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MRNIDX - -

Marine Data Index:
Database description, operation, retrieval, and display

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ABSTRACT

A database referencing the location and content of data stored on magnetic medium was designed to assist in the indexing of time-series and spatially dependent marine geophysical data collected or processed by the U.S. Geological Survey. The database was designed and created for input to the Geologic Retrieval and Synopsis Program (GRASP) to allow selective retrievals of information pertaining to location of data, data format, cruise, geographical bounds and collection dates of data. This information is then used to locate the stored data for administrative purposes or further processing.

Database utilization is divided into three distinct operations. The first is the inventorying of the data and the updating of the database, the second is the retrieval of information from the database, and the third is the graphic display of the geographical boundaries to which the retrieved information pertains.

INTRODUCTION

In 1974, the U.S. Geological Survey (USGS) began collecting an increasingly wider variety of marine geophysical data, and a need developed for a centralized depository and index to data collected. In 1976, after the installation of a Hewlett-Packard 2100MX computer system and the establishment of a branch data library, computerized listings were implemented to assist in the inventorying of the data.

As the amount of data collected increased during the next few years, the existing cruise-based inventories became increasingly awkward to use because of constraints imposed by the unit record based upon a "cruise." Given the ever-increasing size of the inventory files and a need for retrieval of information to locate and identify the data, a decision was made to expand the existing inventory files to allow users to make selective, relational retrievals of information on the location and content of requested data. With the conversion of the Geologic Retrieval and Synopsis Program (GRASP) to the Hewlett-Packard 2100MX computer system in 1979, the ability to make selective, relational retrievals of information was at hand. The Marine Data Index (MRNIDX), the subject of this report, is the first automated index to data in which the unit record is defined by the attributes of a cohesive data aggregate stored in a magnetic medium.

The primary purposes of the MRNIDX are to index marine geophysical data collected or processed by the USGS Woods Hole office, and to supply users with information regarding the location, content, and format of the data. The information may then be used for the locating of data to be processed, plotted, or passed along to other agencies. MRNIDX is designed mainly to index data stored on magnetic tape; however, the database format may also be applied to data stored in other forms such as on disk, cassette, and floppy disk.

DATABASE OPERATION

The database operation is divided into three distinct phases: inventorying and updating of the database as navigational and geophysical data are collected or processed, selective retrieval of information, and a graphic display of the geographical area to which the retrieved information pertains.

Inventorying and updating are the responsibility of those directly involved with database administration. However, the chief scientist responsible for collecting or processing of these data is also responsible for supplying all necessary information to index the data properly.

The second and third phases of operation are the user's selective retrieval of information from the database using GRASP (Bowen, R., and Botbol, J.M., 1975) and the graphic display of the geographical area for which information was retrieved. These programs and their applications are discussed in the section entitled "Data Retrieval."

STRUCTURE OF THE DATABASE

The structure of the database is large and complex because of the wide variety of data types and formats that are collected and processed. All the attributes that could be accounted for or anticipated were included. The raw database (TAPES) was designed for input to GRASP constrained by the limitations of the Hewlett-Packard Interactive Editor (Hewlett-Packard, 1980). Although the GRASP raw-data records are 326 characters long, the editor program limited the size of a record to 150 characters. Thus, three lines of data are input to an editor file to create one GRASP data record. One GRASP data record represents one data aggregate that may be defined by any of the attributes of the unit record. As additional data are collected and inventoried, relevant data are added to the database.

The raw-data record (Table 1) is input to GRASP and contains the GRASP field name (FIELD), the starting (first) column (FC) and ending (last) column (LC) of the field in the raw-data file, and a brief description of the data that are contained in the field.

Table 1.   Raw-data record

FIELD	FC	LC	DESCRIPTION
TAPENO	1	5	tape or inventory number
CRDATE	6	13	creation date (yearmmdd)
CRYEAR	6	9	creation year
CRMON	10	11	creation month
CRDAY	12	13	creation day
SHIP	14	28	name of ship
LEG	29	32	leg of cruise
YEAR	33	36	year of cruise
CRUISE	37	50	cruise identification
DATES	51	83	start and end dates and times of data
SYEAR	51	54	start year of data
SMON	55	56	start month of data
SDAY	57	58	start day of data

STIME	60	65	start time of data
EYEAR	69	72	end year of data
EMON	73	74	end month of data
EDAY	75	76	end day of data
ETIME	78	83	end time of data
MAXLAT	84	93	maximum latitude of data file
MINLAT	94	103	minimum latitude of data file
MINLON	104	113	minimum longitude of data file
MAXLON	114	123	maximum longitude of data file
FILENM	124	129	filename if applicable
CARTNO	130	135	cartridge number if disk file
FORMAT	136	150	data format name
TCHARC	151	161	tape characteristics if magnetic tape
PROGRM	162	167	program that created the data file
STATUS	168	173	status of data
SOURCE	174	185	source of data
FORM	186	187	data storage form
CONTNT	188	207	data content
COMMNT	208	251	comments
TYPE	252	253	data type
LINEID	274	279	seismic line identifier if common-depth-point (CDP) related data
FSHTPT	280	285	first shotpoint in file if CDP related data
LSHTPT	286	291	last shotpoint in file if CDP related data
WHO	292	295	who created or submitted tape
NFILES	296	297	number of files on tape
FILENO	298	299	file number on tape to which information pertains
WHERE	301	306	where data are stored
CHIEF	307	326	chief scientist of cruise

DATABASE CONTENT

The following are summaries of the data fields, the data formats, the programs used to create the data and a brief explanation of the major use of each program. If the user can become familiar with most data types and their content, he or she will find that creating a selective retrieval of information from the GRASP database is a simple and painless task.

TAPENO is a 5-digit integer field representing the inventory tape number assigned by the data library to the magnetic tape, cassette, or floppy disk.

CRDATE is an ASCII (or character string) composite of the fields CRYEAR, CRMON, and CRDAY described below. Its principal use is to facilitate retrieval and printing.

CRYEAR, CRMON, and CRDAY are, respectively, 4-, 2-, and 2-digit integer fields that represent the year, month, and day on which data file was created. If the data file is from an outside source and the creation date is not readily available, then these fields are coded to represent the date that the data were received by the branch and submitted to the data library for inventory.

SHIP is a 15-character ASCII field that identifies the ship used to collect the data.

LEG is a 4-digit integer field that represents the number of the leg of the cruise during which the data were collected.

YEAR is an integer field of 4-digits and represents the year the cruise took place.

The **SHIP** field, together with the LEG and/or YEAR field, will allow the user to selectively retrieve data for a particular cruise.

CRUISE, a 14-character ASCII field, represents the cruise identification code (Table 2) similar to that used in reports from the USGS to the U.S. Bureau of Land Management and in other reports. The cruise identification is usually an abbreviation of the fields SHIP, LEG, and YEAR. For example, leg 4 of 1980 R/V GYRE cruise would be coded as GYRE-80-4; an R/V GILLISS cruise, leg 3, for year 1979 would be coded as GS-7903-3. Table 2 is a list of the cruises currently coded in the database.

Table 2.   Cruise identification codes

SHIP	*CRUISE ID.*
ARGUE MARTIN	ARGU
ATLANTIS-II	AII-nn-leg
CAPE HENLOPEN	CAPEH-yr-leg
CHAIN	CHAIN-nn-leg
ENDEAVOR	ENDV-nn-leg
FARNELLA	FARN-yr-leg
FAY	FAY-leg
FLORENCE	FLORENCE-leg
GILLISS	GS-7903-leg
GYRE	GYRE-yr-leg
HUNT	HUNT-leg
IDA GREEN	IDGR-leg
ISELIN	CI-7807-leg

```
JOHNSON/SEA LINK ............................. JOHNSON-leg
KNORR .................................................. KNOR-nn-leg
LONGHORN .......................................... LHORN-yr-leg
MT MITCHELL ...................................... MTML
NEECHO............................................... NE-yr-leg
OCEANUS ............................................ OCN-leg
SEA ANGEL........................................... ANGEL-yr-leg
STATE ARROW.................................... STATE ARROW
WHITEFOOT......................................... WF-yr-leg
```

DATES: a 33-character ASCII field, is a composite of the fields described below and is stored as an ASCII field for ease in retrieval and printing. If data are time-series dependent, the fields SYEAR, SMON, SDAY, and STIME represent the year, month, day, and time at which the data file begins. The fields EYEAR, EMON, EDAY, and ETIME represent the year, month, day, and time at which the data file ends. Both SYEAR and EYEAR are 4-digit integer fields. The fields SMON, SDAY, EMON, and EDAY are each 2-digit integer fields, and the fields STIME and ETIME are 6-digit real numbers encoded as hour, minutes, and tenths of minute in the form HHMM.M (for example, 1035.4).

BOUNDS: The fields MAXLAT, MINLAT, MINLON, and MAXLON are all coded as real numbers and reflect the maximum and minimum geographic boundaries that the data file covers. The bounds are recorded in decimal degrees as $^{\pm}$XXX.XXXXX. South latitude and west longitude are coded as negative. FILENM and CARTNO: If data are stored on disk, the fields FILENM, a 6 character ASCII field, and CARTNO, a 6-digit integer field, contain the name and cartridge number of the data file.

