NATIONAL GEOPHYSICAL DATA CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

THE MARINE GEOPHYSICAL DATA EXCHANGE FORMAT - MGD77T / Legacy MGD77

(Bathymetry, Magnetics, Gravity and Seismics Navigation)

KEY TO GEOPHYSICAL RECORDS DOCUMENTATION NO. 10 (REVISED)

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I. INTRODUCTION

In January of 1977, a group of 24 geophysical data managers from academia, government, industry and foreign countries participated in a workshop at the National Geophysical Data Center (NGDC) in Boulder, Colorado. The "Workshop for Marine Geophysical Data Formats" established the basic outline of a new format for the exchange of digital underway geophysics data. A six member task force was formed to work with NGDC in implementing the decisions of the workshop into the new format. By the end of 1977 the "MGD77" format was being disseminated by NGDC as its standard exchange format.

The "MGD77" format has experienced much success over the past 30 years. It has been sanctioned by the Intergovernmental Oceanographic Commission (IOC) as an accepted standard for international data exchange, and it has been translated into French, Japanese, and Russian. Most contributors of data to NGDC now send transfer data over the internet in the "MGD77" format.

This newest revision adds a tab-delimited version of the format: “MGD77T”. This allows expanded field lengths, space savings, and easier import into spread sheets, DBMS databases, and various low-level programs.

II. GENERAL DESCRIPTION

The digital format presented, and referred to as "MGD77" or “MGD77T”, is an exchange format for marine geophysical data (bathymetry, magnetics, gravity and seismic navigation). The format is intended to be used for the transmission of data to and from a data center and may be useful for the exchange of data between marine institutions, and to be used by various software programs as an import or export format. Data is to be exchanged as files, a header (documentation) file and a data file for each survey operation. Generally each survey operation is a port-to-port operation of a survey vessel, but in some cases several port-to-port operations of the same vessel are combined into a single survey operation, especially if this is the manner of organizing the data at the contributing institution. Data may be exchanged via the Internet or on various mass storage devices such as magnetic tapes, removable disks and DVDs. The National Geophysical Data Center uses the World Wide Web as its chief method of distribution of these data.

Data Exchange

1. For exchange of MGD77/MGD77T data participants shall establish type and format of the media to be exchanged and method of distribution.

2. For MGD77T (and ideally for MGD77), the Header Record(s) and the data records will be contained in separate files.

3. Each survey operation shall have one MGD77T tab-delimited Header record with a tab following header fields (and a single end-of-record character) or, for Legacy MGD77, one MGD77 Header consisting of 24 80-character logical records (thus 24 end-of-record characters). For Legacy MGD77, unspecified header fields are filled with spaces, and these MGD77 header records can optionally be attached to the beginning of a combined Header/Data MGD77 file. For MGD77T, unspecified fields will contain zero characters (field-ending tab follows previous tab immediately). Tabs are generally omitted for any trailing unspecified fields, including the tab for the last specified field.

4. The MGD77/MGD77T data records are sequentially and chronologically organized until the end of the file. The data records are 120 logical characters for Legacy MGD77, or varying length for MGD77T with a tab following the data fields. (Each record is followed by an end-of-record character.) For Legacy MGD77, unspecified fields are 9’s filled. For MGD77T, unspecified fields will be nil (tab immediately follows previous field’s delimiting tab). Tabs will generally be omitted for any trailing unspecified fields, including the tab for the last specified field (software read statements must be prepared for this).

5. A survey is defined as all observations that conveniently constitute a survey operation (e.g., a port-to-port survey or in some cases several surveys). A survey file ideally should not span two media or 2 file sets.

III. THE HEADER RECORD – MGD77T

The purpose of the (survey) Header Record is to document the content of the geophysical data contained within the data records. In general, documentation that is constant throughout the survey will be in the Header Record, while data that is variable will be in the Data Records.

The Header Record contains fields which are numeric and freely formatted text. Each field is followed by a tab character. Unspecified or unused fields are nil (a tab immediately follows the previous field). Tabs are generally omitted for any trailing unspecified fields, including the tab for the last specified field.

MGD77T headers for groups of surveys can be contained in a single file or in separate files (one file per survey). Generally the grouping method will be the same as that of the MGD77T data files.

