European Centre
for Medium Range Weather Forecasts

COMPUTER NEWSLETTER

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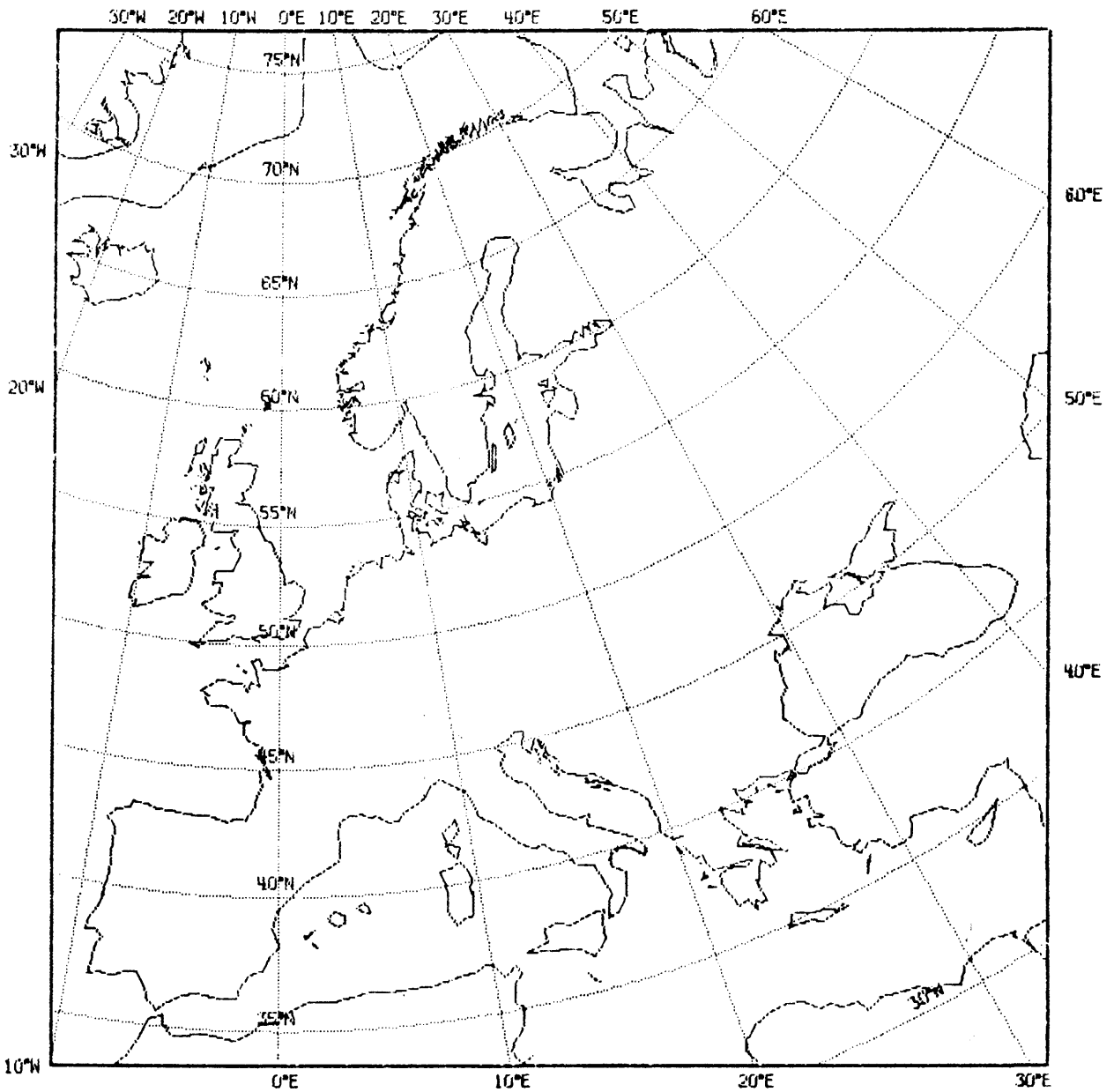

Here you have the very first issue of the new ECMWF Computer Newsletter! The need for a newsletter has become quite clear lately. First, every computer service on Earth has one; here's ours. Second, as the staff at ECMWF grows, so do the problems of information exhange -- it becomes increasingly harder to disseminate information purely by word of mouth, or by discrete memo. This will be even more difficult when we are split between the three buildings in Bracknell and the computer room in Rutherford. We also expect (and hope) this newsletter will encourage documentation efforts at the Centre.

