



European Centre
for Medium Range Weather Forecasts



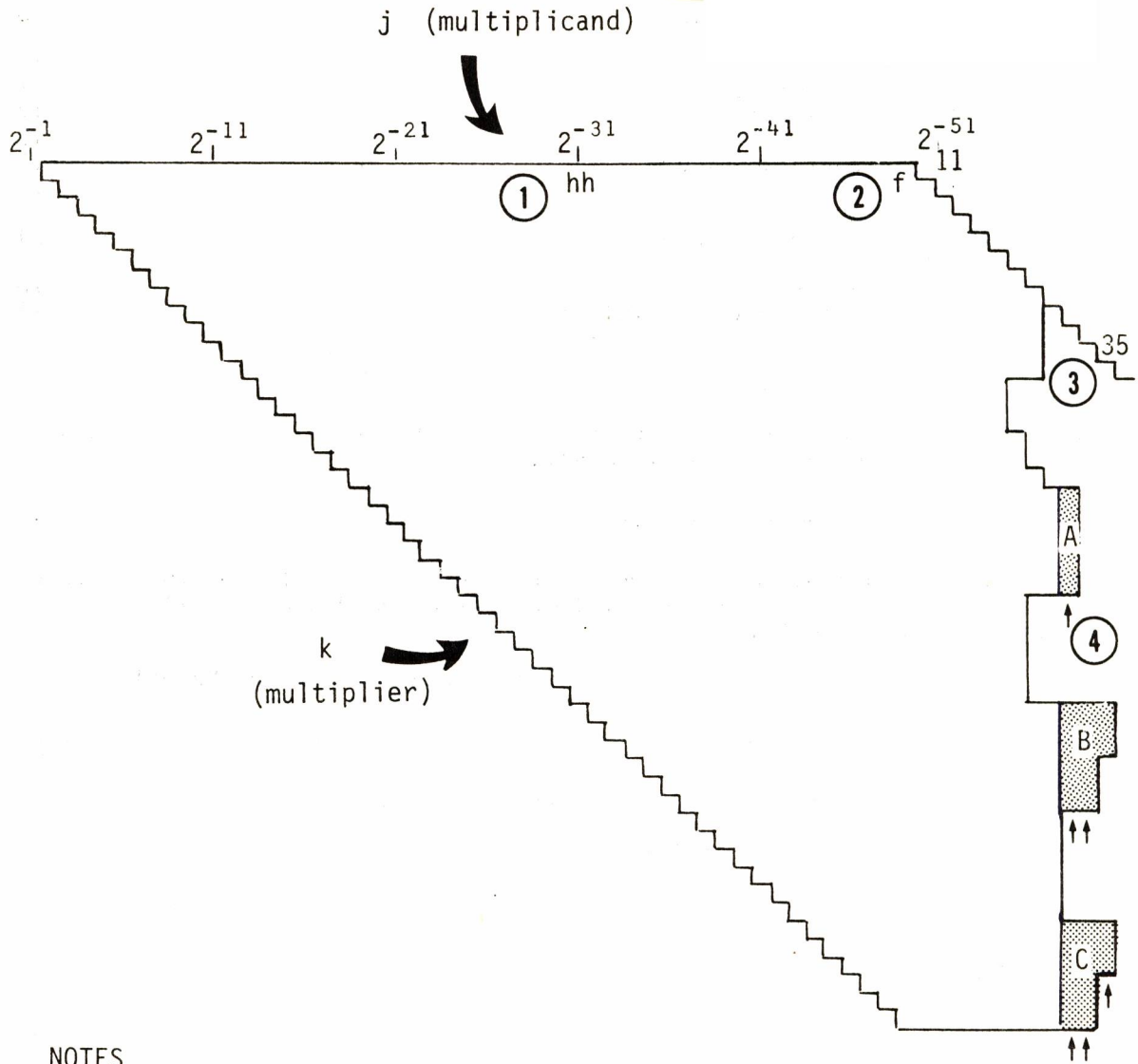
ECMWF NEWSLETTER

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**NOT TO BE
TAKEN AWAY**



NOTES

1. $h = 1$ for half precision round.
2. $f = 1$ for full precision round.
3. Missing carries from the portion of the pyramid below 2^{-60} .
4. Arrows indicate sum bits that are not accumulated into the 57-bit answer.

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

COVER : The "multiplication pyramid" used by the Cray-1, see the article on page 12 titled "Cray Multiplication Hardware" detailing a change to come.

This diagram is from the Cray-1 Hardware Reference Manual

This Newsletter is edited and produced by User Support.

The next issue will appear in June.

BULLETINS CORRECTION PROGRAM (CORBUL) IN USE AT ECMWF

This is another article in the series describing the subsystems making up the complete operational suite. Previous articles include that on decoding (see the Technical Newsletter, December 1979) and on quality control of observational data (see the ECMWF Newsletter, February 1980).

The Bulletins Correction Program, CORBUL, is part of the Operational Watch suite in use at ECMWF. It provides facilities for forecasters or operators to apply corrections manually to bulletins of data which have been rejected by the automatic decoding programs. After correction the user has the choice of sending the bulletin back to the decoding programs for further revalidation or discarding it to a DREGS file. The DREGS file is for bulletins that cannot be corrected by the user or from which no meaningful information can be extracted, Fig. 1 gives a general overview of the Bulletins Correction procedure.

