I.O.S.

COLLECTED PROGRAMS FOR
THE IBM 1800 COMPUTER

REPORT NO. 15

INSTITUTE OF
OCEANOGRAPHIC
SCIENCES

NATURAL ENVIRONMENT RESEARCH COUNCIL

Queries regarding the use or availability of any of the programs in this volume may be made to:-

The Program Librarian,
Data Processing Group,
Institute of Oceanographic Sciences,
Brook Road,
Wormley,
GODALMING,
Surrey,
GU8 5UB.

from whom a comprehensive list of all current IOS Programs is available.

All the programs in this volume have been compiled and executed on an IBM 1800 computer having the following configuration:-

1802 Processor-Controller with 32,768 words of core storage
3 1810 Disk Drives Model A
2 2401 Magnetic Tape Drives (30Kc/s, 7 track)
1443 Printer, 240 lines per minute
1442 Model 6 card Reader-Punch
1816 Keyboard-Printer
Facit Paper Tape Reader, 1000 characters/second
Facit Paper Tape Punch, 150 characters/second.

The operating system used was MPX Version 3.

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COMPUTER PROGRAMS

(Subprograms have negative numbers)

1. General purpose utilities

-161	Free format read	FREAD
-214	Day number conversion	JULAN
-215	Remainder from a division	MOD
-216	Bit testing routine	BITST
-217	Bit setting routine	SETBT
-218	Bit manipulation routine	BITMN
139	Card to papertape conversion	CAPER
295	Card utility program	CDUPS
296	List and sort program names	LOCNY
299	List write-ups from disk	RITUP
300	Print library index	LINDX
301	List programs from source files	LIST
302	List edited programs from source files	EDITL

2. Special purpose utilities

246	Edit data files conversationally	SYKEY
256	Programme budgeting	PROGBUDG
257	Master listings of Geosorted data	BODS3

3. Navigational

304	Check fixes against CDAT file	CHNAV
305	Offline navigation update programs	LNAV1
-152	Course between two points	LCORS
-153	Distance between two points	LDIST
-154	Degrees and minutes to degrees	DEGFR
-188	Plot navigation symbols	MEPLX
-190	Distance between two points	DIST

4. Miscellaneous

288	Analogue input test program	TESAN
297	Pitch and Roll Buoy start	WAVST
303	RJE files to magnetic tape	TAPE

Contd./.....

5. Physical Oceanography

275	Prediction of wave heights	WVRAY
310	Linear interpolation of pressure gauge data	TRUDG

6. Biological

283	Station listings for cruise reports	BIOPR

7. Geological and Geophysical

234	Create data file of gravitational potential	EARTH
307	2-D gravity and mass anomalies	GVTPL
308	Seismic surface wave velocity calculation	HASKL
309	Calculation of magnetic anomalies	MAG3D

8. Mathematical

-137	Point in a polygon	INPOL
-148	Subroutine for use with FFT	RTRAN
-150	Solution of set of linear equations	LINEA

W.K. Strudwick
8 May, 1975

PH

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

NIO PROGRAM - 161

Program Title: (for Lib. List)	Free Format Read
Classification Letter:	U
Program Name:	FREAD
Version Number:	20
Type of Program:	Subroutine
Operating System:	M.P.X./T.S.X.
Language:	1800 Fortran IV
Programmer/date:	T. Voss / 3.11.71
Program Passed By:	C. Spackman
Description:	To read data in free format and return one value per call
System Prerequisites:	None
Inskel Common Variables:	None
Subroutines Called:	FCONV (which calls NCONV, SKIPD, GET, NZONE)
Programs Called:	None
Files Called:	None

Operation and Method:

A = FREAD(LIN,LOUT)

where LIN is the input LUN

LOUT is the output LUN for messages

A change in LIN only becomes effective when all values on the last record have been interpreted.

Inputs:

Input records may contain any number of free format numbers or expressions as laid down in DPG/P/32

Paper Tape When input is from paper tape, records must be of at least 80 characters, of which characters 1-80 will be interpreted. If less than 80 characters are present, FREAD will read into the next record. On the ship, where there is no // inhibit it could read over the // END

Ampersand & When an ampersand is encountered, the remainder of the record is ignored, thus allowing comments e.g.
29.3 14.8, 23E17 & DATA FOR GROUP 1

Output: Error messages from FCONV or NCONV may occur.

Size: 144 words

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DATA PROCESSING GROUP

LABORATORY SUB-PROGRAM DESCRIPTION

SUB-PROGRA -214

Program Title:
(For Lib. List) Day number conversion

Classification Letter: U

Program Name: JULAN

Version Number: 2Ø

Type of Program: Nonprocess

Operating System: MPX or MPXPT

Language: 1800 Assembler

Programmer/date: W.K. Strudwick /12.8.74

Program Passed By: W.K. Strudwick /12.8.74

Description: To convert day number into day of month and month or vice-versa.

Operation and Method:

To use:-

CALL JULAN (IYEAR IDOY, MONTH, IDAY)

where IYEAR is the year minus 1900
IDOY is the day of the year
MONTH is the month of the year
IDAY is the day of the month

To convert a day of the year to month and day set the MONTH and IDAY parameters to zero. Thus:-

```
IDAY=6
MONTH=Ø
IDOY=129
1YEAR=74
```

CALL JULAN (1YEAR, 1DOY, MONTH, 1DAY) on return from the subroutine MONTH and IDAY will be set appropriately.

To convert month and day of month to day of year set the IDOY parameter to zero. Thus:-

```
IDAY=12
MONTH=8
IYEAR=74
IDOY=Ø
```

CALL JULAN (1YEAR, 1DOY, MONTH, 1DAY)

If the subroutine is called as a function a two character code for the day of the

week is given thus:-

IWKDY=JULAN (lYEAR, lDOY, MONTH, lDAY)

Either day of year or month and day may be given.

The subroutine produces correct results from January 1st 1907 until February 28th 2099.

This subroutine is a copy of the EPL program number 1130-99.0.001.

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DATA PROCESSING GROUP

LABORATORY SUB-PROGRAM DESCRIPTION

Sub-Program -215

Program Title (For Lib List)	Remainder of a Division
Classification Letter:	U
Program Name:	MOD
Version Number:	2Ø
Type of Program:	Non Process
Operating System:	MPX or MPXPT
Language:	1800 Assembler
Programmer/date:	W.K. Strudwick / 13.8.74
Program Passed By:	W.K. Strudwick / 13.8.74
Description:	Given two parameters I and J the remainder from the division of the first by the second is returned.

Operation and Method

To Use:- K = MOD (I,J)

I is divided by J and the remainder placed in K.

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DATA PROCESSING GROUP

LABORATORY SUB-PROGRAM DESCRIPTION

Sub-Program - 216

Program Title: (For Lib List)	Bit Testing Routine
Classification Letter:	U
Program Name:	BITST
Version Number:	2Ø
Type of Program:	Non Process
Operating System:	MPX or MPXPT
Language:	1800 Assembler
Programmer/date:	W.K. Strudwick / 13.8.74
Program Passed By:	W.K. Strudwick / 13.8.74
Description:	To test bits in a word

Operation and Method

CALL BITST (NAME,I,J)

Test Bit I of the word NAME. If bit I is a 1, set J equal to 1. If I in a Ø, set J equal to 2. I may range from Ø to 15. This subroutine is taken from the EPL program number 1800 - 06.6.001.

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DATA PROCESSING GROUP

LABORATORY SUB-PROGRAM DESCRIPTION

Sub-Program -217

Program Title: (For Lib List)	Bit Setting routine
Classification Letter:	U
Program Name:	SETBT
Version Number:	2Ø
Type of Program:	Non process
Operating System:	MPX or MPXPT
Language:	1800 Assembler
Programmer/date:	W.K. Strudwick / 13.8.74
Program Passed By:	W.K. Strudwick / 13.8.74
Description:	To set bits in a word

Operation and Method

CALLSETBT (INAM, IPOS,J)

Set the bit at position IPOS in the word INAM to a zero if J is even, or to a one, it J is odd.

This subroutine is taken from the EPL program number 1800 - 06.6.001.

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DATA PROCESSING GROUP

LABORATORY SUB-PROGRAM DESCRIPTION

Sub-program -218

Program Title: (For Lib List)	Bit manipulating routine
Classification Letter:	U
Program Name:	BITMN
Version Number:	2Ø
Type of Program:	Non Process
Operating System:	MPX or MPXPT
Language:	1800 Assembler
Programmer/date:	W.K. Strudwick / 13.8.74
Program Passed By:	W.K. Strudwick / 13.8.74
Description:	To manipulate bits in a word.

