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A PROGRAM FOR STORING OCEANOGRAPHIC DATA ON
MAGNETIC TAPE

Marilyn L. Blodgett, et al

Naval Research Laboratory

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A program has been written for the storage of navigational, bathymetry, and magnetics data on magnetic tape in BCD form. This eliminates the problem of storing vast amounts of data collected on computer cards by oceanographic and geophysical cruises. This program uses a slightly modified format recommended by the National Research Council of the National Academy of Sciences. The program was written in Fortran IV for use on the CDC 3800; however the program can be converted to run on other systems with little difficulty.		

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**A PROGRAM FOR STORING OCEANOGRAPHIC DATA
ON MAGNETIC TAPE**

1.0 IDENTIFICATION

1.1 Title

Storage Program for Navigation, Bathymetric, and Magnetics Data on Magnetic Tape.

1.2 Identification Name

GEODATA.

1.3 Classification Code

None.

1.4 NRL Research Computation Center Identification Number

None.

1.5 Entry Points

GEODATA.

1.6 Programming Language

Language: CDC 3600/3800 Fortran.

Routine Type: Program.

Operating System: Drum Scope 2.1.

1.7 Computer and Configuration

CDC 3800.

1.8 Contributor or Programmer

Marilyn L. Blodgett, Code 4223MB, Research Computation Center,
written for Environmental Sciences Section, Acoustics Division.

1.9 NRL — Naval Research Laboratory, Washington, D.C. 20375.

NOTE: Manuscript submitted January 9, 1975.

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1.10 Program Availability

If supplied with a magnetic tape, a copy of this program will be made available by the Environmental Sciences Section, Acoustics Division.

1.11 Verification

This program has been used and tested by the Environmental Sciences Section, Acoustics Division, for the past year.

1.12 Date

July 1974.

2.0 PURPOSE

2.1 Description of the Routine

This program transfers the data collected by an oceanographic or geophysical experiment to magnetic tape. The program will take up to 3000 navigational data points and an unlimited number of bathymetric and magnetic data points. The program is set up so that if one tape is filled, any number of continuation tapes can be used. The data tape will have one logical record (of 80 characters) for each data point. The different types of data (navigational, bathymetric, and magnetics) will be separated by an end-of-file mark, with a double end-of-file mark at the end of all the data.

2.1.1 Navigation Data

This program is presently set up to read the navigation data from cards. The data are in degrees, minutes, and hundredths of a minute; each navigation fix has an associated Julian date and time (24-hour clock). The southern latitudes and the western longitudes are preceded by a minus sign. This program changes the Julian date to month and day and changes the minutes and hundredths of minutes of latitude and longitude to ten thousandths of a degree.

2.1.2 Bathymetry Data

The bathymetry data are read in with the Julian date followed by five time-depth groups to a card. Time is read to tenths of a minute. The depth can be either uncorrected fathoms or uncorrected meters, but not both in the same run. This program converts the Julian date to month and prints out uncorrected fathoms, uncorrected meters, corrected meters, and Matthews zone. The uncorrected meters are not written on the data tape.

2.1.3 Magnetics Data

The magnetics data are read in with the Julian date, then the hour, followed by 12 magnetic data points (one every five minutes). The program converts the Julian date to month and day and converts the total magnetic intensity in gammas (the data read in) to residual magnetic intensity using the International Geomagnetic Reference Field formula.

2.1.4 Gravity Data

This program is not set up to take gravity data, but a gravity subroutine could easily be inserted.

2.2 Problem Background

The rapid accumulation of many boxes of oceanographic data on computer cards necessitated the transfer of the data from cards to magnetic tape. It was decided that the format recommended by the National Research Council of the National Academy of Sciences would be used with one slight modification, the addition of a fix number with the navigation.

3.0 USAGE

3.1 Calling Sequence or Operational Procedure

Not applicable.

3.2 Arguments, Parameters, and/or Initial Conditions

Not applicable.

3.3 Space Required (Decimal and Octal)

3.3.1 Unique Storage

36533 Octal (15707 decimal) locations exclusive of system library functions.

3.3.2 Common Blocks

None.

3.3.3 Temporary Storage

None.

3.4 Messages and Instructions to the Operator

None.

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3.5 Error Returns, Messages, and Codes

Deck set up incorrectly.
More than 3000 navigation data cards.
Unable to interpolate latitude and longitude.

3.6 Informative Messages to the User

None.

3.7 Input

Input parameters and data are read in via punched cards. The format statements can easily be changed to meet requirements of the user. See Appendix A for samples of our data formats. Each data type (navigation, bathymetry, magnetics) are bracketed by a control card with a negative number in columns 1 and 2. The control card preceding the data sets up the different options available. Appendix B is a complete description of the input setup.

3.8 Output

The program prints out on the standard printer (logical unit 61) the ship and cruise identification, number of cards read, number of logical records written for navigation, bathymetry, and magnetic data. There is an option for listing all the records written on the output tape and for punching out cards. Appendix C shows samples of the output.

3.9 Formats

Appendix B shows the program deck structure.

3.10 External Routines and Symbols

SKIPFILE, BACKFILE, XM0DF, SQRTF, SINF, COSF.

3.11 Timing

This program will process approximately 1300 data points a minute. If a listing of all processed data is required, each data point will generate one line. Consequently, this program can process a great deal of data in little time but also produce large printouts.

3.12 Accuracy

Not applicable.

3.13 Cautions to Users

None.

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3.14 Program Deck Structure

See Appendix B.

3.15 References — Literature

"Formats for Marine Geophysical Data Exchange," National Academy of Sciences, June, 1972.

4.0 METHOD OR ALGORITHM

Not applicable.

5.0 FLOW CHART AND/OR SOURCE LANGUAGE LISTING

Flow chart and listing are given in Appendix D.

6.0 COMPARISON

There are no other known programs available for comparison.

7.0 TEST METHOD AND RESULTS

A sample of the three types of records written on the output tape are included in Appendix C.

8.0 REMARKS

The authors thank Gary Flenner for his review of this report and Wayne Worsley for preparing the illustrations in the appendixes. The authors also thank Leon LaLumiere for providing some of the subroutines used by this program.

NAVIGATION INPUT FORMAT

[illegible]

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BATHYMETRY INPUT FORMAT

Ship Number	Julian Day	Time	Data	Time	Data	Time	Data	Time	Data	Time	Data
1	1	1000	1	1000	1	1000	1	1000	1	1000	1
2	2	1000	2	1000	2	1000	2	1000	2	1000	2
3	3	1000	3	1000	3	1000	3	1000	3	1000	3
4	4	1000	4	1000	4	1000	4	1000	4	1000	4
5	5	1000	5	1000	5	1000	5	1000	5	1000	5
6	6	1000	6	1000	6	1000	6	1000	6	1000	6
7	7	1000	7	1000	7	1000	7	1000	7	1000	7
8	8	1000	8	1000	8	1000	8	1000	8	1000	8
9	9	1000	9	1000	9	1000	9	1000	9	1000	9
10	10	1000	10	1000	10	1000	10	1000	10	1000	10
11	11	1000	11	1000	11	1000	11	1000	11	1000	11
12	12	1000	12	1000	12	1000	12	1000	12	1000	12
13	13	1000	13	1000	13	1000	13	1000	13	1000	13
14	14	1000	14	1000	14	1000	14	1000	14	1000	14
15	15	1000	15	1000	15	1000	15	1000	15	1000	15
16	16	1000	16	1000	16	1000	16	1000	16	1000	16
17	17	1000	17	1000	17	1000	17	1000	17	1000	17
18	18	1000	18	1000	18	1000	18	1000	18	1000	18
19	19	1000	19	1000	19	1000	19	1000	19	1000	19
20	20	1000	20	1000	20	1000	20	1000	20	1000	20
21	21	1000	21	1000	21	1000	21	1000	21	1000	21
22	22	1000	22	1000	22	1000	22	1000	22	1000	22
23	23	1000	23	1000	23	1000	23	1000	23	1000	23
24	24	1000	24	1000	24	1000	24	1000	24	1000	24
25	25	1000	25	1000	25	1000	25	1000	25	1000	25
26	26	1000	26	1000	26	1000	26	1000	26	1000	26
27	27	1000	27	1000	27	1000	27	1000	27	1000	27
28	28	1000	28	1000	28	1000	28	1000	28	1000	28
29	29	1000	29	1000	29	1000	29	1000	29	1000	29
30	30	1000	30	1000	30	1000	30	1000	30	1000	30
31	31	1000	31	1000	31	1000	31	1000	31	1000	31

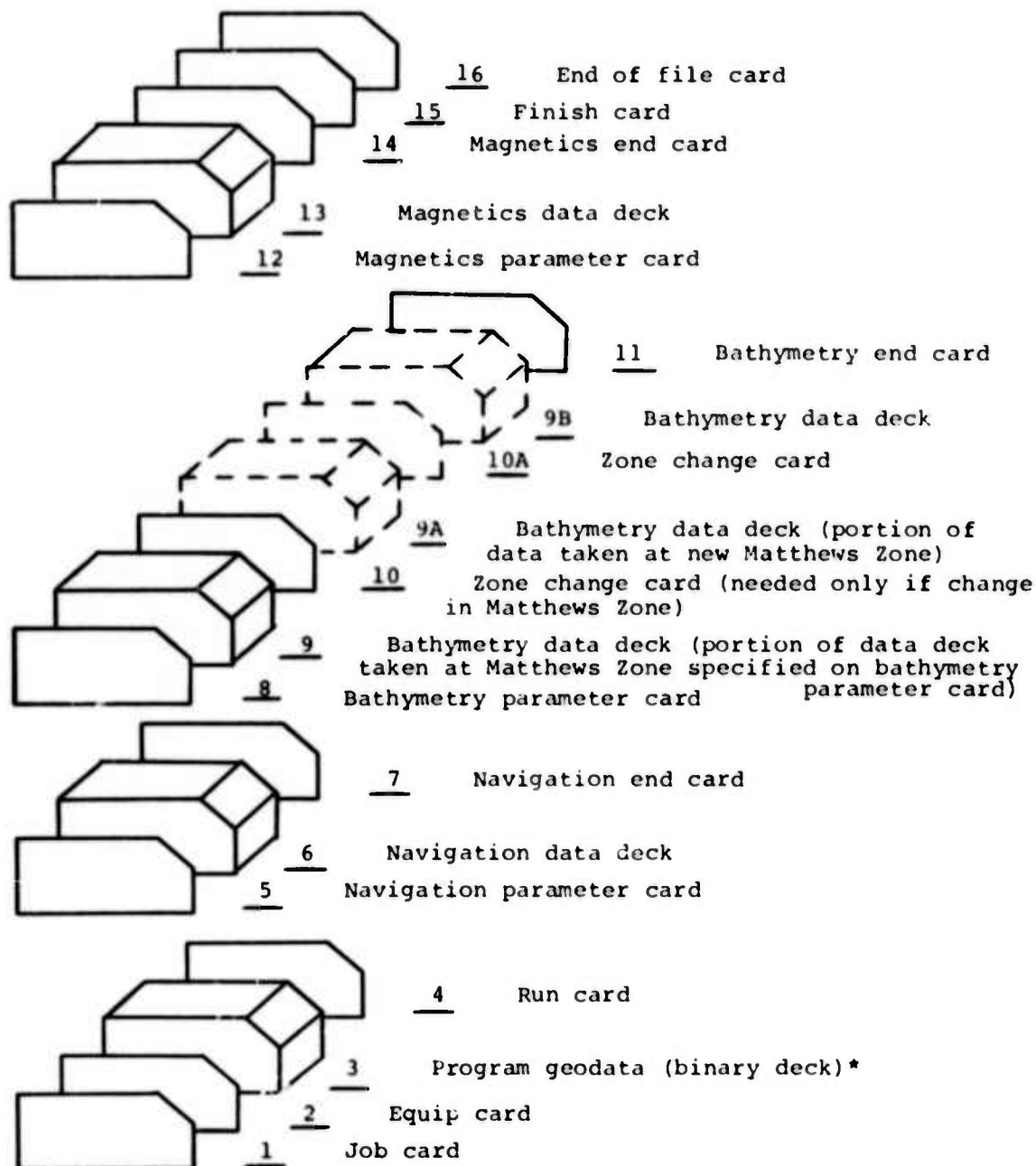
```
204 FORMAT (I2,1X I3,5(1X F2,F3.1,1X I4))
```

