jean Labrousse

## THE FIRST TRIAL OPERATIONAL FORECASTS AT ECMWF

As indicated in Jean Labrousse's article, some trial operational medium-range forecasts have already been carried out with a view to starting dissemination of some products to Member States as from 1 August. In particular, a series of forecasts was prepared for the official opening of ECMWF on 15 June 1979, on a "semi-operational basis" - "semi-operational" because data was obtained and input to the system one day in arrears and the first phase of ECMWF Meteorological Operational Suite (EMOS) had not been fully completed. Overall, the preprocessing of the data, the running of the analysis and forecast cycles as well as the post-processing, were completed only with considerable effort by staff of the Centre. Still, this week was the first real experience of operational medium range weather forecasting at the Centre. Charts from the forecasts were displayed in the Meteorological Operations Room for the official opening on 15 June and the Council meeting which preceded it during the same week. Examples of these forecast charts are given in Fig. 2 and Fig. 3 for the 1000mb height and 850mb temperature fields and 500mb height and temperature. All the forecasts verify on 15 June, and are respectively a 6 day forecast from June 9, 5 days from June 10, 4 days from June 11, etc. The actual situation on June 15 is also given (based on the analysis by the United Kingdom Meteorological Office).

Charts covering the Northern Hemisphere were operationally available, but in the figures given below, only the European-North Atlantic sector is reproduced, illustrating clearly the synoptic scale features in the geopotential and temperature fields in this area. Regarding the charts of 1000mb height and 850mb temperature, the latter field is found to be a useful tool in tracing baraclinic zones in the lower atmospheric levels, indicating the position of fronts at the surface. Thus we were able to add these fronts to the 1000mb charts in an objective way. Generally speaking, the 850mb temperature fields show a discrete resolution of the temperature gradients in the forecast up to day 5, and two frontal systems approaching each other remain well separated and can easily be detected in the analyses and forecasts. As the forecasts proceed, the resolution of the temperature gradients seems to deteriorate and in the late stages of the forecast (after day 7)) very often only the broad scale synoptic features are depicted. However, it must be emphasised that our experience with medium range forecasts is limited to a small sample of cases. The operational EMOS system will provide many model output fields when the routine post-processing is carried out. Thus, it will be possible to assess the useful predictability that the fields may contain. Also, other types of charts from which meaningful information in terms of medium range weather forecasts can be extracted, will be developed, an example of such possibilities was given in Technical Newsletter No. 2, April 1979.

The synoptic situation over Europe and the Atlantic on June 9, 1979, and how it changed until the verifying day June 15, 1979, is now examined and an assessment made of the various forecasts,( i.e. the 6 day forecast from June 1 to the 2 day from June 13) from a synoptic point of view.

On June 9 at the surface, a high pressure belt stretches from the Caspian Sea over central and western Europe to the eastern North Atlantic (Fig. 1). Cyclonic activity is far to the north with cyclones over Greenland and Scandinavia. These features are associated with troughs at 500mb having a longitudinal scale of wave numbers 6 to 7. Southwest of the British Isles there is a cut-off low at the surface and 500mb, which is almost stationary. There was a rather stagnant weather situation over northern France, the Low Countries and southern England. A baroclinic zone from the low over the west of Europe to the low over Scandinavia is indicated by the gradient in the 850mb temperature field. By June 15 there have been major changes in the circulation pattern over Europe. The verification charts for June 15 (bottom right of Figs. 2 and 3) show a depression over the North Sea accompanied by an outbreak of polar air over western Europe. At 500mb there is a deep cut-off vortex over the North Sea. This system developed from a short wave disturbance which came forward from the persistent trough over North America six days earlier and developed and amplified considerably south eastwards as it moved into the Eastern Atlantic, itself becoming one of the major hemispheric features by June 15.

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The trial ECMWF forecasts of different periods for June 15 (Figs. 2 and 3) show an encouraging degree of success in that they correctly indicate the substantial change in the circulation pattern over Europe and the Atlantic several days in advance. In the 6 day and 5 day forecasts for June 15 the deepening of the low between Iceland and Scotland at the surface and at 500mb is over-estimated, and the phase speed is somewhat too low; the transfer of the low into the North Sea and the pressure rise over the Atlantic is not indicated in detail at this stage. However, the 4 day forecast for June 15 verifies very well; the shorter period forecasts maintain this prediction. Overall, the development of the European trough in its correct position, and associated outbreaks of polar air far to the south are well predicted. Regarding Scandinavia and south-eastern Europe, the forecasts from Day 6 to Day 2 are reasonable, these regions remaining out of the influence of the major trough development.

To summarise, the trial forecasts for this week of the opening of the Centre showed useful skill from a forecaster's point of view, illustrating a significant change in the pattern over western Europe. Short wave synoptic scale features were forecast in a satisfactory way as well as the large scale wave pattern up to a few days ahead, well into the second half of the forecasting period.

- Horst Böttger

Legend of Figures

Fig. 1 : ECMWF analyses of 1000 mb geopotential height in decametres (full lines) and 850 mb temperature (dotted lines), left; 500 mb geopotential height in decametres (full lines) and temperature (dotted lines), right, for June 9, 1979, 12Z. Contour intervals of geopotential 4 dkm and of temperature 2°C.

Fig. 2 : ECMWF forecast of 1000 mb geopotential height (full lines) and 850 mb temperature (dotted lines) for 6, 5, 4, 3, 2 day forecasts from June 9, 10, 11, 12, 13, i.e. verifying at 12 on June 15. Surface pressure analysis for June 15 at 12Z bottom right. Contour intervals of geopotential 4 dkm and of temperature 2°C.

Fig. 3 : As figure 2 for the 500 mb geopotential and temperature fields.