Operation and Method

CALLBITMN (INAM,IBITS,IPOS,JNAM,JPOS)

Move the number of bits designated by IBITS from INAM, starting with the bit IPOS, into JNAM, starting the over-lay at the bit JPOS. INAM is undisturbed (unless INAM is the same word as JNAM). No bits in JNAM are altered except the number designated by IBITS starting at JPOS.

This subroutine is taken from the EPL program number 1800 - 06.6.001.

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. Program 139

Program Title: (For Li. List)	High Speed Card to Papertape Conversion
Classification Letter:	U
Program Name:	CAPER
Version Number:	21
Type of Program:	Nonprocess Program
Operating System:	MPX ASCII System
Language:	1800 Assembler
Programmer/date:	M.Olliff 17.7.72
Program Passed By:	R. Wells 13.10.72
Description:	Converts card decks into papertape
System Prerequisites:	
Inskel Common Variables:	
Subroutines Called:	
Programs Called:	PLEAD(-57)
Files Called:	
Operation and Method:	

The program reads in cards and punches out paper tape in ASCII code.
If Data Switch Ø is on, cards are assumed to be in Assembler format, i.e. information starting in Column 21.
If Data Switch 1 is on, all 80 columns are converted and punched out.
If Data Switch 1 is not on, columns 1 to 72 are read and converted.
The program checks for blanks at the end of the card, i.e. a card with information in cols. 1 to 24 only is punched on paper tape as a record 24 characters long, whether or not data switch 1 is on.
//Ø cards are also converted, as the card read is done without a //Ø check.
Each card is checked for all 12 punches in column 80. On reading such a card the program exits.

Input

//ØJOB
//ØXEQØCAPERØØØFX

followed by the deck to be copied including all control cards, if any followed by a terminator card with all holes punched in column 8Ø.

Output A paper tape version of the input deck in ASCII code.

Timing 100-140 characters per second, depending on record length.

N.B. This program will work the same for PTTC/8 tapes if loaded on to a PTTC/8 MPX system disk.

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 295

Program Title:
(For Lib. List) Card utility program

Classification Letter: U

Program Name: CDUPS

Version Number: 20

Type of Program: Non process

Operating System: MPX

Language: Fortran IV

Programmer/date: M. Olliff 21.9.73

Program Passed By:

Description To duplicate, resequence or list card decks.

System Prerequisites:

Inskel Common Variables:

Subroutines Called: IGET, RVERS

Programs Called:

Files Called:

Operation and Method:

The program reads in cards, resequences them if required, and writes them to a temporary file on disk, until a terminator is found. The data is then punched on to new cards, and listed on the 1443 printer as requested.

To Use

```
                                  19
//bJOBb1                          X
                             16
//bXEQbCDUPS                   FX
```

1st data card cc 1 XY

2nd data card AAABBBBBBbCC

followed by the deck to be duplicated and/or listed

Last data card All holes punched in column 80.

Where X is in the range Ø to 9 to indicate the number of decks required to be punched out.

Y is in the range Ø to 9 to indicate the number of times the deck is to be listed.

If resequencing is required

AAA are the three alpha numeric characters at the start of the sequence number

BBBBB is the starting integer value of the sequence number

CC is the integer increment to be added to the sequence number for each card.

If resequencing is not required.

AAA must be *bb and the rest of the card should be blank.

A scratch disk must be put on drive 1 (disk 200 or 201).

IOS (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

Program 296

Program Title:
(for Lib. List) To list and sort program names.

Classification Letter: U

Program Name: LOONY

Version Number: 2Ø

Type of Program: NONPROCESS

Operating System: MPX

Language: FORTRAN IV

Programmer/Date: M. Olliff 4.10.73

Program Passed By:

Description: Lists program names and sorts into user order.

System Prerequisites:

Inskel Common Variables:

Subroutines Called:

Programs Called: UNPAC, NCOMP, PBUFA, CBUFA

Files Called:

Operation and Method:

```
                                        cc 19
                    //␣JOB␣1                X

                   //␣XEQ␣LOONY␣␣␣FX

                    *CCEND

              cc1      7 -2Ø 22      28- 30
Data cards  AAAAA␣B - B␣XXXXX␣ C - C
```

Where A in cols. 1 to 5 is the program, file or subroutine name.

B in cols. 7 to 20 is the user name, left justified

XXXXX is the nc. of the disk (if any) on which the program, file or s/r is stored.

C in cols. 20 to 80 is a comment describing the use of the name.

An ** in columns 1 and 2 is the terminator card.

The deck should be followed by a blank card.

The program reads in the cards, writes them to a temporary file on drive 1, and lists them on the 1443 printer, throwing a page whenever a new letter is found in column 1 on the card.

The program then searches through the file for all the names belonging to a particular user, and lists them on the 1443 printer. This is continued until a listing has been made for all the users which have a name in the file.

This program is for DPG use only, or can be used as a general sort routine to list according to card columns 7 to 20.

The data cards containing the program names allocated so far are kept in the same room as the program library, in alphabetical order.

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 299

Program Title: (For Lib. List)	Lists the write-ups for all programs and subroutines.
Classification Letter:	U
Program Name:	RITUP
Version Number:	20
Type of Program:	Non-Process
Operating System:	M.P.X.
Language:	FORTRAN
Programmer/date:	C. Spackman
Program Passed By:	A. Voss
Description:	This program is one of four, run on SRFLE files on ship disks before a cruise to list the write-ups for all the (programs and subroutines).
System Prerequisites:	The programs must have been indexed previously by program SRFLV.
Inskel Common Variables:	None
Subroutines Called:	PBUFA, BESC, PACC, FLETM, BULKN, USQSH, MOVE, PBUFX.
Programs Called:	
Files Called:	SINDX
Operation and Method:	To execute:-

```
                                        19      24
// JOB                                  X       X
                                        1617
// XEQ RITUP                           FX
```

The program lists the write-up part of the program or subroutine on a SRFLE file.

This is done by the program extracting the comments at the beginning of each program or subroutine and listing them on the line-printer.

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 300

Program Title: (For Lib. List)	Program to print a Library Index
Classification Letter:	U
Program Name:	LINDX
Version Number:	20
Type of Program:	Non-Process
Operating System:	M.P.X.
Language:	FORTRAN
Programmer/date:	C. Spackman
Program Passed By:	A. Voss
Description:	The program is one of four, run on SRFLE files on ship disks before a cruise, and contains a list of programs and (subroutines, versions and modifications and programmer).
System Prerequisites:	The programs must have been previously indexed by program SRFLV.
Inskel Common Variables:	None
Subroutines Called:	PBUFA, BESC, PACC, FLETM, BULKN, USQSH, MOVE, PBUFX.
Programs Called:	
Files Called:	SINDX
Operation and Method:	To execute:-

	19	24
//b JOB	X	X
// b XEQ LINDX	FX (cols 16, 17)	

The program prints a Library index for a disk, printing the program name, it's version and modification numbers and the programmer. The program reads down the number of entries on the disk for programs and subroutines and then by a count lists the relevant part of the header card.

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 301

Program Title: (For Lib. List)	Lists all Programs and Subroutines from SRFLE files.
Classification Letter:	U
Program Name:	LIST
Version Number:	20
Type of Program:	Non-Process
Operating System:	M.P.X.
Language:	FORTRAN
Programmer/date:	C. Spackman
Program Passed By:	A. Voss.
Description:	This program is one of four, run on SRFLE files on ship disks, before a cruise to list all the programs and (subroutines)
System Prerequisites:	The programs must have been sorted and indexed by program SRFLV beforehand.
Inskel Common Variables:	None
Subroutines Called:	PBUFA, BESC, PACC, FLETM, BULKN, USQSH, PBUFX.
Programs Called:	
Files Called:	SINDX

Operation and Method: The program lists the programs and subroutines on SRFLE files in alphabetical order.

It reads in the number of programs and subroutines on the disk, and then prints them until the count is exhausted.

To execute:- // JOB X X (cols 19 and 24)

// XEQ LIST FX (cols 16,17)

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 302

Program Title: (For Lib. List)	Lists Edited Programs from SRFLE files.
Classification Letter:	U
Program Name:	EDITL
Version Number:	20
Type of Program:	Non-Process
Operating System:	M.P.X.
Language:	FORTRAN
Programmer/date:	C. Spackman
Program Passed By:	A. Voss.
Description:	This program is one of four, run on SRFLE files on ship disks, after a cruise, to list the programs that have been (edited during the cruise).
System Prerequisites:	Only programs indexed by a previous run of program SRFLV will be tested.
Inskel Common Variables:	None
Subroutines Called:	PBUFA, BESC, CFDIO, PACC, FLETM, BULKN, USQSH, PBUFX.
Programs Called:	
Files Called:	SINDX
Operation and Method:	To execute:- // JOB (19 X, 24 X) // XEQ EDITL 1619 FX

The program prints a list of all Library programs and subroutines that have been edited during a cruise.