MAGNETICS INPUT FORMAT

```
302 READ (60,304) ISN,JUDY,RMHR,(ING(I),I=1,12)
304 FORMAT (I2,I3,1XF2,12(1XI5))
```

Appendix B

DECK ASSEMBLY



*If the FORTRAN source deck is used instead of the binary deck, a FORTRAN card is required after the Equip card. The FORTRAN card reads--7/9 FTN, L, R, X. In addition a SCOPE card with SCOPE starting in column 10 and a LOAD card which reads 7/9 LOAD must follow the source deck.

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Number	Card Title	Column Number	Description
1	Job	1-21	7/9 JOB, charge No., ID No., time. The charge number consists of alphanumeric characters of any length. The ID number is the programmer identification; it may be any length and appears as given in the control card listing. The time is the maximum time limit in minutes for the entire job. See page 2-2 of the 3600/3800 Computer Systems Drum Scope Manual.
2	Equip	1-18	7/9 EQUIP, 10 = **, WO, HI 10 = logical unit number. WO = write only. HI = high density.
3	Program GEODATA	Deck of cards	This is the main program with associated subroutines. If the Fortran source deck is used instead of the binary deck, a Fortran card is required after the Equip card. The Fortran card reads 7/9 FTN, L, R, X. In addition a Scope card with SCOPE starting in column 10 and a LOAD must follow the source deck.
4	Run	1-13	7/9 RUN, T, P, R, M, D T = time limit in minutes. P = maximum number of print or write operations. R, M, D may be left blank. See page 2-15 of the 3600/3800 Computer Systems Drum Scope Manual.
5	Navigation Parameter	1-2 5	-1 This number designates the Navigation Parameter card. 0, 1, 2 0 = write the navigation data on a new tape. 1 = read the navigation data cards and store the information necessary for interpolation. The program will not write the navigation data on the tape. It will only write the bathymetry data on a tape that already contains the navigation and magnetic data.

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Number	Card Title	Column Number	Description
			2 = Read the navigation data cards and store the information necessary for interpolation. The program will not write the navigation data on the tape. It will only write the magnetics data on a tape that already contains the navigation and bathymetry data.
		19-20	0, 1, 2, 3 0 = just write the navigation data on tape in the required format. 1 = write the navigation data on tape and print out a listing of the data. 2 = write the navigation data on tape and punch out a card for each logical record written on the tape. 3 = write the navigation data on tape and print out a listing. In addition, punch out a card for each logical record written on the tape. If card columns 4-5 are 1 or 2, more of the options in card columns 19-20 are available.
		23-30	Columns 23-30 are for cruise identification. Any eight-digit alphanumeric number may be used.
6	Navigation Data Deck		Place the Navigation Data Deck after the Navigation Parameter card.
7	Navigation End	1-2	-5 This number designates the end of the Navigation Data Deck.
8	Bathymetry Parameter	1-2	-2 This number designates the Bathymetry Parameter card.
		4-5	Columns 4-5 are for the Matthews zone.
		14-15	1 or 2 1 = Depth data in uncorrected fathoms. 2 = Depth data in uncorrected meters.

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Number	Card Title	Column Number	Description
		19-20	0, 1, 2, or 3 0 = just write the bathymetry data on tape in the required format. 1 = write the bathymetry data on tape and print out a listing of the data. 2 = write the bathymetry data on tape and punch out a card for each logical record written on the tape. 3 = write the bathymetry data on tape and print out a listing. In addition punch out a card for each logical record written on the tape.
9	Bathymetry Data Deck		Place that portion of the Bathymetry Data Deck which was taken at the Matthews zone specified on the Bathymetry Parameter card after the Bathymetry Parameter card.
10	Zone Change	1-2	-6 This number designates a change in the Matthews zone. A Zone Change card must precede the first data card taken at the new Matthews zone. These Zone Change cards can be scattered throughout the Bathymetry Data Deck.
		4-6	Value of the new Matthews zone.
11	Bathymetry End	1-2	-7 This number designates the end of the Bathymetry Data Deck.
12	Magnetics Parameter	1-2	-3 This number designates the Magnetics Parameter card.
		6-10	Height in feet above or below mean sea level.
		19-20	0, 1, 2, or 3 0 = just write the magnetics data on tape in the required format. 1 = write the magnetics data on tape and print out a listing of the data.

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Number	Card Title	Column Number	Description
			2 = write the magnetics data on tape and punch out a card for each logical record.
			3 = write the magnetics data on tape and print out a listing. In addition, punch out a card for each logical record written on the tape.
13	Magnetics Data Deck		Place the magnetics data deck after the magnetics parameter card.
14	Magnetics End	1-2	-8 This number designates the end of the Magnetics Data Deck.
15	Finish	1-2	-4 This number designates the end of all data.
16	End-of-File		

Appendix C1
SAMPLE OUTPUT LISTINGS

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SAMPLE NAVIGATION PRINTOUT

SHIP AND CRUISE IDENTIFICATION	TIME ZONE	YEAR	MONTH	DAY	HOUR	MINUTE	LATITUDE	LONGITUDE	FIX DESCRIPTION	FIX NUMBER
73-16-02	0	73	0	22	10	6.0	72.7257	-10.3975	50	200
73-16-02	0	73	0	22	10	40.0	72.7710	-10.3330	50	201
73-16-02	0	73	0	22	10	50.0	72.7850	-10.3167	49	202
73-16-02	0	73	0	22	11	0.0	72.7953	-10.2895	50	203
73-16-02	0	73	0	22	11	30.0	72.8333	-10.2253	50	204
73-16-02	0	73	0	22	11	54.0	72.8647	-10.1642	50	205
73-16-02	0	73	0	22	12	28.0	72.9080	-10.0868	50	206
73-16-02	0	73	0	22	12	48.0	72.9333	-10.0395	50	207
73-16-02	0	73	0	22	13	14.0	72.9685	-9.9792	50	208
73-16-02	0	73	0	22	13	37.0	72.9983	-9.9100	49	209
73-16-02	0	73	0	22	14	14.0	73.0460	-9.8135	50	211
73-16-02	0	73	0	22	14	34.0	73.0708	-9.7570	50	212
73-16-02	0	73	0	22	15	0.0	73.1072	-9.6877	49	213
73-16-02	0	73	0	22	15	28.0	73.1255	-9.6198	50	214
73-16-02	0	73	0	22	15	47.0	73.1375	-9.5817	48	215
73-16-02	0	73	0	22	16	2.0	73.1718	-9.5027	50	216
73-16-02	0	73	0	22	16	46.0	73.2778	-9.2473	50	218
73-16-02	0	73	0	22	17	14.0	73.3527	-9.0455	50	219
73-16-02	0	73	0	22	17	48.0	73.4387	-8.8817	50	220
73-16-02	0	73	0	22	18	5.0	73.4817	-8.7667	49	221
73-16-02	0	73	0	22	18	8.0	73.4865	-8.7435	50	222
73-16-02	0	73	0	22	18	28.0	73.5247	-8.6728	50	223
73-16-02	0	73	0	22	19	8.0	73.5942	-8.4753	50	225
73-16-02	0	73	0	22	19	32.0	73.6428	-8.3643	50	226
73-16-02	0	73	0	22	19	52.0	73.6785	-8.2742	50	227
73-16-02	0	73	0	22	20	14.0	73.7192	-8.1953	50	229
73-16-02	0	73	0	22	20	34.0	73.7575	-8.0848	50	230
73-16-02	0	73	0	22	21	16.0	73.8378	-7.9065	50	231
73-16-02	0	73	0	22	21	38.0	73.8853	-7.8282	50	232
73-16-02	0	73	0	22	22	4.0	73.9326	-7.7025	50	233
73-16-02	0	73	0	22	22	28.0	73.9710	-7.6172	50	234
73-16-02	0	73	0	22	23	0.0	74.0432	-7.4810	50	235
73-16-02	0	73	0	22	23	22.0	74.0893	-7.3897	50	236
73-16-02	0	73	0	22	23	50.0	74.1463	-7.2443	50	237
73-16-02	0	73	0	23	0	10.0	74.1880	-7.1523	50	238
73-16-02	0	73	0	23	0	44.0	74.2380	-6.9860	50	239
73-16-02	0	73	0	23	1	4.0	74.3000	-6.8735	50	240
73-16-02	0	73	0	23	2	6.0	74.4165	-6.5770	50	241
73-16-02	0	0	0	0	0	0.0	0.0000	n.0000	n	0
73-16-02	0	0	0	0	0	0.0	0.0000	n.0000	n	0