The MGD77T survey header(s) file may optionally have a **heading record** of **field identifiers** as the first record of the file, followed by the actual survey header(s). The field identifier names offered in this format description below are not to be considered as the "official" field identifier names. Users may offer their own field id names, or not insert a heading record in the survey header(s) file. However, the use of name "FORMAT_77" as the second field identifier of the first record of the file will make it easy for applications to determine that this record is a heading record for a MGD77T survey header(s) file in the same way that "MGD77T" in the second field of a record identifies the record as a MGD77T survey header record.

Format Conventions for the MGD77T Header Record:

1. For floating pt numbers, all decimal points are **explicit** (e.g. 123.456 signifies a value of +123.456)

2. Leading zeros and blanks are discouraged in numeric fields. Trailing blanks in numeric fields are not allowed.

3. Where floating pt values are whole numbers, the decimal part/decimal pt are not required.

4. In floating pt values, trailing zeros after the last significant digit past the decimal are not required.

5. Unspecified fields are **nil** (tab immediately follows previous field's delimiting tab).

6. All plain language fields should be trimmed of beginning and ending blanks.

7. All "corrections", (such as gravity tare and drift) are understood to be **added**.

8. An End-of-Line (End-of-Record) character follows the last field. Embedded End-of-Line characters within fields are not allowed.

The following is a detailed description of the Header Record for MGD77T. Fields can be of type integer, floating point or character. Fields that always represent whole numbers are designated as integers. Fields that may contain a decimal component are float, and fields that are alphanumeric are character.

[field #]	Type	FIELD_ID	Description
[1]	char	SURVEY_ID	SURVEY IDENTIFIER Identifier supplied by the contributing organization, else given by NGDC in a manner which represents the data. Identical to same in data record.
[2]	char	FORMAT_77	FORMAT ACRONYM - Set to “MGD77T”
[3]	char	CENTER_ID	DATA CENTER FILE NUMBER Survey identifier bestowed by the data center.
[4]	char	PARAMS_CO	PARAMETERS SURVEYED CODES Status of geophysical parameters for this survey. This field must be nil, or exactly 5 characters. nil – entire field unspecified COL. PARAMETER SURVEYED 1 - bathymetry 2 - magnetics 3 - gravity 4 - high-resolution seismics 5 - deep penetration seismics _____ CODE - (for columns 27-31) 0 - unspecified 1 - Parameter NOT surveyed 3 - Parameter surveyed, not in file 5 - Parameter surveyed, in file
[5]	int	DATE_CREAT	FILE CREATION DATE - YYYYMMDD Date data records were last altered/assimilated
[6]	char	INST_SRC	SOURCE INSTITUTION Organization which collected the data or contributor if collector not definitive.
[7]	char	COUNTRY	COUNTRY
[8]	char	PLATFORM	PLATFORM NAME
[9]	int	PLAT_TYPCO	PLATFORM TYPE CODE nil – Unspecified 1 - Surface ship 2 - Submersible ship 3 – Aircraft 4 – Buoy 5 - Mobile land 6 - Fixed land (Station) 7 - Deep tow 8 - Anchored seafloor instrument 9 - Other, specify in next field
[10]	char	PLAT_TYP	PLATFORM TYPE e.g., "Ship","Plane", "Submarine", “Station”,etc.
[11]	char	CHIEF	CHIEF SCIENTIST(S)
[12]	char	PROJECT	PROJECT, CRUISE, LEG e.g., "Survops 6-69", "Indopac, Leg3"