We openly DEMAND your suggestions and criticisms. This issue is certainly only a very first attempt. We would like to hear what you think.

We have left some room for audience participation in this Newsletter: the front-page graphics and the "VOX POP" department. We hope to publish a different graphic item on the front-page each month, which we actively solicit from our readers. This can be anything (within reason), computer graphic or hand-drawn cartoon. (This issue's contribution is from Keld Petersen). The VOX POP department will accept questions from readers and publish replies from the Computer Section staff.

The entire task of putting out this Newsletter is the responsibility of the User Support Section, and we will try to make an issue appear at least once a month. Please send your articles, notes, complaints, drawings, and questions, to : Computer Newsletter, Room 102, Brandon House (ext. 286).

The MNF FORTRAN Compiler : Try it for Debugging

MNF is a FORTRAN compiler written at the University of Minnesota Computer Centre. One of its main virtues is the ease with which programs may be debugged. This results from its excellent diagnostic set, superb cross-reference map and simple to use run-time tracing facilities. For example, by the addition of a mere "T" to the MNF control card parameters you get run-time traces which give information on:-

i. DO loop infringements;
ii. Misuse of formatted input/output;
iii. Use of bad subscripts (very common);
iv. Misuse of assigned and/or computed GOTO's.

At job termination two types of trace summary are printed:-

a. A summary indicating how many times every subroutine has been called -- this includes library functions such as SQRT and COS, etc.
b. A summary for each of your subroutines, functions and main program indicating how many times statement and format numbers have been used.

Explicit traces also exist which may be used, for example, to follow the "life" of a variable and see the various values it takes on and where these assignments take place.

The above is just a short selection of many of the "goodies" in MNF. Try it yourself and judge its worth in debugging your particular applications. In order to help you to use MNF, there exists a computerised write-up that may be printed on the line-printer. Use the following control cards to obtain a copy:-

```
ATTACH,MNFGLP,ID=EWML1.
REWIND,MNFGLP.
COPY,MNFGLP,OUTPUT.
6/7/8/9 end-of-information
```

To run MNF you can try the following:-

```
ATTACH,X,MNF,ID=EWML1.
LIBRARY(X)
MNF,D,T,R=7,B=LGO.
LGO.
7/8/9 end-of-record
   ..your FORTRAN source program
    etc.
```

.../cont.

If you would prefer a less lavish cross-reference map, omit the R=7. If your FORTRAN source program is on some other file than INPUT (e.g. COMPILE), use I=filename as you would for FTN:-

```
MNF,D,T,I=COMPILE,B=LGO.
```

Currently, MNF does not have a post-mortem dump facility like MANTRAP. This will be incorporated into it shortly. Any comments or questions concerning MNF would be appreciated.

-- Mostyn Lewis

Proposed Job Transfer System between CYBER and CRAY

During the period that the CRAY and CYBER are at Rutherford, there will be no hardware link between the two machines. However, it is proposed that the Operating Systems Section provide a mechanism for the transfer of job input from the CYBER to the CRAY and job output from the CRAY back to the CYBER.

Briefly, the CRAY job would be input to the CYBER with a jobcard parameter indicating that it is destined for the CRAY. Periodically, the operators will rur a job which collects CRAY input onto magnetic tape to be loaded onto the CRAY via the ECLIPSE at Rutherford. When the output is available, this will be copied to tape via the ECLIPSE and transferred back to the CYBER for printing.

This apparently complex procedure will allow much easier access to the CRAY via remote job entry links and interactive terminals situated in the Bracknell offices. It should allow a fairly rapid turnaround of CRAY work; certainly much faster than travelling to and from Rutherford. Since jobs will be batched together, it will allow more CRAY time for job development where "hands on" time is necessary.

We are not yet sure whether this procedure is feasible but we expect to have an answer by mid-August. For more information, watch this space...

