



European Centre for Medium Range Weather Forecasts COMPUTER NEWSLETTER

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Edited and produced by User Support Section, Brandon House, ext. 286

```

100 C      OR MODE=-3, AINPUT=MODE'S & OUTPUT=DATA
101 C      TRIP=MODE+3, AINCL=MODE & OUTPUT=COMPS
102 C      WORK IS A WORK AREA OF LENGTH N
103 C      TRIPS & TRIPX ARE CALCULATED ARRAYS
104 C      N=LENGTH OF COMPS & DATA USED
105 C      INC=INTERLEAVING INCREASING FOR AINPUT
106 C      NINC=INTERLEAVING INCREASING FOR OUTPUT
107 C      LOST=0 IF OUTPUT OVERWRITES INPUT, OTHERWISE ISEP NE.0
108 C
109 C      DATA ORDER X(0),X(1),X(2),...,X(N-1)
110 C      COEFFS ORDER A(0),A(1),...,A(N/2),A(1),B(2),...,B(N/2-1)
111 C
112 C      Y(J)=SUM(K=0, N/2)(A(K)*COS(2*PI*K*J/N)+B(K)*SIN(2*PI*K*J/N))
113 C
114 C      A(K)=(2/PI)*SUM(J=0, N-1)(X(J)*COS(2*PI*K*J/N)-Y(J)/2) FOR K=0,N/2
115 C      B(K)=(2/PI)*SUM(J=0, N-1)(X(J)*SIN(2*PI*K*J/N))
116 C
117 C      SUBROUTINE FTTR(AINPUT,TRIPX,OUTPUT,TRIP,INCL,INCL?,ISEP,
118 C      *MODE)
119 C      DIMENSION AINPUT(N),WORK(N),OUTPUT(N),TRIPX(N),TRIPX(10)
120 C      NTRIP=TRIPX(1)
121 C      NH=N/2
122 C      INK1=INCL+INCL
123 C      INK2=INCL2+INCL2
124 C      IJ1=NH*INCL+1
125 C      IJ2=NH*INCL+1
126 C      IF (MODE.EQ.-3) GO TO 30
127 C
128 C      MODE=+3, INCL=DATA, IF FIRST FACTOR GREATER THAN 8 & ISEP NE.0,
129 C      COPY DATA TO WORK OR OUTPUT (TO PROTECT INPUT), OTHERWISE DO
130 C      FIRST PAIRS OF COMPLEX FFT TO WORK OR OUTPUT, LAST PAIRS OF COMPLEX
131 C      FFT SHOULD WRITE ON-DECKS TO WORK, REALS FOR POSTPROCESSING TO
132 C      FTNCL COMPS IN OUTPUT.
133 C
134 C      IF (IFACT(2) LT. 8) GO TO 40
135 C      IF (INCL.EQ.0) GO TO 40
136 C      L=1
137 C      LA=1
138 C      JB=1
139 C      IF (MOD(NTRIP,2) EQ.0) GO TO 20
140 C      TO 12 I=1,N
141 C      OUTPUT(IJ1)=AINPUT(IJ1)

```


* * * Special Lecture * * *

GEORGE MICHAEL of the Lawrence Livermore Laboratory will be visiting the Centre on 16 June, and has agreed to give a talk entitled:

"Computing at the Lawrence Livermore Laboratory"

This will be held in the Brandon House Conference Room on FRIDAY 16 June at 2 p.m.

- David Dent

Fast Fourier Transforms on Cray-1

The Fast Fourier Transform (FFT) provides a rapid way of calculating complex Fourier transforms of length N:

$$x_j = \sum_{k=0}^{n-1} c_k \exp(2ijk\pi/n) \quad \text{or} \quad c_k = \frac{1}{n} \sum_{j=0}^{n-1} x_j \exp(-2ijk\pi/n)$$

where n can be factorised as a product of smaller numbers (preferably small primes). It has a number of important applications in numerical weather prediction. Spectral models in particular depend on it; FFT is also used in the ECMWF gridpoint model to filter high wavenumber components in the fields near the poles, and in the semi-implicit version to solve the Helmholtz equations at each timestep. Normal mode initialisation and diagnostic/verification studies are other areas where the FFT is extremely useful.