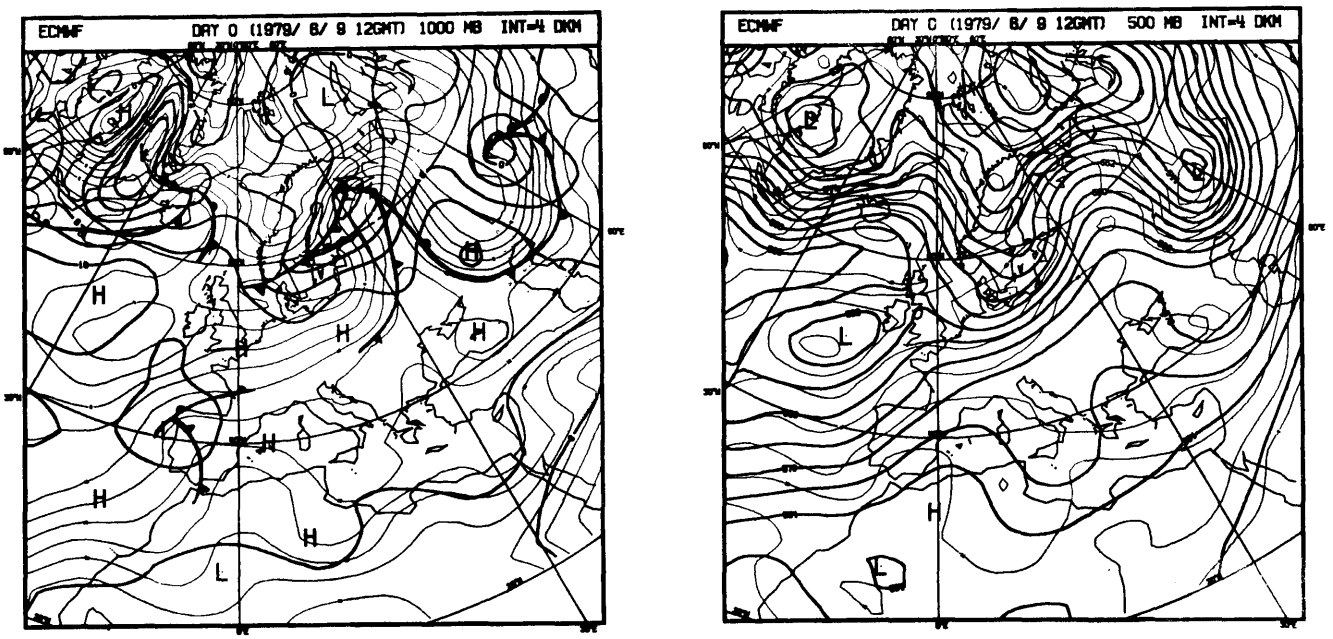



Fig. 1

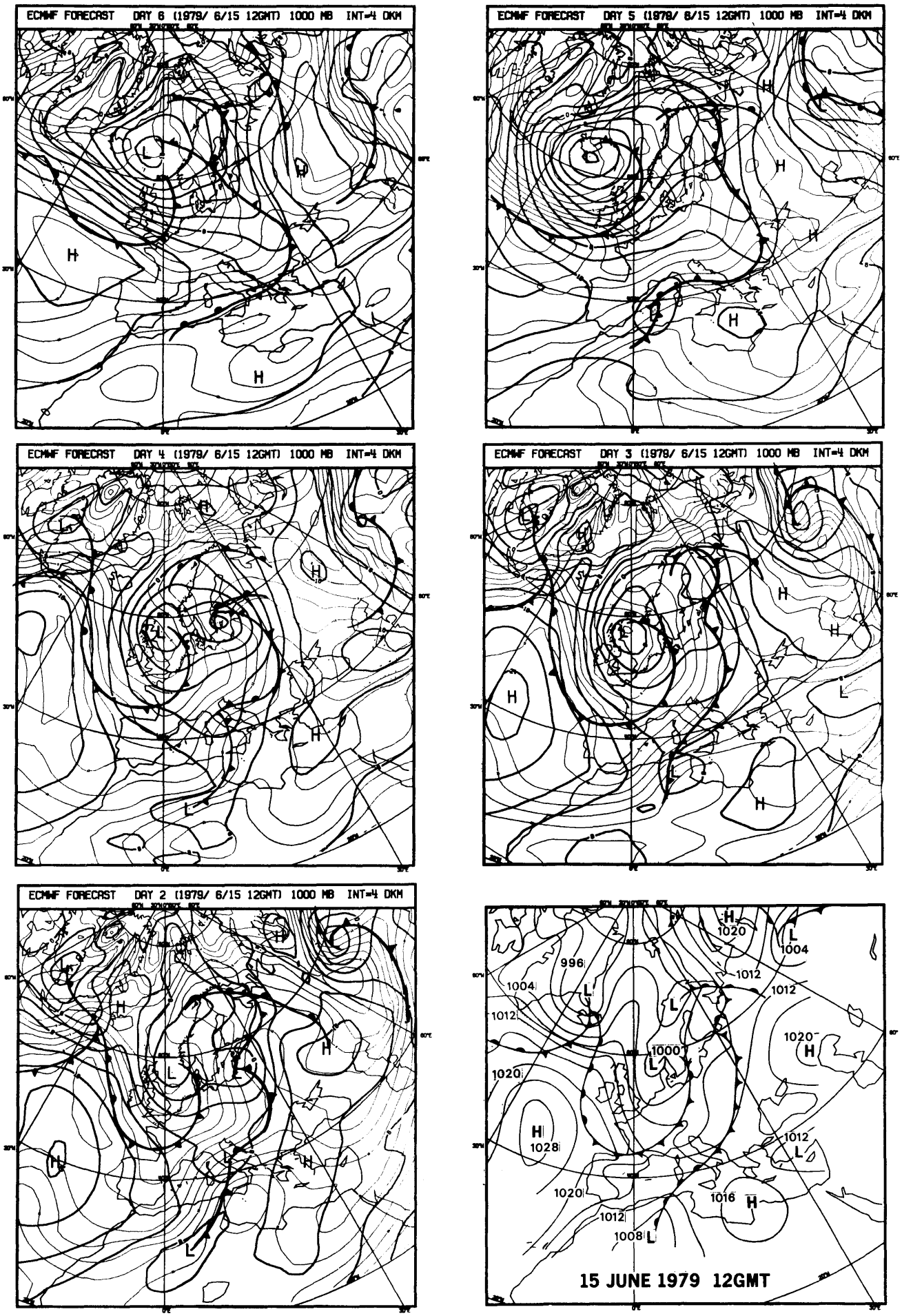
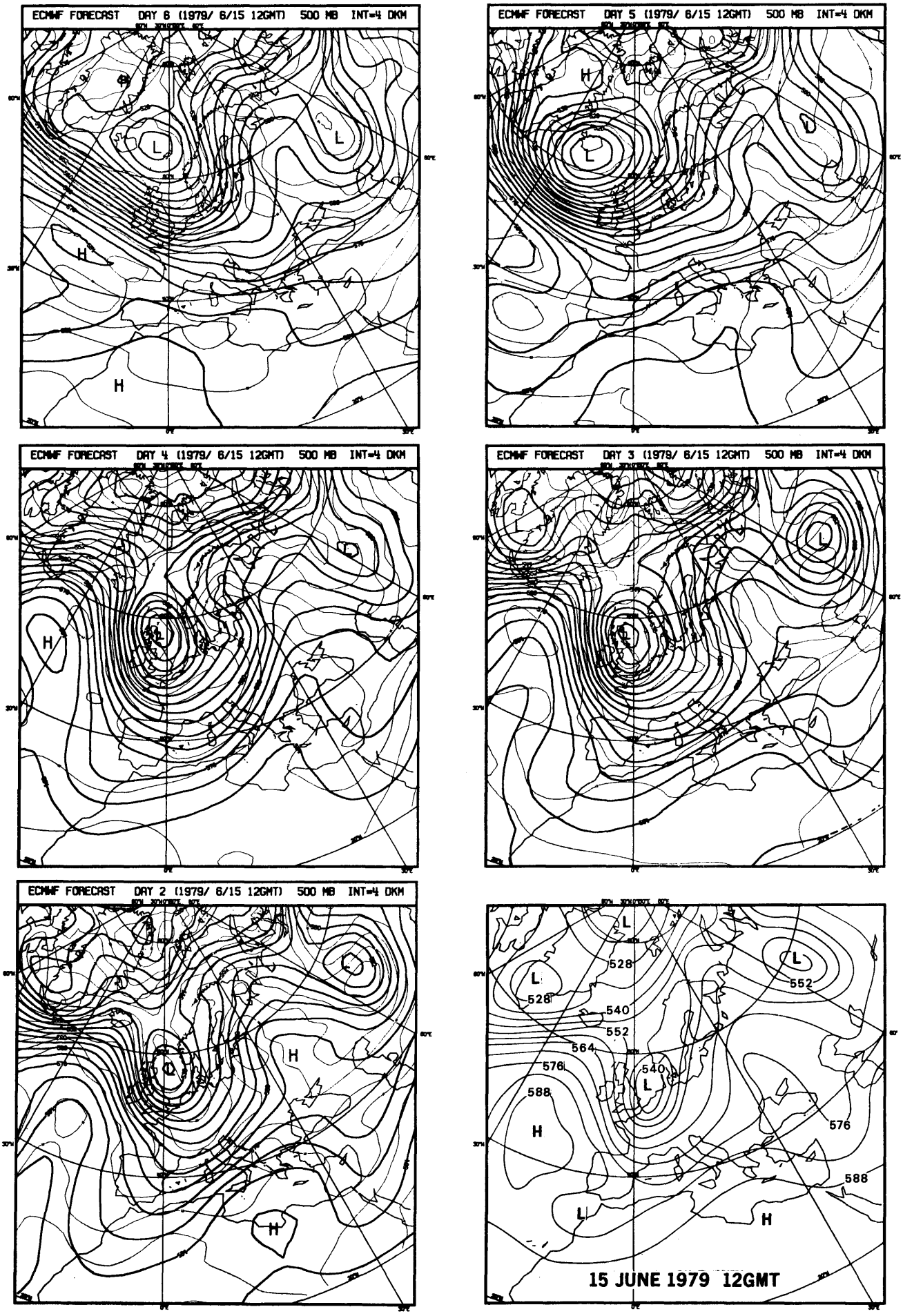