-- Peter Gray

6600 FTN,OPT=2 vs. OPT=1; A Recommendation

The current version of FTN on NOS/BE, level 446, as with all previous versions of this compiler, exhibitis still a number of potentially serious bugs at OPT=2. Most recently discovered and reported to CDC is an instance of a miscompilation of something as innocent looking as:

```
DO 1 I=1,NL
U1(I,2) = UG(K)*SQRT(RCSJ)*CV*100.
V1(I,2) = VG(K)*SQRT(RCSJ)*CV*100.
   ...etc.
```

Certainly enough, these things are extremely context dependent and it is almost impossible to specifically catagorise such bugs. (In the above example, K was computed in the loop and therefore not invariant to I, but RCSJ and CV were invariant; the miscompilation occured in attempting to evaluate the invariant subexpressions outside the loop).

We strongly recommend the use of OPT=1 during all phases of program development and checkout. This includes even those moments of changing "only one card". OPT=2 should be used only when the program has proven itself at OPT=1. Your first run at OPT=2 must be made with data and results already obtained with OPT=1. This will allow you to check the results from OPT=2 against OPT=1. Any differences must be reported to the User Support Section.

In a future issue of this Newsletter, we will discuss what happens at OPT=2 and the general problems of FORTRAN optimisation.

-- Richard Friedman

Recent Experience with CRAY-1 Software

Andrew Lorenc reports on his recent trip to Minneapolis/Chippewa:

1. Temporary Compiler Bugs..
These and other bugs were encountered and reported to Cray Research. Some were corrected in new compiler (CFT) versions; others I am told are in hand and should be remedied by the next visit. New versions of CFT were introduced at least once per day it seemed, and occasionally code which used to compile did not do so on a later version. We stuck to three versions:- CFTP, CFTC, and CFTA. I had one subroutine which only worked under P, several others which needed A, while the bulk of my code needed C.
   a. Intrinsic functions (SHIFTL, SHIFTR, AND, OR) were compiled incorrectly and occasionally gave incorrect compilation diagnostics. This was cured in CFTA.
   b. Statement functions which were defined in terms of other statement functions, or which had other statement function calls as arguments, sometimes generated rubbish code. Better in CFTA, but not cured.
   c. BUFFER IN, IF(UNIT) statements caused system crashes. We were told this was cured, but did not test.
   d. Errors were encountered in the interpretation of some FORMAT statements. We were told this was cured, but did not test.
   e. The loader always aborted when loading a particular subroutine. The loader expert said this was probably due to faulty binary from the compiler.
   f. We were told that the compiler made a complete mess of code like:-

```
      SUBROUTINE SQ(A,B,N)
      DIMENSION A(N),B(N)
      DO 1 I=1,N
    1 A(I) = SQRT(B(I))
```

   g. CFTC did not like octal constants in DATA statements.
   h. There was trouble testing for end-of-file on unformatted READs.

2. More Serious Compiler Bugs and Limitations..
   a. Unsafe optimisation of arguments and common variables is done across subroutine calls:-

```
      I=1
      CALL SUB(I)
      IF(I.EQ.1)GOTO2     the branch is always taken regardless of
```

   what SUB does to I, since the value used in the IF is that saved from the statement before the CALL.
   b. Integers are treated as 24 bit values. To enable full 64 bit integers to be used as bit patterns in arguments to AND, OR, SHIFTL, etc., an intrinsic function LINT has been provided. Plans are being made to provide a type LONG INTEGER for full 64 bit integer quantities.
   c. Diagnostic messages are sometimes misleading.
   d. The ENTRY statement is not implemented.
   e. There is no run-time print limit. This can be disastrous (see 3a).

3. Comments on the Operating System..
   a. The disk of the Chippewa Eclipse was nearly full. If you tried to stage too large a file out from the CRAY the Eclipse went down and had to be re-started (a compilcated procedure). This caused the CRAY operating system to crash as well, loosing all files on the CRAY disks. If working from Minneapolis via the telecommunications link, the Minneapolis Eclips system also crashed. Approximate time lost (with experienced operators for re-starting) was 20 minutes.
   b. Output and dayfile pointers in the CRAY system are unprotected in the user area, and can be overwritten by a programming or compiler error, loosing all the output from the job and sometimes causing the system to crash.
   c. UPDATE should soon be available. It will be similar to CDC's except that only abbreviated directives must be used:- *DK for *DECK etc. This means *COMDECK cards (e.g. an UPDATE "source" file on the CYBER) will have to be edited on the Eclipse to change the *DECK to *DK, etc.
   d. Random I-O should soon be available.
   e. A new Eclipse operating system should soon be available.