The structure of the FFT algorithm is described in ECMWF Technical Note no. 3, "Mixed radix Fast Fourier transforms without re-ordering". There is one pass through the data for each factor of N. Each pass is a nested loop of the form

```
DO 20 K=1,N/(IFAC*LA)
DO 10 L=1,LA
  :
10 CONTINUE
20 CONTINUE
```

where IFAC is the current factor of N and LA is the product of all the factors used in previous passes (LA=1 on the first pass). In general the loops cannot be combined into a single loop because of jumps in the indexing. A typical example of the data flow for N=8=2x2x2 (3 passes) is shown on the cover of this Newsletter.

How to vectorise this structure for use on the Cray is an interesting and by no means trivial problem. A detailed report is planned as an ECMWF Internal Report, but in the meantime a brief summary is presented here.

Some timings for FFT's using different approaches are presented in the accompanying table; all timings except those in column CFFT2 refer to Fortran programs. Column A corresponds to the "obvious" approach; the problem here is that the vector length (LA) is small in the first few passes. However, the nested loop can be "turned inside-out" so that the vector length is large initially and decreases with each pass (column B). Much faster times are achieved if scheme B is used for the first one or two passes, after which scheme A is used for the remainder (column A + B). The Cray-supplied CAL routine CFFT2 appears to use this approach; as shown in the table, CAL times are around 60% of Fortran times for small to medium N, but over 80% for N=1024.

A reformulation of the FFT algorithm due to Pease results in a vector length N/IFAC for each pass (column P*). The snag here is that the answers emerge in a scrambled order; in most applications we have to add an unscrambling operation, which unfortunately is a scalar procedure. Times for the unscrambled transform are in column P - as the table shows, the cost of unscrambling outweighs the advantage of the maximum vector length in the transform itself.

In most of our applications we want to do many FFT's simultaneously, and so an alternative approach to vectorisation is to do them in parallel - the vector length is then just the number of transforms (M) being done at once. Results are shown for M=16 and M=64, and demonstrate clearly that this is the best approach, particularly for short transforms. The times for M=64 correspond to speeds of 40-50 megaflops, and it should be possible to achieve 80-100 megaflops in CAL.

An FFT package is being put together, based on the parallel approach to vectorisation. Routines available so far are FFT33 (for real periodic transforms) and FFT44 (for real sine transforms). Documentation will be issued shortly.

Time per complex transform on Cray-1 (microseconds)

N	A	B	A+B	CFFT2	P*	P	M=16	M=64
32	142	167	70	46	63	89	27	13
36	165	187	81	-	66	94	32	17
48	206	237	89	-	73	110	41	22
50	250	272	99	-	82	121	55	31
64	267	316	106	63	81	131	53	29
96	419	477	171	-	114	188	105	56
100	436	479	175	-	122	199	107	66
128	545	650	191	112	140	239	139	75
1024	4420	5600	1160	953	933	1714	1400	813

- Clive Temperton

Andrew Lea - An Introduction

I joined the Centre on 1 May, as the Head of User Support Section.

In 1965, I received a doctorate from University College London and then spent several years as an active user of large scale scientific computers pursuing theoretical high energy nuclear physics. Having pursued the subject for some time, but never actually having caught up with it, I decided to join the Computer Division of the Rutherford Laboratory in 1970. There I set up and ran the User Support Group. During that period the Laboratory evolved from an IBM 360/75 through to its present large scale dual 360/195 installation.

Most of my working life, I have spoken IBMese, now I need to learn a new language. Until I am fluent in CDCese, etc., adequate simultaneous translation facilities into IBMese will be available through the existing members of User Support, Luigi and David.

My office is in Brandon House, room 101, extension 289.

- Andrew Lea

Reduced Computer Service - October, November, December

Summary

During the last 3 months of this year it is planned to install and accept the computer systems at Shinfield Park. This article outlines the tentative plans for the move, and the consequences to yourselves.

In October the only service available will be on the present Cray-1 at Rutherford. Use of the Cray will be via the Eclipse card reader and line printer. There will be no CYBER service and no telecommunication links to Bracknell.