[13]	char	FUNDING	FUNDING i.e. agency or institution
[14]	int	DATE_DEP	SURVEY DEPARTURE DATE - YYYYMMDD
[15]	char	PORT_DEP	PORT OF DEPARTURE i.e. city, country
[16]	int	DATE_ARR	SURVEY ARRIVAL DATE - YYYYMMDD
[17]	char	PORT_ARR	PORT OF ARRIVAL i.e. city, country
[18]	char	NAV_INSTR	NAVIGATION INSTRUMENTATION e.g. "Sat/LORAN A/Sextant"
[19]	char	POS_INFO	POSITION DETERMINATION METHOD / GEODETIC DATUM e.g. "WGS84/Primary-Satellite, Secondary-LORAN A"
[20]	char	BATH_INSTR	BATHYMETRY INSTRUMENTATION Include information such as frequency, beam width, and sweep speed of recorder.
[21]	char	BATH_ADD	ADDITIONAL FORMS OF BATHYMETRY e.g., "Microfilm","Analog records"
[22]	char	MAG_INSTR	MAGNETICS INSTRUMENTATION e.g., "Proton Precession Mag-GEOMETRICS G-801" or “Airborne AN/ASQ-81 scalar magnetometer, Total Field 1 and Total Field 2 record values are Uncorrected and Corrected”.
[23]	char	MAG_ADD	ADDITIONAL FORMS OF MAGNETICS e.g., "punch tape","analog records"
[24]	char	GRAV_INSTR	GRAVITY INSTRUMENTATION e.g., "L&R S-26"
[25]	char	GRAV_ADD	ADDITIONAL FORMS OF GRAVITY DATA e.g., "Microfilm","Analog records "
[26]	char	SEIS_INSTR	SEISMIC INSTRUMENTATION Include the size of the sound source, the recording frequency filters, and the number of channels e.g., "1700 cu. in., Airgun, 8-62 Hz, 36 Channels"
[27]	char	SEIS_FRMTS	FORMATS OF SEISMIC DATA e.g., "Digital SEG-Y", "Mylar Sections", etc.
[28]	float	LAT_TOP	NORTHBOUND LATITUDE OF SURVEY
[29]	float	LAT_BOTTOM	SOUTHBOUND LATITUDE OF SURVEY
[30]	float	LON_LEFT	WESTBOUND LONGITUDE OF SURVEY Between -180 and 180 degrees
[31]	float	LON_RIGHT	EASTBOUND LONGITUDE OF SURVEY Between -180 and 180 degrees
[32]	float	BATH_DRATE	GENERAL DIGITIZING RATE OF BATHYMETRY

			In minutes. The rate which is present within the data records; e.g., if values were coded every 30 seconds, set to 0.5
[33]	char	BATH_SRATE	GENERAL SAMPLING RATE OF BATHYMETRY This rate is instrumentation dependent; e.g., "1/Second"
[34]	float	SOUND_VEL	ASSUMED SOUND VELOCITY In meters per second. Historically, in the U.S., this speed has been 800 fathoms/sec, which equals 1463.3 meters/sec.; current recorders generally have a calibration of 1500 meters/sec; e.g. 1500
[35]	int	VDATUM_CO	BATHYMETRIC VERTICAL DATUM CODE - 00 - No correction applied 01 - Lowest normal low water 02 - Mean lower low water 03 - Lowest low water 04 - Mean lower low water spring 05 - Indian spring low water 06 - Mean low water spring 07 - Mean sea level 08 - Mean low water 09 - Equatorial spring low water 10 - Tropic lower low water 11 - Lowest astronomical tide 88 - Other, specify in Add. Doc.
[36]	char	BATH_INTRP	INTERPOLATION SCHEME This field allows for a description of the interpolation scheme used, should some of the data records contain interpolated values; e.g., "5-minute intervals and peaks and troughs"
[37]	float	MAG_DRATE	GENERAL DIGITIZING RATE OF MAGNETICS In minutes. The rate which is present within the data records.
[38]	float	MAG_SRATE	GENERAL SAMPLING RATE OF MAGNETICS In seconds. This rate is instrumentation dependent e.g., if the pulse rate is every 3 sec, set to 3
[39]	float	MAG_TOWDST	MAGNETIC SENSOR TOW DISTANCE In meters. The distance from the navigation reference to the leading sensor.
[40]	float	MAG_SNSDEP	SENSOR DEPTH In meters. This is the average depth (positive) of the lead magnetic sensor, or flight altitude (negative) if data is aeromagnetics.
[41]	float	MAG_SNSSEP	HORIZONTAL SENSOR SEPARATION In meters. Where two sensors are used.
[42]	int	M_REFFL_CO	REFERENCE FIELD CODE This is the reference field used to determine the residual magnetics: 00 - Unused 01 - AWC 70 02 - AWC 75 03 - IGRF-65