FORMAT is a 15-character ASCII field and identifies the format in which the data are encoded. The field is large enough to include the complete name of any format being used at this time. If the format is a specially created one, then that format may be defined elsewhere, preferably on the Digital Data Processing Record (APPENDIX A), and may be recorded in the database as being USER-SUPPLIED. The following is a list of the presently used data formats, some of which are described in APPENDIX B.

AQMAG -Observed total magnetic value with ship's heading and speed, date, and Greenwich Mean Time (GMT). If two magnetometers were deployed, then the gradient and separation distance between the magnetometers are included.

AQU1 - Observed gravity value, ship's velocity components (velocity north and east), date, and GMT. The format may also include an observed total magnetic field value and/or corrected depth value in meters for the same time.

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ATNAV - Acoustic transponder navigation. Julian day, time, and ship's distance from transponders recorded in seconds and meters. Also, the system's calculation of ship's position in meters relative to an X-Y grid of transponder placements.

CALCM -Magnetic anomaly, date, GMT, and latitude and longitude recorded as decimal degrees. South latitude and west longitude are negative.

DFS5 -Navigation data, shotpoint values and date and time as recorded by the DFS-V multi-channel system. Data is retrieved from SEGB formatted data tapes for conversion to TSD by program DFSTS.

DRD - Dead-reckoning-data. Western Geophysical Integrated Navigation System (WINS) data format. Twenty-second data recordings of navigation and velocities. May also include observed total magnetic value and/or observed gravity value.

EASYD - Uncorrected depth values in fathoms or meters with date and GMT. Data usually digitized by hand.

EASYG - Observed gravity, ship's velocity components, date and GMT. Data are digitized by hand and may include observed magnetics value.

EASYM - Observed total magnetic field, date, and GMT. Data digitized by hand.

FIXSE - Navigation data with latitude and longitude in degrees and minutes with date and GMT. South latitude and west longitude are negative.

L&R - LaCoste & Romberg gravity. Obeserved gravity values recorded by the LaCoste & Romberg gravimeter.

MBATR - Uncorrected depth values in fathoms, date, GMT, and latitude and longitude as decimal degrees. South latitude and west longitude are negative. If Matthews' table corrections (Matthews, 1939) were applied when the data were processed, the data include corrected depth in fathoms and meters. Data are output from either program DTOB or DTBTS.

MERGE-MERGE - A National Geophysical and Solar-Terrestial Data Center (NGSDC) format for the exchange of data. The format, approved in June 1972, combines bathymetry, gravity, magnetic, and navigation data for a given date and GMT. One or more kinds of data may be present. Latitude and longitude are recorded as decimal degrees. South latitude and west longitude are negative.

MGD77A - National Geophysical and Solar-Terrestial Data Center (NGSDC) format for the exchange of data as approved in September

1977. The digital magnetic tape format combines marine geophysical data for a given date, GMT, and position and allows two different kinds of records. The first, the header records, provide a description of the cruise and instruments used onboard in the collection of the data. The second set are the data records and provide the bathymetry, magnetic, and gravity values, as well as seismic information for a given time and position. At any time, one or more kinds of data may be present and fields may be flagged to indicate the absence of data. Latitude and longitude are recorded as decimal degrees; south latitude and west longitude are recorded as negative values.

NAVC7 - Latitude and longitude with calculated current-velocity data. Data are output from program ATS1 and input to program ATS3 for gravity processing.

NSTAR-1 - Navigation data with latitude and longitude as calculated by the North Star 6000 Loran-C receiver, Loran-C station information, Julian date, and GMT. Latitude and longitude are recorded as degrees and decimal minutes with a N, S, E, or W suffix. Loran-C information includes slave time-delays and signal-to-noise-ratio (SNR) readings.

NSTAR-2 - Navigation data with latitude and longitude as calculated by the North Star 6000 Loran-C receiver, Loran-C station information, Julian date, and GMT. Latitude and longitude are recorded as degrees and decimal minutes with a N, S, E, or W suffix. Loran-C information includes slave time-delays, signal-to-noise-ratio (SNR) readings, and range-range (RHO-RHO) Loran-C calculations.

SEAG1 - Free-air gravity anomaly, date, GMT, and latitude and longitude in radians. South latitude and west longitude are negative. Data are processed using the 1930 International Gravity formula. If data are merged with depth information (output of program MRGDS), data will include depth values and a simple Bouguer anomaly.

SEAG2 - Free-air gravity anomaly, date, GMT, and latitude and longitude in radians. South latitude and west longitude are negative. Data are processed using the 1967 International Gravity formula. Data format is output from program ATS3; if merged with depth information (output of program MRGDS), data will include depth values and a simple Bouguer anomaly.

SEDEP - Uncorrected depths in fathoms, date, and GMT. Data are output from program EZTD. If Matthews' table corrections (Matthews,

1939) were applied, data also includes depth corrections in fathoms and meters.

SEISNAV - A National Geophysical and Solar-Terrestial Data Center (NGSDC) format for the exchange of CDP navigation. The data includes latitude and longitude recorded as decimal degrees, date, GMT, shotpoint value, and CDP line identifier. South latitude and west longitude are negative.

TSD - Time-series-data. This format provides for object-time definition of the data file and record contents. Because of this, a specific data content cannot be summarized as being available to the user. The user must become familiar with the TSD channels available (see APPENDIX B) and the data that would be contained in those channels, because in using any TSD program, the user will have to reference the required data by the appropriate channel number.

USER-SUPPLIED - This code is entered for any other format that may have been used to collect or process data other than those previously described. Specific data cannot be summarized as being available to the user.

TCHARC is an 11-character ASCII field and, if the data are stored on magnetic tape, is coded to reflect the physical characteristics of the tape. The field code is divided in three parts, separated by hyphens as nT-bpi-xxx. The first part, nT, refers to the number of tracks (7 or 9) on the magnetic tape and would be entered as either 7T or 9T. The second part, bpi, refers to the bytes-per-inch that are recorded on the tape. This may be 556, 800, or 1600. The third part, xxx, is an abbreviation of the code (Table 3) in which the data were recorded.

Table 3.   Tape codes

CODE	ABBREVIATION
ASCII	AS
Binary Coded Decimal	BCD
BINARY	BI
EBCDIC	EB
Mixed code	MX

PROGRM is a 6-character ASCII field that reflects the name of the program used to create the data file. This field would be one of the most valuable pieces of information available to the user in searching the database and trying to locate a particular data type. Where data were output from two or more programs (for example NSTAR-TSD output of programs NS1TS and NAVED), the PROGRM

field would be coded to reflect the name of the last program (NAVED) from which the data were output. Any other processing information should be contained in the field COMMNT. Programs currently being used for the processing of data are described below.

PROGRAM	DESCRIPTION
ATS1	Calculates current velocities between fixes from ship's velocities and fix positionns. This program is the firs step in the processing of gravity acquisition data to SEAG2 format. Data are output in NAVC7 format.
ATS3	Computes the free-air gravity anomaly, plus the Bouguer anomaly if corrected depth is available from the input data. A continuous fix stream is computed using the ship's velocity information and navigational corrections. The current velocities, provided by the NAVC7 records output from ATS1, are prorated on the basis of time and are used in the Eotvos calculation. Current velocities are not prorated for the position calculation. The velocities may be corrected for a consistent heading or speed error, and gravity may be corrected for systematic drift. Data are output in SEAG2 format.
CASST	Converts Texas Instruments formatted cassettes to ASCII data files for processing. The program requires that a Texas Instrument terminal model #733 with cassettes be used as its logical unit device in order to read the input data.
CCOPY	Converts Texas Instruments formatted cassettes to ASCII data files for processing. The program is to be used with the Raymond Cassette reader.
CNCTS	Concatenates two TSD-formatted data files.
DFSTS	Converts data in DFS5 format to TSD format.
DISTS	Retrieves discrete navigational updates (satellite, manual, and hyperbolic updates) from a TSD formatted tape for input to NAVED.
DTBTS	Merges break-slope bathymetry records in SEDEP format with navigation data in the TSD format and outputs MBATR format data.
DTOB	Merges break-slope bathymetry records in SEDEP format with navigation data in SEAG1, SEAG2 or FIXSE format and outputs MBATR format data.

ESORT   Separates the output file of the acquisition program, EXEC, into files containing the component record types: gravity, one-minute automatically acquired bathymetry, and messages from the acquisition program itself. Data are output in AQU1 format.

EZTD   Produces SEDEP formatted data from EASYD or SEDEP format input. If the Matthews' table correction numbers are given, then the program will also compute corrected water depths.

FXOTS   Converts selected data channels of latitude and longitude from TSD formatted data to FIXSE format, or converts selected data channels of velocities north and east and observed gravity to AQU1 format.

INSTS   Converts the Western Geophysical Integrated Navigation formatted tapes (DRD format) to TSD format.

LORFX   Converts selected data channels of Loran-C time delay values from TSD input to latitude and longitude positions. Data are output in FIXSE format.

LORTS   Converts selected data channels of Loran-C time delay values from TSD input to latitude and longitude positions. Data are output in TSD format with calculated position in channel #1135.

MANGS   Merges time-series observed magnetic data with navigation data and calculates the magnetic anomaly. Data are output in CALCM format.

MGOTS   Converts selected data channels of observed magnetic data from the TSD format to AQMAG format.

MRGDS   Merges time-series depth data in SEDEP format with gravity records in SEAG1 or SEAG2 format and calculates the Bouguer anomaly. Data are output in SEAG format.