This is done by doing a test on the edit field in the header card, of the program or subroutine. If there is an entry, then the program or subroutine is listed on the line-printer, otherwise the program returns to test the edit field of the next SRFLE file and continues until all programs and subroutines on the disk have been tested and listed when necessary.

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 246

Program Title: (For Lib. List) Edit data files conversationally

Classification Letter: S

Program Name: SYKEY

Version Number: 2Ø

Type of Program: Nonprocess

Operating System: MPX or MPXPT

Language: 1800 FORTRAN IV

Programmer/date: W.K. STRUDWICK/13.12.73.

Description: To edit data files conversationally by means of a set of options.

System Prerequisites: None

Inskel Common variables: None

Subroutines Called: TYPE, QUERY, RGET, INTER, CLEET, TYPST, ALTIY, HEADR, FILE, ALTAL, TYPAL, PACC, IGET, KMIN, FFILE, KTIME, FINDT, ISTAT, DFT, DFTCH, SECUR, ITMLM, NCOMP, FLETM.

Files Called: User specified.

Operation and Method:

On execution of the program asks for the password of the user. It will proceed no further until a valid password has been entered. Once the password has been accepted the user may type in any of the options. These options are listed below.

Note: It is recommended that the LUN option be used first.

1. FILE - to gain access to a particular file.

   format: Fb namef - to access a file with a ship's header
   or Fbnamefb N - to access a file without a ship's header.

   if the second form is used then the program will ask for the number of words per record and the record length. These numbers are entered left justified.

2. HEADER - to look at or change the header if it is a ship's data file.

   format: H

Contd./.....

the program will type out the values of NTOT, NEXT, NAME, WREC and ICRU (see ship description) followed by the message: "ENTER CHANGES", the user may then type in any of the four letter names followed by an equals sign followed by the new value left justified. The user may change any or all of the values. When the last change has been entered just type in an e-o-f to end the sequence.

3. LUN - to change the LUN of output
format: Lbn
Where n is the new LUN.

4. TYPE - to type out records from the file
format: Tbi-j
Where i is the first record to be typed out and j is the last record. If only one record is to be typed omit the j value and the proceeding minus.

5. QUERY - to interrogate the FINDX file for a specific day and time
Qbnamebdaybtime
Where name is the four letter root name of the file, and day and time are the day and time to be searched for. If all the FINDX file is to be listed just type Q.

6. INTERROGATE - interrogate a file for a specific day and time
format: Ibdaybtime
Where day and time are the day and time to be searched for.

7. SELECT - to select certain words in a record to be listed
format: Sbi,j,k,l,m.....
Where i,j,k,l,m etc. are the words to be listed when using an I, T or TA option. If all the words are selected SA may be used.

8. ALTER NUMERIC - to alter words in a file
format: Abr-q. wd,valuebwd,value etc.
Where r represents the first record to be altered q represents the last record to be altered wd represents the word to be altered and value represents the new value. As many words and values as can be fitted on one line may be used. If q is the same as r then it and its proceeding minus may be omitted.

9. ALTER ALPHABETIC - to alter groups of words in a record to contain alphabetic information
format: AAbr-q.wdbXtextX
Where r-q are the first and last records to be altered, wd is the starting word for the text which appears between the characters X, which can be any character not contained in the text. The text is entered in A2 format.

10. TYPE ALPHABETIC - to type out groups of words as an alphabetic string
format: TAb r-q. n-n
Where r and q are the start and ending records and n and n are the start and ending words within the record

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. PROGRAM 256

Program Title:	Programme Budgeting
(For Lib. List)	
Classification Letter:	A
Program Name:	PROGBUDG
Version Number:	1
Type of Program:	
Operating System:	CALL 360
Language:	BASIC
Programmer/Date:	B.J. Hinde/17th Feb. 1972
Program Passed By:	W. Slade
Description:	Program is used to apportion costs of specialist support activities and general overheads to the primary activities of an institute according to the NERC Programme budgeting formulae.
System Prerequisites:	
Inskel Common Variables:	
Subroutines Called:	
Programs Called:	
Files Called:	BUDGET - at least 5 disk storage units in length

Operation and Method: The program is written for any number of primary, support and overhead activities. The dimension statements, the number of activities and the final print statements should be adjusted to suite the number of activities required. Instructions are given in the program.

The program is conversational. Each section begins with the option:-

"Enter 2 to print only, 1 to continue, Ø to escape"

If new data values are to be entered, reply "1"

If no new data is to be entered, reply "Ø"

If a print out of results computed from data existing in the BUDGET file is required reply "2". The first option , however, is:-

"Enter 1 if data in the BUDGET file is to be used, else Ø".

A reply of 1 will cause the data arrays in the program to be initialised with data saved in the BUDGET file from a previous run. If no data exists in the BUDGET file then option Ø must be selected.

Input All expenditures entered should be in thousands of pounds; all input numbers must be separated by commas.

Section 1 Primary Activities, Direct Support

For each activity, enter the total salaries of staff directly engaged on that activity, the gross expenditure, including salaries, on that activity, and the number of staff directly engaged on that activity.

Section 2 Specialist Support

For each specialist support activity enter the total salaries of staff engaged on that activity, the net expenditure (gross less receipts) including salaries on that activity and the number of staff engaged on that activity.

Section 3 Distribution of Specialist Support

For each primary activity, the program will request, for each support activity, the percentage of the support staff engaged on that primary activity and the percentage of the support activity expenditure allocated to that primary activity.

Section 4 General Overheads

For each general overhead activity, enter the number of staff employed on that activity, the net expenditure (gross less receipts), including salaries, on that activity.

Output

Output for sections 1-4 will follow the input for those sections. Output for sections 5-8 will follow that for section 4.

Section 1 Primary Activities, Direct Support

For each primary activity:-

Col 2: the gross direct expenditure.

Col 3: the percentage of the total gross direct expenditure allocated to this activity.

Col 4: the salary costs.

Col 5: the staff numbers in direct support of the activity.

Col 6: the percentage of the total direct support staff that are engaged on this activity.

Section 2 Specialist Support Activities

For each support activity:-

Col 2: the net expenditure (i.e. gross expenditure less the receipts earned by this activity.

Col 3: the percentage of the total net support expenditure allocated to this activity.

Col 4: the staff numbers engaged on this support activity.

Col 5: the percentage of the total support staff that are engaged on this activity.

Col 6: the salary costs.

Section 3 Distribution of Specialist Support

For each primary activity:-

Col 1: the support activity number.

Col 2: the percentage of the support activity staff engaged on this primary activity.

Col 3: the numbers of support staff engaged on this primary activity.
Col 4: the percentage of the support activity expenditure allocated to this primary activity.
Col 5: the support activity expenditure allocated to this activity.

Section 4 General Overheads (a)

The total staff employed on general overhead activities and the total expenditure.

Section 5 Salary Ratios

For each primary activity the value of the salary ratio, s/S where s is the total salaries of the direct and specialist support staff for this activity and S is the total salaries of all the direct and support staff of the institute.

Section 6 General Overheads (b)

For each primary activity:-
Col 1: the general overhead activity number.
Col 2: the percentage of the total staff associated with the overhead activity which is attributable to this primary activity.
Col 3: the numbers of overhead staff engaged on this primary activity.
Col 4: the percentage of the general overhead expenditure allocated to this primary activity.
Col 5: the general overhead expenditure allocated to this primary activity.

Section 7 Programme Budget Matrix-Expenditure

This is a matrix having one row for each primary activity, with the highest numbered row containing totals. The layout is that of R. H. Beverton in his note dated 3rd November 1971.

Col 1: the primary activity number.
Col 2: the direct expenditure on that primary activity.
Col 3: the percentage that this expenditure is of the total direct expenditure.
Cols 4 to (n+4): the specialist support expenditure (support activities 1 to n) associated with this primary activity.
Col (n+4): the total specialist support expenditure.
Col (n+5): the salary costs of the direct staff.
Col (n+6): the salary ratios (see section 5 above).
Col (n+7) to (n+n+6): the general overhead expenditure (overheads 1 to n) associated with this primary activity.
Col (n+n+7): the total general overhead expenditure.
Col (n+n+8): the total expenditure.

Section 8 Programme Budget Matrix-Staff

The layout is similar to the expenditure matrix.

Col 1: the primary activity number.

Col 2: the number of staff employed directly on the project.

Col 3: the percentage that this number is of the total direct staff.

Cols 4 to (n+4): the specialist support staff (support activities 1 to n) associated with this primary activity.

Col (n+4): the total specialist support staff.

Col (n+5): the salary costs of the direct staff.

Col (n+6): the salary ratios (see section 5 above).

Col (n+7) to(n+n+6): the general overhead staff (overheads 1 to n) associated with this primary activity.