SAMPLE BATHYMETRY PRINTOUT

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STATION	CRUISE	TIME	YEAR	DATE	DEPTH	MINUTE	LATITUDE	LONGITUDE	UNCORRECTED FATHOMS	UNCORRECTED METERS	CORRECTED METERS	WATTI 784
73-10-02	0	0	73	22	10	00.0	72.7588	-01.3520	1440.8	2639.0	2642	1
73-10-02	0	0	73	22	10	00.0	72.7649	-01.3425	1448.4	2648.0	2652	1
73-10-02	0	0	73	22	10	00.0	72.7710	-01.3330	1453.4	2658.0	2662	1
73-10-02	0	0	73	22	10	00.0	72.7780	-01.3248	1459.0	2668.0	2672	1
73-10-02	0	0	73	22	10	00.0	72.7850	-01.3167	1467.4	2678.0	2682	1
73-10-02	0	0	73	22	10	00.0	72.7902	-01.3031	1473.0	2684.0	2688	1
73-10-02	0	0	73	22	11	00.0	72.7993	-01.2895	1479.1	2690.0	2694	1
73-10-02	0	0	73	22	11	00.0	72.8017	-01.2788	1482.9	2695.0	2699	1
73-10-02	0	0	73	22	11	00.0	72.8080	-01.2681	1487.3	2700.0	2704	1
73-10-02	0	0	73	22	11	00.0	72.8143	-01.2574	1492.7	2705.0	2709	1
73-10-02	0	0	73	22	11	00.0	72.8207	-01.2467	1497.7	2710.0	2714	1
73-10-02	0	0	73	22	11	00.0	72.8270	-01.2360	1501.5	2715.0	2719	1
73-10-02	0	0	73	22	11	00.0	72.8308	-01.2294	1503.7	2717.0	2721	1
73-10-02	0	0	73	22	11	00.0	72.8399	-01.2124	1509.1	2722.0	2726	1
73-10-02	0	0	73	22	11	00.0	72.8464	-01.1988	1513.5	2726.0	2730	1
73-10-02	0	0	73	22	11	00.0	72.8529	-01.1871	1516.2	2728.0	2732	1
73-10-02	0	0	73	22	11	00.0	72.8594	-01.1744	1520.1	2732.0	2736	1
73-10-02	0	0	73	22	11	00.0	72.8660	-01.1619	1525.5	2737.0	2741	1
73-10-02	0	0	73	22	12	00.0	72.8725	-01.1505	1528.5	2740.0	2744	1
73-10-02	0	0	73	22	12	00.0	72.8790	-01.1391	1529.9	2741.0	2745	1
73-10-02	0	0	73	22	12	00.0	72.8859	-01.1323	1531.8	2742.0	2746	1
73-10-02	0	0	73	22	12	00.0	72.8919	-01.1278	1532.1	2743.0	2747	1
73-10-02	0	0	73	22	12	00.0	72.8984	-01.1164	1536.4	2746.0	2750	1
73-10-02	0	0	73	22	12	00.0	72.9049	-01.1050	1541.1	2750.0	2754	1
73-10-02	0	0	73	22	12	00.0	72.9114	-01.0921	1546.1	2754.0	2758	1
73-10-02	0	0	73	22	12	00.0	72.9179	-01.0783	1552.0	2759.0	2763	1
73-10-02	0	0	73	22	12	00.0	72.9239	-01.0684	1558.5	2764.0	2768	1
73-10-02	0	0	73	22	12	00.0	72.9297	-01.0584	1563.8	2769.0	2773	1
73-10-02	0	0	73	22	12	00.0	72.9360	-01.0466	1570.1	2774.0	2778	1
73-10-02	0	0	73	22	12	00.0	72.9428	-01.0349	1578.9	2780.0	2784	1
73-10-02	0	0	73	22	12	00.0	72.9492	-01.0233	1585.7	2786.0	2790	1
73-10-02	0	0	73	22	13	00.0	72.9543	-01.0140	1594.4	2792.0	2796	1
73-10-02	0	0	73	22	13	00.0	72.9631	-01.0001	1591.7	2789.0	2793	1
73-10-02	0	0	73	22	13	00.0	72.9698	-0.9884	1597.2	2794.0	2798	1
73-10-02	0	0	73	22	13	00.0	72.9763	-0.9762	1603.7	2799.0	2803	1
73-10-02	0	0	73	22	13	00.0	72.9828	-0.9641	1607.4	2803.0	2807	1
73-10-02	0	0	73	22	13	00.0	72.9893	-0.9511	1609.4	2805.0	2809	1
73-10-02	0	0	73	22	13	00.0	72.9957	-0.9311	1609.4	2805.0	2809	1
73-10-02	0	0	73	22	13	00.0	73.0022	-0.9160	1604.8	2800.0	2804	1
73-10-02	0	0	73	22	13	00.0	73.0086	-0.8991	1603.7	2799.0	2803	1
73-10-02	0	0	73	22	13	00.0	73.0151	-0.8761	1603.2	2798.0	2802	1
73-10-02	0	0	73	22	13	00.0	73.0215	-0.8631	1602.4	2797.0	2801	1
73-10-02	0	0	73	22	14	00.0	73.0280	-0.8500	1604.4	2799.0	2803	1
73-10-02	0	0	73	22	14	00.0	73.0344	-0.8370	1605.4	2800.0	2804	1
73-10-02	0	0	73	22	14	00.0	73.0408	-0.8250	1610.3	2804.0	2808	1
73-10-02	0	0	73	22	14	00.0	73.0461	-0.8174	1613.0	2806.0	2810	1
73-10-02	0	0	73	22	14	00.0	73.0534	-0.7965	1626.7	2819.0	2823	1
73-10-02	0	0	73	22	14	00.0	73.0597	-0.7824	1639.3	2831.0	2835	1
73-10-02	0	0	73	22	14	00.0	73.0659	-0.7683	1634.4	2826.0	2830	1
73-10-02	0	0	73	22	14	00.0	73.0722	-0.7543	1637.2	2828.0	2832	1
73-10-02	0	0	73	22	14	00.0	73.0782	-0.7410	1632.2	2823.0	2827	1
73-10-02	0	0	73	22	14	00.0	73.0842	-0.7277	1637.2	2828.0	2832	1
73-10-02	0	0	73	22	14	00.0	73.0932	-0.7143	1630.0	2821.0	2825	1
73-10-02	0	0	73	22	14	00.0	73.1002	-0.7010	1628.4	2819.0	2823	1
73-10-02	0	0	73	22	15	00.0	73.1072	-0.6877	1629.4	2820.0	2824	1
73-10-02	0	0	73	22	15	00.0	73.1104	-0.6754	1628.3	2819.0	2823	1
73-10-02	0	0	73	22	15	00.0	73.1187	-0.6634	1628.2	2818.0	2822	1
73-10-02	0	0	73	22	15	00.0	73.1170	-0.6513	1628.7	2818.0	2822	1

C E 24

SAMPLE MAGNETICS PRINTOUT

SHIP AND CRUISE IDENTIFICATION	TIME ZONE	YEAR	MONTH	DAY	HOUR	MINUTE	LATITUDE	LONGITUDE	TOTAL MAGNETIC INTENSITY	RESIDUAL MAGNETIC INTENSITY
73-16-02	0	73	0	22	11	10.0	72.9000	-10.2801	52009	155
73-16-02	0	73	0	22	11	15.0	72.8143	-10.2574	52004	149
73-16-02	0	73	0	22	11	20.0	72.0207	-10.2407	52002	146
73-16-02	0	73	0	22	11	25.0	72.0270	-10.2360	52002	145
73-16-02	0	73	0	22	11	30.0	72.0333	-10.2293	52005	147
73-16-02	0	73	0	22	11	35.0	72.0399	-10.2126	52004	144
73-16-02	0	73	0	22	11	40.0	72.0464	-10.1998	52007	136
73-16-02	0	73	0	22	11	45.0	72.0529	-10.1871	52005	143
73-16-02	0	73	0	22	11	50.0	72.0594	-10.1744	52005	132
73-16-02	0	73	0	22	11	55.0	72.0660	-10.1619	52004	124
73-16-02	0	73	0	22	12	0.0	72.0725	-10.1505	52005	110
73-16-02	0	73	0	22	12	5.0	72.0790	-10.1391	52014	108
73-16-02	0	73	0	22	12	10.0	72.0855	-10.1278	52008	110
73-16-02	0	73	0	22	12	15.0	72.0919	-10.1164	52047	118
73-16-02	0	73	0	22	12	20.0	72.0984	-10.1050	52002	152
73-16-02	0	73	0	22	12	25.0	72.1049	-10.0937	52005	164
73-16-02	0	73	0	22	12	30.0	72.1113	-10.0821	53035	203
73-16-02	0	73	0	22	12	35.0	72.1178	-10.0703	53075	222
73-16-02	0	73	0	22	12	40.0	72.1243	-10.0584	53124	290
73-16-02	0	73	0	22	12	45.0	72.1307	-10.0466	53109	327
73-16-02	0	73	0	22	12	50.0	72.1372	-10.0349	53197	361
73-16-02	0	73	0	22	12	55.0	72.1437	-10.0233	53224	386
73-16-02	0	73	0	22	13	0.0	72.1502	-10.0117	53235	396
73-16-02	0	73	0	22	13	5.0	72.1567	-10.0001	53236	390
73-16-02	0	73	0	22	13	10.0	72.1631	-9.9884	53206	385
73-16-02	0	73	0	22	13	15.0	72.1696	-9.9762	53165	323
73-16-02	0	73	0	22	13	20.0	72.1763	-9.9641	53111	267
73-16-02	0	73	0	22	13	25.0	72.1828	-9.9511	53043	190
73-16-02	0	73	0	22	13	30.0	72.1893	-9.9381	52904	150
73-16-02	0	73	0	22	13	35.0	72.1957	-9.9250	52931	84
73-16-02	0	73	0	22	13	40.0	72.2022	-9.9122	52855	17
73-16-02	0	73	0	22	13	45.0	72.2086	-9.8991	52826	-29
73-16-02	0	73	0	22	13	50.0	72.2151	-9.8861	52791	-59
73-16-02	0	73	0	22	13	55.0	72.2215	-9.8731	52756	-62
73-16-02	0	73	0	22	14	0.0	72.2280	-9.8600	52756	-66
73-16-02	0	73	0	22	14	5.0	72.2344	-9.8470	52704	-89
73-16-02	0	73	0	22	14	10.0	72.2408	-9.8339	52704	-71
73-16-02	0	73	0	22	14	15.0	72.2472	-9.8209	52609	-47
73-16-02	0	73	0	22	14	20.0	72.2537	-9.8079	52626	-31
73-16-02	0	73	0	22	14	25.0	72.2601	-9.7949	52626	-30
73-16-02	0	73	0	22	14	30.0	72.2666	-9.7824	52626	-26
73-16-02	0	73	0	22	14	35.0	72.2730	-9.7693	52635	-25
73-16-02	0	73	0	22	14	40.0	72.2795	-9.7563	52635	-12
73-16-02	0	73	0	22	14	45.0	72.2859	-9.7430	52649	0
73-16-02	0	73	0	22	14	50.0	72.2924	-9.7297	52605	10
73-16-02	0	73	0	22	14	55.0	72.2988	-9.7163	52674	28
73-16-02	0	73	0	22	15	0.0	72.3053	-9.7030	52605	91
73-16-02	0	73	0	22	15	5.0	72.3117	-9.6897	52617	49
73-16-02	0	73	0	22	15	10.0	72.3182	-9.6764	52614	79
73-16-02	0	73	0	22	15	15.0	72.3246	-9.6631	52604	84
73-16-02	0	73	0	22	15	20.0	72.3311	-9.6497	52604	89
73-16-02	0	73	0	22	15	25.0	72.3375	-9.6362	52605	89
73-16-02	0	73	0	22	15	30.0	72.3440	-9.6227	52605	90
73-16-02	0	73	0	22	15	35.0	72.3504	-9.6093	52605	92
73-16-02	0	73	0	22	15	40.0	72.3569	-9.5957	52601	91
73-16-02	0	73	0	22	15	45.0	72.3633	-9.5822	52604	115
73-16-02	0	73	0	22	15	50.0	72.3698	-9.5687	52607	115
73-16-02	0	73	0	22	15	55.0	72.3762	-9.5552	53005	131
73-16-02	0	73	0	22	16	0.0	72.3827	-9.5417	53014	136