In November it is hoped to accept provisionally both the Cray and Cyber systems at Shinfield Park, to link them, and to build up to a 7 day a week, 24 hours a day service. There will be no telecommunications links from Bracknell to Shinfield. At Shinfield the RJE's and some alphanumeric terminals will be available for users. During the first week of November, as various acceptance tests are run, both the Cray and the Cyber will be unavailable, for about two days each. After the Cray acceptance test the Cyber-Cray link tests are to be prepared and both the Cray and the Cyber will be unavailable for lengthy periods.

By the end of November, it is proposed to run the integrated Cyber-Cray link tests and acceptance trials. This will take about two days, there will be no service in this period. From that point on you should then experience a full service at Shinfield. If your office accommodation is still at Bracknell you will either have to use the courier service to submit work, or travel to Shinfield yourself.

From the above, I hope the message is clear, please reduce to an absolute minimum your demands on the computer services during October and November.

Detail

Starting on the 1 October, the computing service will be moving to Shinfield Park. This is a very complex exercise, involving much equipment and many staff. In planning this exercise, the aim has been to minimise total downtime as much as possible, and to bring reasonable services into operation as soon as possible.

The magnitude of the overall task can be judged from the following list of items to be done:

1. Move existing Cyber 175 from Rutherford to Shinfield;
2. Add enhancements to the Cyber - more main memory, additional PPU's, 6250 bpi tape drives and controllers, terminal controller, additional disks;
3. Change to new releases of NOS/BE and INTERCOM to enable support to be given to the new tape drives, etc.
4. Install the 1 Mword Cray-1 system;
5. Link the Cray and Cyber;
6. Install new graphics system (one on-line Versatec plotter during December);
7. Install the telecommunications front-end system (during December and January);
8. Start 7 days a week, 24 hours a day shift working.

Below shows on a month by month basis the main events, as seen by you. Without doubt, the major assumption is that the buildings at Shinfield Park will be handed over on 1 October, should this be delayed then the whole program will slip correspondingly.

DATE (Tentative)	Cyber	Cray
1 October	Service at Rutherford terminates. Equipment moved to Shinfield and upgraded.	Interim service continues at Rutherford, access via Eclipse card reader/line printer only.
1 November	Cyber service at Shinfield opens, (including about 6 Intercom VDU's) - no telecoms link to Bracknell though.	↓
8 November	↓	Cray (1 Mword) service opens at Shinfield. Service on ½ Mword Cray at Rutherford ceases.
8 November	Two weeks of Cray-Cyber link tests starts, service on both machines liable to lengthy interruptions.	
22 November	Two days of link acceptance tests - no service on either machine	

Once the Cyber service opens at Shinfield, access to it will either be via a courier service (tentatively planned at three van trips per day) or by travelling to Shinfield yourself. It is not yet known when the Centre's staff will move into the office accommodation at Shinfield, hence plans are being made to provide you with working space in the computer block. At this stage, it is believed space will be available for some 20 transient users each day.

This article has attempted to give you an overall idea of the plans for moving into Shinfield. More detailed information will be given to you when available.

- Andrew Lea

The Telecommunications Project

The contract with SIA Ltd., London, for delivery of a turnkey telecommunications subsystem to ECMWF was signed on 14 March 1978. SIA are now in the system and program design phase which should be finished by 1 June when coding will start. The hardware comes from Regnecentralen, Denmark, and is built around an RC8000 computer. The equipment has recently been shipped to the U.K. and has now been installed at SIA's premises, and first hardware checkouts are underway.

The RC system will interface into a Cyber 175 PPU via a coupler also provided by Regnecentralen. The software interface will be the new INTERCOM 5 whose first version is due for release by CDC middle of this year. Analysis undertaken in the design phase has shown that only minor modifications to the INTERCOM 5 driver should be necessary. The concurrent handling of the CDC 2550 for our local network will be possible. It will be the task of the RC system to match the data transmission procedures with the Member States into CDC INTERCOM compatible procedures.

Data transmission to and from the Member States will be governed by a layered set of "protocols" which will be according to available international standards and quite independent of CDC transmission procedures. For the lowest levels, viz. the physical and the data link level, the CCITT adopted X.25 procedures had been selected which will simplify a later change from point-to-point to public packet switching network connections. For higher levels of protocols, the Centre is actively engaged in promoting and adopting international standards, and has found the support of ECMWF's Communications Advisory Committee for its proposals.