ECMWF FORECAST DAY 6 (1979/ 6/15 12GMT) 1000 MB INT=4 DKM
ECMWF FORECAST DAY 5 (1979/ 6/15 12GMT) 1000 MB INT=4 DKM
ECMWF FORECAST DAY 4 (1979/ 6/15 12GMT) 1000 MB INT=4 DKM
ECMWF FORECAST DAY 3 (1979/ 6/15 12GMT) 1000 MB INT=4 DKM
ECMWF FORECAST DAY 2 (1979/ 6/15 12GMT) 1000 MB INT=4 DKM
1020
1004
996
1012
1000
1028
1016
1008
15 JUNE 1979 12GMT

Fig. 2


ECMWF FORECAST DAY 6 (1979/ 6/15 12GMT) 500 MB INT=4 DKM
ECMWF FORECAST DAY 5 (1979/ 6/15 12GMT) 500 MB INT=4 DKM
ECMWF FORECAST DAY 4 (1979/ 6/15 12GMT) 500 MB INT=4 DKM
ECMWF FORECAST DAY 3 (1979/ 6/15 12GMT) 500 MB INT=4 DKM
ECMWF FORECAST DAY 2 (1979/ 6/15 12GMT) 500 MB INT=4 DKM
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15 JUNE 1979 12GMT

Fig. 3

## COMPUTER FACILITY STATUS *

The last two months have seen several equipment deliveries and software changes. Over the summer, these changes will be consolidated to produce the final system that has been planned for some time. This will then bring the computer configuration to that detailed in ECMWF Technical Newsletter No. 1.

### Cray-1

The compiler and other products have been brought up to level 1.05. Problems discovered in COS (1.05) in June caused it to be withdrawn from service. These have now been cured and COS (1.05) will be re-instated shortly.

The new features of COS (1.05) and CFT (1.05) were detailed in the last newsletter. In addition the following changes to the system specification were made:

- Default jobcard priority is now 4.
- PDS table was quadrupled in size.
- Job logfile maximum length increased to 200 sectors.
- ASSIGN command no longer causes the job to abort if the device specified in a DV parameter is not available. Instead the file is allocated to any free device.
- The ACQUIRE problem described in News Sheet 57 (wrong cycle being specified on ACQUIRE-ATTACHes) has now been fixed.

### Cyber 175

In late June the following equipment was delivered:

- 4 disk units and 2 disk controllers.
- 2 tape units and 2 tape controllers.

This equipment has been installed and is now operational. There was a delay in bringing it into service due to (unrelated) faults in the Cyber diverting effort.