Col (n+n+7): the total general overhead staff.

Col (n+n+8): the total staff.

Note that, although section 7 column (n+n+8), row 15 shows the 'total' institute expenditure, only 'net' figures are included under specialist support expenditure, the receipts earned by these activities should therefore be added to obtain the true gross total.

At the end of each section of the program, all data held by the program is saved on disk in the BUDGET file.

To run the program, sign-on and then enter:-

RUN *PROGBUDG

After the titles have been printed, the data option is requested.
Always enter "1" unless a completely new programme budget is to be established or the dimensions of one of the arrays has been altered since the last run.
To enter new data in any section, always reply "1" to the question "Enter 2 to print only, 1 to continue, Ø to escape" preceding that section.
Skip sections by entering Ø.
Sections 5-8 can only be skipped by pressing the ATTN key, thus aborting the program.
To obtain a print-out of results, entering no new data, always reply "2".

Execution Time and Cost

A complete run, entering all new data requires about 30 minutes at a 2741 terminal and takes 6 seconds of processor time. The cost, including telephone charges at the standard rate is £4.15. These estimates are based on a run with 14 primary activities, 4 support activities and two general overheads.

Layout of Arrays

This information is given for the benefit of those wishing to modify the program.

If there are A1 primary activities
A2 support activities
and A3 general overheads:-

Array D, dimension (A1+1,A2+A3+7) - Primary Activities, direct support, expenditure
Rows 1 to A1 represent primary activities 1 to A1
Row (A1+1) contains totals of rows 1 to A1
Col. 1: direct expenditure on the activities
Col. 2: percentage that this expenditure is of the total direct expenditure
Cols. 3 to (A2+2) the specialist support expenditure (support activities 1 to A2) associated with this primary activity
Col. (A2+3) the total specialist support expenditure
Col. (A2+4) the salary costs of the direct staff
Col. (A2+5) the salary ratios
Col. (A2+6) to (A2+A3+5) the general overhead expenditure (overheads 1 to A3) associated with the primary activity
Col. (A2+A3+6) the total general overhead expenditure

Array E, dimension (A1+1,A2+A3+7) - Primary Activities, Direct Support, Staff
The layout is as for array D, except that staff numbers replace expenditure

Array G, dimension (A3+1,2) - General Overhead Activities
Rows 1 to A3 represent general overhead activities 1 to A3

Row (A3+1) contains totals of rows 1 to A3
Col. 1: The numbers of general overhead staff
Col. 2: The expenditure on the general overhead

Array Q, dimension (A2+1,5) - Specialist Support Activities
Rows 1 to A2 represent support activities 1 to A2
Row (A2+1) contains totals of rows 1 to A2
Col. 1: The expenditure on the support activity
Col. 2: The percentage of the total net support expenditure that is allocated to the activity
Col. 3: The staff numbers engaged on this support activity
Col. 4: The percentage of the total support staff that are engaged on the activity
Col. 5: The salary costs.

Array S, dimension (A1+1,A2) Distribution of support, % staff
Rows 1 to A1 represent activities 1 to A1
Row (A1+1) contains totals of rows 1 to A1
Cols. 1 to A2 represent specialist support activities

The array elements contain the percentage of the specialist support activity staff associated with the primary activity.

Array T, dimension (A1+1,A2) Distribution of support, % expenditure
The layout is as for array S
The array elements contain the percentage of the support activity expenditure allocated to the primary activity.

Array U, dimension (A1+1,A2) Distribution of support in staff numbers
The layout is as for array S
The array elements contain the numbers of support activity staff associated with the primary activity.

Array V, dimension (A1+1,A2) Distribution of support , expenditure
The layout is as for array S
The array elements contain the support activity expenditure allocated to the primary activity.

Array W, dimension (2*A3) General Overheads , % expenditure
Rows 1 to A3 contain the percentage of the general overhead expenditures 1 to A3 associated with the current primary activity.

Rows (A3+1) to (2+A3) contain the total percentage expenditure (i.e. should be 100%) of general overheads 1 to A3.

Array X, dimension (2*A3) General overheads, % staff
Rows 1 to A3 contain the percentage of the general overhead staff 1 to A3 associated with the current primary activity.
Rows (A3+1) to (2+A3) contain the total percentage staff (i.e. should be 100%) of general overheads 1 to A2.

The arrays are backed up in the BUDGET file and are stored sequentially by means of a MAT PUT statement in the order D,E,G,Q,S,T,U,V. W and K are re-calculated each time the program is run.

NATIONAL INSTITUTE OF OCEANOGRAPHY

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. PROGRAM 257

Program Title: (For Lib. List)	Selective Master Listings by Marsden Square of BODS Geosorted Data
Classification Letter:	D
Program Name:	BODS3
Version Number:	2Ø
Type of Program:	Non-Process
Operating System:	M.P.X.
Language:	Fortran (with Assembler S/R's)
Programmer/date:	J. Crease
Program Passed By:	C. Spackman
Description:	To read BODS 800 b.p.i. even parity tapes blocked 1200 characters and find master records within specified Marsden Square limits and then to print them
System Prerequisities:	
Inskel Common Variables:	
Subroutines Called:	MAGOP, ZZIPU, BCDA1, IGET
Programs Called:	
Files Called:	

Operation and Method:

The first and last Marsden Squares on each tape are held and listed in the BODS office.

Inputs:

```
                          cc19
// JOB                     X
// XEQ BODS3  FX
(Data)
// END
```

Record 1 Name of BODS tape in cc. 1-8

Record 2 Marsden sub-square between which master records are to be listed.

cc. 1-6 has starting Marsden Square e.g. 181.45

cc. 8-13 has finishing Marsden Square e.g. 183.59

Records 1 and 2 may be repeated as often as required until a record 2 is found with a Marsden Square entry of 999.99. This terminates the program. N.B. The successive record 2 cards should have Marsden Squares in ascending order.

Output:

For each Marsden sub-square the following fields from all master records are printed.

1. Month
2. Country Code
3. Ship Code
4. Latitude in degrees and decimals of a minute) N/S,E/W are
5. Longitude " " " " ") not printed
6. Year
7. Day
8. Originator's Cruise No.
9. Originator's Station No.
10. Max-sample depth in 100's of metres
11. No. of samples
12. Depth of water in metres

An additional field which is the count of observed records following the master is also printed as field 11 which should be the same but is not always entered.

At the end of the job a summary is printed of:-

1. The total No. of physical records processed (10 logical/physical).
2. The No. of master records.
3. The No. of observed records.
4. The No. of standard records.
5. The No. of corrected errors on tape.
6. The No. of uncorrected errors on tape.

Items 2.,3.,4., are only counted when tape is within limits specified by the Marsden Square data entries.

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 304

Program Title: (For Lib. List)	To check fixes in FIXC file against CDAT file.
Classification Letter:	N
Program Name:	CHNAU
Version Number:	20
Type of Program:	Non process
Operating System:	MPX
Language:	Fortran IV
Programmer/date:	Ruth Sherwood/Jan 1974.
Program Passed By:	W. Strudwick / April 74.
Description:	To check fixes in the FIXF file against fix data in the CDAT file to see if they agree to within 0.1 minutes of latitude or longitude.
System Prerequisites:	
Inskel Common Variables:	
Subroutines Called:	FINFI, DFT, FINDT, CONFX
Programs Called:	/
Files Called:	Various navigation files

Operation and Method:

The control cards for execution are as follows

```
//   JOB        14    19    24
                X     X     X

//   XEQ   CHNAV      16    17
                      F     X
```

There follows 1 data card in the following format.

NDAYS, NHRS, NMINS, NDAYE, NHRE, NTIME, NTYP

Format (2(I3, IX, 2I2, IX), I1)

where

NDAYS - day of start of checking in columns 1-3 right justified.

NHRS - time in hours of start of checking in columns 5-6 right justified.

NMINS - time in minutes of start of checking in columns 7-8 right justified.

NDAYE - day of end of checking in columns 10-12 right justified.

NHRE - time in hours of end of checking column 14-15 right justified.

NTIME - time in minutes of end of checking in columns 16-17 right justified.

NTYP - type of navigation checked (=1 for satellites, see definition of FIXF file for further details).

e.g. to check between day 315 20 hrs 45 mins and day 320 6 hrs 3 minutes.

```
cc 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
   3 1 5   2 0 4 5   3  2  0     0  6  0  3     1
```

Method

Using a listing of the FIXF files on a particular drive 2 disk, all fixes of a particular type can be checked in one execution of the program by specifying the times of the first fix on the first file and the last fix on the last file. N.B. first time must be on or after the first fix time. The program uses DFT to find the appropriate FIXF and CDAT files and prints out a message if one is missing. If the times on the two files do not agree, the correct time and position on the CDAT file is interpolated.