The telecommunications subsystem of ECMWF will also involve a purpose designed network control centre providing easy switching of connections and equipment (thereby enhancing reliability) and testing facilities on the line and modem level.

Following a proposal brought forward by some Member States, a seminar was held at the Meteorological Office College, Shinfield, from 9 - 11 May 1978, in order to present in detail and discuss the adopted data transmission protocols. This seminar complemented the series of documents already mailed to the Member States on various occasions. A document was prepared for the seminar, describing ways of protocol working at the various levels, and giving hints on how the layers of protocol could be implemented on various typical computer configurations.

For several reasons it is not possible to provide all 17 Member States with medium-speed (i.e. at least 2400 bits per second) connections to the Centre from 1979. Simple, character-oriented low-speed (telegraphic) lines are offered as an interim alternative. The countries scheduled for medium-speed connections in 1979 are U.K., Germany, France, Italy, Finland and Sweden. They all seem to be well advanced with that planning and implementation and we expect most of these connections to become operational in the first half of 1979. Special care is taken to achieve the acquisition of the observational data from UKMO as early as possible and a close working liaison between the Centre and the UKMO has been established in this matter.

There are several pending tasks in the telecommunications project which are tackled now and will be completed by early summer. This will be a first approach to defining procedures for set-up and testing (on all protocol levels) of medium-speed connections. Also the operating procedures for low-speed connections are to be defined. Tenders are invited and equipment will be selected for the modems on the ECMWF site. The detailed design for the network control centre will have to be available. Job stream structures for RJE access by the Member States will be laid down. And, finally, the criteria for Provisional Acceptance of the SIA project will have to be defined.

-Fritz Königshofer

Problems with Newbury Labs VDU's model 7005
(or, why your terminal doesn't behave the way you want.)

Many users have experienced problems using our 7005 terminals (the visual display units) on Intercom. These are caused by the extra features built into the units which Intercom cannot handle.

The most common cause for complaint is the appearance of special mode character displays on the screen. There are 3 special modes for the display: blinking, inverted, and protected. In blink mode the affected characters flash on and off about twice per second; in inverted mode the characters appear dark on a (local) bright background, and in protected mode the characters cannot be removed from the screen. Protected characters are especially annoying because any subsequent output only appears in the gaps between the protected characters, which do not roll off the

screen when the display shifts up one line but reappear on the bottom line when they are shifted off the top.

Two other 'strange' states the vdu's can get into are 'send page' mode, where the vdu tries to output all the data from its screen to the computer, and direct cursor addressing, where a group of 3 characters from the computer or the keyboard drives the cursor (the position where the next character will be displayed) to a specific location on the screen. Send page can be very disruptive if it happens by accident, because the screen contents are unlikely to make sense to Intercom, and any error messages sent from the computer will be mixed with the existing screen characters to produce further confusion. Cursor addressing is less of a problem because it simply appears to ignore two further characters and resume output at a strange point on the screen.

Users of these terminals may suffer such problems from one of 3 possible causes: obviously, random key depressions can produce odd effects (especially CTRL combinations); random noise on the communications line can appear to be control characters to the vdu, and can switch it into one of these modes; but the most common cause is for the vdu to receive input simultaneously from the computer and from the keyboard: the internal circuit which allows characters from the keyboard to appear on the screen then mixes up the two lots of data and effectively sends garbage to the vdu.

What can be done about these effects? Obviously, the cure for keying random characters and for entering characters while the computer is sending data is not to do it: this is not always practicable however since some output from Intercom may be unsolicited - e.g. operator messages. About line noise little can be done, except that we can complain to the Post Office if one of our lines is particularly bad. This will remain an occasional source of random characters however.

The most practical approach is to learn how to clear a 7005 vdu to its normal operational state from any condition it may have got into. The following sequence of key operations will always work (if you find a case where it doesn't, let me know) and leave the vdu in normal state with a clear screen.