-- Andrew Lorenc

The CRAY-CFT Test Cycle : An Open Invitation

We are now in the process of gathering programs to embody our test cycle for the CFT compiler, to be used during the CRAY acceptance period. We would like to make this cycle somewhat representative of the type of programs that we will be running on the CRAY, and would appreciate receiving donations from all programmers. For practicality's sake, donated programs must be reasonable - - reasonable length, reasonable output, reasonable duration of execution, and be a reasonable exercise of the compiler. It goes without saying that having a reasonable test cycle to run against the compiler and system on the CRAY will benefit everyone. If you think you might have just such a candidate for inclusion in the cycle, please contact us ...

-- Richard Friedman

Contouring Software Changes

The long awaited change of the contouring software to work in metric units has now been done. The changed system will be put into operation on Tuesday, 30 August, 0830hrs. This should give sufficient time for all holidaymakers to be able to return and make the changes.

A new subroutine (preliminary) is introduced:

```
          CALL PUNIT(I)
where       I = 1 implies all measurements are in millimetres
            I = 2 implies inches
            I = 3 implies raster units
```

The default is I=1 (millimetre). The only change needed for existing programs is then CALL PUNIT(2) to be inserted after the call to INITT.

An extensive change of documentation has been necessary, so a completely new version will be released at the date above in a more permanent cover (new delightful brown binders).

-- Keld Petersen

6600 Performance Statistics

Week ending	3/7	10/7	17/7	24/7
Uptime (hours)	143	147	148	130
Downtime (hours)	25	21	20	38
Availability %	85	87	88	78
MTBF (hours)	56	24	84	56
Jobs from central site	974	1120	882	958
Jobs from remote site	304	407	295	334
Machine time CPU hours	81	77	63	70
• PPU hours	123	124	77	75
Cards input (thousands)	85	115	94	87
Lines printed (x 1000)	1004	858	764	815
Plots	44	99	88	82
Plots (in feet,approx.)	150	300	600	600

"Availability" = Uptime/(Uptime + Downtime) as %

MTBF = "Mean Time Between Failure"

-- Eric Walton

Training Schedule

A training schedule for Cray and CDC has been arranged. The following classes are intended for users and systems staff:-

3 - 8 October	CRAY	user overview: architecture and operating system; JCL, utilities, file organisation, link principles, assembly language, Cray Fortran, vectorisation.
17 - 21 October	CDC	user overview: architecture and operating system; JCL, utilities, file organisation, link, use of Record Manager.

The following additional classes are intended for systems staff but may be of interest to users as well:-

10 - 15 October	CRAY	Assembly language, operating system internals, system maintenance.
24 October - 4 November	CDC	CPU and PPU assembly language, NOS/BE system internals, operating system maintenance.

-- Richard Friedman

Computer Systems Seminars

The User Support and Operating Systems Sections plan to hold a number of technical and tutorial seminars on various aspects of programming and computer architecture pertinent to the CYBER-CRAY during the coming year. These will be announced in this Newsletter. Topics being considered include UPDATE, Cyber and/or Cray assembler, vectorisation, loading and libraries, etc. We welcome further suggestions of specific topics.

-- Richard Friedman

An ECMWF Program Library?

We are just beginning to formulate plans to create an ECMWF program library. This will come from many sources, including the "P3" library now being used on the 6600 Research Staff. The advent of both the CYBER and CRAY make this task somewhat complex, and we are most interested in hearing your suggestions concerning the form and makeup of such a library.

-- E. Edberg, M. Lewis
R. Friedman

VOX POP

This Newsletter will accept queries sent to it by anyone on subjects pertaining to the ECMWF Computer Service. Queries will be answered by the computer systems staff and published in the next issue. Queries need not be signed, but we do reserve the right to edit and shorten them. Send your cards and letters to: VOX POP, Newsletter, Room 102, Brandon House.