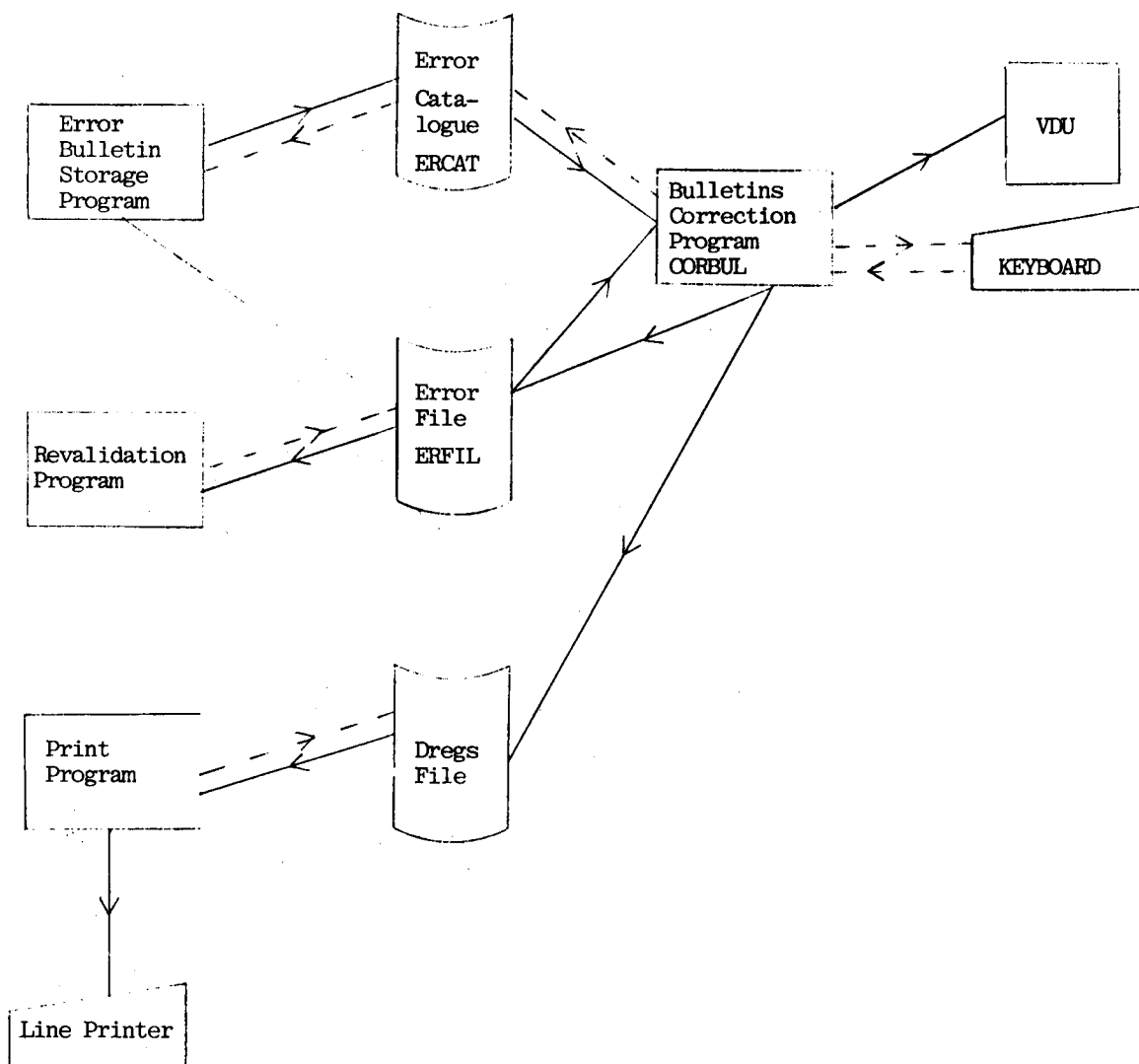


Fig. 1 General View of Bulletins Correction Procedure

Bulletins rejected by the decoding programs during the data acquisition period are stored in an error file (ERFIL). A list of the bulletins in the error file is kept in a separate catalogue file (ERCAT), together with information (including a "status word") about each bulletin and its address in the error file. Using the catalogue file enables the listing of the contents of the error file without any time-consuming searching and also provides easy access to the error file.

Both files, ERFIL and ERCAT, are divided into ten sections, each section corresponding to a different meteorological code-type or group of code types, e.g. SYNOP, TEMP, SATOB etc. One of these sections is a miscellaneous section for storing bulletins whose code type cannot be distinguished. The sections are of variable length, depending on the average number of *bulletins* of each code type rejected each day. Table 1 shows the average number of *reports* rejected each day (based on a survey from 1-15 December 1979) and the size of each section. It should be noted that the number of bulletins rejected will be lower than the number of reports rejected as one bulletin may contain more than one rejected report.

Code Type	SYNOP	TEMP	TEMP	PILOT	PILOT	BATHY		SATEM		
	SHIP	Parts A&C	Parts B&D	Parts A&C	Parts B&D	TESAC	DRIBU	AIREPS	SATOB	MISC.
Average daily number of rejected reports	878	237	129	186	105	3		348	3	-
Size of section	800	200	100	200	100	100		600	100	100

Table 1. Average number of reports rejected daily December 1-15, 1979 (top line) and size of section available for rejected bulletins.

If the number of bulletins rejected for any one section exceeds the size of that section, then further rejected bulletins for that section are stored in the miscellaneous section. The sizes of the various sections can be altered quite easily and may be changed at some future date depending on how the program performs when real-time data acquisition begins and on changes to the decoding programs. These changes in section sizes, if any, will be largely transparent to the user.

The CORBUL program may be used in two modes, sequential correction or selection correction. In Sequential Mode, the bulletins in the error file will be displayed automatically, starting at the first bulletin. After each bulletin has been corrected, the next error bulletin in the error file will be displayed. In Selection Mode, the user may select the bulletin he wishes to correct. An interactive dialogue, between the program and the user, is supplied to enable the user to define the mode of correction and the bulletin required (in Selection Mode) and also to apply corrections.