BLODGETT AND MASSINGILL

SAMPLE PRINTOUT OF DATA PROCESSED

SHIP AND CRUISE IDENTIFICATION 751602

NAVIGATION DATA

NUMBER OF NAVIGATION CARDS READ ■ 60

NUMBER OF LOGICAL RECORDS WRITTEN ON TAPE = 60

BATHYMETRY DATA

DEPTH DATA GIVEN IN UNCORRECTED METERS

MATTHEWS ZONES PASSED THROUGH WERE 1 2 3

NUMBER OF BATHYMETRY CARDS READ ■ 72

NUMBER OF LOGICAL RECORDS WRITTEN ■ 357

MAGNETICS DATA

HEIGHT IN FEET ABOVE OR BELOW SEA LEVEL IS 420

NUMBER OF MAGNETICS CARDS READ ■ 23

NUMBER OF LOGICAL RECORDS WRITTEN ■ 258

Appendix C2

SAMPLE OUTPUT CARDS

NAVIGATION OUTPUT CARD

Cruise Number	Time Zone	Year	Month	Day	Hour	Minute	Latitude	Longitude	Fix Description	Fix Number
731202		67	8	22	11	30	22.8333	10.2250		204
0000000	000000	00	00	00	00	00	00000000	00000000	00000000	00000000
1234567	89101112	13	14	15	16	17	18192021	22232425	26272829	30313233
1111111	1111111	11	11	11	11	11	11111111	11111111	11111111	11111111
2222222	2222222	22	22	22	22	22	22222222	22222222	22222222	22222222
3333333	3333333	33	33	33	33	33	33333333	33333333	33333333	33333333
4444444	4444444	44	44	44	44	44	44444444	44444444	44444444	44444444
5555555	5555555	55	55	55	55	55	55555555	55555555	55555555	55555555
6666666	6666666	66	66	66	66	66	66666666	66666666	66666666	66666666
7777777	7777777	77	77	77	77	77	77777777	77777777	77777777	77777777
8888888	8888888	88	88	88	88	88	88888888	88888888	88888888	88888888
9999999	9999999	99	99	99	99	99	99999999	99999999	99999999	99999999

175 WRITE (62,110) (CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I),XLAT(I),XLONG(I),IFIX(I),NAVFIX(I),I=1,IWRITE)

110 FORMAT (A8,I5,I2,I2,I2,1XF2,F3,F8.4,F9.4,I2,7XI5,24X)

^A Implies a decimal point

BLADGETT AND MASSINGILL

BATHYMETRY OUTPUT CARD

Cruise Number	Time Zone	Year	Month	Day	Hour	Minute	Latitude	Longitude	Uncorrected Fathoms	Corrected Meters	Matthews Zone
731602	073	62	03	11	50	00	25.4981	3.7654	20067	3704	3
000000	00000	00000	00000	00000	00000	00000	00000000	0000000000	0000000000	0000000000	0000000000
11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	1111111111	1111111111	1111111111	1111111111
22222222	22222222	22222222	22222222	22222222	22222222	22222222	22222222	2222222222	2222222222	2222222222	2222222222
33333333	33333333	33333333	33333333	33333333	33333333	33333333	33333333	3333333333	3333333333	3333333333	3333333333
44444444	44444444	44444444	44444444	44444444	44444444	44444444	44444444	4444444444	4444444444	4444444444	4444444444
55555555	55555555	55555555	55555555	55555555	55555555	55555555	55555555	5555555555	5555555555	5555555555	5555555555
66666666	66666666	66666666	66666666	66666666	66666666	66666666	66666666	6666666666	6666666666	6666666666	6666666666
77777777	77777777	77777777	77777777	77777777	77777777	77777777	77777777	7777777777	7777777777	7777777777	7777777777
88888888	88888888	88888888	88888888	88888888	88888888	88888888	88888888	8888888888	8888888888	8888888888	8888888888
99999999	99999999	99999999	99999999	99999999	99999999	99999999	99999999	9999999999	9999999999	9999999999	9999999999

229 WRITE (62,224) (CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I),XLAT(I),XLONG(I),NAVFIX(I),ICRMET(I),IFIX(I),I=1,IWRITE)

224 FORMAT (A8,I5,I2,I2,I2,1XF2,F3,F8.4,F9.4,10X I5,I5,I2,16X)

^A Implies a decimal point

MAGNETICS OUTPUT CARD

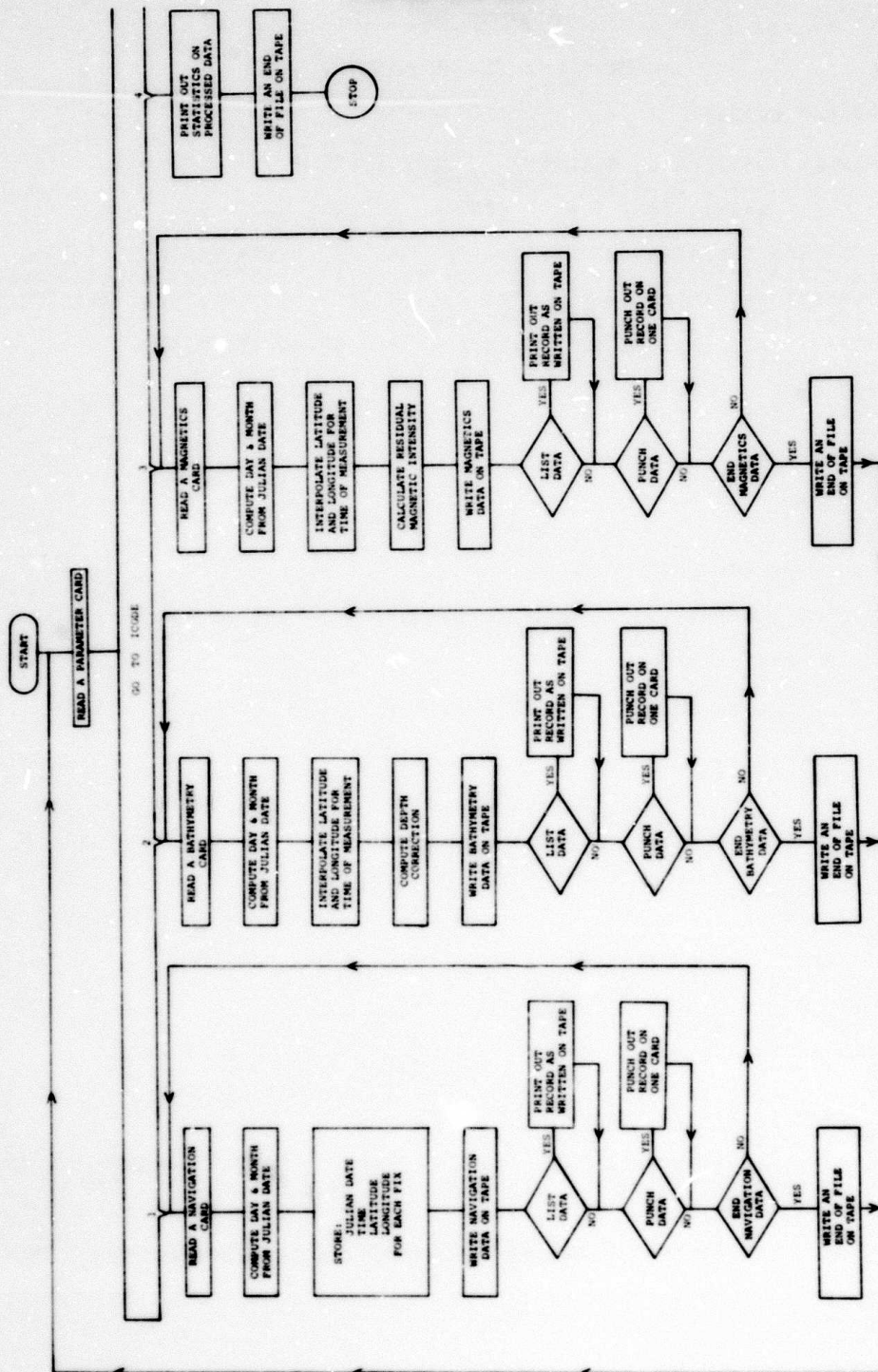
Cruise Number	Time Zone	Year	Month	Day	Hour	Minute	Latitude	Longitude	Total Magnetic Field in Gammas	Residual Magnetic Intensity
721-05	07	1962	11	20	11	20	72.8207	10.2467	52962	72
000000	000000	000000	000000	000000	000000	000000	000000	000000	000000	000000
111111	111111	111111	111111	111111	111111	111111	111111	111111	111111	111111
222222	222222	222222	222222	222222	222222	222222	222222	222222	222222	222222
333333	333333	333333	333333	333333	333333	333333	333333	333333	333333	333333
444444	444444	444444	444444	444444	444444	444444	444444	444444	444444	444444
555555	555555	555555	555555	555555	555555	555555	555555	555555	555555	555555
666666	666666	666666	666666	666666	666666	666666	666666	666666	666666	666666
777777	777777	777777	777777	777777	777777	777777	777777	777777	777777	777777
888888	888888	888888	888888	888888	888888	888888	888888	888888	888888	888888
999999	999999	999999	999999	999999	999999	999999	999999	999999	999999	999999

323 WRITE(62,318) (CURISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I),XLAT(I),XLONG(I),NAVFIX(I),ICRMET(I),I=1,IWRITE)

318 FORMAT (A8,I5,I2,I2,I2,1XF2,F3,F8.4,F9.4,23X,I5,I5,5X)

^A Implies a decimal point

Appendix D1
FLOW CHART



Appendix D2

SOURCE LANGUAGE LISTING

PROGRAM GEODATA

```

C
C PROGRAMMER  MARILYN L. BLODGETT   CODE 7817MLB
C              NAVAL RESEARCH LABORATORY
C              WASHINGTON, D.C.   20375
C
      DIMENSION IYEAR(20),MONTH(20),IDAY(20),HR(20),XMIN(20),XLAT(20),
      1XLONG(20),IFIX(20),NAVFIX(20),IDATE(3000),STIME(3000),STLAT(3000),
      2STLONG(3000),KEEPM(24),BHR(5),BMIN(5),IDP(5),ICRMET(20),ZAVFIX(20
      3),ITM(12),IMG(12),ZMIN(20),SIDP(20)
      DATA((ITM(I),I=1,12)=0.5,10,15,20,25,30,35,40,45,50,55)
      REAL IDEPTH
C      REWIND 06
      REWIND 10
C      IFLIGHT=1
      ITMZNE=0
      ICNTB=0
      ICNTN=0
      ICTMAQ=0
C
C READ A PARAMETER CARD
C
160 READ(60,10)ICODE,MT,ALT,INPUT,IOUT,SHIPID
10  FORMAT(12,1X12,F5,3X12,3X12,2XA8)
      IF(ICODE)12,11,11
11  WRITE(61,13)
13  FORMAT(1H0,23HDECK SET UP INCORRECTLY)
      STOP
12  IF(4*ICODE)11,14,14
14  ICODE=ICODE
      GO TO (100,200,300,400), ICODE
C
C PROCESS THE NAVIGATION DATA CARDS
C
100 CRUISE=SHIPID
      IOPT=IOUT
      NOWRIT=MT
      IF(NOWRIT )166,165,166
166 CALL SKIPFILE(10)
      READ(10,110)CRUISE
      IF(EOF,10)167,166
167 CALL BACKFILE(10)
      GO TO 120
165 IF(IOPT)121,120,121
121 IF(IOPT-2)122,120,122
122 WRITE(61,501)
501 FORMAT(1H1,123HSHIP AND CRUISE      TIME      YEAR      MONTH      DAY
      1      HOUR      MINUTE      LATITUDE      LONGITUDE      FIX
      2      FIX)
      WRITE(61,502)
502 FORMAT(1H ,24HIDENTIFICATION      ZONE,79X,22HDESCRIPTION      NUMB
      1ER)
120 IENDFL=0
      IWRITE=0
      ALREC=0
      NPREC=0