It is planned to use the 16 disk drives we now have, as follows:

| Usage | Period A | Period B | Period C |
|---|---|---|---|
| System plus input/output queues | 2 | 2 | 2 |
| Default permanent file set plus scratch | 7 | 7 | 7 |
| Operational forecast usage | 1 | 3 | 5 |
| Private pack usage | 6 | 4 | 2 |
| | 16 | 16 | 16 |

Period A is normal user service time, including the pre-processing time for the operational forecast.
Period B is whilst the operational analysis suite is running on the Cray.
Period C is whilst the operational forecast is running on the Cray and during the post processing phase.

The maximum CM parameter has also increased to 377700B.

### Cray-Cyber Link

A more reliable version of the Cyber station entered service on 27 June. Early experience has been good and it is clear that many of the problems existing in our old station have now been solved. The main reason for the decreasing reliability of the old station was our greatly increasing usage of the link.

A change to the specification of JOBSR took place when the new station was implemented. The JOBSR now has a revised syntax which can be found by typing

```
JOBSR,S.
```

The new version of JOBSR will allow the status of any Cray job originating from the Cyber to be established, and is no longer limited to only those jobs originating from your terminal.

.../cont.

Telecommunication Subsystem

The Network Front End Processor (NFEP) was installed at ECMWF during the first week of June. The Provisional Acceptance (PA) has not yet started and is unlikely to begin before the middle of August. In fact, several problems remain in the modules chain involved in the medium-speed line connections. Nevertheless, the complete file dissemination sequence is working pretty well on the low-speed line connections.

These implicitly demonstrate both that the "CYBER to NFEP" modules chain, and the File Transfer Protocol Module (FTP) have been implemented correctly. The File Transfer Protocol is required for both low and medium speed line connections. These facts give an indication of the future achievement and completion of this long telecommunications project.

Consequently, in the near future, the NFEP subsystem can be dedicated, during over-night sessions, to the dissemination of Meteorological Products over low-speed line connections, while during the day, the last stage of implementation and PA preparation can be completed,

In Table 1 you can find current information about the status of the telecommunication lines.

Graphics

A second Versatec electrostatic plotter has been delivered and will be used as a standby. It is not yet in service due to problems with a grey background produced on the plots.

The possible use of a bureau service for COM (Computer Output on Microfilm) has been studied. It is being proposed that a trial service be set up for graphics COM using the Rutherford Laboratory.

- Andrew Lea
- Philippe Quoilin

Table 1 : Status of telecommunication line connections

| MEMBER STATE | MEDIUM SPEED CONNECTION | | | LOW SPEED CONNECTION | |
|---|---|---|---|---|---|
| | SPEED (BPS) | P.O.ESTABLISHMENT | START | SPEED(BAUDS) | START |
| UNITED KINGDOM | 2400 | ESTABLISHED | IN TEST | - | - |
| GERMANY F.R. | 4800 | 15/09/79 | 15/10/79 | - | - |
| FRANCE | 4800 | 01/03/80 | - | 50 | BPO:17/10/79<br>French PO:01/08/79 |
| SWEDEN | 2400 | 01/10/79 | 15/10/79 | - | - |
| FINLAND | 2400 | 01/12/79 | - | - | - |
| DENMARK | 2400 | 01/11/79 | 01/12/79 | - | - |
| IRELAND | 2400 | - | JULY 80 | - | - |
| ITALY | 2400 | - | JULY 80 | 50 | AS SOON AS POSS. |
| GREECE | 2400 | - | SEPT.80 | 100 | 27/07/79 |
| SPAIN | 2400 | - | DEC.80 | 50 | AS SOON AS POSS. |
| YUGOSLAVIA | 2400 | - | DEC.80 | 50 | AS SOON AS POSS. |
| BELGIUM | 2400 | - | JULY 81 | - | - |
| AUSTRIA | 2400 | - | JULY 81 | - | - |
| PORTUGAL | 2400 | - | JULY 81 | 50 | AS SOON AS POSS. |
| NETHERLANDS | 2400 | - | OCT.81 | 100 | 27/07/79 |
| TURKEY | 2400 | - | NOV.81 | 50 | AS SOON AS POSS. |
| SWITZERLAND | 2400 | - | JAN.84 | - | - |

## THE CRAY-1 ARCHITECTURE

This is the third and final article describing the Cray-1 architecture in some detail. It has been adapted from "The Cray-1 Computer System" by Richard M. Russell (Cray Research) published in the Communications of the ACM (January 1978). †

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### Evolution of the Cray-1

The Cray-1 stems from a highly successful line of computers which S. Cray either designed or was associated with. Mr. Cray was one of the founders of the Control Data Corporation. While at CDC, Mr. Cray was the principal architect of the CDC 1604, 6600 and 7600 computer systems. While there are many similarities with these earlier machines, two things stand out about the Cray-1; first it is a vector machine, secondly it utilises semiconductor memories and integrated circuits rather than magnetic cores and discrete components.

Early (first generation) vector processors such as the STAR 100 and the ASC were designed to handle long vectors. Because of the startup time associated with data streaming, vector length is of critical importance. Vectors had to be long if the STAR 100 and the ASC vector processors were to be at all competitive with a scalar processor. Another disadvantage of the STAR 100 architecture was that elements of a "vector" were required to be in consecutive addresses.

In contrast with these earlier designs, the Cray-1 can be termed a short vector machine. Whereas the others require vector lengths of a 100 or more to be competitive with scalar processors, the cross-over point between choosing scalar rather than vector mode on the Cray-1 is between 2 and 4 elements. This is demonstrated by a comparison of scalar/vector timings for some mathematical library routines shown in Figure 1 (1).

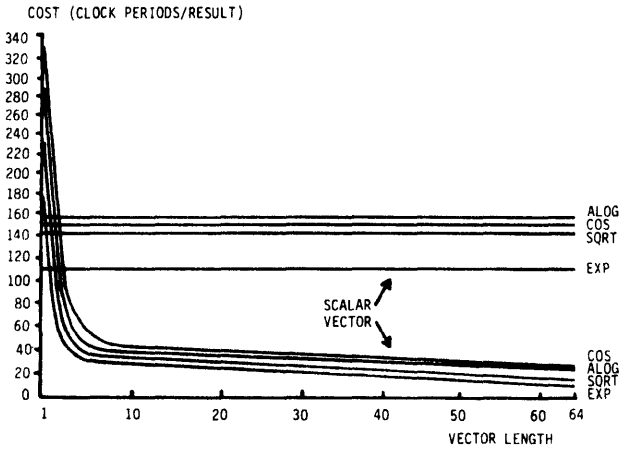


Fig. 1 Scalar/vector timing

Also, the Cray-1's addressing scheme allows complete flexibility. When accessing a vector, the user simply specifies the starting location and an increment. Arrays can be accessed by column, row or diagonal; they can be stepped through with nonunary increments; and, there are no restrictions on addressing, except that the increment must be a constant.