A check is made between the FIXF and CDAT positions, and if they differ by more than 0.1 minute of latitude or longitude both positions are printed on the 1443 printer followed by an asterisk. If the FIXF position is a rejected fix with a negative status in the FIXF file, the position is printed with a minus sign. If no discrepancy is found the positions are printed by themselves. Records with a minus sign and asterisk can be ignored, those with one or the other require attention.

There are three error messages

1) That no CDAT record can be found or interpolated.

2) DFT error has occurred.

3) The required files are on different drive 2 disks when the program has finished.

'Checking Completed' is printed.

Execution Time.

About 15 minutes per disk.

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 305

Program Title: (For Lib. List)	Offline Navigation Update Programs.
Classification Letter:	N
Program Name:	LNAV1
Version Number:	20
Type of Program:	Nonprocess
Operating System:	MPX
Language:	FORTRAN IV
Programmer/date:	Ruth Sherwood/Jan 1974.
Program Passed By:	W. Strudwick/April 1974.
Description:	This is a suite of 4 linked coreloads to update the navigation and associated data.
System Prerequisites:	
Inskel Common Variables:	
Subroutines Called:	FINPI, OWRIT, ODRVE, OCORS
Programs Called:	
Files Called:	Various navigation files.

Operation and Method:

LNAV1 initiates the execution of 4 coreloads LNAV1, LNAV2, LMETC, LMARA which update navigation, meteorological, magnetic and depth data between given times.

Method.

1. LNAV1

This first coreload searches through the LOGF file to find which type of navigation is in use (e.g. satellites on Loran) and if a cold start update is required.

2. ONAV2

The second coreload searches the FIND file to ascertain the starting and finishing FIXF and CDAT files and whether or not they are on the same drive 2 disk. The relevant fixes are then evaluated and rejected or accepted and the course is updated. The fixes used are printed out by subroutine OWRIT.

3. OMETC

This disk updates the met and magnetic data between calculated records.

4. OMARA

The final link updates the Matthews Areas and depths on the CDAT file between calculated records.

For greater detail of the operation of these coreloads see the description of the ship programs NAVL1, NAVL2, METCO and MARAC. The programs have been written for land use and subsequently use files FIND1, LOGF1 and DATK1. It expects to find files FIXF1, CDAT1 etc., but if FIXF or CDAT should be required for any work, they can be accessed by putting data switch 0 on.

Data Cards

For execution the following control cards are needed.

```
                    14      19      24
// b  JOB           X       X       X
// b XEQ    LNAVIbbb    FX
```

followed by 1 data card as follows.

NDAYS, NHRS, MINS, NDAYE, NHRE, MINSE, NDCH, LDKA

format (2(I3, 1X, 2I2, 1X) I3, 1X, I1)

where

NDAYS - day of start of update columns 1-3 right justified.

NHRS - time in hours of start of update columns 5-6 right justified.

MINS - time in minutes of start of update columns 7-8 right justified.

b = ONE BLANK

NDAYE - day of end of update columns 10-12 right justified.

NHRE - time in hours of end of update columns 14-15 right justified.

MINSE - time in minutes of end of update columns 16-17 right justified.

NDCH - columns 19-21 right justified. For a normal run set this to 0. If an end of leg or cruise run is required, or you went to D.R. to a time between fixes set this to -10'. In this case set WHRE, MINSE to the correct end time required.

LDKA - column 23. If a cold start run is to be done set LDKA to a value of 1, and NDAYS, NTIMS to the time of the first data record in CDAT to be corrected. Otherwise set LDKA to 0.

When deciding what times to use for updating note that the program will update data from the first good fix before the time given to the next good fix after the end time.

In the FIXF files the status of the fix (word 8 of any record) is -1 if permanently and manually rejected. If the status is any other negative number, the operator can decide either to set the status to -1 (using SYICEY) or leave it, when it may be accepted during the update.

Output.

To the line printer. Each fix used is printed with position, current velocity, direction and fix status.

These are followed by information on the files and record numbers updated.

Word 1 - number of CDAT file used for the update e.g. 2 for CDAT 2

Word 2 - Starting record on the CDAT file.

Word 3 - Ending record on the CDAT file.

Up to five CDAT files can be used per run.

N.I.O. SUBPROGRAM -152 CLASSIFICATION G

Title	Course between two navigation points.
Name	LCORS(DLAT,DLON,XLAT,MCORS)
Language	1800 Fortran IV
Operating System	M.P.X.
Machine	I.B.M. 1800
Purpose	Given the difference in latitude and longitude between two points A and B at a specified latitude to compute the bearing of B from A. Flat earth approximation is used.
Input	DLAT = Latitude of B - Latitude of A in degrees DLON = Longitude of B - Longitude of A in degrees XLAT = Mean Latitude of A and B.
Output	MCORS = Course from A to B expressed in units of 1/10th of a degree.
Programmer	Meirion T. Jones.

N.I.O. SUBPROGRAM -153 Classification G

Title	Distance between two navigation points.
Name	LDIST(DLAT,DLON,XLAT,DIS)
Language	1800 Fortran IV
Operating System	M.P.X.
Machine	I.B.M. 1800
Purpose	Given the difference in latitude and longitude between two points at a specified latitude to compute the distance between them in nautical miles. Flat earth approximation is used.
Input	DLAT = Latitude difference in degrees. DLON = Longitude difference in degrees. XLAT = Mean latitude of the two points.
Output	DIS = Distance between two points in nautical miles.
Programmer	Meirion T. Jones.

N.I.O. SUBPROGRAM -154 Classification G

Title	Degrees and minutes to degrees conversion.
Name	FUNCTION DEGFR(LDEG,AMIN)
Language	1800 Fortran IV
Operating System	M.P.X.
Machine	I.B.M. 1800
Purpose	Converts angular measure in degrees (LDEG) and minutes (AMIN) into units of a degree. The sign is assumed to be incorporated solely in LDEG unless LDEG = 0.
Programmer	Meirion T. Jones.

NATIONAL INSTITUTE OF OCEANOGRAPHY

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. PROGRAM -188

Program Title: (For Lib. List)	Plot various symbols
Classification Letter:	N
Program Name:	MEPLX
Version Number:	20
Type of Program:	Subroutine
Operating System:	TSXPT
Language:	Fortran
Programmer/date:	M. Fashan/24.5.71
Program Passed By:	M. Fashan
Description:	The S/R is used by TRPLA for plotting various crosses to identify fixes and track postion.
System Prerequisites:	Called by TRPLA
Inskel Common Variables:	
Subroutines Called:	EPLOT
Programs Called:	
Files Called:	
Operation and Method:	

Calling sequence

CALL MEPLX(I,J,X,Y,SIZE)

where I,X,Y have same function as in CALL EPLOT(I,X,Y)

J identifies symbol that will be plotted at position X,Y.

where J = 0 for a square
= 1 for a St. Andrew's cross (X)
= 2 for a St. George's cross (+)
= 3 for an asterisk (*)

SIZE is size of symbol in users units (inches in the case of TRPLA)

The S/R leaves the pen up after plotting symbol.

NATIONAL INSTITUTE OF OCEANOGRAPHY

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. PROGRAM -190

Program Title: (For Lib. List)	Calculate distance between two points on surface of flat earth
Classification Letter:	N
Program Name:	DIST
Version Number:	20
Type of Program:	Function Subroutine
Operating System:	TSX/MPX
Language:	Fortran IV
Programmer/date:	J. Sherwood Feb 1972
Program Passed By:	E. Page
Description:	
System Prerequisites:	
Inskel Common Variables:	
Subroutines Called:	
Programs Called:	
Files Called:	
Operation and Method:	

The function DIST(DLAT1,DLON1,DLAT2,DLON2)

where DLAT1,DLON1 is position of first point (real)

DLAT2,DLON2 is " " second " (real)

using the convention N,W positive S,E negative will return the value DIST in Nautical Miles

where $DIST = 60 * \sqrt{Dx^2 + Dy^2}$

where $Dy = DLAT1 - DLAT2$

and $Dx = (DLON1-DLON2) \times COS((DLAT1+DLAT2)*0.872665)$

I.C.S. (WOOLLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 288

Program Title: (For Lib. List)	Analogue input test program
Classification Letter:	P
Program Name:	TESAI
Version Number:	20 mod 0
Type of Program:	
Operating System:	MPX
Language:	Fortran
Programmer/date:	B.D. Page 5.9.73
Program Passed By:	Eileen Page
Description:	The program will sample either relay or solid-state multiflexor prints in either single print or sequential mode and list the sampled voltages on the 1443.
System Prerequisites:	
Inskel Common Variables:	None
Subroutines Called:	SSWTC, DATSW, IADDR, AISQN, AISN, EMPY, EDIV, ELD, ESTO, ESTOX, FLOAT, ISTOX, MWNT, MCOMP, MIOFX, MIOI, SUBSC, PAUSE, TYPEN, HOLEB, PRNTN, EBPRT
Programs Called:	None
Files Called:	None

Operation and Method:

The program is executed by the following card sequence

```
// JOB    X19
// XEQ  TESAI
*CCEND.
```

The program executes in a conversational manner all instructions being printed on the 1816. The instructions state the various execution options available and the required options are selected by use of the sense switches and program switches as indicated by the 1816 print-out.