NAVED   Edits TSD formatted navigation data and outputs a corrected cruise track.

NGSTS   Converts data from either the NGSDC MERGE-MERGE or MGD77 format to TSD.

NS1TS   Converts data in the NSTAR-1 format recorded by the North Star 6000 Loran-C receiver to TSD format.

NS2TS   Converts data in the NSTAR-2 format recorded by the North Star 6000 Loran-C receiver to TSD format.

SEGB   Extracts navigation information, shotpoint values, and date and time from the extended header of the DFS-V multi-channel seismic SEGB formatted tapes.

SNAVR   Retrieves seismic navigation data for selected CDP lines at a user selected shotpoint interval from data in the NGSDC SEISNAV data format. Data is output in an acceptable format for plotting using the MAPGEN program LINGEN.

RFMTS   Reformats a TSD data file. The program allows a user to strip user-selected TSD channels between user-specified times and create a new TSD-formatted data file.

TSDED   Edits TSD formatted data.

WEDIT   Western Geophysical navigation editing program.

XYNAV   Converts data recorded by the ATNAV system to TSD format and calculates a geographic co-ordinate from the transponder XY meter distances. Latitude and longitude positions are output in TSD channel #1136.

STATUS, a 6-character ASCII field, indicates the edit status of the data. Table 4 lists each possible edit status and the code by which each is recorded in the data-base.

Table 4.   Edit status

STATUS   *CODE*

edit version 'n' .... E(n)
final version .... FINAL
questionable data.................................... NG?
unedited or raw-data .... UE

SOURCE is a 12-character ASCII field that represents either the name of the equipment used to collect the data or the outside source from which the data were received (Table 5). For example, the navigation data for a particular cruise may include data recorded by both the North Star 6000 Loran-C receiver and the Western Integrated Navigation System. To retrieve only the North Star Loran-C navigational data, the user searches the SOURCE field for the appropriate code for the North Star 6000. To locate information appropriately coded as being received from an outside source, the user would find the abbreviation representative of that source and use it in his or her search. For example, common-depth-point (CDP) navigational data received from Digicon would

contain DIGICON in the source field. The current sources and their abbreviations are listed in Table 5.

Table 5.   Data sources

DATA SOURCE	ABBREVIATION
Acoustic Transponder Navigation	ATNAV
Bedford Institute of Oceanography	BIO
Decca Survey Inc.	DECCA
Digicon	DIGICON
Defense Mapping Agency	DMA
EPSCO Loran-C receiver	EPSCO
Geophysical Services Inc.	GSI
data recorded by gravity hut	GRAVITY-HUT (or G-H)
LaCoste & Romberg gravity system	L&R
data digitized from log-book	LOG-BOOK
Lamont-Doherty Geological Observatory	LDGO
Mini-ranger navigation	MINIR
National Geophysical Data Center	NGDC
National Geophysical and Solar-Terrestrial Data Center	NGSDC
National Marine Fisheries Service	NMFS
National Ocean Survey	NOS
North Star 6000 Loran-C receiver	NSTAR
Lease block coordinates from protraction diagrams	PROTRACTION
Scripps Institution of Oceanography	SCRIPPS
Teledyne	TELEDYNE
University of Rhode Island	URI
University of Texas	UTX
Western Integrated Navigation System	WINS
Woods Hole Oceanographic Institution	WHOI

FORM is a 2-character ASCII field that reflects the physical storage medium of the data. The abbreviations currently used to represent the storage medium are listed in Table 6.

Table 6.   Data storage form

FORM	ABBREVIATION
disk file	DF
floppy disk	FD

```
magnetic tape...................................................MT
Texas Instruments recorded cassette ...............TI
```

CONTNT is an ASCII field 20 characters in length that includes a brief description of the most important data attributes in the particular format. The abbreviations currently used to represent the data content are listed in Table 7.

Table 7.   Data content

DATA CONTENT   *ABBREVIATION*

```
Bathymetry ........................................................BT
latitude-longitude[1] ...........................................LATLON
LaCoste and Romberg gravity values ...............L&R
processed gravity data ......................................GRV
processed magnetic data ..................................MAG
navigation[1] ......................................................NAV
range recorded as meters .................................RANGEM
range recorded as time .....................................RANGET
Loran-C range-range recordings .......................RR
observed gravity values ....................................RWG
observed magnetic values.................................RWMG
shotpoint values ...............................................SP
Loran-C signal-to-noise ratio.............................SNR
Loran-C time-delay values ................................TD'S
Velocities..........................................................VEL
ship's velocity east ...........................................VE
ship's velocity north..........................................VN
ship's location in X-Y grid .................................XYLOC
```

FORMAT VS. CONTENT: If a user becomes familiar with the relationship between data formats and their content, he or she will be able to create more meaningful retrievals. For example, to locate the bathymetry data for a particular cruise he or she may enter 'CONTNT CS BT' as one of the conditions when defining the retrieval. (Data retrieval is discussed in more detail in a following section.) Table 8 below shows that, if available, data in the format of AQU1 and SEAG may fulfill the condition, whereas data in EASYD and MBATR format will definitely fulfill the retrieval condition. This type of retrieval may result in more information than the user had anticipated and may overwhelm him or her; a retrieval with a condition of 'FORMAT CS MBATR' may have been all that was

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[1] Latitude-longitude and navigation both refer to a geographical coordinate that may be used for plotting. However, data containing LATLON should not be confused with a final navigation format. These types are coded as NAV.

needed. Table 8 is a list of the currently available data formats and the data that each may contain.

Table 8.   Data format vs. data content

FORMAT	CONTNT
AQMAG	RWMG
AQU1	RWG-VN-VE
	RWG-VN-VE-RWMG
	RWG-VN-VE-BT
	RWG-VN-VE-RWMG-BT
ATNAV	RANGET-RANGEM-XYLOC
CALCM	LATLON-MAG
DRD	NAV-VEL
	NAV-VEL-RWMG
	NAV-VEL-RWMG-RWG
	NAV-VEL-RWMG-RWG-L&R
EASYD	BT
EASYG	RWG
	RWG-RWMG
EASYM	RWMG
FIXSE	NAV
L&R	RWG
MBATR	LATLON-BT
NAVC7	LATLON-VEL
NSTAR-1	NAV-TD'S-SNR
NSTAR-2	NAV-TD'S-SNR-RR
SEAG	NAV-GRV-VEL
	NAV-GRV-VEL-BT
TSD	Can be almost anything. See APPENDICES A, B.
USER-SUPPLIED	Can be almost anything. See APPENDIX A.

TYPE is a 2-character ASCII field that reflects one of five general types of data. It is important to note the difference between raw and processed data. Processed data have been output through some processing programs and have, as a result, been modified from their original form. Raw-data, even though they may have been output from a processing program, are unchanged.   As an example, data in the format of AQMAG output of program MGOTS are simply the raw magnetic information stripped from a TSD-formatted data file for processing. These data, although they are in a format different from that of the original data, are still in a raw, unprocessed form and cannot be analyzed without further processing. Table 9 is a summary of the data types and their abbreviations.

Table 9.   Data types

CDP Seismic information: If the data are common-depth-point (CDP) related, the fields LINEID, FSHTPT, and LSHTPT represent the seismic line identification, the first shot point in the file, and the last shot point in the file, respectively. LINEID is a 6-character ASCII field. FSHTPT and LSHTPT are each 6-digit integer fields.

WHO is a 4-character ASCII field that represents, by initials, the person who submitted the data for archiving.

 NFILES and FILENO: If the data are stored on magnetic tape, NFILES and FILENO are both 2-digit integer fields that represent the number of files on the tape and the file number to which the information pertains, respectively.

WHERE, a 6-character ASCII field, represents the site at which the data are physically stored. Presently storage locations are entered as shown in Table 10.

Table 10.   Data storage locations

CHIEF, a 20-character ASCII field, is used for entering the last name of the Chief Scientist aboard during data collection. If data were received from an outside source or if the Chief Scientist's name is not known, then the field is blank.

UPDATING THE DATABASE

As data are collected or processed, they should be submitted to the data library for inventory and storage. Data must be accompanied by a Digital Data Processing Record (APPENDIX A) that has been filled out as completely as possible.

Updating of the MRNIDX database is divided into three steps and is the responsibility of the database administrator. The first step is the creation of the MRNIDX raw-data records. When the data and proper inventory information have been received by the data library, program BLDIX is executed. This interactive program prompts the user to enter the necessary information to inventory the data properly and creates the raw-data records. (When program BLDIX is executed, the information to be added to the database must be entered with the tape numbers in ascending order.) If necessary, the output file may be input to the system editor to correct input errors before proceeding with the second step, MRGIX.

The second step is to merge the newly created file (detail file) with the master raw-data file TAPES. This is done by executing program MRGIX. The information in the detail file is then merged with the master file according to tape number. If an error exists in the order of the tape numbers in the detail file or if a tape number in the detail file already exists in the master file, an error message is displayed and the program halts. When the program is being executed and the files are being merged, the output file should be directed to magnetic tape. If the program runs to completion without errors, this tape becomes a backup of the current master file. After the merge is completed, the database administrator must replace the old master file with the new file.

The third and final step is the updating of the GRASP-formatted data file. This is done by using the convert option of GRASP. Before executing this convert option of GRASP, however, the database administrator must delete the GRASP files that will be recreated, and pack the cartridge to allow room for the creation of the new files. When the conversion is completed, the temporary files created by GRASP may be deleted.