```

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```

C      ISTORE=1
C      READ A NAVIGATION CARD
C
100  READ(60,101)ISN,IY,JUDY,RNHR,RNMIN,IFN,XLAD,XLAM,XLOD,XLOM,IFIXTY
C101  FORMAT(12,4X12,1X13,1XF2,F2,2X13,1XF2,F6,2,F4,F6,2,1X12,36X)
101  FORMAT(12,4X12,1X13,1XF2,F2,15,F3,F6,2,F4,F6,2,1X12)
      IF(5+ISN)11,102,104
102  IF(NOWRIT)160,170,160
170  IENDFL=1
      IF(IWRITE)150,150,103
103  NLREC=NLRAC+IWRITE
      NPREC=NPRES+1
      IBEG=IWRITE+1
      DO 117 K=IBEG,20
          IYEAR(K)=0
          MONTH(K)=0
          IDAY(K)=0
          HR(K)=0
          XMIN(K)=0,0
          ZMIN(K)=0
          XLAT(K)=0,0
          XLONG(K)=0,0
          IFIX(K)=0
117  NAVFIX(K)=0
      IWRITE=20
      GO TO 140
104  IYR=IY
      ICNTN=ICNTN+1
      IF(3001-ICNTN)105,105,106
105  WRITE(61,107)
107  FORMAT(1H,36HMORE THAN 3000 NAVIGATION DATA CARDS)
      STOP
C
C      COMPUTE DAY AND MONTH FROM JULIAN DATE
C
106  CALL JULIAN(IYR,JUDY,ID,M,LBYR)
C      XL0D=XLOD
      XL0D=XLOD
      MINUS=4000000000000000GB
      XLAM=ABSF(XLAM)
      XL0M=ABSF(XLOM)
      KEY=XLAD,AND,MINUS
      IF(KEY,EQ,MINUS)27,28
27  COMLAT=XLAD-XLAM/60,0
      GO TO 29
28  COMLAT=XLAD + XLAM/60,0
29  KEY=XL0D,AND,MINUS
      IF(KEY,EQ,MINUS)30,31
30  COMLEN=XL0D-XLOM/60,0
      GO TO 164
31  COMLEN=XL0D+XLOM/60,0
164  TIME=RNHR+RNMIN/60,0
C
C      STORE JULIAN DAY, TIME, LATITUDE AND LONGITUDE FOR EACH FIX
C

```

BLODGETT AND MASSINGILL

```

IDATE(ISTORE)=JUDY
STIME(ISTORE)=TIME
STLAT(ISTORE)=COMLAT
STLONG(ISTORE)=COMLON
ISTORE=ISTORE+1
IF(NEWRT)108,171,108

```

C C STORE INFORMATION FOR WRITING ON TAPE
C

```

171 IWRITE=IWRITE+1
IYEAR(IWRITE)=IYR
MONTH(IWRITE)=IM
IDAY(IWRITE)=ID
HR(IWRITE)=RNHR
XMIN(IWRITE)=RNMIN*1070
ZMIN(IWRITE)=XMIN(IWRITE)/10.0
XLAT(IWRITE)=COMLAT
XLONG(IWRITE)=COMLON
IFIX(IWRITE)=IFIXTY
NAVFIX(IWRITE)=IFN
IF(20*IWRITE)109,109,108
109 NPREC=NPREC+20
NPREC=NPREC+1

```

C C WRITE LOGICAL RECORDS ON TAPE
C

```

140 WRITE(10,110)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I
1),XLAT(I),XLONG(I),IFIX(I),NAVFIX(I),I=1,IWRITE)
110 FORMAT(A8,I5,I2,I2,I2,1XF2,F3,F8.4,F9.4, 12.7X15,24X)
IF(10PT)111,112,111
111 IF(10PT-2)113,115,114
116 FORMAT(1H ,2XA8,7X15,7X12,7X12,7X12,7XF2,7XF4,1.6XF8,4.5XF9,4.9X12
1,10X15)
113 IF(NPREC-1)601,600,601
600 WRITE(61,116)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),ZMIN(I
1),XLAT(I),XLONG(I),IFIX(I),NAVFIX(I),I=1,IWRITE)
GO TO 112
601 IF(MOD(NPREC,3),NE,1) GO TO 600
WRITE(61,501)
WRITE(61,502)
GO TO 600
114 IF(NPREC-1)604,603,604
603 WRITE(61,116)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),ZMIN(I
1),XLAT(I),XLONG(I),IFIX(I),NAVFIX(I),I=1,IWRITE)
GO TO 115
604 IF(MOD(NPREC,3),NE,1) GO TO 603
WRITE(61,501)
WRITE(61,502)
GO TO 603
115 WRITE(62,110)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I
1),XLAT(I),XLONG(I),IFIX(I),NAVFIX(I),I=1,IWRITE)
112 IWRITE=0
IF(IENDFL)150,108,170
150 ENDFILE 10
GO TO 160

```

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C PRECESS THE BATHYMETRY DATA CARDS

```

C
200 DO 201 L=1,24
201 KEEPMT(L)=0
    KKMT=1
    KEEPMT(1)=MT
    IENDFL=0
    IWRITE=0
    IFIELD=0
    IBLREC=0
    IBPREC=0
    IOPT=1OUT
    KINPUT=INPLT
    IF(IOPT)241,240,241
241 IF(IOPT-2)242,240,242
242 WRITE(61,504)
504 FORMAT(1H,133HSHIP AND CRUISE    TIME    YEAR    MONTH    DAY    HOUR
      1 MINUTE    LATITUDE    LONGITUDE    UNCORRECTED    UNCORRECTED    CORR
      2ECTED    MATTHEWS)
    WRITE(61,505)
505 FORMAT(1H,22HIDENTIFICATION    ZONE,65X,44HFATHOMS    METERS
      1 METERS    ZONE)
240 DO 202 J=1,ICNTN
    IF(IFIELD)203,205,203

```

C READ A BATHYMETRY CARD

```

C
205 READ(60,204)ISN,JUDY,(BHR(1),BMIN(1),IDP(1),I=1,5)
204 FORMAT(12,11,1X,5(F2,F4,1,1X14))
204 FORMAT(12,1X13,5(1XF2,F3,1,1X14))
    IF(ISN)206,207,207
206 IF(ISN+6)209,208,209
209 IF(ISN+7)11,234,11
234 IENDFL=1
    IF(IWRITE)232,232,235
235 IBLREC=IBLREC+IWRITE
    IBPREC=IBPREC+1
    IBEG=IWRITE+1
    DO 236 K=IBEG,20
        IYEAR(K)=0
        MONTH(K)=0
        IDAY(K)=0
        HR(K)=0
        XMIN(K)=0
        XLAT(K)=0
        XLONG(K)=0
        NAVFIX(K)=0
        ICRMET(K)=0
        SIDP(K)=0
236 IFIX(K)=0
        IWRITE=20
        GO TO 223
208 MT=JUDY
208 MT=BHR(1)
DO 210 L=1,24
    IF(KEEPMT(L))211,211,212

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BLODGETT AND MASSINGILL

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212 IF(KEEPMT(L)-MT)210,205,210
210 CONTINUE
211 KEEPMT(L)=MT
    KKMT=L
    GO TO 205
207 ICNTB=ICNTB+1
    JUDY=ISN*10 + JUDY
    IFIELD=1
C
C   COMPUTE DAY AND MONTH FROM JULIAN DATE
C
    CALL JULIAN(IYR,JUDY,ID,IM,LPIR)
C
C   INTERPOLATE LATITUDE AND LONGITUDE AT THE TIME OF MEASUREMENT
C
203 TIME=BHR(IFIELD)+BMIN(IFIELD)/60.0
    IF(BHR(IFIELD))273,270,273
270 IF(BMIN(IFIELD))273,271,273
271 IF(ICR(IFIELD))273,209,273
273 IF(IDATE(J)-JUDY)202,213,217
213 IF(TIME-LE,STIME(J))215,202
215 IF(TIME-STIME(J))217,216,217
216 XD=STLONG(J)
    YD=STLAT(J)
    GO TO 237
217 TNB=STIME(J)
    TNA=STIME(J-1)
    TDX=TIME
    XNA=STLONG(J-1)
    YNA=STLAT(J-1)
    XNB=STLONG(J)
    YNB=STLAT(J)
    CALL PROPER(TNA,TNB,TDX,XNA,YNA,XNB,YNB,XD,YD)
C
C   COMPUTE DEPTH CORRECTION ACCORDING TO THE MATTHEWS ZONE NUMBER
C
237 IF(INPUT=1)219,219,216
218 IDEPTH=IDP(IFIELD)/1.0288
    GO TO 220
219 IDEPTH=IDP(IFIELD)
220 CALL MTCOR(IDEPTH,MT,KORFAT,KORMET,METUNC,MTDC)
    IWRITE=IWRITE+1
C
C   STORE INFORMATION FOR WRITING ON TAPE
C
    IYEAR(IWRITE)=IYR
    MONTH(IWRITE)=IM
    IDAY(IWRITE)=ID
    HR(IWRITE)=BHR(IFIELD)
    XMIN(IWRITE)=BMIN(IFIELD)*10.0
    XLAT(IWRITE)=YD
    XLONG(IWRITE)=XD
    NAVFIX(IWRITE)=IDEPTH*10.
    ICRMET(IWRITE)=KORMET
    IFIX(IWRITE)=MT
    IF(INPUT=1)274,274,275