Corrections to the data are group oriented, that is, a user may change, delete, insert or interchange groups within a bulletin. A group here means a normal coded meteorological data group. The user may also delete an entire line of a bulletin or the remainder of a bulletin after a particular group. Full details on how to use the program are contained in "OPERATIONAL WATCH PROGRAM'S USER GUIDE".

After a bulletin has been corrected, it is stored in its original position in the error file. However, the "status word" of its corresponding entry in the catalogue file is changed (if the user decides that it should be sent for revalidation), to show that the bulletin now awaits revalidation. The revalidation procedure may be started by the user when he has applied all the corrections he can. It is important that any bulletins which are corrected be revalidated before the analysis is run, to ensure that data contained in these bulletins are available for data assimilation. The revalidation program will take each bulletin that awaits revalidation from the error file. It will then reset the "status word" of its catalogue entry to zero, indicating an empty record. This record may now be used to store another bulletin that is rejected by the decoding programs.

At the beginning and at the termination of the program, the current state of the error file will be displayed, giving details of the number of bulletins in each "code-type" section and other statistics. This display may also be produced on request during the running of the program. Figure 2 shows an example of this display and also a typical "selection" mode correction sequence.

FIG. 2. EXAMPLE OF DISPLAY OF DATA FOR CORRECTION,
AND CORRECTION USING THE BULLETIN PROGRAM 'CORBUL'

(as seen by user on VDU screen, user input underlined)

Command - CORBUL

Total number of bulletins awaiting correction : 1294

Total number of bulletins awaiting revalidation: 0

Total number of bulletins in DREGS file : 196

Number of error bulletins in each section

SM.	US.	UK.	UP.	UQ.	BA.	AR.	AR.	ST.	MI.
632	172	57	149	89	15	170	0	10	0

Number of revalidation bulletins in each section

SM.	US.	UK.	UP.	UQ.	BA.	AR.	AR.	ST.	MI.
0	0	0	0	0	0	0	0	0	0

Option? S

Which code-type do you want? UK

UK Section

No.	IDEN.	TIME.	CAUSE.	NUM.
1	UEDN22	18.38.10.	14	(1)
2	UKUK85	18.40.26.	11	(1)
3	UKIV1	18.40.28.	14	(1)
4	UKWF86	18.43.01.	14	(1)
5	UEBX1	18.43.12.	12	(1)
6	UKNR1	18.43.45.	12	(1)
7	UEZA1	18.44.01.	11	(1)
8	UKMB1	18.44.10.	14	(1)
9	UECM1	18.44.20.	14	(1)
10	UEIY1	18.44.29.	11	(1)
11	UKRA12	18.44.42.	14	(1)
12	UKRA11	18.44.52.	31	(1)
13	UKSB1	18.45.08.	14	(1)
14	UKRA14	18.45.11.	14	(1)
15	UKCV1	18.45.23.	14	(1)
16	UKRA16	18.45.34.	14	(1)
17	UKLY1	18.45.37.	14	(1)
18	UKRA13	18.45.41.	14	(1)
19	UKWF1	18.45.45.	14	(1)
20	UEUK1	18.45.50	11	(1)

STOP/GO? STOP

Select> C, UK, 009

Page: 1 Errors: 14

	1	0	0	0	0	0	0	0	0
1	UECM1	FKKK	051200						
2	TTDD	5511/	64910						
3	11901	715//	22926	765//	33868	739//	44715	783//	55605 769//
4	66458	675//	77444	659//	88428	583//	99379	597//	11373 565//
5	22298	4575/	33291	547//	44284	471//			
6	22212	11700	12013	22615	12012	33510	09038=		

CORR> R, 06, 01, 21212

CORR> P, 01

Page: 1 Errors: 14

	1	0	0	0	0	0	0	0	0
1	UECM1	FKKK	051200						
2	TTDD	5511/	64910						
3	11901	715//	22926	765//	33868	739//	44715	783//	55605 769//
4	66458	675//	77444	659//	88428	583//	99379	597//	11373 565//
5	22298	4575/	33291	547//	44284	471//			
6	21212	11700	12013	22615	12012	33510	09038		

CORR> K

STOP/GO? STOP

SELECT> F

CORBUL TERMINATING

Total number of bulletins awaiting correction: 1293

Total number of bulletins awaiting revalidation : 1

Total number of bulletins in DREGS file : 196

Number of error bulletins in each section

SM.	US.	UK.	UP.	UQ.	BA.	AR.	AR.	ST.	MI.
632	172	56	149	89	15	170	0	10	0

Number of revalidation bulletins in each section

SM.	US.	UK.	UP.	UQ.	BA.	AR.	AR.	ST.	MI.
0	0	1	0	0	0	0	0	0	0

After the display of the state of the error file, the program prints the prompt 'OPTION?'. The user may now decide which 'correction mode' he wants, sequential or selection. In the above example the 'S' shows that selection mode is required. The program now responds with the prompt 'which code type do you want?'. The reply to this should be one of the Section definitions as shown in the display above i.e. 'SM' 'UK', 'US', 'AR', etc. These are abbreviations for the code-types of the particular sections, e.g. 'SM=synop+ship, 'US'=Temps part A,C. In this case the user selects 'UK', temps parts C and D. The program responds with a listing of the first 20 bulletins in that section, together with the time and cause of rejection, and the number of reports (in brackets) in each bulletin which contain errors. The response to the 'STOP/GO' prompt decides whether the listing of the bulletins in the section is to continue or not. In this case, the listing is stopped. The 'SELECT' prompt enables the user to select a bulletin from this section for correction. In the above example bulletin number 9 was selected (C,UK,009). The program will now display this bulletin in pages of 15 lines each, together with the numbers of the reports in the bulletin that contain errors. The 'CORR' prompt enables corrections to be applied. The user, in this case, replaced group number 1 in line 6 with the group '21212' (R,06,01,21212). Reprinting the page (P, 1) shows that the replacement has been made. The 'K' response indicates that the bulletin is to be kept for revalidation. At this stage the response to the 'STOP/GO?' prompt determines whether the next bulletin after the current one is to be displayed. The program is terminated by the 'F' response and the state of the error file is displayed again. Note the number of bulletins awaiting revalidation has been increased by 1 and the number awaiting correction has been reduced by 1.