An example of the GRASP update procedure as it would be executed on the Hewlett-Packard 2100MX computer is given on the next page.

COMMAND: MEANING:

```
:PU,MRNIDX::1804          -- Purge files to be re-created
:PU,MRNDFN::1804             during this GRASP conversion.
:PU,MRNMSK::1804
:PU,MRNADF::1804
:PK,1804                  -- Pack cartridge 1804
```

```
:GRASP,,IN                     -- Execute GRASP with convert
option.



                          G R A S P
                        NOV  24, 1980


 ENTER GRASP INDEX CARTRIDGE: 1804

 ENTER GRASP SECURITY CODE:
 CONVERT IS A GENERAL PURPOSE GRASP FILE CREATION/UPDATE PROGRAM.
  EXISTING FILES MAY BE EXPANDED OR COMPLETELY NEW FILES CREATED.
  IN EITHER CASE USE A NEW NAME FOR THE OUTPUT MASTER FILE.
 THE DATA DEFINITION (DD) MAY BE READ FROM A FILE OR
 ENTERED ITEM BY ITEM AT THE KEYBOARD.
 ENTER FILE NAME TO READ DD FROM A FILE:  TAPEDD
        IDIM       NCREC        NSKIP        KNTI
         41         326           0           150
 ENTER MASK FILE NAME:  MRNMSK
 ENTER DICTIONARY FILE NAME:  MRNDFN
 ARE THE MASK/DICTIONARY FILES NEW? YES
 ENTER OUTPUT MASTER FILENAME: MRNIDX
 ENTER RAW DATA INPUT FILE NAME:  TAPES
 DO YOU HAVE ANOTHER INPUT FILE TO PROCESS? NO
 DO YOU WANT AN ABBREVIATED DEFINITIONS FILE CREATED? YES
 ENTER DEFINITIONS FILE NAME: MRNADF
 SUB-DICTIONARY FOR SHIP   PROCESSED WITH   36 ENTRIES
 SUB-DICTIONARY FOR FORMAT PROCESSED WITH   25 ENTRIES
 ENTER MASTER FILE DESCRIPTION: MARINE DATA INDEX
 TOTAL NUMBER OF RECORDS CREATED=  2067
 FILE15 HAS BEEN CREATED CONTAINING THE INDEX
   FILE RECORD ASSOCIATED WITH MR

:PU,FILE15::1804                        -- Purge temporary files
:PU,MRNADF::1804
:ST,TMPADF::1804,MRNADF::1804::-1  -- Store temporary file
                                       TMPADF as MRNADF
:
```

DATA RETRIEVAL

As previously mentioned, the data are retrieved by means of the Geological Retrieval and Synopsis Program (GRASP). GRASP is presently operational on the USGS Hewlett-Packard computer system in Woods Hole, the three USGS HONEYWELL MULTICS systems, and a variety of other computer systems around the world.

For a user to retrieve information from the MRNIDX database, no special computer training is required other than how to access the particular computer system to be used. A short introductory course in the rules and commands available to run GRASP would be all the user would need to make a simple retrieval of information. After accessing the selected computer system and beginning execution of GRASP, the user must define conditions for retrieval and must link these selected conditions as a logical statement. (See the example that follows.)

Once a logical statement has been defined, the user must search the database. When a search is executed on a GRASP-formatted file, the file is searched sequentially, and any data records for which the specified logic statement is true are extracted and output to a user-named file which becomes a subset of the master file. Records meeting the specified logic are not deleted from the master file but are merely duplicated in the new output file. The user may now continue to retrieve information from this subset or from the master file to create as many subsets as desired.

After the requested information has been retrieved, the user may select to list either the entire record or one or two selected items of information in the records contained in the output file.

It is assumed that the primary reason for retrieving information from this database is to find where data are stored. The following example shows a simple retrieval. In the example given, the user is attempting to locate any data related to CDP lines TD1, TD2, TD6, BT1, 31, and 32.

```
:GRASP

            G  R  A  S  P
          NOV  24, 1980

 ENTER GRASP INDEX CARTRIDGE: 1804

 ENTER GRASP SECURITY CODE: 0
 WELCOME TO THE USGS GRASP RETRIEVAL SYSTEM.
 AT THE CURRENT TIME THE FOLLOWING DATA BASES ARE AVAILABLE:
```

```
MRNIDX- MARINE DATA INDEX

LORMAP- N.O.S. LORAN-C MAP DIRECTORY

BEFORE ANY OF THESE DATA BASES MAY BE ACCESSED,
A DATA BASE FROM THE ABOVE LIST MUST BE SELECTED.
ENTER DATABASE NAME: MRNIDX

ENTER COMMAND: CONDITION
A. LINEID CS TD1
B. LINEID CS TD2
C. LINEID CS TD6
D. LINEID CS BT1
E. LINEID CS 31
F. LINEID CS 32
G.

ENTER COMMAND: LOGIC
ENTER LOGIC: A.OR.B.OR.C.OR.D.OR.E.OR.F

ENTER COMMAND: SEARCH
ENTER INPUT FILE NAME:
ENTER OUTPUT FILE NAME:  EXAMP1
     1320 RECORDS OF MRNIDX SEARCHED
        7 RECORDS FOUND WHICH SATISFY THE REQUEST.
THEY HAVE BEEN STORED IN EXAMP1

ENTER COMMAND: LIST
ENTER NAME OF FILE:  EXAMP1
ENTER NUMBER OF RECORDS/PAUSE:
ENTER LISTING TYPE (COLUMN, USER FORMAT, OR ROW):  ROW
ENTER THE LIST OF ITEM NAMES.
1  TAPENO
2  FILENO
3  NFILES
4  LINEID
5  COMMNT
6  FSHTPT
7  LSHTPT
8  SOURCE
9  FORMAT
10 DATES
11

TAPENO=    930
FILENO=      1
NFILES=     13
LINEID=TD1
COMMNT=PART 1 OF 2
FSHTPT=   1001
LSHTPT=  -1921
SOURCE=TELEDYNE
```

```
FORMAT=USER-SUPPLIED
DATES =1977      1406.6 - 1977      1654.1
***********************
TAPENO=     930
FILENO=       2
NFILES=      13
LINEID=TD1
COMMNT=PART 2 OF 2
FSHTPT=  -5281
LSHTPT=  -1001
SOURCE=TELEDYNE
FORMAT=USER-SUPPLIED
DATES =1977      1217.1 - 1977      2022.7
***********************
TAPENO=     930
FILENO=       3
NFILES=      13
LINEID=TD2
FSHTPT=  -6641
LSHTPT=   -941
SOURCE=TELEDYNE
FORMAT=USER-SUPPLIED
DATES =1977      2039.7 - 1977      1536.9
***********************
TAPENO=     930
FILENO=       9
NFILES=      13
LINEID=TD6
FSHTPT=   1001
LSHTPT=   6471
SOURCE=TELEDYNE
FORMAT=USER-SUPPLIED
DATES =1977      0155.6 - 1977      1735.6
***********************
TAPENO=     964
FILENO=       1
NFILES=      28
LINEID=32
FSHTPT=   6213
LSHTPT=    304
SOURCE=GSI
FORMAT=USER-SUPPLIED
DATES =19780529 1211.6 - 19780601 0113.0
***********************
TAPENO=     964
FILENO=       2
NFILES=      28
LINEID=31
FSHTPT=    101
LSHTPT=   3874
SOURCE=GSI
FORMAT=USER-SUPPLIED
```

```
     DATES =19780605 0559.5 - 19780606 0224.5
     ***********************
     TAPENO=   1806
     FILENO=      1
     NFILES       3
     LINEID=BT1
     FSHTPT=      1
     LSTHPT=   7810
     SOURCE=GSI
     FORMAT=USER-SUPPLIED
     ***********************
```