- 1.) Put the vdu in LOCAL mode (latching key marked LOCAL to left of keyboard - illuminates in local mode)
- 2.) Hit RESET (extreme right at row above keyboard)
- 3.) Hold down CTRL and hit S - this turns off any protection
- 4.) Hold down CTRL and hit F - this turns off inverted mode
- 5.) Hold down CTRL and hit W - this turns off blink mode
- 6.) Hit CLEAR (extreme left of row above keyboard)
- 7.) If the PAGE button (in row to left of keyboard) is lit, hit the ROLL button above it, which should light
- 8.) Take vdu back out of LOCAL by hitting the LOCAL key again.

Not all of these steps are always necessary, but if in doubt it is always better to be sure. The 3 control combinations can be used selectively depending on what is wrong with the display.

Finally it perhaps ought to be stated that these special facilities and modes of the terminal are not always a liability: it is possible to use all of them from a FORTRAN program by making the proper subroutine calls. Thus where a lot of output (or input) is made interactively to a single program it may be practical to make use of the special features at the terminals. Any users who believe they may be able to do so should contact user support in the first instance for advice.

- Dick Dickson

The 844 - 41 Disc Pack

The 844-41 disc pack is referred to as the "double density" pack, and is the disc pack currently used on the CYBER 175.

This pack comprises 808 cylinders of 19 tracks. Each track contains 24 sectors or physical record units (PRUs) which each hold 64 60-bit words of data. The PRU is the smallest addressable unit of data.

Rotating Mass Storage (RMS) or Disc Space is assigned a record block at a time. On the Cyber 175 all record blocks currently comprise 56 PRUS.

The capacity of the 844-41 disc pack is equivalent to:

5,656 blocks of 4096 words
6,464 record blocks of 56 PRUS each
361,984 PRUs
23,166,976 words of 60 bits.

The LIMIT control card

The LIMIT control card specifies the OCTAL number of 4096-word blocks of rotating mass storage (RMS) that may be assigned to a job. An RMS block is equivalent to 64 disc sectors or PRUs.

The RMS limit specified applies to RMS files actually created or extended by the job and does not include the INPUT file or attached permanent files. Any RMS file deleted by the job decreases the count of assigned blocks.

The default mass storage LIMIT is 3000₈ which corresponds to:

$\frac{1}{4}$ of a disc pack (approximately)
1536 blocks of 4096 words
98,304 sectors of PRUs
6,291,456 60-bit words

Using LIMIT,13000 would set the RMS limit to approximately the capacity of a disc pack.

- Tony Stanford

Computer Manual Distribution

An up to date set of CYBER & CRAY manuals is about to be distributed to computer users. The manuals are organised into sets as defined below. Each user will receive a PERSONAL set. Each room containing at least one user will receive a USER OFFICE set. REFERENCE sets are already located in John Scott House, Fitzwilliam House (terminal room), Brandon House & Rutherford Laboratory. There is a MACHINE ROOM set near to the operators consoles. Additionally, there are special sets for system programmers, user support and computer operators. Users may of course retain any manuals not in their standard sets. We would, however, like to document these additional manuals in order that they may be updated routinely. We hope to do this documenting at the same time as we deliver the new sets.

PERSONAL set: (CDC) NOS/BE User's Guide
FTN Reference
FTN User's Guide
(CRAY) CFT Fortran Reference

USER OFFICE set: (CDC) NOS/BE Reference
NOS/BE Diagnostic Handbook
COMPASS Reference
LOADER Reference
Record Manager Reference
Record Manager Users Guide
FTN Common Library Math Routines
INTERCOM Reference
INTERCOM Guide for FTN users
UPDATE Reference
(CRAY) CAL Assembler
COS External Reference Specs
UPDATE Reference

A CRAY job with several input files

The following CRAY-1 problem was recently passed to User Support and is interesting because it illustrates some differences in file structure and file handling between CYBER and CRAY operating systems.

The control card deck was as follows:

```
JOB (JN= ... )  
CFT.  
LDR.  
CFT.  
LDR.  
----- eof  
fortran 1  
----- eof  
data 1  
----- eof  
fortran 2  
----- eof  
data 2  
----- eof
```

Both programs read data cards from the \$IN dataset. Program 1, read exactly the number of cards contained in data 1 and ran successfully. The second execution of the compiler failed, complaining that there was no Fortran deck for it to read.