			04 - IGRF-75 05 - GSFC-1266 06 - GSFC (POGO) 0674 07 - UK 75 08 - POGO 0368 09 - POGO 1068 10 - POGO 0869 11 - IGRF-80 12 - IGRF-85 13 - IGRF-90 14 - IGRF-95 15 - IGRF-00 16 - IGRF-05 17 - IGRF-10 18 - IGRF-11 88 - Other, specify nil – Unspecified reference field code
[43]	char	MAG_REFFLD	REFERENCE FIELD e.g., "IGRF-85"
[44]	char	MAG_RF_MTH	METHOD OF APPLYING RESIDUAL FIELD The procedure used in applying this reduction to the data; e.g., "Linear Interp. in 60-mile Square"
[45]	float	GRAV_DRATE	GENERAL DIGITIZING RATE OF GRAVITY In minutes. The rate present within the data records
[46]	float	GRAV_SRATE	GENERAL SAMPLING RATE OF GRAVITY In seconds. This rate is instrumentation dependent. If recording is continuous, set to 0
[47]	int	G_FORMU_CO	THEORETICAL GRAVITY FORMULA CODE 1 - Heiskanen 1924 2 - International 1930 3 - IAG System 1967 4 - IAG System 1980 8 - Other, specify
[48]	char	GRAV_FORMU	THEORETICAL GRAVITY FORMULA e.g., "International '30", "IAG System 1967", etc.
[49]	int	G_RFSYS_CO	REFERENCE SYSTEM CODE Identifies the reference field: 1 - Local system, specify 2 - Potsdam system 3 - System IGSN 71 9 - Other, specify
[50]	char	GRAV_RFSYS	REFERENCE SYSTEM e.g., "Potsdam System", "System IGSN 71", etc.
[51]	char	GRAV_CORR	CORRECTIONS APPLIED Drift, tare and bias corrections applied; e.g. "+0.075 mgal per day
[52]	float	G_ST_DEP_G	DEPARTURE BASE STATION GRAVITY In milligals. At sea level - Network value preferred.
[53]	char	G_ST_DEP	DEPARTURE BASE STATION DESCRIPTION Indicates name and number of station

[54]	float	G_ST_ARR_G	ARRIVAL BASE STATION GRAVITY In milligals. At sea level - Network value preferred.
[55]	char	G_ST_ARR	ARRIVAL BASE STATION DESCRIPTION Indicates name and number of station
[56]	int	IDS_10_NUM	NUMBER OF 10-DEGREE IDENTIFIERS This is the number of 4-digit 10-degree identifiers which will follow this field, excluding the "9999" flag. (see APPENDIX A)
[57]	char	IDS_10DEG	10-DEGREE IDENTIFIERS A series of 4-digit codes, separated by commas, which identify the 10-degree squares through which the survey collected data (see APPENDIX A). Code "9999" after last identifier.
[58]	char	ADD_DOC	ADDITIONAL DOCUMENTATION Information concerning this survey not contained in other header fields. Embedded End-of-Line characters are NOT ALLOWED.

IV. THE DATA RECORD – MGD77T

The data record presents underway marine geophysical data in a correlative manner. Geophysical data (bathymetry, magnetics, and gravity) and line/point identification (e.g. seismic line and shot-point ids) are presented with a corresponding time and position. Documentation that is variable throughout the survey also is included within each data record. If primary navigation exists at a juncture where no geophysical data are present, this record should be included with the data parameter fields left unspecified (nil).

MGD77T data files for groups of surveys can be contained in a single file, or in separate files (one file per survey). Generally the grouping method will be the same as that of the MGD77T header files.

Format Conventions for the MGD77T Data Record:

1. For floating pt numbers, all decimal points are **explicit** (e.g. 123.456 signifies a value of +123.456)

2. Leading zeros and blanks are discouraged in numeric fields. Trailing blanks in numeric fields are not allowed.

3. Where float values are whole numbers, the decimal part/decimal pt are not required.

4. In floats, trailing zeros after the last significant digit past the decimal are not required.

5. Unspecified fields are **nil** (tab immediately follows previous field's delimiting tab).

6. All character fields should be trimmed of beginning and ending blanks.

7. Trailing tabs (trailing unspecified values) are generally omitted, including the tab for the last specified (used) field.

8. All "corrections", such as time zone, diurnal magnetics, and Eotvos, are understood to be **added** (e.g., time-zone correction is the number of hours which must be added to the recorded time to determine GMT).

9. For field values which differ from the definitions below, use the Additional Documentation to describe how the values were arrived at.

10. A Column Heading record will generally be the first record of each data file. This can be omitted. The suggested Field Ids of the data records should be considered, as they work well with GEODAS and other software, and as shape file descriptors.

The following is a detailed description of the MGD77T Data Record. Fields can be of type integer, floating point, or character. Fields that always represent whole numbers are described as type **int**; fields that may contain a decimal component are **float**, and fields that are alphanumeric are **char**.