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275 SIDP(IWRITE)=IDP(IFIELD)
GO TO 276
274 SIDP(IWRITE)=IDP(IFIELD)+1.8288
276 IF(20-IWRITE)222,222,221
222 IBLREC=IBLREC+20
    IBPREC=IBPREC+1
C
C WRITE LOGICAL RECORDS ON TAPE
C
223 WRITE(10,224)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I)
    1),XLAT(I),XLONG(I),NAVFIX(I),ICRMET(I),IFIX(I),I=1,IWRITE)
224 FORMAT(A8,15,12,12,12,1XF2,F3,78.4,F9,4,10X15,15,12,16X)
    IF(IOPT)225,226,225
607 WRITE(61,228)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),ZMIN(I)
    1),XLAT(I),XLONG(I),ZAVFIX(I),SIDP(I),ICRMET(I),IFIX(I),I=1,IWRITE)
228 FORMAT(1H,2XA8,5X17,5X12,5X12,5X12,5XF2,5XF4.1,4XF8.4,3XF9.4,5XF6
    1.1,8XF6.1,7X15,9X12)
GO TO 226
225 DO 230 I=1,20
    ZMIN(I)=XMIN(I)/10.0
230 ZAVFIX(I)=NAVFIX(I)/10.
    IF(IOPT-2)227,229,231
227 IF(IBPREC=1)605,607,605
605 IF(MOD(IBPREC,3).NE.1) GO TO 607
    WRITE(61,504)
    WRITE(61,505)
GO TO 607
231 IF(IBPREC=1)609,608,609
609 IF(MOD(IBPREC,3).NE.1) GO TO 608
    WRITE(61,504)
    WRITE(61,505)
GO TO 608
608 WRITE(61,228)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),ZMIN(I)
    1),XLAT(I),XLONG(I),ZAVFIX(I),SIDP(I),ICRMET(I),IFIX(I),I=1,IWRITE)
229 WRITE(62,224)(CRUISE,ITMZNE,IYEAR(I),MONTH(I),IDAY(I),HR(I),XMIN(I)
    1),XLAT(I),XLONG(I),NAVFIX(I),ICRMET(I),IFIX(I),I=1,IWRITE)
226 IWRITE=0
    IF(IENDFL)232,221,232
232 ENDFILE 10
GO TO 160
221 IFIELD=IFIELD+1
    IF(IFIELD=6)203,205,205
202 CONTINUE
    WRITE(61,233)
233 FORMAT(1H0,44HUNABLE TO INTERPOLATE LATITUDE AND LONGITUDE)
STOP
C
C PROCESS THE MAGNETICS DATA CARDS
C
300 M=1
    IOPT=IOUT
    IENDFL=0
    IWRITE=0
    IBLREC=0
    IBPREC=0
    IFIELD=0

```


BLODGETT AND MASSINGILL

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      IF(I0PT)341,340,341
341  IF(I0PT-2)342,340,342
342  WRITE(61,507)
507  FORMAT(1H1,129HSHIP AND CRUISE      TIME      YEAR      MONTH      DAY
      1HOUR      MINUTE      LATITUDE      LONGITUDE      TOTAL MAGNETIC      RESID
      2HUAL MAGNETIC)
      WRITE(61,508)
508  FORMAT(1H ,23HIDENTIFICATION      ZONE;73X,29HINTENSITY      I
      INTENSITY)
340  DO 301 J=1,ICNTN
      IF(IFIELD)303,302,303
C
C  READ A MAGNETICS CARD
C
C302  READ(06,304)JUDY,(RMHR(1),RMHIN(1),RMSEC(1),IALT(1),IMG(1);
      1I=1,12)
C304  FORMAT(13,6(3F2,14,15)/6(3F2,14,15))
C      IF(EOF,06)305,306
C305  IFLIGHT=IFLIGHT +1
C      IF(IFLIGHT-13)302,302,325
302  READ(60,304)ISN,JUDY,RMHR,(IMG(1),I=1,12)
304  FORMAT(12,13,1XF2,14(1X15))
      IF(ISN)305,306,306
305  IF(ISN+8)11,325,11
325  IENDFL=1
      IF(IWRITE)324,324,326
326  MLREC=MLREC+IWRITE
      MPREC=MPREC+1
      IBEG=IWRITE+1
      DO 327 K=IBEG,20
      IYEAR(K)=0
      IMONTH(K)=0
      IDAY(K)=0
      XLAT(K)=0
      XLONG(K)=0
      HR(K)=0
      XMIN(K)=0
      ZMIN(K)=0
      NAVFIX(K)=0
327  ICRMET(K)=0
      IWRITE=20
      GO TO 317
306  ICTMAG=ICTMAG+1
      IFIELD=1
C
C  COMPUTE DAY AND MONTH FROM JULIAN DATE
C
C      CALL JULIAN(IYR,JUDY,ID,IM,LPYR)
C
C  INTERPOLATE LATITUDE AND LONGITUDE AT THE TIME OF MEASUREMENT
C
303  TM=IM*(IFIELD)
      TIME=RMHR+TM/60.0
C303  TM=RMHIN(IFIELD) + RMSEC(IFIELD)/60.0
C      TIME=RMHR(IFIELD) + TM/60.0
C      IF(IFLIGHT-2)700,700,701

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C700 ALT=1200,
C    GO TO 702
C701 ALT=1ALT(IFIELD)*100
      IF(IMG(IFIELD))350,312,350
350  IF(IDATE(J)-JUDY)301,307,308
307  IF(TIME.LE,STIME(J))309,301
309  IF(TIME-STIME(J))300,310,308
310  XD=STLONG(J)
      YD=STLAT(J)
      GO TO 330
308  TNB=STIME(J)
      TNA=STIME(J-1)
      TDX=TIME
      XNA=STLONG(J-1)
      YNA=STLAT(J-1)
      XNB=STLONG(J)
      YNB=STLAT(J)
      CALL PROPER(TNA,TNB,TDX,XNA,YNA,XNB,YNB,XD,YD)
C
C    CALCULATE RESIDUAL MAGNETIC INTENSITY
C
330  CALL SPHERE(XD,YD,GLON,GLAT)
      ZYR=IYR
      IF(LPVR-2)311,329,311
329  LEAP=366
      GO TO 312
311  LEAP=365
312  DATE=1900, + ZYR + (FLOATF(JUDY)/FLOATF(LEAP))
      ITYPE=1
      IF(ALT)314,313,314
313  ALT=1,0
314  BLT=,3048 = ALT/1000.
      CALL IGRF(DATE,ITYPE,BLT,GLAT,GLON,XV,YV,ZV,TV)
      ITV=TV
      NDP=IMG(IFIELD)-ITV
      STALT=ALT
C
C    STORE INFORMATION FOR WRITING ON TAPE
C
      IWRITE=IWRITE+1
      IYEAR(IWRITE)=IYR
      IMONTH(IWRITE)=IM
      IDAY(IWRITE)=ID
      XLAT(IWRITE)=YD
      XLONG(IWRITE)=XD
      HR(IWRITE)=RMHR
      XMIN(IWRITE)=ITM(IFIELD)*10
      ZMIN(IWRITE)=ITM(IFIELD)
      NAVFIX(IWRITE)=IMG(IFIELD)
      ICRMET(IWRITE)=NDP
      IF(20-IWRITE)316,316,315
316  MLREC=MLREC+20
      MPREC=MPREC+1
C
C    WRITE LOGICAL RECORDS ON TAPE
C

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BLODGETT AND MASSINGILL

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317 WRITE(10,318)(CRUISE,1THZNE,IYEAR(1),MONTH(1),IDAY(1), HR(1),XMIN(
11),XLAT(1),XLONG(1),NAVFIX(1),ICRMET(1),I=1,IWRITE)
318 FORMAT(A8,15,12,12,12,1XF2,F3,F8,4,F9,4,23X,15,15,5X)
IF(1OPT)319,320,319
319 IF(1OPT-2)321,323,322
321 IF(MPREC=1)611,610,611
611 IF(MOD(MPREC,3),NE,1) GO TO 610
WRITE(61,507)
WRITE(61,508)
GO TO 610
322 IF(MPREC=1) 613,612,613
613 IF(MOD(MPREC,3),NE,1) GO TO 612
WRITE(61,507)
WRITE(61,508)
GO TO 612
610 WRITE(61,328)(CRUISE,1THZNE,IYEAR(1),MONTH(1),IDAY(1), HR(1),ZMIN(
11),XLAT(1),XLONG(1),NAVFIX(1),ICRMET(1),I=1,IWRITE)
GO TO 320
612 WRITE(61,328)(CRUISE,1THZNE,IYEAR(1),MONTH(1),IDAY(1), HR(1),ZMIN(
11),XLAT(1),XLONG(1),NAVFIX(1),ICRMET(1),I=1,IWRITE)
328 FORMAT(1H,2XA8,6X15,3(6X12),6XF2,6XF4,1,5XF8,4,4XF9,4,8X15,15X15)
323 WRITE(62,318)(CRUISE,1THZNE,IYEAR(1),MONTH(1),IDAY(1), HR(1),XMIN(
11),XLAT(1),XLONG(1),NAVFIX(1),ICRMET(1),I=1,IWRITE)
320 IWRITE=0
IF(1ENDFL)324,315,324
324 ENDFILE 10
GO TO 160
315 IFIELD=IFIELD + 1
315 IFIELD=IFIELD+1
IF(1FIELD=13)303,302,303
301 CONTINUE
WRITE(61,233)
STOP
C
C WRITE OUT ACCUMULATED DATA
C
400 WRITE(61,510)
510 FORMAT(1HB)
WRITE(61,401)CRUISE
401 FORMAT(1H1,35HSHIP AND CRUISE IDENTIFICATION ,A8)
IF(NOWRIT)173,172,173
172 WRITE(61,403)
403 FORMAT(1H0,15HNAVIGATION DATA)
WRITE(61,404)ICNTN
404 FORMAT(1H0,34HNUMBER OF NAVIGATION CARDS READ = ,I4)
WRITE(61,405)NLREC
405 FORMAT(1H0,44HNUMBER OF LOGICAL RECORDS WRITTEN ON TAPE = ,I4///)
173 IF(NOWRIT-1)174,174,175
174 WRITE(61,407)
407 FORMAT(1H0,15HBATHYMETRY DATA)
IF(KNPUT=1)408,408,409
408 WRITE(61,410)
410 FORMAT(1H0,39HDEPTH DATA GIVEN IN UNCORRECTED FATHOMS)
GO TO 411
409 WRITE(61,412)
412 FORMAT(1H0,38HDEPTH DATA GIVEN IN UNCORRECTED METERS)

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411 WRITE(61,413)(KEEPMT(K),K=1,KKMT)
413 FORMAT(1H0,35HMATTHEWS ZONES PASSED THROUGH WERE ,24I4)
    WRITE(61,414)ICNTB
414 FORMAT(1H0,34HNUMBER OF BATHYMETRY CARDS READ = ,I5)
    WRITE(61,415)IBLREC
415 FORMAT(1H0,36HNUMBER OF LOGICAL RECORDS WRITTEN = ,I6///)
175 IF(NOWRITE=1)176,177,176
176 WRITE(61,417)
417 FORMAT(1H0,14HMAGNETICS DATA)
    WRITE(61,418)STALT
418 FORMAT(1H0,43HHEIGHT IN FEET ABOVE OR BELOW SEA LEVEL IS ,F5)
    WRITE(61,419)ICTMAG
419 FORMAT(1H0,33HNUMBER OF MAGNETICS CARDS READ = ,I12)
    WRITE(61,420)MLREC
420 FORMAT(1H0,36HNUMBER OF LOGICAL RECORDS WRITTEN = ,I12)
177 ENDFILE 10
    REWIND 10
    STOP
    END