A user may also want to retrieve information from the MRNIDX database in order to locate navigation data that could be used as input for plotting a cruise track. The following example shows a retrieval of information by which to locate FIXSE-formatted data for the cruises OCEANUS leg 81, ISELIN leg 2, GILLISS leg 3, and the GYRE leg 7 cruise for 1980. The example is a continuation of the previous GRASP session.

```
 ENTER COMMAND: CONDITION
 A. CRUISE CS OCN-81
 B. CRUISE CS GYRE-80-7
 C. SHIP CS GILLISS
 D. LEG EQ 3
 E. SHIP CS ISELIN
 F. LEG EQ 2
 G. FORMAT CS FIXSE
 H.

 ENTER COMMAND: LOGIC
 ENTER LOGIC: ((A.OR.B).AND.G).OR.((C*D)*G).OR.((E*F)*G)

 ENTER COMMAND: SEARCH
 ENTER INPUT FILE NAME:
 ENTER OUTPUT FILE NAME:  EXAMP2
      1320 RECORDS OF MRNIDX SEARCHED
        10 RECORDS FOUND WHICH SATISFY THE REQUEST.
 THEY HAVE BEEN STORED IN EXAMP2

 ENTER COMMAND: LIST
 ENTER NAME OF FILE:  EXAMP2
 ENTER NUMBER OF RECORDS/PAUSE:
 ENTER LISTING TYPE (COLUMN, USER FORMAT, OR ROW):  ROW
 ENTER THE LIST OF ITEM NAMES.
 1  TAPENO
 2  FILENO
 3  NFILES
```

```
4  CRUISE
5  DATES
6  SOURCE
7  CHIEF
8

TAPENO=    1036
FILENO=       1
NFILES=       3
CRUISE=GYRE-80-7
DATES =19800806 1815.1 - 19800813 1830.0
SOURCE=NSTAR
CHIEF =AARON
**********************
TAPENO=    1036
FILENO=       2
NFILES=       3
CRUISE=GYRE-80-7
DATES =19800814 2030.1 - 19800819 1655.0
SOURCE=NSTAR
CHIEF =AARON
**********************
TAPENO=    1036
FILENO=       3
NFILES=       3
CRUISE=GYRE-80-7
DATES =19800819 1700.0 - 19800822 0310.1
SOURCE=NSTAR
CHIEF =AARON
**********************
TAPENO=    1760
FILENO=       1
NFILES=       1
CRUISE=CI-7807-2
DATES =19780909 - 19780927 0805.0
SOURCE=NSTAR
CHIEF =AARON
**********************
TAPENO=    1936
FILENO=       1
NFILES=       1
CRUISE=GS-7903-7
DATES =19790607 1800.0 - 19790625 0355.0
SOURCE=NSTAR
CHIEF =AARON
**********************
TAPENO=    2092
```

```
FILENO=        1
NFILES=        5
CRUISE=OCN-81
DATES =19800525 2035.0 - 19800525 2240.0
SOURCE=NSTAR
CHIEF =BUTMAN
**********************
TAPENO=   2092
FILENO=        2
NFILES=        5
CRUISE=OCN-81
DATES =19800527 1920.1 - 19800527 2215.0
SOURCE=NSTAR
CHIEF =BUTMAN
**********************
TAPENO=   2092
FILENO=        3
NFILES=        5
CRUISE=OCN-81
DATES =19800528 1120.0 - 19800528 1535.0
SOURCE=NSTAR
CHIEF =BUTMAN
**********************
TAPENO=   2092
FILENO=        4
NFILES=        5
CRUISE=OCN-81
DATES =19800528 1720.1 - 19800528 1920.0
SOURCE=NSTAR
CHIEF =BUTMAN
**********************
TAPENO=   2092
FILENO=        5
NFILES=        5
CRUISE=OCN-81
DATES =19800529 1800.0 - 19800529 2035.0
SOURCE=NSTAR
CHIEF =BUTMAN
**********************
```

For more information on the rules and commands for executing program GRASP, the user should obtain a copy of the "GRASP USER MANUAL" (Jones, Bowen, and Botbol, 1978).   GRAPHIC DISPLAY OF THE GEOGRAPHIC AREA OF DATA COLLECTION

Once the user has retrieved information from the database, he or she may obtain a plot showing the boundaries of the area of influence of the data. This plot is obtained by executing program PLMDI after exiting GRASP. Before exiting program GRASP, however, the user must extract nine selected fields from the retrieved information and create a disc file for input to program PLMDI.

To output the necessary fields from the database, the user must execute the "list" option of GRASP and, when prompted to list the item names, enter the following nine fields in the order given below:

```
1.  TAPENO
2.  FILENO
3.  NFILES
4.  FILENM
5.  CARTNO
6.  MAXLAT
7.  MINLAT
8.  MINLON
9.  MAXLON
```

This procedure will create a user-named disc file that contains the fields necessary for input to program PLMDI. The use of the ".STORE" command along with filename PLNMS eliminates the need for repetitive entry of the list of names.

Once the data file has been created and the user has exited GRASP, program PLMDI may be executed. When this program prompts the user for the name of the data file, the name of the disc file just created by GRASP should be entered.

The name of the plotter device to which the interactive graphics output will be directed is requested by the system. If none is entered, the default device is T4014, the Tektronix 4014 graphics terminal. The default is selected by entering a space and carriage return (CR).

The program will next request the name of an optional plot-deferred file. If a plot-deferred file is created, this file may then be plotted on any one of the graphic devices on the branch Hewlett-Packard computer system. If the user does not wish to create a plot-deferred file, he or she must enter a space and a CR.

The program will read the data file and calculate the maximum and minimum latitude and longitude within the file. The range will be expanded by the program to generate a clear neat line around the geographic area of the data and a good working area for plotting. The exact range of the data file and the bounds that the program will use for plotting are displayed on the terminal, at which time the user will be given the option of altering those bounds. If he or she chooses not to, (default response), the program will plot the bounds that it has calculated. If a yes response is entered, the program will request the user to enter the bounds

he or she wishes plotted. New bounds may be entered as decimal degrees, as degrees and decimal minutes, or as degrees, minutes, and seconds. South latitude and west longitude must be negative. For example, longitude 73{o 30' west may be entered as -73.5 (decimal degrees) or as -73,30 (degrees and minutes).

Once the bounds for the area to be plotted have been established, the program will ask the user if he or she wishes to have the outline of each area annotated. If "yes" (default), the program will annotate the area pertaining to each information record with the tape number and file number or, if a disc file, both the filename and cartridge number. If the user responds "no", the program will outline but not annotate each area.

The last request made to the user is for a plot title. The title is centered at the base of the plot.

An example of the procedure to extract the necessary information required by program PLMDI and execution of the program follows. The example uses the file created during retrieval example number 1. Figure 1 is an example of the graphics output from program PLMDI.

```
 ENTER COMMAND: LIST
 ENTER NAME OF FILE:  EXAMP1
 ENTER NUMBER OF RECORDS/PAUSE:
 ENTER LISTING TYPE (COLUMN, USER FORMAT, OR ROW):  COLUMN
 WOULD YOU LIKE OUTPUT TO BE TO DISK? YES
 ENTER NAME OF DISK DATA FILE TO BE CREATED:  CDPNAV
 WOULD YOU LIKE A HEADER RECORD CONTAINING ITEM NAMES?  NO
 ENTER THE LIST OF ITEM NAMES.
 1  .STORE PLNMS
 10

 ENTER COMMAND: QUIT

 THE FOLLOWING FILES HAVE BEEN CREATED DURING THIS SESSION:
    1     EXAMP1
    2     EXAMP2
 DO YOU WISH TO SAVE ANY OF THEM? YES
 ENTER A LIST OF NUMBERS CORRESPONDING TO
 THOSE FILES YOU WISH TO SAVE (IE. 1-3,5).
1-2
:


:PLMDI


    *****  PROGRAM PLMDI  *****
```

28

ENTER NAME OF RETRIEVED DATA FILE: CDPNAV::1804

ENTER PLOTTER DEVICE NAME: T4014

ENTER NAME OF PLOT DEFERRED FILE:

MAXIMUM & MINIMUM BOUNDS OF DATA FILE ARE:
     34   40.80   26   12.00   -79 -17.40   -74 -26.40

I HAVE ROUNDED THE BOUNDS AND CALCULATED THE
NEW AREA FOR THE WINDOW TO BE PLOTTED AS:
       35   26   -80   -73

DO YOU WISH TO CHANGE THE BOUNDS? (YES/NO): NO

DO YOU WANT AREA ANNOTATED? (YES/NO): YES

 ENTER PLOT TITLE. 50 CHARACTERS MAXIMUM.
CDP NAV LINES TD1, TD2, TD6, BT1, 31 & 32
 15
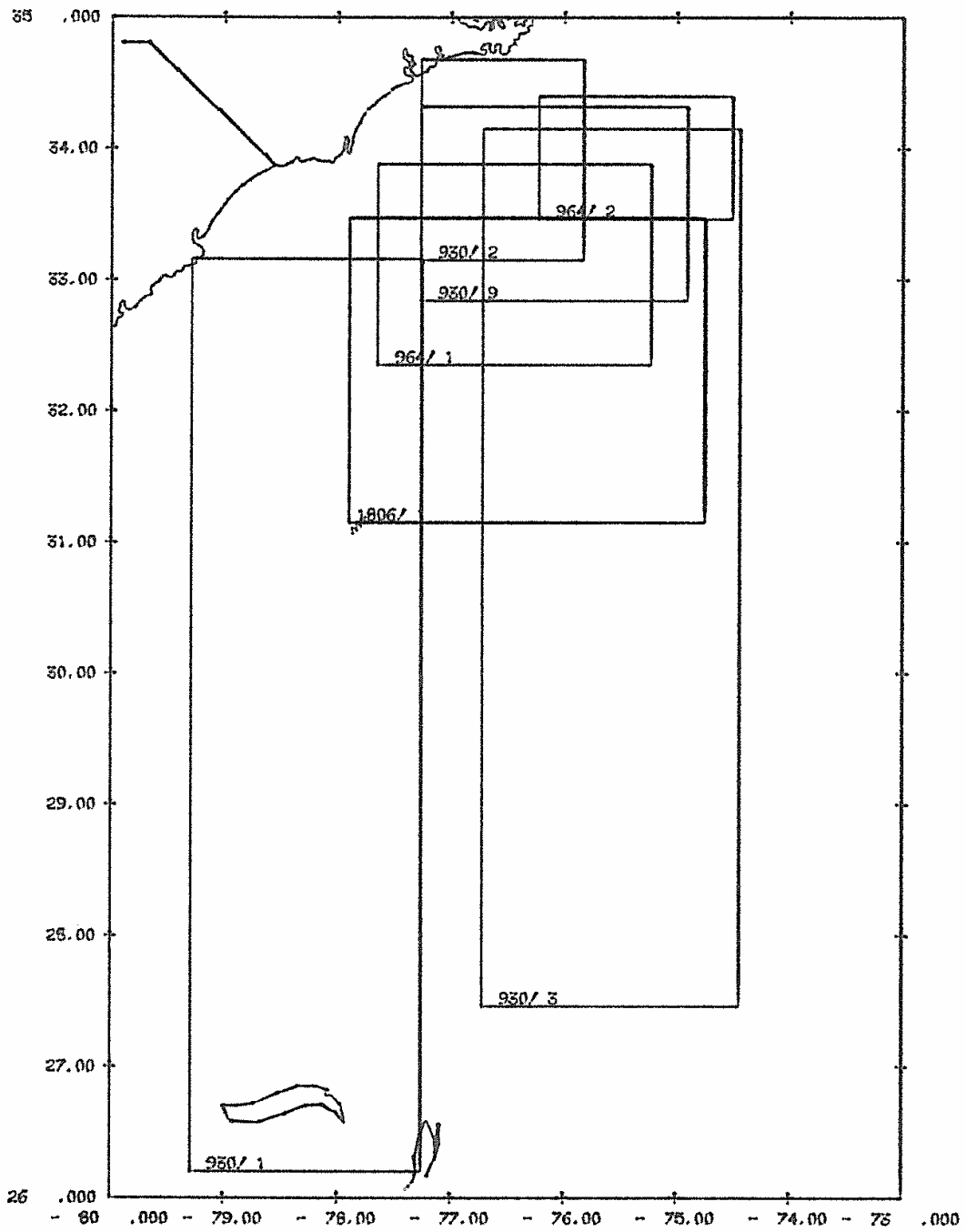
CDP NAV LINES TD1, TD2, TD6, BT1, 31 & 32