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DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. PROGRAM 297

Program Title:
(For Lib. List) Pitch and Roll Buoy Start

Classification Letter: S

Program Name: WAVST

Version Number: 20

Type of Program: INTERRUPT CORELOAD

Operating System: MPX

Language: FORTRAN

Programmer/date: B.D.PAGE 14.6.73

Program Passed By:

Description: CALLS LEVEL (Ø4,Ø5) to enter QSORT (Program No. 29Ø)

System Prerequisites:

Inskel Common Variables:

Subroutines Called:

Programs Called: INITW

Files Called:

Operation and Method: Execution is initiated by a process interrupt on level Ø2 bit 1Ø. This interrupt is caused by pressing the appropriate switch on the the computer switch panel.

WAVST requires no input and produces no output.

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 303

Program Title: (For Lib. List)	RJE FILES TO MAGNETIC TAPE
Classification Letter:	S
Program Name:	TAPE
Version Number:	20
Type of Program:	NON - PROCESS
Operating System:	MPX
Language:	FORTRAN
Programmer/date:	R. BENTLEY 9/1/74
Program Passed By:	J. SMALLBONE
Description:	SEE BELOW
System Prerequisites:	NONE
Inskel Common Variables:	NONE
Subroutines Called:	FILE 2
Programs Called:	NONE
Files Called:	M FILE

Operation and Method:

The user is required to know the name of his file, the disk it is on (including the drive number) and a tape number. Cards are as follows:-

// ß JOBßßßßß X ßßßßß X

// ß XEQ ß TAPEßßßß FX

Followed by two data cards

The first card contains the tape number (left justified in the first six columns e.g. M123 CCI

The second card contains the name or number of the user file (left justified in the first six columns), the letters M FILE in

ß = ONE BLANK

columns 7 to 11 and the drive number of the disk in column 20 e.g.

CCI	CC7	CC20
FILE NM	M FILE	1

The program will read the file M FILE and find the next available file on the tape (note the file M FILE must have been initialised at a previous stage with the program INITM). Users wishing to use the service of transferring data to the Rutherford Laboratory may contact the D.P.G. for a tape which has been initialised. The program having found the status of the tape will advance it to the next available file and will then copy your data file to the tape in 40 A2 format with a LRCL = 80 and BLKSIZE = 640. The tape will be written with odd parity and a density of 800 bpi (DEN = 2). When the program detects a END in your data file it will remove this and substitute zeros. If your program does not fill the last sector on the disk file, it will "fill" the unused part with zeros before writing the sector to tape.

IOS (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 275

Program Title: (For Lib. List)	Prediction of actual wave heights from significant height and time zero crossing
Classification Letter:	P
Program Name:	WVRAY
Version Number:	21
Type of Program:	Non process
Operating System:	
Language	1800 Fortran IV
Programmer/date:	J. Smallbone and S. Seymour
Program Passed By:	L. Draper
Description:	Program reads scatter diagram from card and computes no. of waves for different height intervals in one year.
System Prerequisites:	
Inskel Common Variables:	
Subroutines Called:	None
Programs Called:	None
Files Called:	None

Operation and Method: A scatter diagram of significant wave height vis time zero crossing is punched to card. The program writes the scatter diagram to printer for visual verification and then computes the number of waves per year for different wave heights. The individual and cumulative totals are printed. For a more detailed description see documentation enclosed with listings.

INSTITUTE OF OCEANOGRAPHIC SCIENCES

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 310

Program Title: (For Lib List)	linear interpolation of pressure Guage Data.
Classification Letter:	P
Program Name:	TRUDG
Version Number:	20
Type of Program:	Non Process
Operating System:	MPX
Language:	1800 FORTRAN IV
Programmer/date:	S. Urry / 12.8.74
Program Passed By:	W.K. Strudwick / 12.10.74
Description:	Interpolates readings from 0.0 to 2070.0 KNS/M^2 and lists each appropriate counter reading of the pressure gauge
Subroutines Called:	PBUFA, PBUFX
Operation and Method:	Original data arrives in Kgs/cm^2 form

There are 21 set readings (each with a gauge reading); the first being 0.0 (0.0) - However these readings must be extended to 22 by finding the average difference of the previous 21 readings and adding this to the 21st reading. The 22 readings must then be converted from Kgs/cm^2 to KN/M^2. (This is done by multiplying each piece of data by 98.0665). The data is now in the correct units for use with the program.

The data is now added to the program via 42 data cards.

The first data card is in the format (F9.4). This card contains the X2 value which is the second reading from the KN/M^2 array.

The second data card is in the format (4x,F9.4,6x,F7.3,6x,F7.3)

The first value is the XØ value which is the first reading from the KN/M^2 array
The next two values are the YØ and Y2 values respectively. The YØ value is the first value from the gauge reading array. Similarly Y2 is the second reading. (see listing of previous data cards).

The output is in single page form and contains three columns, each of two arrays. The arrays are 'headed' "KNS/MSQ" and"COUNTER READING" respectively.

NATIONAL INSTITUTE OF OCEANOGRAPHY

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

N.I.O. PROGRAM 283

Program Title:	Station listing in cruise report format
(For Lib. List)	
Classification Letter:	B
Program Name:	BIOPR
Version Number:	20
Type of Program:	Non-Process
Operating System:	TSX / MPX
Language:	Fortran IV
Programmer/Date:	J. Sherwood June 1972
Program Passed By:	C. Spackman
Description:	
System Prerequisites:	1443 Printer, Card Reader (Paper Tape on Ship)
Inskel Common Variables:	
Subroutines Called:	DFT, IFREC, POSN, JULAN, LTIME, BIOK
Programs Called:	
Files Called:	The BIOF files required for printing

Operation and Method:

Input Data

```
                                    19   24
//bJOB                              X    X
//bXEQbBIOPR
*CCEND
1 3   6
NbIYER
1     7
IFIL1bIFIL2  etc.
//bEND
```

Card 1:- cc 1 N = No. of file names on card 2.

cc 3-6 IYER = Year in which the cruise took place.

Card 2:- cc 1-5 IFIL1 = File names in order of printing. Up to 9 names allowed.

cc 7-11 IFIL2 If paper tape is used the record must be 54 characters long.

etc

Method The following data are listed, 12 stations to a page, in cruise report format. Refer to cruise 45 report for example.

Station and series number

Date

Positions of start and finish of hauls

Gear used

Range of depth fished

Fishing time

Remarks

Error Messages:

If all the files requested are not present etc, the message 'BIOPR DFT ERROR NN FILE XXXXX' refer to DFT description for the meaning of NN. XXXXX is the file which is at fault. The program will exit without printing in this case.

N.I.O.P. Program 234 Classification G

Title Create data file for earth's gravitational potential

Name EARTH

Type Mainline

Language FORTRAN

Operating System 1800 TSX or MPX

Purpose To take data from Smithsonian Astroplysical Observatory (ref. 1) for the figure of the earth and write it in suitable form on disk file for use by FUNCTION GEOID.

Input
```
//ØJOB
//ØFOR EARTH

//ØXEQ EARTH
*FILES(1,SMITH,Ø)
*CCEND
(data)
//ØEND
```

Notes

1) SMITH is 6 sectors long and the record length is 3 words. (i.e. extended precision f.p.).
2) There are 555 records as follows:-

record1	-	equatorial radius in metres
record2	-	reciprocal of the flattening
record3	-	product of gravitational constant and earths mass.
record4-279-		cosine coeffients of spherical harmonic expansion of geopotential, - Cn,m
record280-555-		sine coefficients - Sn,m where 0 m n 22.

3) The input data is taken from P.8 and P.60 of ref. 1. The only manipulation that is done on it is that the tesseral harmonics are all multiplied by $\left(\frac{2(2n+1)(n-m)!}{(n+n)^1}\right)^{\frac{1}{2}}$ as the tesseral harmonics used in the report are normalised ones and we require for GEOID the standardised un-normalised ones:-
4) In the data files the data is stored in order of increasing m for each value of n i.e. in the order Co,o , C1,o, C1,1, C2,o, C2,1, C2,2.
5) The data is held at the back of the master program deck

Programmer J.Crease Date 25.3.71

Ref1 Smithsonian Astrophysical Observatory

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 307

Program Title: (For Lib. List)	2-D gravity and mass anomalies.
Name:	GVTPL
Language	FORTRAN IV
Machine	1800
Purpose	To calculate the gravity anomalies, and total mass in a vertical column, of a model comprising a number of infinite horizontal prisms. There is an optional plotter output which draws a cross-section of the model and the computed gravity profile. Note: it is recommended that this program be modified for use with a VDU when such becomes available.