```

BLODGETT AND MASSINGILL

5.4DS GEODATA

	IDENT	GEODATA
PROGRAM LENGTH	33405	
ENTRY POINTS	30767	
EXTERNAL SYMBOLS		
		GCENTRY THEND. G80STOPS Q1010100 G80DICT. SKIPFILE BACKFILE JULIAN PROPOR MTCGR SPHERE IGRF XMOLF G80IFE0F EFT. REW. TSH. STH. CNSINGL.
00625 SYMBOLS		

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```

SUBROUTINE JULIAN (IY,JUDY,ID,IM,LPYR)
CONVERTS JULIAN DATE INTO DAY, MONTH, YEAR FOR ANNOTATION IN OCEANO
IY = YEAR, JUDY = JULIAN DAY, ID = CALENDER DAY, IM = CALENDER MON
COMPLIMENTS OF BOB FEDEN - CODE 8174 = 17 NOV 1971
MODIFIED BY LEON LA LUMIERE - CODE 8178 = 17 NOV 1971

DIMENSION JJ(13), AA(12)
TYPE INTEGER AA
DATA ((JJ(I), I = 1, 13) = 0, 31, 59, 90, 120, 151, 181, 212, 243,
1273, 304, 334, 365)
DATA ((AA(I), I = 1, 12) = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)
LL=IY
MM=JUDY
IF (LL,LT,0) GO TO 10
IF (LL,EC,0) GO TO 1
IF (MOD(LL,4),EQ,0) GO TO 4
1 IF (MM,LE,0,OR,MM,GT,365) GO TO 4
2 DO 3 K=2,13
IF (MM,LE,JJ(K)) GO TO 6
3 CONTINUE
4 LPYR=2
IF (MM,LE,0,OR,MM,GT,366) GO TO 10
IF (MM,LE,59) GO TO 2
IF (MM,EC,60) GO TO 5
MM=MM+1
GO TO 2
5 II=29
K=3
GO TO 7
6 II=MM-JJ(K-1)
IF (LL,EC,0) GO TO 8
IF (MOD(LL,4),NE,0) GO TO 8
IF (MOD(LL,4),EQ,0,AND,MM,LE,59) GO TO 8
MM=MM+1
7 IF (LL,GE,10) GO TO 8
8 ID=II
IM=AA(K-1)
9 RETURN
10 PRINT 11, LL,MM
GO TO 9
11 FORMAT (1X,'YEAR = ',I2,1X,'JULIAN DAY = ',I3,1X,'ARE BAD DATES')
END

```

BLODGETT AND MASSINGILL

9.4DS JULIAN

		IDENT	JULIAN
PROGRAM LENGTH		00301	
ENTRY POINTS	JULIAN	00053	
EXTERNAL SYMBOLS	THEND, GBCDICT, XMODF STH, ONSINGL.		
00116 SYMBOLS			

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SUBROUTINE PROPER (TNA,TNB,TDX,XNA,YNA,XNB,YNB,XD,YD)
 COMPUTES THE X-Y COORDINATES FOR PLOTTING BATHYMETRY
 PROGRAMMER - LEON LA LUMIERE - CODE 8174 - 15 DEC 1971

PERIOD=TNB-TNA
 DELT=TDX-TNA
 RATIO=DELT/PERIOD
 DELX=XNB-XNA
 DELY=YNB-YNA
 XC=DELX-RATIO-XNA
 YD=DELY-RATIO-YNA
 RETURN
 END

H 1
 H 2
 H 3
 H 4
 H 5
 H 6
 H 7
 H 8
 H 9
 H 10
 H 11
 H 12
 H 13.

BLODGETT AND MASSINGILL

9.4DS PROPR

PROGRAM LENGTH			IDENT	PROPR
ENTRY POINTS	PROPR	00140		
EXTERNAL SYMBOLS		00003		
00054 SYMBOLS	080DICT.			

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FTN5.4A