The explanation is that, under COS, no file repositioning takes place between programs. Therefore, the \$IN dataset remained logically positioned after the last data card of file 'DATA 1', ready to read the end of file control word. This is treated as a separate record by COS and must therefore be read. In this case, CFT read the EOF as the first record and concluded that its input stream was empty.

The solution is to change the program I/O structure so as to read until EOF is detected (use the IEOF function), this leaving the input stream positioned at the beginning of the next file. (For a description of the CRAY blocked dataset format see 'External Reference Specification', Chapter 2).

New Cray Software

1. Fortran Compiler

A new release of CFT has been received and will shortly be available as a test version. There is one significant change, concerning the handling of integer arithmetic. Integer variables are now handled through the S register, thus allowing integers in the range

$$- 2^{63} \leq I \leq 2^{63}$$

In particular, character and bit manipulation may be performed using integer variables.

The disadvantage of this change is that integer multiply and divide will take substantially longer. To offset this, array indexing computation will continue to be carried out in the A register with a 24 bit limitation on the integer size.

EX:

```
A(K+I) = B(2-K+J)  
      (K+I) and (2*K+J) calculated in A register
```

but

```
MM = 2*M+8  
A(MM) = B(J)  
      MM is calculated as a 64 bit integer.
```

There is a compiler directive to specify that named integer variables be treated as 24 bit integers. This could be useful for inner loops where there is a significant amount of integer multiplication and/or division. In addition, there are several new compiler directives: -

```
CDIR$ EJECT - force a new page  
      NOLIST - suppress all listable output  
      LIST - resume production of listable output  
      CODE - produce generated code listing  
      NOCODE - suppress generated code listing  
      NOVECTOR - suppress attempts to vectorize inner DO loops  
      VECTOR - resume attempts to vectorize inner DO loop  
      IVDEP - ignore vector dependencies  
      FNT24 a,b,c - specifies a 24 bit integer data type for the variables a,b,c.
```

Additional new features in the compiler are:

implied DO in DATA statements
 new cross-reference table
 PARAMETER statement allows constant expressions
 on subroutine CALL's, the actual parameter count is placed in A7 (useful for
 called CAL routines).

There are various bug fixes, some of which relate to problems discovered by ECMWF staff. These will be checked out individually in the near future.

2. Fortran library

A new release of the Fortran library contains various bug fixes. Both test versions will be obtainable by including:

```
ACCESS (DN = CFT, PDN = CFTEST)
ACCESS (DN = $FTLIB, PDN = $FTLIBTEST)
```

3. Operating system

The April release of the operating system (COS 1.0.1) together with some subsequent modifications is about to undergo on site testing. If all goes well, it is hoped that the new system will be operational before the end of June. The important changes include:

```
I/O improvements
new control card (ADJUST) to modify the size of an existing dataset
new operator displays
new station software.
```

Details of these changes will be supplied when the system goes into service. A report on the improved I/O transfer rates will be included in the next Newsletter.

4. Maths routines

Several mathematical routines are now available. These are, or will be, part of the Cray product set. Documentation has been received on the FFT routines only. However, there are test programs which are sufficient to deduce the user interfaces. Interested users please contact User Support. The routines have been organised into a library, useable as follows:

```
ACCESS (DN=L, PDN=CRAYLIB)
LDR (LIB=L:$FTLIB)
```

The routines are:

```
CFFT2 - complex FFT
CFFT - real FFT
MXM - matrix multiply
DOT - scalar product
MINV - matrix inversion
```

- David Dent

External Libraries

Up to the present, the NAG library has been the principal numerical software library available to the computer user community. This will remain true in the future, but several developments are worth noting.

Firstly, the existing NAG library on the CYBER is Mark 5 and is in fact optimised for the CDC 6600. We hope to receive very shortly, a Mark 6 version, optimised for the CYBER 175. Mark 6 sees the addition of 64 new routines which provide new surface fitting facilities, a substantial expansion of the optimisation chapter, and a new suite of random number generator routines. We then plan to begin an implementation exercise with the object of making this Mark 6 version available on the CRAY-1. Until this is complete, the routines now available on the CRAY-1 must be regarded as untested & preliminary. They should be used with great caution.