Figure1: Example of graphics output from program PLMDI

REFERENCES CITED

Bowen, R.W., and Botbol, J.M., 1975, The Geological Retrieval and Synopsis Program (GRASP): U.S. Geological Survey Professional Paper 966; 87p.

Evenden, Gerald I., October 1976, Time Series Data (TSD): Unpublished administrative report on file at U. S. Geological Survey, Woods Hole, MA

Hewlett-Packard, 1980, RTE-IVB Terminal User's Reference Manual, 3rd edition: Hewlett-Packard Company, 11000 Wolfe Road, Cupertino, CA

Jones, Gary E., Bowen, Roger W., and Botbol, Joseph Moses, 1978, GRASP USER MANUAL: Unpublished administrative report on file at U. S. Geological Survey, Woods Hole, MA

Matthews, D.J., 1939, Tables of the Velocity of Sound in Pure Water and Sea Water, 2nd edition: London Hydrographic Department, Admiralty

APPENDIX A --

EXAMPLES OF PROPERLY COMPLETED

DIGITAL DATA PROCESSING RECORDS

USGS, WOODS HOLE, MA
Digital Data Processing Record

Tape No. 01806   Status Final   Data form* MT

Date created 28 Nov. 1978   By whom V. Paskevich

Cruise and leg*_____

Data format* user-supplied   Source* G.S.I

Creation Program* Editr   Data type*_____

Data Content* NAV-SP_____

Code AscII   Tracks 9T   Density 800   No. of files 3

Tape released for other use by_____ Date_____

Tape released to_____ Date_____

File number	1	2	3
Start date	n/a	n/a	n/a
End date	n/a	n/a	n/a
File termination (N, EOR, EOF)	EOF	EOF	EOF/EOF
CDP Line id*	BT1	BT4	BT8
First shotpoint	1	1	1
Last shotpoint	7810	5393	4125

Comments: Seismic navigation for Bermuda Triangle lines

cols: 1-3   line identifier
      6-12 latitude (Deg + dec. min; I2, 1X, F4.1)
      16-24 longitude (Deg + dec. min; I3, 1X, F4.1)

      27-32 shotpoint value
      40-48 latitude (decimal degrees; F9.6)
      51-60 longitude (decimal degrees; F10.6)

*See Marine Data Index Report for more information.

USGS, WOODS HOLE, MA
Digital Data Processing Record

Tape No. 01976   Status Final   Data form* MT

Date created 12 Aug. 1978   By whom V. Paskevich

Cruise and leg* R/V FAY-23

Data format* TSD   Source* WINS

Creation Program* INSTS   Data type* PR

Data Content* NAV-VEL

Code MX   Tracks 9T   Density 800   No. of files 1

Tape released for other use by_____   Date_____

Tape released to_____   Date_____

File number   1

Start date   12 Sept. '76/1149

End date   17 Sept. 76/1207

File termination   EOF/EOF
   (N, EOR, EOF)

CDP Line id*

First shotpoint

Last shotpoint

Comments: Tape #01052 (WINS-DRD Composite tape output Western Edit Program) converted to TSD using INSSPC.

---

*See Marine Data Index Report for more information.

USGS, WOODS HOLE, MA
Digital Data Processing Record

Tape No. 00940   Status Final   Data form* MT

Date created 4 Sept. 1980   By whom V. Paskevich

Cruise and leg* Oceanus - 81

Data format* mBATR   Source* NSTAR - 3.5

Creation Program* DTOB   Data type* PR

Data Content* LATLON - BT

Code ASCII   Tracks 9T   Density 800   No. of files 1

Tape released for other use by_____ Date_____

Tape released to_____ Date_____

File number	1		
Start date	30 May '80/2030.0		
End date	31 May '80/1520.0		
File termination (N, EOR, EOF)	EOF/EOF		
CDP Line id*			
First shotpoint			
Last shotpoint			

Comments: Bathymetry for Lydonia Canyon merged
with North Star 6000 navigation. Bathymetry
processed without Matthew's Table Correction.

_____

_____

*See Marine Data Index Report for more information.

APPENDIX B --

DESCRIPTION OF DATA FORMATS

AQMAG

COLS	FIELD NAME	FORMAT
1-2	day	I2
3-4	month	I2
5-6	year	I2
7-11	time of day as Greenwich Mean Time (GMT) recorded as HHMMT	F5.1
7-8	hour of day	I2
9-10	minute of day	I2
11	tenths of minute	I1
12-20	ship's heading (degrees)	F9.2
21-29	ship's speed (knots)	F9.2
30-38	observed magnetic value from magnetometer 1 (gammas)	F9.1
39-47	observed magnetic value from magnetometer 2 (gammas)	F9.1
48-62	gradient (gammas)	E15.7
63-68	separation distance	F6.2

If two magnetometers were not deployed, the fields containing the observed magnetic value for magnetometer 2 and the separation distance between the magnetometers will be zero.

AQU1

COLS	FIELD NAME	FORMAT
1	record type indicator	I1
2-3	day	I2
4-5	month	I2
6-7	year	I2
8-11	time of day (GMT as HHMM)	I4
8-9	hour	I2
10-11	minute	I2
12	tenths of minute	I1
13-18	velocity north (knots)	F6.2
20-25	velocity east (knots)	F6.2
27-33	observed gravity value (milligals)	F7.1
35-39	observed magnetic value (gammas)	I5
41-45	corrected depth (meters)	I5

Record-Type Indicators:

1 = data record
9 = end of reel or end of data

CALCM

COLS	FIELD NAME	FORMAT
1-2	ship	A2
3-5	cruise number	I3
6-8	time zone	I3
10-13	year	I4
15-16	day	I2
17-18	month	I2
20-25	time of day (GMT as HHMM.T)	F6.1
20-21	hour	I2
22-25	minute and tenths of minute	F4.1
26-32	latitude (decimal degrees)	F7.4
33-40	longitude (decimal degrees)	F7.4
42-47	observed magnetic value (gammas)	F6.0
48-53	regional magnetic value (gammas)	F6.0
54-58	magnetic anomaly (gammas)	I5
59-61	altitude	F3.1
62-68	distance along track (kilometers)	F7.2
70-72	ship's heading (degrees)	I3
73-76	ship's speed (knots)	I4
77-83	2nd observed magnetic value (gammas)	F6.0
84-91	separation distance (meters)	F6.2
92-106	gradient (gammas/km)	E15.7

DFS5

COLS	FIELD NAME	FORMAT
1-3	julian day	I2
5-6	hour of day	I2
8-9	minutes of day	I2
11-12	seconds of day	I2
14-16	milli-seconds of day	I3
18-21	North Star Loran-C repitition rate	I4
23-31	North Star Time Delay - station 1	F8.1
32-39	North Star Time Delay - station 2	F8.1
41-48	North Star Time Delay - station 3	F8.1
50-57	North Star Time Delay - station 4	F8.1
59-67	Mini-ranger - station 1	F8.1
69-75	Mini-ranger - station 2	F8.1
77-81	DFS-V shotpoint value	I5
83-91	North Star latitude position (decimal degrees)	F9.4
93-101	North Star longititude position (decimal degrees)	F9.4

SHIP is a 2-character ASCII abbreviation for the name of the ship.

CRUISE NUMBER is the leg number of the cruise.

If two magnetometers were deployed, SEPARATION DISTANCE is the distance in meters between the magnetometers.

EASYD

The EASYD format is a simplified format for the keypunching of bathymetry data and consists of 3 different record types. Record-type 1 is always 9900 and indicates a change in date or time zone and is immediately followed by a type-2 record that indicates the date and time zone. Record-type 3 contains time and uncorrected depth values. Record-types 1 and 2 must be the first two records in the data file and may be followed by any number of type-3 records. Record-types 1 and 2 must be present at a change of date or time zone and may again be followed by any number of type 3-records.