```
SUBROUTINE SPHERE(DLON,DLAT,GLON,GLAT)
  IF(DLON)10,20,20
10  GLON=DLON
   GO TO 30
20  GLON=360. + DLON
30  GLAT=90. -DLAT
   RETURN
  END
```

BLODGETT AND MASSINGILL

3.4DS SPHERE

		IDENT	SPHERE
PROGRAM LENGTH		00102	
ENTRY POINTS	SPHERE	00003	
EXTERNAL SYMBOLS			
	C8CDICT.		
00033 SYMBOLS			

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SUBROUTINE MTCOR (IDEP,MT,KCDF,KCDM,MTDC)
J 1
JAN 10, 1972
J 2
J 3
MODIFIED FOR CDC 3800 BY LEON LA LUMIERE - CODE 8174 - 20 MAR 1972
J 4
J 5
SUBROUTINE MTCOR(ARG); MATTHEWS TABLE CORRECTION
J 6
VERSION WHERE COEFFICIENTS ENTERED AT RUN TIME
J 7
ALCULATES CORRECTED DEPTH IN METERS WHEN GIVEN
J 8
MATTHEWS TABLE COEFFICIENTS AND UNCORRECTED
J 9
DEPTH IN FATHOMS;
J 10
COPIED FROM WHOI PRUGHAM FOR IBM 1130
J 11
J 12
INPUT,
J 13
IDEP = UNCORRECTED DEPTH IN FATHOMS
J 14
MT = MATTHEWS TABLE COEFFICIENT(1 - 52)
J 15
J 16
OUTPUT,
J 17
KCDF = CORRECTED DEPTH IN FATHOMS
J 18
KCDM = CORRECTED DEPTH IN METERS
J 19
MTDC = MATHEWS TABLE DEPTH CORRECTION (METERS)
J 20
J 21
INTERNAL
J 22
NUDF WATER DEPTH UNCORRECTED FATHOMS
J 23
WUDF WATER DEPTH UNCORRECTED FATHOMS
J 24
WUDM WATER DEPTH UNCORRECTED METERS
J 25
WCDR CORRECTION IN METERS
J 26
J 27
J 28
SETTING MATTHEWS TABLE COEFFICIENTS SUPPLIED BY C, GANTAR
J 29
DIMENSION MTN(52),AMT(52),BMT(52),CMT(52),DMT(52),EMT(52),FMT(52)
J 30
J 31
REAL IDEP
DATA (MTN=1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22
J 32
1.23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44
J 33
2.45,46,47,48,49,50,51,52)
J 34
DATA (AMT=-.05,.21,.19,.25,.35,.43,.12,-.21,.76,-.19,-.07,1.29,.34
J 35
1.-.04,.12,.39,1.18,1.25,-1.11,.44,-.31,.43,-.29,-.06,-.110,-.08,-.2
J 36
23,.06,1.14,-.38,.2,.26,1.34,.58,1.15,.58,.01,.59,2.49,.97,3.93,1.4
J 37
36,-.15,.09,.06,.42,-.05,.03,-.41,-.19,-.01,.07)
J 38
DATA (BMT=-.01683,-.00247,.006885,.000632,.015719,.004269,.013881,
J 39
1.025565,.030789,.023035,.031673,.036491,.031972,.049788,.032253,.0
J 40
240042,.037533,.043541,.046531,.034097,.019659,.025893,.012063,.005
J 41
3833,-.000139,-.006374,-.00994,-.012026,-.019317,-.011231,.034103,.
J 42
4037121,.037874,.03524,.031429,.037872,.043038,.0393,.025775,.03583
J 43
58,.021001,.0186,.021906,.013118,.001109,.044699,.02651,.028006,.03
J 44
65524,.03841,.049807,.000832)
J 45
DATA (CMT=.130695,-.028055,-.033416,.030785,.169795,.049419,-.059
J 46
1931,-.156579,-.141266,.00679,-.101806,-.121871,-.040565,-.233986,.
J 47
2011268,-.363995,-.227838,-.239633,-.383832,-.24561,-.044804,-.2165
J 48
309,-.014753,-.009209,.021746,.082109,.101101,.11845,.193882,.06327
J 49
48,-.255508,-.174712,-.196492,-.149662,-.141422,-.17812,-.210477,-.
J 50
5103453,-.092957,-.142494,-.04741,-.02271,-.117873,-.039335,.023648
J 51
6,-.271705,-.041812,.048156,-.059269,-.097981,.001276,.161859)
J 52
DATA (DMT=-.040587,.017161,-.00471,.012525,.115271,-.015992,.04609
J 53
14,.083656,.05727,-.01941,.036137,.039775,.004688,.083487,-.030352,
J 54
2.207727,.102774,.095135,.187189,.123539,.02245,.119429,.008118,.02
J 55

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34232, .01811, -.013313, -.020412, .030545, -.061797, .001826, .121471, . J 56
4064336, .081801, .056314, .055151, .067, .083684, .020131, .037683, .09235 J 57
59, .018848, .00924, .00013, .023795, .007413, .103092, .167905, .004016, .0 J 58
670316, .097868, -.000464, .162078) J 59
DATA (EMT=.092394, .048995, .127138, -.02266, .249166, .06975, .087349 J 60
1, .154994, -.075775, .081004, -.035675, .040077, .023167, .115909, .107 J 61
256, -.470139, -.166568, .137278, .366057, .235691, .029841, .232583, J 62
3, .015918, .046104, -.045777, .024588, .037058, .062662, .110085, .001486, J 63
4, .214992, .08885, .138137, .079156, .07518, .09377, .136212, .01265 J 64
52, .041351, -.186534, .014159, .001108, .09774, .025662, .004717, -.1 J 65
642748, .983392, .000155, .170839, .2527, .24145, .983392) J 66
DATA (FMT=.072171, .158148, -.23102, .012058, .190978, .076755, .0646 J 67
179, .109779, .038823, .075341, .011294, .015287, .027333, .062495, -.096 J 68
2216, .403122, .10073, .074903, .267798, .169277, .021495, .16502, .028903 J 69
3, .035913, .040884, .014177, .022102, .045831, .06729, .001066, .14100 J 70
47, .04968, .094743, .048085, .039534, .050998, .089176, .032552, .017001, J 71
5, .140729, .003867, -.004373, .058355, .010515, .000162, .067775, .2.003205, J 72
6, .00155, .149654, .232294, .623288, -2.003205) J 73
C NZERO=0 J 74
C J 75
NUDF=IDEP J 76
IF (NUDF) 3,5,1 J 77
1 IF (52-MT) 4,2,2 J 78
C J 79
2 WUDF=IDEP J 80
WUDM=WUDF*.18288 J 82
WCOR=AMT(MT)+BMT(MT)+WUDM*CHT(MT)*1.E-04*(WUDM+.2)*DHT(MT)*1.E-07* J 83
1(WUDM+.3)*EMT(MT)*1.E+11*(WUDM+.4)*FMT(MT)*1.E+15*(WUDM+.5) J 84
KCDM=WUDM*WCOR J 85
KCDM=KCDM*.5 J 86
MTDC=WCOR*.5 J 87
KCDF=(KCDM*.54681)*.075 J 88
METUNC=WUDM J 89
RETURN J 90
3 PRINT 6 J 91
GO TO 5 J 92
C J 93
4 PRINT 7 J 94
ERROR EXIT J 95
5 KCDM=NZERO J 96
MTDC=NZERO J 97
KCDF=NZERO J 98
RETURN J 99
C J 100
6 FORMAT (1X, 'DEPTH READ IS NEGATIVE') J 101
7 FORMAT (1X, 'MATTHEWS ZONE NUMBER IS GREATER THAN 52') J 102
END J 103
J 104

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5.4DS MTCOR

		IDENT	MTCOR
PROGRAM LENGTH		01015	
ENTRY POINTS	MTCOR	00577	
EXTERNAL SYMBOLS			
	01010100		
	THEND,		
	000DICT,		
	STW,		
00074 SYMBOLS			

BLODGETT AND MASSINGILL

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SUBROUTINE IGRF (DATE, ITYPE, ALT, COLAT, ELONG, X, Y, Z, T)
C GENP IGRF
C
C THIS SUBROUTINE COMPUTES VALUES OF X, Y, Z AND T FOR A GIVEN EPOCH
C AND POSITION FROM THE SPHERICAL HARMONIC COEFFICIENTS OF THE
C INTERNATIONAL GEOMAGNETIC REFERENCE FIELD
C DATA DATE = REQUIRED EPOCH IN YEARS AND DECIMALS OF A YEAR, A.D.
C ITYPE = 1 IF GEODETIC COORDINATES ARE BEING USED
C ITYPE = 2 IF GEOCENTRIC COORDINATES ARE BEING USED
C ALT = HEIGHT ABOVE MEAN SEA LEVEL IN KILOMETERS
C ALT = RADIAL DISTANCE FROM CENTRE OF EARTH IN KILOMETERS
C COLAT = COLATITUDE IN DEGREES (0.0 TO 180.0)
C ELONG = EAST LONGITUDE IN DEGREES (0.0 TO 360.0)
C OUTPUT X = NORTH COMPONENT OF MAGNETIC FORCE IN GAMMAS
C Y = EAST COMPONENT OF MAGNETIC FORCE IN GAMMAS
C Z = VERTICAL COMPONENT OF MAGNETIC FORCE IN GAMMAS
C (POSITIVE DOWNWARDS)
C T = TOTAL MAGNETIC FORCE IN GAMMAS
C N.B. THE COORDINATE SYSTEM FOR X, Y AND Z IS THE SAME AS THAT
C SPECIFIED BY ITYPE
C DIMENSION P(44), O(44), CL(8), SL(8), AGH(80), DGH(80)
C THE S.H. COEFFICIENTS ARE SUPPLIED BY THE FOLLOWING DATA STATEMENTS
C ALTERNATIVELY, THE COEFFICIENTS MAY BE SUPPLIED BY STATEMENTS OF
C THE FORM = AGH(1) = -30339; AGH(2) = -2123, ETC
C OR THE COEFFICIENTS MAY BE READ IN THE MASTER PROGRAM AND MADE
C AVAILABLE TO THE SUBROUTINE BY A COMMON STATEMENT
C
C SET INITIAL VALUES
C
C DATA (AGH = -30339., -2123., 5758., -1654., 2994., -2006., 1567., 130.,
C A1297., -2036., -403., 1289., 242., 843., -176., 958., 805., 149., 492.,
C B-280., -392., 8., 256., -262., -223., 357., 16., 246., 125., -26., -123.,
C C-161., -107., -51., 77., 47., 60., -14., 4., 106., -229., 68., 3., -32., -4.,
C D-10., -112., -13., 71., -54., -57., 0., -27., 12., -8., -25., 9., -9., 23.,
C E13., -19., -2., -17., 10., 19., 3., -3., -13., -12., 5., -4., -17., 7., 4., -5.,
C F22., 12., -3., 6., -16.)
C DATA (DGH = 15.3, 8.7, -2.3, -24.4, 0.3, -1.8, -1.6, -16.7, 0.2, -10.8,
C A4.2, 0.7, 0.7, -3.8, -7.7, -0.7, 0.2, -0.1, -3.0, 1.6, -0.1, 2.9, -2.1, -4.2,
C B1.9, 1.1, 1.2, 3.2, 9.1, 7.0, 6., -2.4, 0.0, 0.8, 1.3, -0.3, -0.1, -0.3, -0.9, 1.1,
C C-0.4, 1.9, 2.0, -0.4, -1.1, 0.4, 0.1, -0.2, 0.9, -0.5, -0.3, -1.1, -0.7, 0.3,
C D-0.5, 0.4, 0.3, 0.2, 0.0, 0.4, -0.2, 0.2, -0.6, 0.3, 0.1, 0.4, 0.1, 0.6, -0.2,
C E0.0, -0.3, 0.0, -0.2, -0.1, 0.3, 0.3, -0.4, -0.3, -0.3, -0.5, 0.3)
C T=DATE-1965.0
C R=ALT
C ONE=COLAT*0.0174533
C SLAT=COS(ONE)
C CLAT=SIN(ONE)
C ONE=ELONG*0.0174533
C CL(1)=COS(ONE)
C SL(1)=SIN(ONE)
C X=0.0
C Y=0.0
C Z=0.0
C CD=1.0
C SD=0.0

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L=1
M=1
N=0
GO TO (1,2), ITYPE
C
C CONVERSION FROM GEODETIC TO GEOCENTRIC COORDINATES
C
1 A2=40680925.
  B2=40408585.
  ONE=A2*CLAT*CLAT
  TWO=B2*SLAT*SLAT
  THREE=ONE+TWO
  FOUR=SQRT(THREE)
  R=SQRT(ALT*(ALT+2.0*FOUR)*(A2*ONE+B2*TWO)/THREE)
  CD=(ALT+FOUR)/R
  SD=(A2-B2)/FOUR*SLAT*CLAT/R
  ONE=SLAT
  SLAT=SLAT*CD-CLAT*SD
  CLAT=CLAT*CD+ONE*SD
C
2 RATIO=6371.2/R
C
C COMPUTATION OF SCHMIDT QUASI-NORMAL COEFFICIENTS P AND X(=Q)
C
P(1)=2.0*SLAT
P(2)=2.0*CLAT
P(3)=4.5*SLAT*SLAT-1.5
P(4)=5.1961524*CLAT*SLAT
Q(1)=CLAT
Q(2)=SLAT
Q(3)=-3.0*CLAT*SLAT
Q(4)=1.7320508*(SLAT*SLAT*CLAT*CLAT)
DO 15 K=1,44
  IF(N-M) 3,4,4
3 M=0
  N=N+1
  RR=RATIO*(N+2)
  FN=N
4 FM=M
  IF(K=5) 8,5,5
5 IF(M=N) 7,6,7
6 ONE=SQRT(1.0-0.5/FM)
  J=K-N+1
  P(K)=(1.0+1.0/FM)*ONE*CLAT*P(J)
  Q(K)=ONE*(CLAT*Q(J)*SLAT/FM*P(J))
  SL(M)=SL(M-1)*CL(1)*CL(M-1)*SL(1)
  CL(M)=CL(M-1)*CL(1)*SL(M-1)*SL(1)
  GO TO 8
7 ONE=SQRT(FN*FN-FM*FM)
  TWO=SQRT((FN-1.0)*2-FM*FM)/ONE
  THREE=(2.0*FN-1.0)/ONE
  I=K-N
  J=K-2*N+1
  P(K)=P(FN+1.0)*(THREE*SLAT/FN*P(I)-TWO/(FN-1.0)*P(J))
  Q(K)=THREE*(SLAT*Q(I)*CLAT/FN*P(I))-TWO*Q(J)
C

```

JS179200
 JS179300
 JS179400
 JS179500
 JS179600
 JS179700
 JS179800
 JS179900
 JS180000
 JS180100
 JS180200
 JS180300
 JS180400
 JS180500
 JS180600
 JS180700
 JS180800
 JS180900
 JS181000
 JS181100
 JS181200
 JS181300
 JS181400
 JS181500
 JS181600
 JS181700
 JS181800
 JS181900
 JS182000
 JS182100
 JS182200
 JS182300
 JS182400
 JS182500
 JS182600
 JS182700
 JS182800
 JS182900
 JS183000
 JS183100
 JS183200
 JS183300
 JS183400
 JS183500
 JS183600
 JS183700
 JS183800
 JS183900
 JS184000
 JS184100
 JS184200
 JS184300
 JS184400
 JS184500
 JS184600
 JS184700

BLODGETT AND MASSINGILL

C	SYNTHESIS OF X,Y AND Z IN GEOCENTRIC COORDINATES	JS184800
C		JS184900
	8 ONE=(AGH(L)+DGH(L)*T)*RR	JS185000
	IF(M) 10,9,10	JS185100
	9 X=X+ONE*Q(K)	JS185200
	Z=Z-ONE*P(K)	JS185300
	L=L+1	JS185400
	GO TO 14	JS185500
	10 TWO=(AGH(L+1)+DGH(L+1)*T)*RR	JS185600
	THREE=ONE*CL(M)+TWO*SL(M)	JS185700
	X=X+THREE*Q(K)	JS185800
	Z=Z-THREE*P(K)	JS185900
	IF(CLAT) 12,12,11	JS186000
	11 Y=Y+(ONE*SL(M)-TWO*CL(M))*FM*P(K)/((FN+1.0)*CLAT)	JS186100
	GO TO 13	JS186200
	12 Y=Y+(ONE*SL(M)-TWO*CL(M))*Q(K)*SLAT	JS186300
	13 L=L+2	JS186400
	14 M=M+1	JS186500
	15 CONTINUE	JS186600
C		JS186700
C	CONVERSION TO COORDINATE SYSTEM SPECIFIED BY IYPE	JS186800
C		JS186900
	ONE=X	JS187000
	X=X*CD+Z*SD	JS187100
	Z=Z*CD-ONE*SD	JS187200
	T=SQRT(X*X+Y*Y+Z*Z)	JS187300
C		JS187400
	RETURN	JS187500
C		JS187600
C	LIBRARY FUNCTIONS USED BY THIS SUBROUTINE ARE SIN,COS,SQRT	JS187700
C		JS187800
C	SAMPLE RESULTS	JS187900
C	IGRF(1965,0,1,0.0,0.0,30.0,2541.,-240.,,563497,56407,)	JS188000
C	IGRF(1965,0,1,0.0,180.0,295.0,12923.,9661.,,56900.,59144,)	JS188100
C	IGRF(1969,3,1,0.0,57.0,195.0,25092.,5729.,30145.,39638,)	JS188200
C	IGRF(1965,0,2,6371.2,45.0,10.0,21848.,-1052.,40417.,45556,)	JS188300
C	IGRF(1967,5,2,9000.0,31.0,359.0,5750.,-1226.,17853.,18796,)	JS188400
C		JS188500
	END	JS188600

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5.4DS IGRF

IDENT IGRF

PROGRAM LENGTH		01266
ENTRY POINTS	IGRF	00413
EXTERNAL SYMBOLS		

02007110
0800ICT,
SORTF
SINF
COSF

00163 SYMBOLS

LOAD
RUN,60,9500