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Vector Startup Times

To be efficient at processing short vectors, vector startup times must be small. On the Cray-1, vector instructions may issue at a rate of one instruction parcel per clock period. All vector instructions are one parcel instructions (parcel size = 16 bits). Vector instructions place a reservation on whichever functional unit they use, including memory, and on the input operand registers. In some cases, issue of a vector instruction may be delayed by a time (in clock periods) equal to vector length of the preceding vector operation + 4.

Functional unit times are shown in Table I. Vector operations that depend on the result of a previous vector operation can usually "chain" with them and are delayed for a maximum "chain slot" time in clock periods of functional time + 2.

| | Register usage | Function unit time (clock periods) |
|---|---|---|
| Address function units | | |
| address add unit | A | 2 |
| address multiply unit | A | 6 |
| Scalar functional unit | | |
| scalar add unit | S | 3 |
| scalar shift unit | S | 2 or 3 if double-word shift |
| scalar logical unit | S | 1 |
| population/leading zero count unit | S | 3 |
| Vector functional units | | |
| vector add unit | V | 3 |
| vector shift unit | V | 4 |
| vector logical unit | V | 2 |
| Floating-point functional units | | |
| floating-point add unit | S and V | 6 |
| floating-point multiply unit | S and V | 7 |
| reciprocal approximation unit | S and V | 14 |

Table I : Cray-1 Functional Units

Once issued, a vector instruction produces its first result after a delay in clock periods equal to functional unit time. Subsequent results continue to be produced at a rate of 1 per clock period. Results must be stored in a vector register. A separate instruction is required to store the final result vector to memory. Vector register capacity is 64-elements. Vectors longer than 64 are processed in 64-element segments.

Some sample timings for both scalar and vector are shown in Table II (2). Note that there is no vector ASIN routine and so a reference to ASIN within a vectorised loop generates repetitive calls to the scalar ASIN routine. This involves a performance degradation but does allow the rest of the loop to vectorise (in a case where there are more statements than in this example). Simple loops 14 and 15 show the influence of chaining. For a long vector, the number of clock periods per result is approximately the number of memory references + 1.

.../cont.

| Loop | Body | N=1 | 10 | 100 | 1000 | 1000 Scalar |
|---|---|---|---|---|---|---|
| 1. | A(I)=1. | 41.0 | 5.5 | 2.6 | 2.5 | 22.5 |
| 2. | A(I)=B(I) | 44.0 | 5.8 | 2.7 | 2.5 | 31.0 |
| 3. | A(I)=B(I)+10. | 55.0 | 6.9 | 2.9 | 2.6 | 37.0 |
| 4. | A(I)=B(I)+C(I) | 59.0 | 8.2 | 3.9 | 3.7 | 41.0 |
| 5. | A(I)=B(I)*10. | 56.0 | 7.0 | 2.9 | 2.6 | 38.0 |
| 6. | A(I)=B(I)*C(I) | 60.0 | 8.3 | 4.0 | 3.7 | 42.0 |
| 7. | A(I)=B(I)/10. | 94.0 | 10.8 | 4.1 | 3.7 | 52.0 |
| 8. | A(I)=B(I)/C(I) | 89.0 | 13.3 | 7.6 | 7.2 | 60.0 |
| 9. | A(I)=SIN(B(I)) | 462.0 | 61.0 | 33.3 | 31.4 | 198.1 |
| 10. | A(I)=ASIN(B(I)) | 430.0 | 209.5 | 189.5 | 188.3 | 169.1 |
| 11. | A(I)=ABS(B(I)) | 61.0 | 7.5 | 2.9 | 2.6 | |
| 12. | A(I)=AMAX1(B(I),C(I))<br>C(I)=A(I) | 80.0 | 11.2 | 5.2 | 4.8 | |
| 13. | A(I)=B(I)<br>B(I)=CCI | 90.0 | 12.7 | 6.3 | 5.8 | 47.0 |
| 14. | A(I)=B(I)*C(I)+D(I)*E(I) | 113.0 | 14.7 | 6.6 | 6.0 | 63.0 |
| 15. | A(I)=B(I)*C(I)+D(I) | 95.0 | 12.7 | 5.5 | 5.0 | 52.0 |

Table II : Execution time in clock periods per result for various DO loops of the form:

```
DO 10 I = 1,N
IOA(I) = B(I)
```

## Software

The Cray Operating System (COS) and Cray Fortran Compiler (CFT) are now in regular use at a number of user sites. COS is a batch operating system capable of supporting up to 63 jobs in a multiprogramming environment. COS is designed to be the recipient of job requests and data files from front-end computers. Output from jobs is normally staged back to the front-ends upon job completion.

CFT is an optimising Fortran compiler designed to compile ANSI 66 Fortran IV to take best advantage of the Cray-1's vector processing architecture. In its present form, CFT will not attempt to vectorise certain loops which, due to dependence conditions, appear at first sight, unvectorisable.

However, future versions of CFT will be designed to eliminate as many dependency conditions as possible increasing the amount of vectorisable code. Basically, to be vectorisable a DO loop should manipulate arrays and store the results of computations in arrays. Loops that contain branches such as GO TO's, IF's, or CALL statements are not currently vectorised. Loops may contain function references if the function is known to the compiler to have a vector version. Most of the mathematical functions in the Cray library are vectorisable. By using the vector mask and vector merge features of the Cray-1, future versions of the compiler will be able to vectorise loops containing IF and GO TO statements.

Other Cray-1 software includes Cray Assembler Language (CAL) which is a powerful macro assembler, an overlay loader, a full range of utilities including a text editor, and some debug aids.

.../cont.