In order to provide alternative numerical routines, parts of the NCAR library have been obtained and will soon be available on the CRAY-1. These consist of those parts of the NCAR library which have been implemented by NCAR on their CRAY-1. Hence, they can be used with some confidence. A list of routines will be made available shortly and the NCAR library manuals will be placed in the Fitzwilliam House terminal room.

- David Dent

Program Advisory Service

User Support staff will be available on Wednesday afternoons in Fitzwilliam House starting from 14th June. When available, the conference room will be used. Visits to John Scott House on Wednesday afternoons will continue as at present.

- Andrew Lea

Q & A

Question: What is the maximum amount of memory available on the CRAY-1 for a user job.

Answer: With the existing system, COS 1.0.0, the memory not used by the system or by buffers and tables allocated to the system is

$$1604000_8 \text{ words} = 460800_{10} \text{ words}$$

A single job making use of this space requires 5000₈ words for the Job table Area, leaving 1577000₈ words for the job's field length. From this, the following areas are automatically required:

Job control block:	200
DSP tables for \$IN, \$OUT files:	32
buffers for " " "	10000
	<hr/>
	10232
	<hr/>

In addition, each user's file requires (by default) a buffer space of 4000 words and a DSP table.

These figures will change somewhat when COS 1.0.1 becomes operational.

- David Dent

RJE Terminals

The RC terminal in John Scott House has passed the final acceptance test. Details of the changeover from the DATA 100 terminal in Fitzwilliam House are as follows:

1st June	a.m. - CDC engineers remove DATA 100
	p.m. - RC engineers instal new equipment
2nd June	checkout
5th June	acceptance trial and operational use.

Reminder - Computer Courses

CRAY user course	6, 7, 8 June
Advanced CYBER course	19, 20, 21, 22 June

All sessions will be in the Brandon House conference room, 2 p.m. - 5 p.m.

Computer Bulletins

New issues this month:

B 2.2/1	Introduction to Control statements on the CRAY-1
B 8.1/1	CRAY-1 Audit of Permanent Datasets.

It is planned to issue an index of existing bulletins with the next Bulletin release.

COMING SOON

CRAY 1/O rates with COS 1.0.1
Spectral Modelling

Local Modifications to the CYBER 175's Job Schedule

Modifications to the job scheduler on the CYBER 175 are at present undergoing tests. These modifications, made by ECMWF, are designed to aid the operators in selecting jobs to be run, and to optimise machine throughput. The idea behind the mods is to introduce a class system for jobs, based on CP time limit. The classes will be named as 'A' to 'G', and will be related to the CP time limit specified on the jobcard by the table:

<u>Class</u>	<u>CP time (octal secs)</u>	<u>(Approx)</u>
A	1 to 100	(< 1 minute)
B	101 to 400	(< 4 minutes)
C	401 to 1000	(< 8 minutes)
D	1001 to 4000	(< ½ hour)
E	4001 to 10000	(< 1 hour)
F	10001 to 40000	(< 4 hours)
G	0 or >40000	(> 4 hours)

The system is such that the operators will be able to limit the number of jobs in any class that can be in execution at any one time. Normally the limit for class A would be less than that for class B which would be less than that for class C etc. If the limit for any class is reached, then no more jobs for that class will enter execution until one of those currently executing, terminates.

As you can see, this system encourages you, the user, to code a realistic time limit on your jobcard. If you code a higher value than you require then you could find that your job stays in the input queue longer than is necessary because that class is already full.

An enhancement to this system is to take into account the amount of field length (central memory) that a job requires. The inclusion of this is only a tentative proposal as yet, and no firm plans have, as yet, been made.

- Neil Storer

NOS/BE Changes

The following changes to NOS/BE system parameters apply from next Monday, 5th June.

1. QCRAVIN file size limitations are changed to
1.5 Mb for STCRA
6 Mb for STCRB
2. LIMIT (n) n may now be 777777 or any octal number up to 20000. For operational reasons, please DO NOT use n=777777 (represents no limit)
3. REDUCE There is an automatic field length reduction at the start of a job. This will not affect users unless they code CM on the job card. In this case, the CM value acts as a field length limit for the duration of the job.

- Jean-Luc Pepin

NEWSLETTER next issue

The next issue will be in JULY. Articles, items of interest, comments will be gratefully received.