[Field #]	Type	Field Id	Description
[1]	char	SURVEY_ID	SURVEY IDENTIFIER Identifier supplied by the contributing organization, else given by NGDC in a manner which represents the data. Identical to that in MGD77/MGD77T header record.
[2]	float	TIMEZONE	TIME-ZONE CORRECTION In hours. Corrects time (in fields 3-4) to GMT when added: equals zero when time is GMT. Time-zone normally falls between -13 and +12 inclusively.
[3]	int	DATE	DATE (YYYYMMDD) e.g. 19720530
[4]	float	TIME	TIME Hours and decimal minutes i.e. 11:59:40pm = 2359.6667
[5]	float	LAT	LATITUDE in decimal degrees + = North; - = South Between -90 and 90 degrees
[6]	float	LON	LONGITUDE in decimal degrees + = East; - = West Between -180 and 180 degrees
[7]	int	POS_TYPE	POSITION TYPE CODE Indicates how lat/lon was obtained: 1 = Observed fix 3 = Interpolated 4 = Fixed Station nil = Unspecified
[8]	int	NAV_QUALCO	QUALITY CODE FOR NAVIGATION 1 – good 2 – fair 3 – poor 4 – bad 5 – Suspected, by the originating institution 6 – Suspected, by the Data Center nil – Unspecified (Note: - Should Institution code the field as 1 through 5, the data center will not contradict.)
[9]	float	BAT_TTIME	BATHYMETRY, 2- WAY TRAVELTIME In seconds Corrected for transducer depth and other such corrections, especially in shallow water
[10]	float	CORR_DEPTH	BATHYMETRY, CORRECTED DEPTH In (positive) meters. e.g. 1234.56
[11]	int	BAT_CPCO	BATHYMETRIC CORRECTION CODE This code details the procedure used for determining the sound velocity correction to depth: 01-55 – Matthews' Zones with zone 59 – Matthews' Zones, no zone specified

			60 – S. Kuwahara Formula 61 – Wilson Formula 62 – Del Grosso Formula 63 – Carter's Tables 88 – Other (see Add. Doc.) 97 – Computed using 1500 meters/sec 98 – Unknown if Corrected nil – Unspecified
[12]	int	BAT_TYPCO	BATHYMETRIC TYPE CODE Indicates how the bathymetric value was obtained: 1 – Observed 3 – Interpolated nil – Unspecified
[13]	int	BAT_QUALCO	QUALITY CODE FOR BATHYMETRY 1 – good 2 – fair 3 – poor 4 – bad 5 – Suspected bad by Contributor 6 – Suspected bad by Data Center nil - Unspecified
[14]	float	MAG_TOT	MAGNETICS TOTAL FIELD, 1ST SENSOR In nanoteslas; for leading sensor. Use this field for single sensor, or for aeromagnetics this can be the Uncorrected Total Field value (Detail in MAGNETICS INSTRUMENTATION header field).
[15]	float	MAG_TOT2	MAGNETICS TOTAL FIELD, 2ND SENSOR In nanoteslas; for trailing sensor, or for aeromagnetics this can be the Corrected Total Field value, (detail in MAGNETICS INSTRUMENTATION and Additional Documentation header fields).
[16]	float	MAG_RES	MAGNETICS RESIDUAL FIELD In nanoteslas; (reference field used is in Header)
[17]	int	MAG_RESSEN	SENSOR FOR RESIDUAL FIELD 1 - 1st or leading sensor 2 - 2nd or trailing sensor nil – Unspecified (or single sensor)
[18]	float	MAG_DICORR	MAGNETICS DIURNAL CORRECTION - In nanoteslas (gammas). If nil, total and residual fields are assumed to be uncorrected; if used, total and residuals are assumed to have been already corrected with diurnal.
[19]	int	MAG_SDEPTH	DEPTH/ALTITUDE OF MAGNETICS SENSOR In meters. + = Below sea-level, - = Above sea-level
[20]	int	MAG_QUALCO	QUALITY CODE FOR MAGNETICS 1 – good 2 – fair 3 – poor 4 – bad 5 – Suspected bad by Contributor 6 – Suspected bad by Data Center nil - Unspecified
[21]	float	GRA_OBS	OBSERVED GRAVITY