- Paddy O'Sullivan

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ECMWF METEOROLOGICAL PUBLICATIONS

JANUARY - MARCH 1980

Technical Report No.16:

H.Økland, Model studies of a developing boundary layer over the ocean

Technical Memorandum No.11:

J-F. Geleyn, C. Girard and J.A. Woods,

Monthly report on ECMWF's operational models performance, November 1979

Technical Memorandum No.12:

K. Arpe, Preliminary Assessment of a 50 day run with the ECMWF operational forecast model

Lecture Note No.3:

A. Lorenc, Meteorological Data Analysis

Lecture Note No.6:

A. Simmons, Dynamics of large-scale atmospheric motion

Lecture Note No.8:

L. Bengtsson, The energy balance in the atmosphere and its role in the general circulation

Lecture Note No.9:

J-F. Louis, The parameterization of the planetary boundary layer

Proceedings of the ECMWF SEMINAR 1979 on Dynamical Meteorology and Numerical Weather Prediction (two volumes)

MEMBER STATE TECHNICAL AND COMPUTING REPRESENTATIVES

The ECMWF Council has set up a Technical Advisory Committee (TAC) to advise it on all technical aspects of the Centre's work. This covers such areas as the operational forecast and its products, the computer facilities, and the communication network, all as seen from the Member State viewpoint. Every Member State has a representative on the TAC, the current membership being given in the table below. The TAC has held one meeting at the Centre 4-6 September 1979, and another is planned for this year (3-6 June). However, the bulk of its work is done by correspondence, via a series of circular letters.

To assist the Centre in day to day matters regarding the computer facilities, each Member State has appointed a Computing Representative. The idea of such a representative is to have someone whom the Centre can approach whenever problems arise with that Member State's usage of ECMWF's computer facilities. Such problems could be a Member State's project overrunning its allocation, or a particular Member State's job causing operational problems, etc. The current list of Computing Representatives is given below. The Centre believes it could be of great interest to call a meeting of Computing Representatives to discuss informally the day to day running of the computing facility, and to hear the opinions and experiences of Member States using the facility. Such a meeting will shortly be arranged for September or October this year.

- Andrew Lea

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TABLE OF TAC AND COMPUTING REPRESENTATIVES

Member State	TAC Representative	Computing Representative
Belgium	Mr. W. Struylaert	Mr. W. Struylaert
Denmark	Mr. E. Busch	Mr. T. Glaven/O. Masson
Germany	Dr. W. Buschner	Dr. R. Lamp
Spain	Mr. B. Orfila	Mr. M. Hortal
France	Mr. J. Lepas	Mr. L. Jouaillec/J.P. Bourdette
Greece	Mr. G. Barbounakis	Mr. G. Barbounakis
Ireland	Mr. W.H. Wann	Mr. W.H. Wann
Italy	Dr. G. de Florio	Dr. G. de Florio
Yugoslavia	Mr. Z. Butigan	Mr. M. Gvozdenovic
Netherlands	Mr. P. Kastelein	Mr. J.A. Geurts
Austria	Dr. G. Wihl	Dr. K. Cehak
Portugal	Mr. S. Cristina	Mr. M.J. Rodrigues de Almeida
Switzerland	Mr. M. Haug	Mr. G. Siegwart
Finland	Mr. A. Lange	Mr. A. Lange
Sweden	Dr. R. Berggren	Mr. S. Orrhagen
Turkey	Director General	Director General
United Kingdom	Dr. R. Wiley	Dr. A. Dickinson

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USER SUPPORT ACTIVITIES

The future plans of Systems Software Section, and Telecommunications & Graphics Section have been outlined in past Newsletters. This article covers User Support functions and future activities.

The Section is currently 7 strong, including a consultant (here until June), and a member of Systems Software seconded for a period. Our prime function is to act as an interface between the user community on one side and the computer staff on the other: we provide a "conduit" through which information flows in both directions.

We provide both on-going (or continuous) services and special project support. Our main on-going functions are well known and include such things as:

- Advisory : we man an advisory office on a rota basis to deal with all technical queries, problem solving, helping newcomers, provision of information etc. This service is detailed in ECMWF Computer Bulletin B1.5/1.
- Documentation : providing manufacturers' manuals and updates, writing additional documentation (e.g. bulletins) to cover areas not in the manuals, editing and supervising newsletters and newsheets. In other words, providing the complete spectrum of written information that users require.
- Accounts : we produce regular statistics on user usage, and also maintain the register of those authorised to use the computer facilities.
- Training : twice a year we provide a series of courses ranging from a basic introduction to the computer facilities (for those familiar with another system elsewhere), to detailed Cray and Cyber training for those who want to use the machines in depth. Courses this year are in March and October. In addition, we arrange occasional training by others e.g. a series of specialised Cray 1 courses were recently presented by Cray Research Inc. staff.

All the on-going activities take well over half our effort, the remaining time is spent on special projects. Currently activity is focussed on the following:

Efficiency studies: now that both machines are fully loaded there is a clear case for studying selected programs to recommend efficiency or optimisation improvements. Currently we are spending much time, usually in collaboration with Research, studying the operational forecast suite of programs. Substantial work has been done on post-processing, and is now being done on analysis. In the near future we hope to look at quality control. In addition, a timing monitor is being provided to allow users to time their own programs and so identify the heavily used areas of code. Bulletins are in preparation on optimisation hints.