COLS	FIELD NAME	FORMAT

Record-type 1:

1-4	change indicator 9900	I4

Record-type 2:

1-2	day	I2
3-4	month	I2
5-6	year	I2
8-10	time zone	I3

Record Type 3:

1-4	time of day (GMT as HHMM)	I2
1-2	hour of day	I2
3-4	minutes of day	I2
5	tenths of minutes	I1
6-10	uncorrected depth values	I5

Uncorrected depth values may be recorded in either meters or fathoms.

EASYG

The EASYG format is a simplified keypunching format for raw gravity records and consists of 3 different record types. Record-type 1 is always 9900 and indicates a change in the date or the gravity or magnetic range initialization and is immediately followed by a type-2 record that indicates the date and gravity and magnetics range. Record-type 3 contains time and observed gravity values. Record-type 3 has two different formats. Format 3A allows for the ship's velocity north and east to be recorded. Format 3B allows for recording the ship's motion as speed and heading vectors.

The format also allows for observed magnetic values to be included with the gravity. However, if the user has only observed magnetic data he or she may prefer to use the EASYM format. In the EASYG data file, record-types 1 and 2 must be the first two records in the data file and may be followed by any number of type-3 records. Record-types 1 and 2 must be present at a change of date or a change in the gravity or magnetic range. They may again be followed by any number of type-3 records.

COLS	FIELD NAME	FORMAT

Record-type 1:

1-4	change indicator 9900	I4

Record-type 2:

1-2	day	I2
3-4	month	I2
5-6	year	I2
8-10	gravity range (milligals)	I3
12-13	magnetics range (gammas)	I2

Record-type 3A:

1-4	time of day (GMT as HHMM)	I2
1-2	hour of day	I2
3-4	minutes of day	I2
6-9	observed gravity (milligals)	F4.1
11-16	velocity north (knots)	F6.2
18-23	velocity east (knots)	F6.2

25-27 observed magnetic value (gammas)   I3

Record-type 3B:

        1-4   time of day (GMT as HHMM)   I2
        1-2   hour of day   I2
        3-4   minutes of day   I2
        6-9   observed gravity value (milligals)   F4.1
        11-16 ship's speed (knots)   F6.2
        18-23 ship's heading (degrees)   F6.2
        25-27 observed magnetic value (gammas)   I3

RANGE is the medium-order digits of the observed value and OBSERVED values are the 3 low-order digits. Example:

        980326.4 milligals

        9 - implied
        803 - range
        26.4 - observed gravity

EASYM

The EASYM format is a simplified keypunching format for observed magnetic values and consists of 3 different record types. Record-type 1 is for date and/or time-zone initialization. Record-type 2 contains time and observed magnetic values in gammas. Record-type 1 must be the first record in the data file and may be followed by any number of type-2 records. Record-type 3 indicates a change in date or time zone. Record-types 1 and 3 must be present at a change of date or time zone and may, again, be followed by any number of type 2-records.

COLS	FIELD NAME	FORMAT

Record-type 1:

COLS	FIELD NAME	FORMAT
1-2	day	I2
4-5	month	I2
7-8	year	I2
10-12	time zone	I3

Record-type 2:

COLS	FIELD NAME	FORMAT
1-4	time of day (GMT as HHMM)	I2
1-2	hour of day	I2
3-4	minutes of day	I2
6-10	observed magnetic value (gammas)	I5

Record-type 3:

COLS	FIELD NAME	FORMAT
1-2	change indicator 99	I2

FIXSE

COLS	FIELD NAME	FORMAT
1-2	day	I2
3-4	month	I2
5-6	year	I2
7-10	time of day (GMT as HHMM)	I4
7-8	hour of day	I2
9-10	minutes of day	I2
11	tenths of minute	I1
12-14	time zone	I3
16-18	degrees latitude	I3
20-26	decimal minutes latitude	F7.3
27-30	degrees longitude	I4
32-38	decimal minutes longitude	F7.3
39	K79 indicator	I1
40	K80 indicator	I1
42	KFT1 descriptor	I1
43	KFT2 descriptor	I1
44	KFQ descriptor	I1

Indicators:

K79 - indicates the quality of EM log velocity data

> 0 = normal
> 1 = velocity data following this fix, until next fix with K79*=0, are in error
>   and should be replaced by dead-reckoned velocities.

K80 - indicates fix usability

> 0 = normal
> 1 = first good fix in a group; used with K80*=9
> 7 = non-satellite fix to be used for gravity processing
> 9 = last good fix in a group; used with K80*=1

Fix-acquisition descriptors:

> KFT1 - primary fix type or first of a pair of fix types
> 0 = unspecified
> 1 = dead-reckoned
> 2 = visual

3 = radar
4 = celestial
5 = Loran-A
6 = Loran-C
7 = VLF
8 = Omega
9 = satellite

KFT2 - second fix type, if any, for combination of fixes.

Uses same fix-type numbers as KFT1.

KFQ - estimated fix quality

0 = unspecified
1 = excellent
2 = good
3 = fair
4 = poor
5 = test (may be good or bad)

MBATR

COLS	FIELD NAME	FORMAT
1-2	day	I2
3-4	month	I2
5-6	year	I2
7-11	time of day (GMT as HHMMT)	I4
7-8	hour of day	I2
9-10	minute of day	I2
11	tenths of minute	I1
12-14	time zone	I3
16-20	uncorrected depth (fathoms)	I5
22-23	Matthews' table correction number	I2
26-30	corrected depth (fathoms)	I5
33-37	corrected depth (meters)	I5
39-46	latitude (decimal degrees)	F8.4
47-55	longitude (decimal degrees)	F9.4
56-63	distance along track (kilometers)	F8.2
64-66	ship's heading (degrees)	I3
68-71	ship's speed (knots)	F4.1

UNCORRECTED DEPTH:

Raw water depth recorded in fathoms.

MATTHEWS' TABLE CORRECTION:

Number of Matthews' table correction applied to depth values. If no Matthews' table correction was applied, field is zero.

CORRECTED DEPTH:

Depth values in both fathoms and meters after Matthews' table corrections were applied. If Matthews' table corrections were not applied, then fields are zero.

NAVC7

COLS	FIELD NAME	FORMAT
1-2	day of left fix	I2
3-4	month of left fix	I2
5-6	year of left fix	I2
7-10	time of left fix (GMT as HHMM)	I4
7-8	hour of left fix	I2
9-10	minute of left fix	I2
11-19	latitude of left fix (radians)	F9.6
20-28	longitude of left fix (radians)	F9.6
29	K79 indicator of left navigation fix	I1
30	K80 indicator of left navigation fix	I1
32-33	day of right fix	I2
34-35	month of right fix	I2
36-37	year of right fix	I2
38-41	time of right fix (GMT as HHMM)	I4
38-39	hour of right fix	I2
40-41	minute of right fix	I2
42-50	latitude of right fix (radians)	F9.6
51-59	longitude of right fix (radians)	F9.6
60	K79 indicator of right navigation fix	I1
61	K80 indicator of right navigation fix	I1

The K79 and K80 indicators are carried over from the FIXSE data input to program ATS1.

SEAG

COLS	FIELD NAME	FORMAT
1	record type	I1
2-3	day	I2
4-5	month	I2
6-7	year	I2
8-11	time of day (GMT as HHMM)	I4
8-9	hour of day	I2
10-11	minute of day	I2
12-14	time zone	I3
15-23	latitude (radians)	F9.6
24-32	longitude (radians)	F9.6
33-37	ship's velocity north (knots)	I5
38-42	ship's velocity east (knots)	I5
43-49	observed gravity (milligals)	F7.1
50-54	free-air anomaly (milligals)	F5.1
55-59	Bouguer anomaly (milligals)	F5.1
60-64	current velocity north (knots)	I5
65-69	current velocity east (knots)	I5
70-74	corrected depth (meters)	I5
75-77	depth correction (meters)	I5
78-79	Matthews' table correction number	I2
80-84	observed magnetic value (gammas)	I5
85-89	Eotvos correction (milligals)	F5.1

Record Type:

> 1 = data processed using 1930 International gravity formula
> 2 = data processed using 1967 International gravity formula
> 9 = end of reel or data

OBSERVED GRAVITY:

> Total gravity field in milligals. The value is corrected for the Eotvos factor and may have been corrected for gravity-meter drift and for bias. Free-air and Bouguer anomalies have not been applied.

FREE-AIR ANOMALY:

> The calculated gravity anomaly, in milligals, at data point. If data not available, the field equals 9999.

BOUGUER ANOMALY:

If depth data are present, the Bouguer anomaly, in milligals, at data point. If data not available, field equals 9999.

VELOCITY OF CURRENT NORTH & EAST:

The difference between velocities calculated from the navigation fixes and those taken from the EM log.

MATTHEWS' TABLE:

Matthews' table reference number 1-52.

OBSERVED MAGNETIC VALUE:

If available, observed magnetic value for data point.

EOTVOS CORRECTION:

The Eotvos correction that was applied to the raw gravity data.