			In milligals Corrected for Eotvos, drift, and tares
[22]	float	EOTVOS	EOTVOS CORRECTION In milligals E = 7.5 V cos(phi) * sin(alpha) + 0.0042 V*V
[23]	float	FREEAIR	FREE-AIR ANOMALY In milligals Free-air Anomaly = G(observed) minus G(theoretical)
[24]	int	GRA_QUALCO	QUALITY CODE FOR GRAVITY 1 – good 2 – fair 3 – poor 4 – bad 5 – Suspected bad by Contributor 6 – Suspected bad by Data Center nil - Unspecified
[25]	char	LINEID	LINE/TRACK/SEGMENT ID Used, for example, to cross reference with seismic data.
[26]	char	POINTID	SEISMIC SHOT-POINT NUMBER/POINT ID

V. THE HEADER RECORD – Legacy MGD77

The purpose of the Header Record is to document both the content and structure of the geophysical data contained within the survey data records. In general, documentation that is constant throughout the survey will be in the Header Record, while documentation that is variable will be in the Data Records.

The Header Record contains fields which are both fixed and freely formatted. For MGD77, the Header consists of a "sequence" of twenty four 80-character images.

Format Conventions for the MGD77 Header Record:

1. For MGD77, all decimal points are **implied** (e.g. 1234 in 10ths of units signifies a value of 123.4); for MGD77T, all decimal points are **explicit** (e.g. 123.456 signifies a value of 123.456)

2. Leading zeros and blanks are equivalent in numeric fields.

3. Unspecified (unknown or unused) fields are to be **blank filled**.

4. All plain language fields should be left justified.

5. All "corrections", such as gravity tare and drift, are understood to be **added**

The following is a detailed description of the Header Record for (legacy) MGD77. Fields can be of type integer, floating point or character. Fields that represent whole numbers are integers. Fields that may contain a decimal component are float, and fields that are alphanumeric are char.

Character Nos.	Length of Field	Type	Description
Sequence No. 1			
1	1	int	RECORD TYPE - Set to "4"
2-9	8	char	SURVEY IDENTIFIER Identifier supplied by the contributing organization, else given by NGDC in a manner which represents the data. Identical to that in data record.
10-14	5	char	FORMAT ACRONYM - Set to"MGD77"
15-22	8	char	DATA CENTER FILE NUMBER Survey identifier bestowed by the data center. First 2 chars indicate the source, first 4 indicate platform.
27-31	5	int	PARAMETERS SURVEYED CODE Status of geophysical parameters for this survey. COLUMN PARAMETER SURVEYED 27 bathymetry 28 magnetics 29 gravity 30 high-resolution seismics 31 deep penetration seismics CODE - (for columns 27-31) 0 or blank - unspecified 1 - Parameter NOT surveyed 3 - Parameter surveyed, not in file 5 - Parameter surveyed, in file
32-39	8	int	FILE CREATION DATE (YYYYMMDD) Date data records were last altered (including century).
40-78	39	char	SOURCE INSTITUTION Organization which collected the data. Include contributor if different from collector.
79-80	2	int	SEQUENCE NUMBER - Set to "01"
Sequence No. 2			
1-18	18	char	COUNTRY
19-39	21	char	PLATFORM NAME
40	1	int	PLATFORM TYPE CODE 0 - Unspecified 1 - Surface ship 2 - Submersible ship 3 - Aircraft 4 - Buoy

			5 - Mobile land 6 - Fixed land (Station) 7 - Deep tow 8 - Anchored seafloor instrument 9 - Other, specify
41-46	6	char	PLATFORM TYPE (e.g., "SHIP","PLANE", "SUB","STATON" etc.)
47-78	32	char	CHIEF SCIENTIST(S)
79-80	2	int	SEQUENCE NUMBER - Set to "02"

Sequence No. 3

1-58	58	char	PROJECT (e.g., "SURVOPS 6-69", "INDOPAC, Leg3")
59-78	20	char	FUNDING (i.e. agency or institution)
79-80	2	int	SEQUENCE NUMBER - Set to "03"

Sequence No. 4

1-8	8	int	SURVEY DEPARTURE DATE (YYYYMMDD)
9-40	32	char	PORT OF DEPARTURE (i.e. city, country)
41-48	8	int	SURVEY ARRIVAL DATE (YYYYMMDD)
49-78	30	char	PORT OF ARRIVAL (i.e. city, country)
79-80	2	int	SEQUENCE NUMBER - Set to "04"

Sequence No. 5

1-40	40	char	NAVIGATION INSTRUMENTATION (e.g. "SAT/LORAN A/SEXTANT")
41-78	38	char	GEODETIC DATUM/POSITION DETERMINATION METHOD (e.g. "WGS84/PRIM - SATELLITE, SEC-LORAN A")
79-80	2	int	SEQUENCE NUMBER - Set to "05"