## Front-End Computer Interface

The Cray-1 was not designed for stand-alone operation. At the very minimum, a mini-computer is required to act as a conduit between the Cray-1 and the everyday world. Cray Research software development is currently being done using a Data General Eclipse computer in this category. The Cray Research "A" processor, a 16-bit, 80 MIPS minicomputer is scheduled to replace the Eclipse. Front-end computers can be attached to any of the Cray-1's 12 i/o channels.

The physical connection between a front-end computer and the Cray-1 is shown in Figure 2. In this example an IBM 370/168 is assumed in the front-end role. Note that each computer requires a channel adapter between its own channel and a Cray Research phase-modulated long line. The link can only be driven at the speed of its slowest component. In this example it is the IBM block multiplexer channel speed of 3 megabytes/second. The discipline of the link is governed by the Cray Link Interface Protocol.

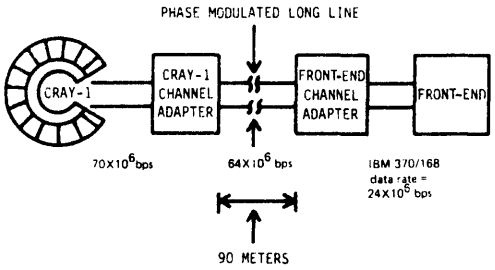


Fig. 2 : Front-end System Interface

## Cray-1 Development Problems

Two of the most significant problems (3) encountered on the way to the Cray-1 were building the first cold bar and designing circuits with a completely balanced dynamic load.

## Building the Cold Bar

It took a year and a half of trial and error before the first good cold bar was built. The work was done by a small Minnesota company. A major problem was the discovery, quite early, that aluminum castings are porous. If there is a crack in the stainless stell tubing at the bond between the tubing and the elbow then the Freon leaks through the aluminum casing. The loss of the Freon is not itself a problem, but mixed with the Freon is a little oil, and the oil can cause problems if it is deposited on the modules. Aluminum also tends to get bubbles in it when it is cast, requiring a long process of temperature cycling, preheating of the stainless steel tube, and so on.

## Designing the Circuits

Cray-1 modules are 6 inches wide. The distance across the board is about a nanosecond which is just about the edge time of the electrical signals. Unless due precautions are taken, when electric signals run around a board, standing waves can be induced in the ground plane. Part of the solution is to make all signal paths in the machine the same length. This is done by padding out paths with foil runs and integrated circuit packages. All told, between 10 and 20 per cent of the IC packages in the machine are there simply to pad out a signal line. The other part of the solution was to use only simple gates and make sure that both sides of every gate are always terminated. This means that there is no dynamic component presented to the power supply.

.../cont.

This is the principal reason why simple gates are used in the Cray-1. If a more complex integrated circuit package is used, it is impossible to terminate both sides of every gate. So all of the Cray-1's circuits are perfectly balanced. Five layer boards have one ground layer, two voltage layers, and then the two logic layers on the outside. Twisted pairs which interconnect the modules are balanced and there are equal and opposite signals on both sides of the pairs. The final result is that there is just a purely resistive load to the power supply!

Summary

The design of the Cray-1 stems from user experience with first generation vector processors and is to some extent, evolved from the 7600 (4). The Cray-1 is particularly effective at processing short vectors. Its architecture exhibits a balanced approach to both scalar and vector processing. In (5), the conclusion is drawn that the Cray-1 in scalar mode is more than twice as fast as the CDC 7600. Such good scalar performance is required in what is often an unvectorisable world.

As the population of Cray-1 computers expands, it will become clear that the Cray-1 has made a significant step on the way to the general-purpose computers in the future.

References

(1) Work done by Paul Johnson, Cray Research.
(2) Work done by Richard Hendrickson, Cray Research
(3) The section on Cray-1 development problems is based on remarks made by Seymour Cray in a speech to prospective Cray-1 users in 1975.
(4) Cray-1 Final Evaluation by T.W. Keller, LASL, LA-6456-MS.
(5) Cray-1 Report, Auerbach Computer Technology Report, Auerbach Publisher's, 6560 North Park Drive, Pennsauken, N.J. 08109.

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## PROJECT AND USER IDENTIFIERS *

We wish to remind users that all the project identifiers which they use on their ACCOUNT cards must be registered with User Support.

Please check all your project identifiers. If you are not using a registered identifier you should check the project identifiers which were originally registered with User Support for the use of your section, and begin using the appropriate one. Should you then find the need for additional identifier(s), it is imperative that you register it/them as soon as possible as we will shortly be validating the project identifiers specified on the ACCOUNT card. Use of an unregistered project will simply abort the job.

We would also like to remind you that all your batch job names should begin with your three character user identifier (two character section identifier plus one unique character allocated to you by your section head).

All the naming conventions and registration procedures are described in detail in Bulletin B1.1/1.

- Andrew Lea

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## THE INTRODUCTION OF THE CYBER JOB CARD PRIORITY PARAMETER *

Now that the ECMWF computer service has begun running the operational forecasting suite as well as serving the research and development needs of internal users, the Centre must ensure that the necessary deadlines for the operational suite can be met by adopting a rigid policy on the use of the priority (P) field on the jobcard when submitting jobs to either the Cyber or the Cray. It is very important that all users adhere to this policy, otherwise the operational role of the Centre will be jeopardised.

There are now 6 priority bands available, of which 4 are available to normal Centre users. The bands and their availability are as follows:

| Band | Priority | Availability | Usage |
|---|---|---|---|
| Base | 0 | All | Used for jobs of low importance which will be run only when no other work is available to be run. Typically turn around will be of the order of 1 week. |
| Low | 1,2 | All | Used by jobs which are not very important and will usually be run overnight, although they will be run as soon as higher priority work is processed. |
| Normal | 3,4,5 (priority 4 will be used if no P field is present on the jobcard) | All | Used by all normal priority work. Turn around will normally occur during the day time. |
| High | 6,7 | All (but not more than 10% of work should be submitted as high priority) | Used in the abnormal situation when a high priority is to be given to a particular project. Not more than 10% of computer usage should be in this category. |
| Operational | 10 - 13 | EMOS and FGGE only | Used only for the operational production jobs. Development of EMOS and FGGE jobs will be done using lower priorities. |
| System/ operator | 14 - 17 | Certain house-keeping tasks only | Used only for a few house-keeping tasks and for the Cray station. Development by the Computer Division staff will be done using lower priorities. |

This policy became effective from June 4.