Program libraries: at the request of the TAC we are putting substantial effort into creating the first version of ECLIB. This is the Centre's own library and contains subroutines, utilities, etc. created or optimised especially for the mainframes at ECMWF. Recently, a library of CCL procedures was created for users of INTERCOM to help cut down the user time spent manipulating files, submitting jobs and retrieving output (see ECMWF Newsletter, no.1, page 8).

Usage control: we are approaching the time when control of usage will become more systematic to ensure that all users get their fair share of the ever more loaded machines. Research Department wish to revise their project structure and allocations, this entails some changes to be made. Later we will introduce job validation, that is, jobs will only be allowed to run if they are associated with a valid project, and time is available for that project. A more stringent control of permanent file space is also on its way. Looking ahead, we will have to collect and collate Member State bids for machine resources needed in 1981, to be presented to the TAC, then Council, for approval.

- Andrew Lea

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LINKS TO DWD AND BMO BECAME OPERATIONAL

As previewed in the last Newsletter, the provisional acceptance trials for the special software for the Deutscher Wetterdienst (DWD) in Offenbach commenced as scheduled in early February. All trials were passed successfully, thus the three months' final acceptance period for the Joint Project has started.

With the special software developed by SIA Ganymede, London, it is now possible to pass ECMWF's forecast products online via a WMO protocol interface directly into DWD's network processor.

DWD has been receiving forecast products since 6th February, as well as using the remote job entry facility provided by their terminal.

With Denmark now using their interim configuration, all three participating Member States of the joint project are now online and the terminal software is proving to be reliable and up to now has only caused minor problems.

Concerning our link to the British Meteorological Office (BMO), since 22nd January we have been receiving GTS observational data in 3-hourly batches. The link is very reliable, which was proved by comparison of the data received via the NFEP with the data received via tape from Bracknell. Only on a few occasions has the 3-hourly data acquisition had to be delayed, but there was always sufficient time to make up this delay. The next step, which will happen soon, will be to take the data as primary input for the forecast, leaving the tapes as back up.

Furthermore, BMO is now implementing the necessary software to receive our products. Some first tests have already been carried out.

- A. Haag

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NAG SEMINAR

A seminar entitled "Tools for Software Engineering" by Steve Hague from NAG Central Office is being given on Friday 30 May at AERE Harwell. As this seminar covers the general philosophy behind the NAG Library it may be of interest to some Centre staff. Further details from myself.

- Andrew Lea

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* JOB CARD PRIORITY PARAMETER

Last June we introduced a job priority system (see ECMWF Technical Newsletter no.4, page 13). We propose to introduce slight modifications in the light of experience gained to date. In outline, these changes are:

- i) redefine the numerical priority levels for base, low and normal priority groups (see table below).
- ii) allow user job submission only at the lower priority value within each group e.g. at priority 4 only for the normal group. Jobs submitted at other values would be dropped before execution. The operators will be able to raise a job's priority within a group if necessary for operational reasons e.g. from 4 to 5.

Job priorities to be as follows on both the Cyber and the Cray. All priority levels are in octal.

<u>Priority group</u>	<u>Octal Priority</u>	<u>Usage</u>
Base	0*	to be used for work of a background nature. These jobs will be run only when no other work is available. Turn around time will be long. Resources used will be reported, but not taken from any allocation.
Low	2*	to be used by work for which a relatively long turn around (typically overnight) is acceptable. These jobs will be run as soon as higher priority work has been processed.
Normal	4*	to be used for all normal priority work. Turn around for these jobs will be normally during the daytime, except for jobs >T3000g. Cyber jobs >CM140000g may not turnround during the day especially if they are >T400g.
High	6*	to be used in special situations where a high priority has to be given to work. Jobs specifying >T3000g will usually be run overnight. Cyber jobs >CM260000g may not turnround during the day especially if they are >T400g.
Operational	10-13	to be used <u>only</u> for ECMWF's operational forecast.
Operator	14-17	used <u>only</u> for some housekeeping tasks and the Cray station,

* only these values will be available to the general user for job submission. Default priority will remain at 4.

- Andrew Lea

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THE TIMING OF COMPUTER PROGRAMS

In days of recession, a car's petrol consumption is a decisive factor for many buyers.

In a heavily loaded computer, a program's demand for the CPU is one of the decisive factors for a better turnaround. Apart from technical features a car's consumption depends on driving habits to a large extent, and in this instance the performance of a mechanical object can no longer be considered a decisive factor per se, without relating it to a specific human skill.

The CPU consumption of a program depends on coding habits to an extent which should not go underestimated, No matter what CPU, human skill can affect the speed of a given program enormously.

Some tools exist which measure the seconds per subroutine or even the seconds per DO loop within a program. They should be used not only to get the most out of a machine but to improve code and refine coding abilities as well. Of these tools, two are readily usable: "TIMING" (Rex Gibson's timing package) which can be used on both Cyber and Cray, and the Cray-only CFT option "FLOWTRACE". A Bulletin will soon appear about TIMING. In anticipation, here is a typical output:

Subroutine Function** DO loops	No. of times subroutine called or DO executed	Number of DO loops found	Total time for subroutine or DO loop	Average time for subroutine or DO loop	Percentage of total
MAIN PGM	1	2	0.327656662488E-03	0.327656662488E-03	3.770333
75	1		0.322703125001E-03	0.322703125001E-03	
77	1		0.980476562500E-02	0.980476562500E-02	
MIX	6	2	0.790379527495E-02	0.131729921249E-02	90.948678
75	6		0.861130625000E-02	0.143521770833E-02	
2760	30		0.785939375000E-02	0.261979791667E-03	
PDUMP	250	0	0.344340624797E-03	0.137736249919E-05	3.962315
RNDM****	0	1	0.000000000000E+00	0.000000000000E+00	0.000000
128	125		0.476714062500E-02	0.381371250000E-04	
SORT	6	2	0.114597924958E-03	0.190996541597E-04	1.318674
15	6		0.674706249998E-03	0.112451041666E-03	
9	24		0.642000000015E-04	0.267500000006E-05	
TOTALS			0.869039048719E-02		100.000000

NOTE: Only subroutines actually called are listed above.
Only DO loops actually executed are listed above.
Function names are followed by asterisks and only appear
for functions containing DO loops.
Function timing and number of calls are not available.