Data input

1) One card containing an alphanumeric title in columns 2-55.

2) IX NP
formatted 2I3, where

IX is the number of field points at which computations are required.

NP is the number of prisms in the model

3) IX cards, each of which contains:

XFP(I) ZFP(I) OBS(I)
formatted 3 FI0.3, where

XFP(I) is the X-co-ordinate (perpendicular to the strike of the model) of the field-point, in km below sea-level.

ZFP(I) is the depth of the field-point below sea-level, in km OBS(I) is optional and is the observed value of gravity at the field-point, in mgal. If not known or required, set it to zero.

4) One card containing:

XSC GSC DSC XMIN XMAX ZMAX formatted 8F10.3, where

XSC is the required scale of the x-axis of the plot, in inches/km. If XSC = 0, no plot will be produced and the other items on this card will be irrelevant.

GSC is the required scale of the gravity axis, in inches/mgal.

DSC is the required depth scale, in inches/km.

XMIN is the least (left-most) value of x to be plotted, in km.

XMAX is the greatest (right-most) value of x to be plotted. The x-axis will be marked at intervals of (XMAX-XMIN)/10, so suitable values should be chosen.

ZMAX is the maximum depth in the model, in km, and should preferably be an even whole-member.

If the plotter is initialized with the pen raised and in the lower left (most negative X and Y) corner of the paper, the plot will automatically be correctly positioned. However, to fit the plot into 31" wide paper will normally require that: ZMAX. DSC + 400. GSC 27

5) One card containing:

DPR	NC
formatted	F10.3, I3

where

DPR is the density of the prism in gm cm^{-3} NC is the number of corners in the prism, counting the first one twice.

6) NC cards, each containing:-

X (I) Z(I)

formatted 2F10.3, where

X(I) is the X-co-ordinate of the Ith corner of the prism in km

Z(I) is the depth below sea-level to the Ith corner.

The co-ordinates of the last corner must be the same as the co-ordinates of the first.

7) Repeat (5) and (6) NP times.

Output

1) The title, as input item (1)

2) Density and corner co-ordinates of the first prism

3) Field-point co-ordinate (X), computed gravity, and mass in a vertical column below the field-point, for this prism only.

Items (2) and (3) are then repeated for all the prisms in the model.

4) Field point co-ordinate (X), observed gravity, total computed gravity, COMP2, and the total mass in a vertical column below the field point. COMP2 is the computed gravity at the field-point minus the mean difference between computed and observed gravity for all field points; thus the mean of COMP2 in zero.

5) If XSC ≠ 0, results will also be plotted.

The plot will show the cross-sections of all prisms in the model, and plotted above these using the same X-scale will be the COMP2 anomalies (crosses) and observed anomalies (continuous line).

Restrictions.

Total number of field points ≤ 100
Number of corners in any one prism ≤ 100

If a corner of a prism has the same X-co-ordinate as a field-point, the latter will be incremented by 5×10^{-6} before continuing. Normally, the only noticeable effect will be that if a field-point lies above two or more corners simultaneously (i.e. a vertical edge) then the contribution of the prism to the mass sum will be either zero, or equivalent to the total height of the vertical side. The effect on the computed gravity anomaly will be negligible.

Failures.

The only error message to be printed is:-

ERROR IN PRISM INTERSECTIONS PRISM NO. XXXX FP NO. YYYY

I = ZZZZ.

This means that a vertical line below field point No. YYYY intersects prism No. XXXX in ZZZZ places, where ZZZZ is not an even number. Remedy: check the input data for this prism.

Execution time

Very approximately,

0.1 x IX x C sec,

where C is the total no. of prism corners in the model. This does not include plotting time.

Method.

The essential part of N.I.O. 87 is used as a subroutine for computing gravity anomalies. Another subroutine determines the positions of intersections of a vertical with prism boundaries, by testing successive pairs of corner co-ordinates until a pair is found whose X-co-ordinates straddle the line. Hence the sum of the mass under the field point is determined.

Programmer R.C. Searle.

I.O.S. (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 308

Program Title: (For Lib. List)	Seismic surface wave velocity calculations.
Name	HASKL
Machine	IBM 1800 or 360 (with LUN's 2 and 3, not 5 and 6)
Language	FORTRAN IV
Purpose	To compute, for different wave periods (frequencies), the phase and group velocities of Love and Rayleigh waves passing through a horizontally stratified medium. The ratio of vertical to horizontal ground motion amplitude for Rayleigh waves is also computed. The propagation medium is defined as a number of discrete horizontal layers, whose thicknesses compressional-wave and shear-wave velocities, and densities are given. Layers may be liquid (shear-wave velocity = 0).

Data input

1) One card containing:

   N TITLE

   formatted
   I3, 69H where

   N is the number of layers in the model ($\leq$ 21);
   N $\leq$ 0 will cause the program to terminate.

   TITLE is any alphanumeric string.

2) For each of the N layers in order, starting with the topmost, one card containing:

   H ALPHA BETA RHO where

   H is the thickness of the layer in km,

   ALPHA is its compressional (P) wave velocity in km s^{-1}

   BETA is its shear (S) wave velocity in km s^{-1}

   RHO is its density in gm cm^{-3}.

< = LESS THAN $\leq$ = LESS THAN, OR EQUAL TO.

3) For each period for which calculations are required, one card containing

T S
formatted
2 F10.3
where

T is the required period in seconds.

S is a trial value of phase velocity. S must be punched on the first card in this set, but optionally for subsequent cards only T need be given, and the result from the previous calculation will be used as the new trial value. The sign of S is vital: it must be positive if S is less than the actual phase velocity value, and negative if S is greater than the actual value, otherwise the root-finding search will proceed in the wrong direction and fail. The values of T do not need to be in any order.

Love-wave velocities will be computed for each period input. To obtain Rayleigh wave velocities, insert a card with T = 0, followed by a new set of T, S cards, the first of which must have S specified as above.

Setting T 0 will cause the program to look for new data starting from 1).

Output All output is via lineprinter. For each model:-

1) Input items 1) and 2) are printed

2) A table giving, period, phase velocity, and group velocity for Love waves (also printed is a column labelled 'H/V' which will contain zero's and should be ignored).

3) (If requested via the input) a table giving period, phase velocity, group velocity and ratio of horizontal to vertical ground motion for Rayleigh waves.

Failures

If no root of the phase velocity equation can be found between S and the edge of the search area, a message to that effect will be printed and the program will proceed to the next period input. The limits of the search area are: the value of BETA for the lowest layer (unless that is zero, in which case the ALPHA for the deepest layer), and 0.85 x (the value of ALPHA for the top layer or the smallest value of BETA if it is less than ALPHA (1) or the smallest value of ALPHA if all BETAS are zero). If the lower limit is not less than ALPHA for the deepest layer, the message: 'No real roots are possible - check layers' will be printed.

Restrictions

Maximum number of layers in body is 21. It is preferable that the model satisfies

where C is the actual phase velocity.

Execution time.

Approximately N seconds for each period-value on the 1800.

Method

The program is based on the Haskell matrix method of calculating group velocities (Haskell, N.A. Bull. Seism. Soc. Am. 43, 17-34, 1953) as developed by Dorman (Dorman, J. Bull Seism. Soc. Am. 52, 389-397, 1962), to allow liquid layers. The program is very similar to that described by Dorman, Ewing and Oliver (Bull. Seism. Soc. Amer. 50, 87-115, 1960).

Programmer.

The program was written by J. Dorman of Lamont Geological Observatory, and has been modified to run on the 1800 and 360 by R.C. Searle.

INSTITUTE OF OCEANOGRAPHIC SCIENCES (WORMLEY)

DATA PROCESSING GROUP

LABORATORY PROGRAM DESCRIPTION

PROGRAM 309

Program title: (For Lib. List)	Calculation of magnetic anomalies
Classification Letter:	G
Program Name:	MAG3D
Version Number:	20
Type of Program:	Non-Process
Operating System:	MPX
Language:	Fortran IV
Programmer/date:	R.C. Searle 18/7/74
Program Passed By:	W.K. Strudwick 18/7/74
Description:	Calculation of magnetic anomalies due to any number of three - dimensional bodies represented by contours.
Machine:	IBM 1800 (on disc 12 as of 4 July 74). IBM 360 (stored in MIOLDLIB as of 4 July 74).
Purpose:	The model whose magnetic anomalies are required is defined by contours representing the shape of one or more bodies. Each body may have a different magnetisation vector. None, some, or all of the bodies may be in contact with each other. The resultant components and total magnetic anomolies due to the vector sum of the effects of all the different bodies are pointed out.