The co-operation of all users in this matter will be appreciated in order that the primary role of the Centre can be achieved.

- Jean Labrousse

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## COS 1.05 DEBUG FACILITY

The following experiences are useful when using DEBUG in conjunction with the COS Reference Manual:-

Some of the DEBUG parameters are not as documented.
BLOCKS as specified in the manual is actually BLKS and the default number of blocks dumped is 0 not 'all' as mentioned in the manual.
Using the BLKS parameter only causes one common block to be dumped and not 'all'.
MAXDIMS as documented is actually MAXDIM.

- David Dent

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## WRITING 6250 bpi TAPES

The NOS/BE system introduced on Monday 11 June was modified to write 6250 bpi tapes. (Group Encoded tapes) with recoverable errors by default. This is equivalent to having the EEC parameter on the REQUEST or LABEL card.

This change should make no difference to the reliability of these tapes in normal production usage.

Those users who have a particular need to write a "perfect" Group Encoded tape should use the IEC parameter on the REQUEST or LABEL card.

- Tony Stanford

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## BULLETINS IN PREPARATION

The following Computer Bulletins are being prepared:

Use of terminals.
Working limits, defaults and installation parameters.
Introduction to the loader.
Random I/O on the Cray.
Optimising file handling and I/O.
FTN-CFT differences.
Conversion hints.
Files, partitions and sections.
CFT vectorising.
Management and Personnel list.
Levels of software support.

Revision of:

Cyber-Cray job transmission and file staging.
Introduction to control statements on the Cray.

- David Dent

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## CARD PUNCHING *

We now have a new person to punch cards for users, her name is Margaret Clarke. Margaret is contracted to work from 1000 - 1600hrs each day, Monday to Friday.

All users are encouraged to make use of Margaret's services, by submitting card punching work to her, rather than punching their own cards.

An input tray for such work exists on the Computer Reception counter.

- Eric Walton

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## PUNCHING CONVENTIONS

Please use the following conventions when preparing work for the punch operator:

ABCDEFGHIJKLMNOPQRSTUVWXYZ  Ø123456789

The most usual coding mistakes are:-

1) A string of numbers with the zeros uncrossed e.g. 18096 should be 18Ø96.
2) Z instead of Z. The first of these two characters will be punched as a seven.
3) S and 5 could be interchanged if not written clearly.

- Graham Holt

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## STILL VALID NEWS SHEETS *

Several users have queried our News Sheet policy, especially reprinting News Sheet information in either the Newsletter or Bulletins. We will be gathering views over the summer, so we can make some proposals later this year.

In the meantime we have been asked to provide a list of News Sheets that still contain some valid information that has not been incorporated into the Bulletin set. This list is given below (up to News Sheet 58), all other News Sheets are redundant and can be thrown away.

| No. | Still valid article |
|---|---|
| 11 | FTN Rounding Option |
| 15 | Private packs on the Cyber (MOUNT/DISMOUNT) |
| 16 | Checkpointing & program termination |
| 17 | Private packs and interactive jobs |
| 19 | CRAY UPDATE (temporary datasets used) |
| 22 | CRAY jobs using large scratch area (STCRB) |
| 23 | Cyber PF space control |
| 31 | Fortran callable tape REQUEST |
| 37 | IN trays for Cray & Cyber jobs |
| 42 | Cyber scheduler (see News Sheet 48 also) |
| 43 | Cray AUDIT |
| | Transfer of coded files |
| 45 | DISPOSE - WAIT (see News Sheet 50 also) |
| 47 | Libraries on the Cray-1 |
| 48 | ECMWF Cyber Scheduling (see News Sheet 42 also) |
| 50 | DISPOSE - WAIT becomes the default (see News Sheet 45 also) |
| | 8 disc CRAY system |
| | Terminal procedure |
| 51 | Cyber disk reconfiguration |
| 53 | Cyber job card priority usage |
| | Writing 6250bpi tapes (EEC parameter) |
| | Punching conventions (coding forms) |
| 54 | Things not to do to the station |
| 55 | New Cyber Peripherals |
| 56 | DISP |
| 58 | COS 1.05 Status |

- Andrew Lea

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## NEW USER SUPPORT STAFF

Two new members have joined User Support in July. Stefano Tinti comes from Bologna with qualifications in physics and computer science. He has worked for several years at the Instituto di Fisica "A. Righi" (Bologna University) in both meteorology and oceanography. He studied such problems as cyclogenesis in the lee of the Alps, and numerical modelling of harbour resonances caused by oceanic waves. For the last year he has been a systems analyst working with CDC equipment at CINECA (a computer centre serving universities in North East Italy), in the Data Communication Section.

He joins User Support as a general staff member, his room is 005, telephone extension 346.

Dale Robertson has joined as a 12 month consultant from the Canadian Met Service ("Research into Numerical Prediction" unit). Originally a theoretical physicist in electron scattering he has spent the last seven years doing research and development in numerical weather forecast models (including finite difference, spectral and finite element models). His speciality has been vectorising such models for optimum performance on various CDC machines, especially the 7600.

During his time here he will be providing expert assistance in the following areas

- optimising user programs
- building up & improving the ECMWF subroutine library.

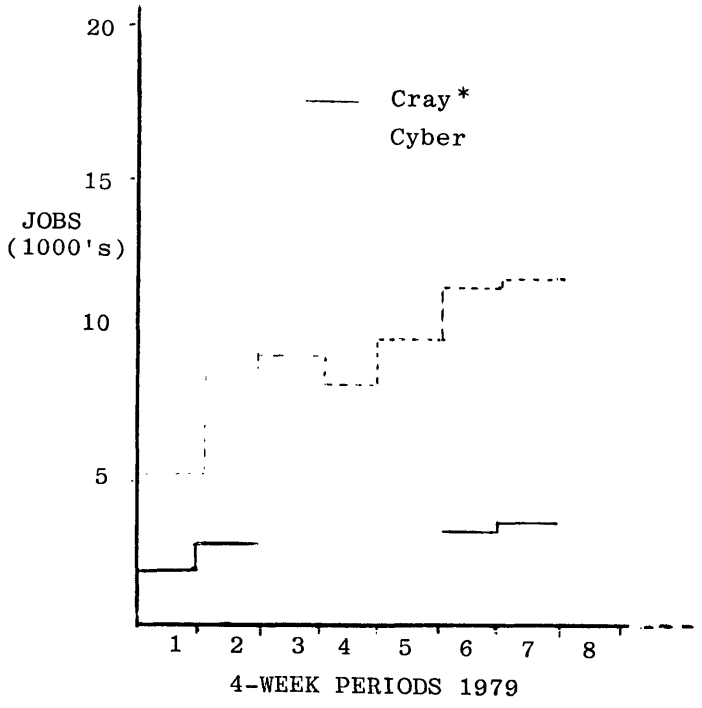
He is temporarily in room 104, extension 376/7.