The correction factor used for subroutines was 0.306063750000E-05

The correction factor used for DO loops was 0.113843750000E-04

FLOWTRACE is documented in your CFT manual. It can be tried easily in its present version by compiling a program with the F option on: CFT (ON=F)

The following Flowtrace summary refers to a program performing matrix multiplication in 5 different ways, with subroutines PRDMX1, PRDMX2, PRDMX3, PRDMX4, PRDMX5. None of the DO loops in these routines vectorises:

FLOWTRACE SUMMARY

Routine	Time	%	Called	Average T
1 PRG1	0.026097	0.56	1	0.026097
2 MPRINT	0.081026	1.75	7	0.011575
3 TIMER	0.000188	0.00	50	0.000004
4 PRDMX1	1.019182	22.03	5	0.203836
5 PRDMX2	1.084206	23.44	5	0.216841
6 PRDMX3	0.666376	14.40	5	0.133275
7 PRDMX4	0.999184	21.60	5	0.199837
8 PRDMX5	0.750037	16.21	5	0.150007
***TOTAL	4.626298			
***OVER- HEAD	0.002153			

SUBROUTINE LINKAGE OVERHEAD SUMMARY 83 CALLS

	Minimum	Maximum	Average	Cycles	Seconds	%
T REGISTERS	0	6	1.1	60	7.50E-07	0.0000
B REGISTERS	2	5	2.6	68	8.50E-07	0.0000
ARGUMENTS	0	9	3.6	1184	1.48E-05	0.0003
TOTAL				1312	1.64E-05	0.0004

MAXIMUM SUBROUTINE DEPTH = 2

After optimising the code manually so that it vectorises, the flowtrace summary for the same routines shows what has been gained:

FLOWTRACE SUMMARY

Routine	Time	%	Called	Average T
1 PRG	0.032280	5.19	1	0.032280
2 MPRINT	0.092402	14.87	8	0.011550
3 PRDMX1	0.136101	21.90	5	0.027220
4 PRDMX2	0.134284	21.60	5	0.026857
5 PRDMX3	0.083771	13.48	5	0.016754
6 PRDMX4	0.050001	8.04	5	0.010000
7 PRDMX5	0.092707	14.92	5	0.018541
***TOTAL	0.621546			
***OVER- HEAD	0.000892			

SUBROUTINE LINKAGE OVERHEAD SUMMARY 34 CALLS

	Minimum	Maximum	Average	Cycles	Seconds	%
T REGISTERS	1	6	1.9	60	7.50E-07	0.0001
B REGISTERS	3	5	4.1	68	8.50E-07	0.0001
ARGUMENTS	0	9	7.3	996	1.25E-05	0.0020
TOTAL				1124	1.41E-05	0.0023

MAXIMUM SUBROUTINE DEPTH = 2

This example was provided by CRAY Research at a CFT course recently held at ECMWF.

- Luigi Bertuzzi

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* COS 1.07

At present we are in the final stages of testing version 1.07 of COS. As you may recall, the last version we implemented, in August last year, was 1.05. We did not go to 1.06 because we did not feel that the extra features of that release warranted the effort required to Q.A. (quality assure) the system. However, we are very interested in the Job Class Scheduler, which requires a 1.07 system, so much so, that we are hoping to go to COS 1.07 on 26th March.

There are very few new features offered by COS 1.07, there have been a few minor 'cosmetic' changes to a few control cards and a rewritten UPDATE but no significant new features. COS 1.05 had 'recovery of rolled jobs' which has proved to be exceedingly useful, and COS 1.06 had major changes to the station (these, of course, are in 1.07), but COS 1.07 is mainly a 'corrective code' release. We would probably not be going to COS 1.07 but for the fact that the Job Class Scheduler requires this level of operating system.

The Job Class Scheduler is a part of the Operating System which deals with job initiation. At the moment we have very little control over which jobs start execution, we can limit the total number of jobs in execution, but that is all. The Job Class Scheduler will allow us to place jobs into different classes or categories according to such criteria as 'time limit', 'priority', 'memory requested' etc. It will also allow us to specify how many jobs of each class may be taken from the input queue and put into the executing queue, in much the same way as ECMWF's CYBER Job Class Scheduler does. This is very important as it will enable us to schedule the CRAY-1 efficiently at a time when the increasing workload on the machine and the limited scheduling facilities of COS 1.05 are making it difficult.

Initially, COS 1.07 will be implemented without the job class scheduler, then, when we are satisfied with the system's performance we will test out the scheduler. When we do the implementation, a member of Cray Research will be on site to help and to fix any 'teething' problems which we may encounter. We hope to have the Job Class Scheduler in production by early or mid-May.

- Neil Storer

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*FORTRAN SUBROUTINE INTERFACE

Cray Research have stated their intention of changing the subroutine interface on the CRAY-1. The new interface, which is significantly different from the current one, may be introduced in release 1.08. Therefore, we have only a short time to prepare for the change.

All subroutine calls will be affected. However, the interface between two Fortran routines or between Fortran and a library routine is generated by the compiler CFT. Therefore, a recompilation of ALL Fortran code will be all that is necessary.

Routines written in Cray assembler language CAL, must be modified to conform to the new interface. To make this change as painless as possible, a set of MACROS has been provided in release 1.07. These provide all of the facilities needed to pass control between routines. The current version of these macros (1.07) conforms to the present interface. When the operating system which supports the new interface is released, it will be necessary to reassemble all code to obtain the new macro definitions.