Sequence No. 6

1-40	40	char	BATHYMETRY INSTRUMENTATION

			Include information such as frequency, beam width, and sweep speed of recorder.
41-78	38	char	ADDITIONAL FORMS OF BATHYMETRIC DATA (e.g., "MICROFILM","ANALOG RECORDS")
79-80	2	int	SEQUENCE NUMBER - Set to "06"

Sequence No. 7

1-40	40	char	MAGNETICS INSTRUMENTATION (e.g., "PROTON PRECESSION MAG-GEOMETRICS G-801" or “Airborne AN/ASQ-81 scalar magnetometer, Total Field 1 and Total Field 2 record values are Uncorrected and Corrected”.)
41-78	38	char	ADDITIONAL FORMS OF MAGNETICS DATA (e.g., "PUNCH TAPE","ANALOG RECORDS")
79-80	2	int	SEQUENCE NUMBER - Set to "07"

Sequence No. 8

1-40	40	char	GRAVITY INSTRUMENTATION (e.g., "L and R S-26")
41-78	38	char	ADDITIONAL FORMS OF GRAVITY DATA (e.g., "MICROFILM", "ANALOG RECORDS")
79-80	2	int	SEQUENCE NUMBER - Set to "08"

Sequence No. 9

1-40	40	char	SEISMIC INSTRUMENTATION Include the size of the sound source, the recording frequency filters, and the number of channels (e.g., "1700 cu. in., AIRGUN, 8-62 Hz, 36 CHANNELS")
41-78	38	char	FORMATS OF SEISMIC DATA (e.g., "DIGITAL", "MICROFILM", "NEGATIVES", etc.)
79-80	2	int	SEQUENCE NUMBER - Set to "09"

Sequence No. 10

1	1	char	FORMAT TYPE Set to "A", which means format contains integers, floating points, and alphanumerics
2-76	75	char	FORMAT DESCRIPTION

			This is one method of reading (not writing) the data in FORTRAN. Set to the following: "(I1,A8,I3,I4,3I2,F5.3,F8.5,F9.5,I1,F6.4, F6.1,I2,I1,3F6.1,I1,F5.1,F6.0,F7.1," (NOTE: continued in sequence no. 11)
79-80	2	int	SEQUENCE NUMBER - Set to "10"

Sequence No. 11

1-19	19	char	FORMAT DESCRIPTION Continued, set to following: "F6.1,F5.1,A5,A6,I1)"
41-43	3	int	NORTHBOUND LATITUDE OF SURVEY ** (to next whole degree)
44-46	3	int	SOUTHBOUND LATITUDE
47-50	4	int	WESTBOUND LONGITUDE
51-54	4	int	EASTBOUND LONGITUDE
79-80	2	int	SEQUENCE NUMBER - Set to "11"

Sequence No. 12

1-3	3	float	GENERAL DIGITIZING RATE OF BATHYMETRY In tenths of minutes. The rate which is present within the data records (e.g., if values were coded every 5 minutes, set to "050")
4-15	12	char	GENERAL SAMPLING RATE OF BATHYMETRY This rate is instrumentation dependent (e.g., "1/SECOND")
16-20	5	float	ASSUMED SOUND VELOCITY In tenths of meters per second. Historically, in the U.S., this speed has been 800 fathoms/sec, which equals 1463.0 meters/sec.; however, some recorders have a calibration of 1500 meters/sec (e.g., "14630")
21-22	2	int	BATHYMETRIC DATUM CODE - 00 - No correction applied 01 - Lowest normal low water 02 - Mean lower low water 03 - Lowest low water 04 - Mean lower low water spring 05 - Indian spring low water 06 - Mean low water spring 07 - Mean sea level 08 - Mean low water 09 - Equatorial spring low water 10 - Tropic lower low water 11 - Lowest astronomical tide 88 - Other, specify in Add. Doc.