- Andrew Lea

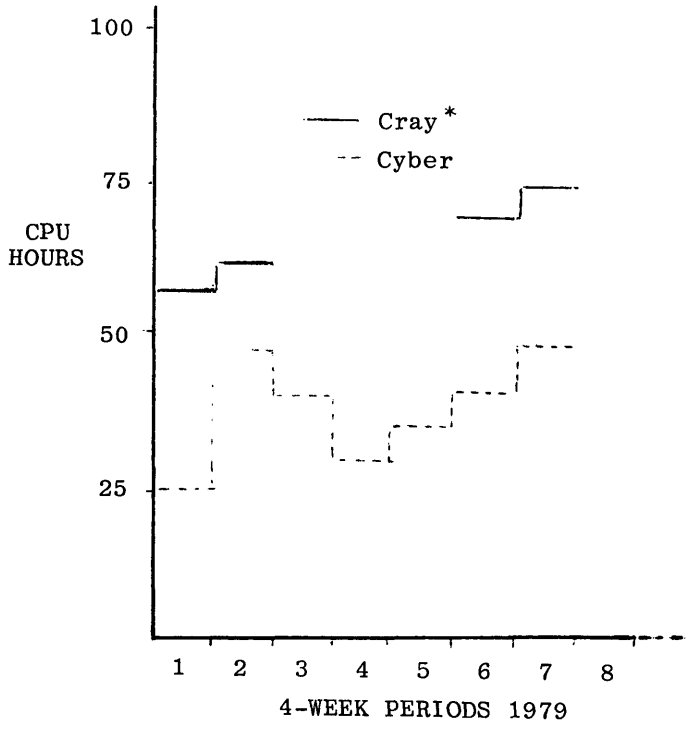
## STATISTICS

The tables below show the weekly average for the number of jobs and CP time used for both systems. They are presented as averages over 4-week periods, to smooth out random week by week variations.

Average number of jobs per week within each period




Average CPU hours used per week within each period




* CRAY statistics for periods 3, 4 and 5 are not yet available.

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## NAG LIBRARY DEVELOPMENT

The residual problems in the NAG Mark 6 implementation on the Cray have been resolved. All test programs now work.

It is planned to make Mark 6 the default Cyber NAG library on 3 September.

Please report any problems from either implementation to User Support.

- John Greenaway
- David Dent

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## LAWS OF COMPUTER PROGRAMMING

1) Any given program, when running, is obsolete.
2) Any given program costs more and takes longer.
3) If a program is useful, it will have to be changed.
4) If a program is useless, it will have to be documented.
5) Any given program will expand to fill all available memory.
6) The value of a program is proportional to the weight of its output.
7) Program complexity grows until it exceeds the capability of the programmer who must maintain it.

# INDEX

## INDEX of Still Valid Newsletter Articles

This is an index of the major articles published in this ECMWF Technical Newsletter series, plus those in the original ECMWF Computer Newsletter series. Articles in the original series which are still valid will eventually all be reprinted in this Technical Newsletter, making the Computer Newsletter then obsolete. Currently, Computer Newsletter numbers 1 to 9 can be thrown away. Some back copies of Computer Newsletter numbers 10 and 11 are still available, please apply to Mrs. P. Prior (ext. 355).

As one goes back in time, some points in these articles may no longer be accurate. When in doubt, contact the author, or User Support.

# INDEX



*C indicates article appeared in the previous ECMWF Computer Newsletter series.

## USEFUL NAMES AND 'PHONE NUMBERS WITHIN ECMWF

| | | Room* | Ext.** |
|---|---|---|---|
| ADVISORY OFFICE Open 9-12,14-17 daily | | CB 037 | 308/309 |
| Computer Division Head | - Rob Brinkhuysen | OB 009A | 340/342 |
| Disk Space and Permanent File Problems | | AS FOR ADVISORY | |
| DOCUMENTATION Officer | - Pam Prior | OB 016 | 355 |
| Libraries (ECMWF,NAG,CERN, etc.) | - John Greenaway | OB 017 | 354 |
| OPERATIONS | - Console/Shift Leader | CB Hall | 334 |
| Reception Counter | - Judy Herring | CB Hall | 332 |
| Terminal Queries | | AS FOR SHIFT LEADER | |
| Operations Section Head | - Eric Walton | OB 002 | 349/351 |
| Deputy Ops. Section Head | - Graham Holt | CB 023 | 307 |
| METEOROLOGICAL DIVISION | | | |
| Division Head | - Roger Newson | OB 008 | 343 |
| Operations Section Head | - Austin Woods | OB 107 | 406 |
| Applications Section Head | - Joel Martellet | OB 011 | 344 |
| Meteorological Analysts | - Ove Akesson | OB 106 | 380 |
| | - Horst Böttger | OB 104A | 378 |
| | - Rauno Nieminen | OB 104A | 378 |
| | - Stefan Panin | OB 104A | 379 |
| | - Herbert Pumpel | OB 106 | 380 |
| Meteorological Operations Room | | CB Hall | 328/443 |
| Registration (User and Project Identifiers, INTERCOM) | - Pam Prior | OB 016 | 355 |
| Research Department Computer Co-ordinator | - Rex Gibson | OB 126 | 384 |
| Tape Requests | - Pauline Litchfield<br>- George Stone | CB Hall | 335/334 |
| User Support Section Head | - Andrew Lea | OB 003 | 348 |

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* CB - Computer Block
OB - Office Block

** The ECMWF telephone number is READING (0734) 85411