We recommend that all who have coded routines in CAL should modify their code during the next few weeks to make use of the macros. The macro names are:

ENTER EXIT ARGADD BREG TREG CALL

Information concerning the use of these macros has been distributed to those who we know will be affected. Anyone who wants information but has not received it, please contact me.

- David Dent

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CRAY MULTIPLICATION HARDWARE

Most users of the CRAY-1 are aware that there is something slightly 'peculiar' about the floating point multiply hardware. The peculiarity is soon to be removed.

A real number on the Cray is represented by a 15 bit exponent and a 48 bit coefficient. Therefore the floating point multiply unit has an input of two 48 bit coefficients as operands. The multiply pyramid truncates part of the lower bits of the 96 bit product, i.e. a full 96 bit product is not generated. (See the Hardware Reference Manual for a fuller description). To adjust for this truncation a constant is unconditionally added above the truncation. The range of errors for all possible operand coefficients can be shown to be in the range 1.28×10^{-16} to 6.66×10^{-16} . The effect of this error is at most a round up of bit 2^{-48} of the result. However, reversing the multiplier and multiplicand can generate different results. i.e. $A*B$ is not necessarily = $B*A$.

Cray Research now have a hardware modification to overcome this deficiency. ECMWF plan to install this modification sometime during the next few months. The work will probably take a substantial part of a weekend.

Program execution after the modification will be affected only to the extent that previously incorrect products will then be correct. The Fortran library \$FTLIB contains some constants designed to minimise the errors in function evaluations (EXP, LOG, SQRT etc.). These constants will be changed to take account of the new hardware. It is unlikely that any user program contains code which will have to be changed.

If you are concerned about the effect of this change on your program, we do have a simulator routine which will generate the modified product on our present Cray-1 hardware and which can be invoked simply by setting a compiler switch. However, it will be VERY EXPENSIVE to execute, as all floating point products will be executed by return jumps to the simulator routine.

- David Dent

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FEBRUARY 29TH OR MARCH 1ST???

1980 is a leap year. The Cyber knew it, the DG Eclipse knew it, the Regnecentralen NFEP knew it - even the automatic clock/calendar at ECMWF knew it. However, in common with many of the digital watches owned by staff at the Centre, the Cray refused to believe that February can ever have 29 days! However, it compensated by having March 1st twice.

Unfortunately, the solution to the problem was not simple. The Cray operating system stores its date and time internally as the number of 12.5 nanosecond clock periods since 0 A.D. It got that part of the calculation right. However, when converting clock periods back to date it was consistently 1 day wrong, on 29th February.

Fortunately, the operational suite finds its date from the Cyber, whose operating system has already seen a good number of leap years. However, the permanent file system, the accounting system and the users became very confused.

Next time we install a computer there will be an acceptance test to ensure that its operating system knows about leap year day!

- Peter Gray

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*CRAY STATION - CURRENT EXPERIENCE

The version of the Cray station now in service has been in operation since the middle of January 1980. In contrast to some earlier station changes, this one has produced a considerable improvement, especially in terms of robustness (particularly important to the Cyber operators).

The load on the station continues to increase, and currently stands at around 5500 permanent files and 11000 queue files (jobs and job outputs) transferred between the machines each week, totalling 2.7×10^9 64-bit words (or about 9 times the total capacity of the disc store on either machine). The station down time is now less than 0.1% of the scheduled running time.

There are still some problems in the station software which may affect Cray users: we hope to be able to fix these soon without adversely affecting the station's stability. The problems are:

- i. Several blocked-binary file transfer end-cases are still not handled correctly. The following is not necessarily an exhaustive list:
 - (a) If an EOF control word occurs immediately after a BCW and is followed by data (not by immediate EOD), the data ACQUIRED will be corrupt.
 - (b) If an RT=W, BT=I file on the Cyber is not correctly terminated (e.g. by dropping the job which created it), the station can get stuck in a C.P. loop trying to send that file to the Cray.
 - (c) If an unused bit count on the Cyber is greater than 60 bits (quite an unusual situation) a block number error will result if the file is ACQUIRED to the Cray and used.
- ii. ACQUIRE and DISPOSE with ED=nnn both result in the cycle number used on the Cyber being the two least significant digits of the specified ED. This problem can be circumvented by using a TEXT field with an explicit ATTACH or CATALOG.

Recently we have seen a few users' jobs running on the Cyber with the same mainframe identifier as the station SPOT jobs. This appears to be due to a bug within NOS/BE and results in the output for the job being lost. For some reason there were 6 such jobs in the week beginning 9.3.80; these were:

COZU92, DDK01N1, CD500OH on 10.3.80
MAOP23Y, CD500ZU, FGBFF9X on 11.3.80

The week before there were two: DCHS300 and PAGOOAQ on 4.3.80.

We know of no reason why this is occurring, but we are investigating.

Finally, please remember that the station is still sensitive to the use of certain special filenames in the DN field of ACQUIRE and DISPOSE, or as the lfn in a text field; these are:

CRAYLIB, IPSPOT, OPSPOT, GOODPF, BADPF.

Strange things happen if these names are used, so please try not to do it (especially CRAYLIB, which is a tempting name to use).

- Dick Dixon

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COLOUR RASTER INTELLIGENT TERMINAL

On March 17, the Centre dispatched an invitation to tender for the supply, installation and setting to work of a colour raster graphic "intelligent" terminal. This device will basically consist of a high resolution eight colour raster display with added computing and storage capabilities. The delivery is expected by the end of 1980. This rather sophisticated terminal will be used to investigate new ways of graphically representing and analysing meteorological data. The first two experiments which will be undertaken are:

(i) Local offline edition of maps

CRAY or CYBER generated maps will be sent to the device where they will be stored on a 5 megabyte disc system. Housekeeping and display on demand of these maps can then take place locally and off-line. Full use will be made of colour and of the high resolution (i.e. in the range 1024x1024) 19" screen.