SEDEP

COLS	FIELD NAME	FORMAT
1-2	day	I2
3-4	month	I2
5-6	year	I2
7-11	time of day (GMT as HHMMT)	I4
7-8	hour of day	I2
9-10	minute of day	I2
11	tenths of minute	I1
12-14	time zone	I3
16-20	uncorrected depth (fathoms)	I5
22-23	Matthews' table correction number	I2
26-30	corrected depth (fathoms)	I5
33-37	corrected depth (meters)	I5

UNCORRECTED DEPTH:

Raw water depth recorded in fathoms.

MATTHEWS' TABLE CORRECTION:

Number of Matthews' table correction applied to depth values. If no Matthews' table correction was applied, field is zero.

CORRECTED DEPTH:

Depth values in both fathoms and meters after Matthews' table corrections were applied. If Matthews' table corrections were not applied, then fields are left zero.

TSD

A TSD file consists of two types of records. The first type, which must be the first record in the data file, is the header record. This record provides for general identification and run-time definition of the data records. The second record type is the actual data record. The header record may be followed by any number of data records. The data records are blocked, and each block contains an integral number of logical records as defined in the header record. Each logical data record contains the date and time and the appropriate data values. Values may be flagged to indicate the absence of data. (G.I. Evenden, unpub. data, 1976)

USGS TSD CHANNEL DEFINITIONS

```
 500      WINS LINE NUMBER
 600      WINS 2-SECOND FLAGS- 2 WORDS/2SECS.
1080      WINS DISCRETE STATUS BITS (SONAR/LORAN)
1081      WINS SYSTEM MODE
1050      WINS VELOCIMETER CONSTANT, METERS.
1051      WINS VELOCIMETER COUNT.
1100      WINS SYSTEM POSITION (LAT-LON, RADIANS)
1101      WINS SYSTEM VELOCITY (VN-VE, KNOTS)
1102      WINS SYSTEM HEADING (RADIANS COUNTERCLOCKWISE FROM
          TRUE NORTH
1115      WINS MANUAL UPDATE POSITION (LAT-LON, RADIANS)
1120      WINS SYSTEM UPDATE (LAT-LON)
1130      WINS CORRECTED SYSTEM POSITION (LAT-LON, RADIANS)
1135      COMPUTED POSITION OUTPUT PROGRAM LORTS (LAT-LON,
          RADIANS)
1136      COMPUTED POSITION OUTPUT PROGRAM XYNAV (LAT-LON,
          RADIANS)
1200      WINS SATELLITE FIX (LAT-LON, RADIANS)
1210      WINS ELEV ANGLE, LAST SATELLITE. (DEG.)
1211      WINS FIX TIME OF LAST SATELLITE (MINUTES)
1220      WINS SAT. MISS ACCEPTANCE RAD. (FEET)
1300      WINS GYRO POSITION (LAT-LON, RADIANS)
1301      WINS GYRO VELOCITY (VN-VE, KNOTS)
1302      WINS GYRO HEADING
1303      WINS GYRO ALIGNMENT ANGLE.
1400      WINS RHO-RHO LORAN POSITION (LAT-LON, RADIANS)
1401      WINS RHO-RHO LORAN VELOCITY (VN-VE, KNOTS)
1410      WINS LORAN STATION CODES.
1411      WINS LORAN RAW-DATA WORDS.
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1412	WINS FILTERED & CORRECTED TIME DELAY VALUES FOR LORAN-C SLAVES A AND B
1413	WINS SECONDARY PHASE CORRECTION - MASTER (MSECS)
1414	WINS SECONDARY PHASE CORRECTION - A (MICROSECS)
1415	WINS SECONDARY PHASE CORRECTION - B (MICROSECS)
1416	WINS CORA (MICROSECONDS)
1417	WINS CORB (MICROSECONDS)
1450	WINS HYPERBOLIC LORAN POSITION (LAT-LON, RADIANS)
1465	WINS HYPERBOLIC UPDATE POSITION (LAT-LON, RADIANS)
1500	NORTH STAR 6000 POSITION (LAT-LON, RADIANS)
1501	NORTH STAR TIME DELAY STATION 1 (MICROSECONDS)
1502	NORTH STAR TIME DELAY STATION 2 (MICROSECONDS)
1503	NORTH STAR TIME DELAY STATION 3 (MICROSECONDS)
1504	NORTH STAR TIME DELAY STATION 4 (MICROSECONDS)
1510	NS MASTER FLAG WORDS (STATION-CYCLE-SNR ERRORS)
1511	NS STATION 1 FLAG WORDS (STATION-CYCLE-SNR ERRORS)
1512	NS STATION 2 FLAG WORDS (STATION-CYCLE-SNR ERRORS)
1513	NS STATION 3 FLAG WORDS (STATION-CYCLE-SNR ERRORS)
1514	NS STATION 4 FLAG WORDS (STATION-CYCLE-SNR ERRORS)
1520	NORTH STAR SIGNAL TO NOISE RATIO (SNR) - MASTER
1521	NORTH STAR SIGNAL TO NOISE RATIO (SNR) - STATION 1
1522	NORTH STAR SIGNAL TO NOISE RATIO (SNR) - STATION 2
1523	NORTH STAR SIGNAL TO NOISE RATIO (SNR) - STATION 3
1524	NORTH STAR SIGNAL TO NOISE RATIO (SNR) - STATION 4
1530	NORTH STAR REPETITION RATE - MASTER
1531	NORTH STAR I.D. - STATION 1 (W-X-Y-Z)
1532	NORTH STAR I.D. - STATION 2 (W-X-Y-Z)
1533	NORTH STAR I.D. - STATION 3 (W-X-Y-Z)
1534	NORTH STAR I.D. - STATION 4 (W-X-Y-Z)
1540	NS RHO-RHO LORAN-C
1550	NS CORRECTED SYSTEM POSITION (LAT-LON, RADIANS)
1600	WINS DOPPLER-SONAR POSITION (LAT-LON, RADIANS)
1601	WINS DOPPLER-SONAR VELOCITY (VN-VE, KNOTS)
1650	WINS WATER-TRK SONAR POSITION (LAT-LON, RADIANS)
1652	WINS WATER-TRK SONAR ALIGNMENT ANGLE
3010	WINS WATER VELOCITY (VN-VE, KNOTS)
3011	WINS WATER TEMPERATURE (CELSIUS)
3020	WINS FATHOMETER
5110	WINS MAGNETOMETER 1 (GAMMAS)
5111	WINS MAGNETOMETER 2 (GAMMAS)
5115	WINS MAGNETOMETER SEPARATION (METERS)
5210	WINS VELOCITY COMMON FILTER (SECONDS)
5211	WINS 10 SEC. VELOCITY (VN-VE, KNOTS)
5212	WINS 20 SEC. VELOCITY (VN-VE, KNOTS)
5310	WINS SHOT POINT NUMBER
5311	WINS SEISMIC IDENTIFICATION

5800	WINS GRAVITY TIME LAG (SECONDS)
5801	WINS GRIM - NAV. MODE SELECTION
5802	WINS RAW GRAVITY (MILLIGALS - 970000.00)
5803	WINS EOTVOS CORRECTION (MILLIGALS)
5804	WINS FREE-AIR ANOMALY (MILLIGALS)
5805	WINS CORRECTED GRAVITY (MILLIGALS - 970000.00)
5806	WINS POSITION (LAT-LON, RADIANS)
5807	WINS GRAVITY VELOCITY (VN&VE, KNOTS)
5810	WINS LA COSTE & ROMBERG GRAVITY
6000	DFS5 SHOT POINT NUMBER
6010	DFS5 LINE NUMBER
7000	NGSDC POSITION (LAT-LON, RADIANS)
7010	NGSDC NAV POINT IDENTIFICATION (0, 1 OR 2)
7011	NGSDC POSITION TYPE
7015	NGSDC FIX DESCRIPTION
7100	NGSDC CRUISE IDENTIFIER
7200	NGSDC TIME ZONE
7300	NGSDC AZIMUTH OF CURRENT (DEGREES)
7310	NGSDC VELOCITY OF CURRENT (KNOTS)
7400	NGSDC DEPTH (UNCORRECTED FATHOMS)
7405	NGSDC BATHYMETRY TYPE CODE
7410	NGSDC DEPTH (CORRECTED METERS)
7420	NGSDC MATTHEWS' TABLE CORRECTION NUMBER
7430	NGSDC BATHYMETRY CORRECTION CODE
7440	NGSDC BATHYMETRY 2-WAY TRAVEL TIME (SECONDS)
7500	NGSDC TOTAL MAGNETIC INTENSITY SENSOR #1 (GAMMAS)
7505	NGSDC TOTAL MAGNETIC INTENSITY SENSOR #2 (GAMMAS)
7510	NGSDC RESIDUAL MAGNETIC INTENSITY (GAMMAS)
7515	NGSDC SENSOR USED FOR RESIDUAL FIELD
7530	NGSDC MAGNETICS DIURNAL CORRECTION
7540	NGSDC DEPTH OF LEAD MAGNETIC SENSOR
7600	NGSDC FREE-AIR ANOMALY (MILLIGALS)
7610	NGSDC OBSERVED GRAVITY (MILLIGALS)
7620	NGSDC EOTVOS CORRECTION
7700	NGSDC SHOT POINT ID
7801	NGSDC GRAVITY QUALITY CODE
7802	NGSDC MAGNETIC QUALITY CODE
7803	NGSDC BATHYMETRY QUALITY CODE
7804	NGSDC NAVIGATION QUALITY CODE