Data input:

1) A single card containing an alphnumeric title, formatted 72H.

2) IOUT (one card) formatted 15.

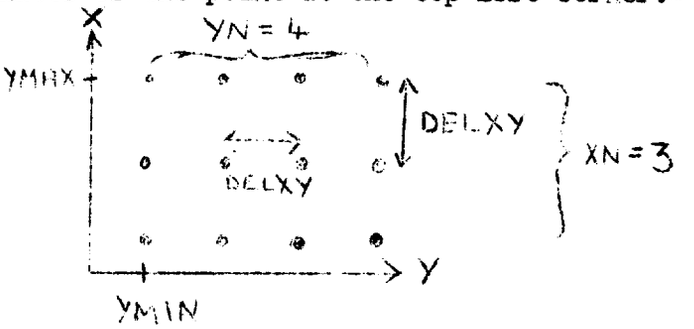
IOUT controls the output produced. If it is positive, results including anomaly components will be output in table form.

If it is zero, the total field anomaly only will be output in the form of a matrix corresponding to the matrix of fieldpoints input. If IOUT 0, both types of output will be produced.

3) IOB, (one card) I5. IBOD is the number of bodies in the model.

4) 'X 'Y DELXY XMAX YMIN (one card) formatted 215, 3F10.5

These define a matrix of field points at which the anomalies will be calculated. 'X and 'Y are the numbers of rows and columns of points in the X and Y directions, respectively DELXY is the distance between adjecent rows and columns, in km, and XMAX, YMIN arethe coordinates of the point at the top left corner:-



Note the configuration of the X and Y axes, such that if X is N, Y is E. However, the axes need not bear any special relation to geographic direction, and often it will be convenient to have them paralleling sides of the model. The axis is always down.

5) D I formatted 2F10.5

D is the angle from the x-axis to the magnetic north (i.e. to the direction of the horizontal projection of the Earths present field) in degrees.

I is the inclination of the Earths field, positive downwards, in degrees.

6) NQ formatted I10

NQ is the number of contours in the body to be described next, and must be greater than 2.

7) MID ZEE LL DUM formatted I5, F10.5, I5, F5.0

MID is an arbitrary identifier.

ZEE is the depth of the contour being described, in km below sea-level.

LL is the number of corners in the contour being described, counting the first twice.

DUM is a control variable such that if DUM = 0 the X and Y coordinates of the contour corners follow, but if DUM = 0 the coordinates for this contour are set equal to those of the preceding contour. DUM must be zero for the first contour in each body.

8) The coordinates of the corners of the contour, XX, YY, are input next, 3 corners to a card, formatted 6F 12.7. Continue until all LL corners have been input, remembering to repeat the first corner at the end.

9) Repeat items (7) and (8), MQ times.

10) AM B A

formatted 3F 10.5

AM is the intensity of magnetisation of the body just described, in gammas.

B is the angle from the X-axis to the horizontal projection of the magnetisation vector.

A is the inclination of the magnetization vector, positive downwards, in degrees.

11) Repeat items (6) through (10) for each of the IBOD bodies.

Output

1) All the input data, with the exception of the field-point coordinates, is output first.

2) Subsequent O/P depends on the value of IOUT. If IOUT = 0, a table will be printed listing the following quantities:

K, X, Y, Z, DELX, DELY, DELZ, DELH, DELT

K is an arbitrary identifier.

X,Y,Z, are the field-point coordinates (Z=0 always).

The other quantities are the values of the computed magnetic anomaly for the X, Y, vertical, horizontal and total field components, in gammas.

If IOUT 0, a grid of the DELT (total field anomaly) values will be output. The grid will correspond to the matrix of field points, with the X-axis vertical and the Y-axis horizontal on the line-printer page.

Restrictions

Maximum number of field-points = 225 (1800 version) or 400 (360 version).

Maximum value of NX = 20 (both versions)

Maximum no. of contours in one body = 12 (1800) or 20 (360). Minimum number = 3.

Maximum no. of corners in one contour = 15 (1800) or 20 (360).

There is no restriction on the total number of bodies in the model.

Note: core required on 360 is 74K.

Execution time

Approximately 50 + 0.065 C.F. seconds on the 1800, where C is the total no. of contour corners in the model and F is the number of field-points. This applies when IOUT 0. If IOUT 0, the execution time will be slightly different. The 360 version is roughly 50 times faster.

Method

As described by Talwani (Geophysics, 30, 797-817, 1965). The program is based on a deck obtained from Talwani for single-body computations, and has been modified to accept more than one body.

Programmers

Original program written by M. Talwani, of Lamont Geological Observatory. Modified by R.C. Searle to compute for any number of bodies. Any publication utilising results obtained with the program

should contain acknowledgement to Talwani, and the program must not be released outside I.O.S. without his permission.

N.I.O. SUBPROGRAM -137 CLASSIFICATION M,N

Title Point in a polygon

Name Subroutine INPOL Version 1

Machine I.B.M. 1800

Language Fortran IV

Purpose To determine whether a given point lies inside, outside or on a polygon.

Use

CALL INPOL (COOR, N, WORK, P, TOL, KODE)

where

N ($N \geq 2$) defines number of sides of polygon

COOR (length 2N) contains the co-ordinates of the corners, stored as $X_1, X_2, X_3 \ldots, Y_1, Y_2, Y_3 \ldots\ldots\ldots\ldots$

or

COOR (N,2) stored as COOR(n,1) = X_n

COOR(n,2) = Y_n

WORK(length N + 1) is work space

P(length 2) contains the point X,Y

TOL is a tolerance for the decision on whether a point lies on a side or not. See method.

KODE gives the answer as follows

KODE = -1 P lies outside

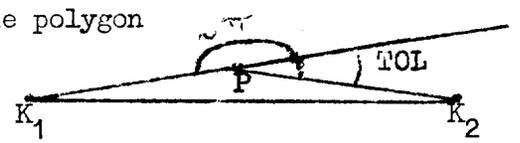
KODE=$\emptyset$ P lies inside

KODE = J($J > \emptyset$) has following meaning

$1 \leq J \leq N$ P lies on Jth corner

$N < J \leq 2N$ P lies on (J-N)th side

Method An exterior angle is subtended by adjacent corners if P lies outside the polygon



If the angle is within TOL radians of π the point is taken as on the line.

Note	In the special case N=2, KODE cannot be returned as Ø. If P lies on the line, KODE may be returned as 3 or 4.
Checks	None
Core size	350 Words
Other Routines	ATAN2
Programmer	A. Voss

N.I.O. Subroutine -148 Classification M

Title: Subroutine for use with FFT (N.I.O. - 134) to analyse real data

Name: RTRAN (A,B,N,ISN)

Machine: IBM 1800

Language: 1800 Fortran IV

Purpose: As for title

Input: Takes real data values stored alternately in arrays A and B (dimension n) e.g. A(1), B(1), A(2), B(2).....A(n), B(n)

CALL FFT (A, B, n, n, n, 1)

CALL RTRAN (A, B, n + 1, 1)

The output of RTRAN after scaling by $\frac{0.5}{n}$ gives the former Sine x Cosine Coefficients in arrays A and B

The inverse transform is obtained by putting ISN = -1

N.B. The arrays in RTRAN must be dimensioned 1 greater than the arrays in FFT

Programmer: W.J. Gould (from Subroutine REALTR by R.C. Singleton Stanford Research Institute)

N.I.O. SUBPROGRAM -150 CLASSIFICATION M

Title Solution of set of linear equations

Name LINEA

Machine I.B.M. 1800

Operating System T.S.X.

Language 1800 Fortran IV

Purpose To solve the matrix equation $\underline{\underline{A}} \cdot \underline{\underline{Y}} = \underline{\underline{B}}$ where $\underline{\underline{A}}$ is positive definite and symmetric. Note that this is true for the normal equations resulting from linear least squares methods.

Call CALL LINEA (A, B, Y, N, C, X)

N is the number of equations
A is the matrix of coefficients whose lower triangular part only is stored by row in a singly dimensional array with dimension N(N+1)/2
B is the R.H.S. of the equation stored as an array with dimension N
C should be of dimension N(N+1)/2
X should be of dimension N
C and X are working storage arrays
Y is the array of dimension N which holds the solution

S/R's required CHOLY, LTRIQ, UTRIQ

Note Results unpredicatable if A is not positive definite.

Method A is first decomposed into lower and upper triangular matrices by CHOLY then two successive back-substitutions using LTRIQ and UTRIQ yield the solution.

Programmer J. Crease.