Various interactive functions such as magnification, layout specification and dynamic selection of colour and line-style will be available.

(ii) Animation

A series of up to 100 maps can be automatically displayed in sequence by the 16 bit microprocessor under user control. The maximum rate will be about 2 maps/second. The user will have the ability to select and change the rate, hold the sequence and restart it backwards or forwards. A lower resolution (512x512) will be used.

Further experiments implying an upgrade of the system will include 3D colour representation, shaded areas and enhanced animation. However, the first experiments will, we hope, result in the specification of a so-called "meteorological station" similar to AFOS and NEDS which could be used advantageously within the Centre on a more operational basis.

In the meantime all ideas and suggestions are welcome.

- Alain Lemaire

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OVER ENTHUSIASTIC OPTIMISATION

A recently exposed Cray-1 compiler problem has the effect of producing wrong results because of the way in which CFT generates code for a loop invariant expression.

```
DO 10 I = 1, N
10 A(I) = B(I) + (C(I) - D(I))/NT * NJ
```

The programmer intended that the division by NT be performed by real arithmetic

```
ie (C(I)-D(I))/FLOAT(NT)*FLOAT(NJ)
```

The compiler removed the expression NJ/NT from the loop and performed the calculation beforehand as an INTEGER division. Under ANSI 77 Fortran rules this results in the calculation being performed in the wrong order, and as such must be considered as a compiler bug.

- David Dent

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STILL VALID NEWS SHEETS

Below is a list of News Sheets that still contain some valid information which has not been incorporated into the Bulletin set (up to News Sheet 73). All other News Sheets are redundant and can be thrown away.

- | <u>No.</u> | <u>Still valid article</u> |
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| 15 | Private Packs on the Cyber (MOUNT/DISMOUNT) |
| 16 | Checkpointing and program termination |
| 17 | Private packs and interactive jobs. |
| 19 | CRAY UPDATE (temporary datasets used). |
| 31 | Fortran Callable Tape REQUEST. |
| 37 | IN trays for Cray and Cyber Jobs. |
| 42 | Cyber scheduler (see News Sheet 59 also) |
| 43 | Cray AUDIT.
Transfer of coded files. |
| 47 | Libraries on the Cray-1. |
| 50 | 8 Disc Cray System.
Terminal Procedure. |
| 51 | Cyber Disc Reconfiguration. |
| 53 | Cyber Job Card Priority Usage.
Writing 6250 bpi Tapes (EEC Parameter).
Punching Conventions (Coding Forms). |
| 54 | Things not to do to the Station. |
| 55 | New Cyber Peripherals. |
| 56 | DISP |
| 59 | New Cyber System (Scheduler Changes) |
| 63 | Daily Schedule for Operational Suite. |
| 64 | New Version of Graphics Software. |
| 65 | Data Security on Cyber and Cray. |
| 66 | New Cray Audit.
Cyber Accounting |
| 67 | Attention Cyber BUFFER IN Users. |
| 68 | Protected Files on the Cray. |
| 70 | Cyber/Cray Station. |
| 71 | Cray software release 1.07
PACKS command |
| 72 | COS 1.07 Product testing
The change to BST |
| 73 | COS 1.07 Field Trial
Minimum Cyber Field Length |

- Andrew Lea

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MEMBER STATES' USAGE OF CRAY RESOURCES UP TO MARCH 16 1980 (in units)

France	15172 units
Germany	1 unit
United Kingdom	37157 units
Sweden	148 units

- Andrew Lea

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INDEX OF STILL VALID NEWSLETTER ARTICLES

This is an index of the major articles published in the ECMWF Newsletter plus those in the original ECMWF Technical Newsletter series. As one goes back in time, some points in these articles may have been superseded. When in doubt, contact the author, or User Support.

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*T indicates the original Technical Newsletter series

USEFUL NAMES AND 'PHONE NUMBERS WITHIN ECMWF

		<u>Room*</u>	<u>Ext.**</u>
Head of Operations Department	- Daniel Söderman	OB 010A	373
ADVISORY OFFICE - Open 9-12, 14-17 daily		CB 037	308/309
	Other methods of quick contact:		
	telex (no. 847908)		
	COMFILE (see Bulletin B1.5/1)		
Computer Division Head	- Rob Brinkhuysen	OB 009A	340/342
COMPUTER OPERATIONS			
Console	- Shift Leaders	CB Hall	334
Reception Counter)	- Judy Herring	CB Hall	332
Terminal Queries)			
Operations Section Head	- Eric Walton	OB 002	349/351
Deputy Ops. Section Head	- Graham Holt	CB 023	307
DOCUMENTATION	- Pam Prior	OB 016	355
Libraries (ECMWF, NAG, CERN, etc.)	- John Greenaway	OB 017	354
METEOROLOGICAL DIVISION			
Division Head	- Roger Newson	OB 008	343
Applications Section Head	- Joel Martellet	OB 011	360
Operations Section Head	- Austin Woods	OB 107	406
Meteorological Analysts	- Ove Åkesson	OB 106	380
	- Veli Akyildiz	OB 104A	379
	- Horst Böttger	OB 104A	378
	- Pauno Nieminen	OB 104A	378
	- Herbert Pümpel	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
Systems Software Section Head	- Peter Gray	CB 133	323
Tape Requests	- Pauline Litchfield	CB Hall	335/334
	- George Stone		
TELECOMMUNICATIONS			
Fault Reporting	- Pierre-Pascal Regnault	CB 028	397/375
Section Head	- Fritz Königshofer	CB 130	310
User Support Section Head	- Andrew Lea	OB 003	348

* CB - Computer Block
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