23-78	56	char	INTERPOLATION SCHEME This field allows for a description of the interpolation scheme used, should some of the data records contain interpolated values (e.g., "5-MINUTE INTERVALS AND PEAKS AND TROUGHS").
79-80	2	int	SEQUENCE NUMBER - Set to "12"

Sequence No. 13

1-3	3	float	GENERAL DIGITIZING RATE OF MAGNETICS In tenths of minutes. The rate which is present within the data records.
4-5	2	int	GENERAL SAMPLING RATE OF MAGNETICS In seconds. This rate is instrumentation dependent (e.g., if the pulse rate is every 3 sec, set to "03")
6-9	4	int	MAGNETIC SENSOR TOW DISTANCE In meters. The distance from the navigation reference to the leading sensor.
10-14	5	float	SENSOR DEPTH In tenths of meters. This is the estimated average depth (postitive) of the lead magnetic sensor, or flight altitude (negative) if data is aeromagnetics.
15-17	3	int	HORIZONTAL SENSOR SEPARATION In meters. Where two sensors are used.
18-19	2	int	REFERENCE FIELD CODE This is the reference field used to determine the residual magnetics: 00 - Unused 01 - AWC 70 02 - AWC 75 03 - IGRF-65 04 - IGRF-75 05 - GSFC-1266 06 - GSFC (POGO) 0674 07 - UK 75 08 - POGO 0368 09 - POGO 1068 10 - POGO 0869 11 - IGRF-80 12 - IGRF-85 13 - IGRF-90 14 - IGRF-95 15 - IGRF-00 16 – IGRF-05 17 – IGRF-10 18 – IGRF-11 88 - Other, specify
20-31	16	char	REFERENCE FIELD (e.g., "IGRF-85")
32-78	47	char	METHOD OF APPLYING RESIDUAL FIELD

			The procedure used in applying this reduction to the data (e.g., "LINEAR INTERP. in 60-mile SQUARE")
79-80	2	int	SEQUENCE NUMBER - Set to "13"

Sequence No. 14

1-3	3	float	GENERAL DIGITIZING RATE OF GRAVITY In tenths of minutes. The rate present within the data records
4-5	2	int	GENERAL SAMPLING RATE OF GRAVITY In seconds. This rate is instrumentation dependent. If recording is continuous, set to "00"
6	1	int	THEORETICAL GRAVITY FORMULA CODE 1 - Heiskanen 1924 2 - International 1930 3 - IAG System 1967 4 - IAG System 1980 8 - Other, specify
7-23	17	char	THEORETICAL GRAVITY FORMULA (e.g., "INTERNATIONAL '30", "IAG SYSTEM (1967)", etc.)
24	1	int	REFERENCE SYSTEM CODE Identifies the reference field: 1 - Local system, specify 2 - Potsdam system 3 - System IGSN 71 9 - Other, specify
25-40	16	char	REFERENCE SYSTEM (e.g., "POTSDAM SYSTEM", "SYSTEM IGSN 71", etc.)
41-78	38	char	CORRECTIONS APPLIED Drift, tare and bias corrections applied. (e.g., "+0.075 MGAL PER DAY")
79-80	2	int	SEQUENCE NUMBER - Set to "14"

Sequence No. 15

1-7	7	float	DEPARTURE BASE STATION GRAVITY In tenths of milligals. At sea level (Network value preferred.)
8-40	33	char	DEPARTURE BASE STATION DESCRIPTION Indicates name and number of station
41-47	7	float	ARRIVAL BASE STATION GRAVITY In tenths of milligals. At sea level (Network value preferred.)
48-78	31	char	ARRIVAL BASE STATION DESCRIPTION Indicates name and number of station

79-80	2	int	SEQUENCE NUMBER - Set to "15"

Sequence No. 16

1-2	2	int	NUMBER OF 10-DEGREE IDENTIFIERS ** This is the number of 4-digit 10-degree identifiers, excluding the "9999" flag, which will follow this field. (see APPENDIX A)
4-78	75	int	10-DEGREE IDENTIFIERS A series of 4-digit codes,separated by commas, which identify the 10-degree squares through which the survey collected data (see APPENDIX A). Code "9999" after last identifier.
79-80	2	int	SEQUENCE NUMBER - Set to "16"

Sequence No. 17

1-75	75	int	10-DEGREE IDENTIFIERS Continued
79-80	2	int	SEQUENCE NUMBER - Set to "17"

Sequence Nos. 18-24

1-78	78	char	ADDITIONAL DOCUMENTATION information concerning this survey not contained in header fields.
79-80	2	int	SEQUENCE NUMBER ("18" thru "24")

** Fields 41-54 in sequence Number 11 and Fields 1-78 in sequence numbers 16 and 17 may be blank filled by the contributing institution. The data center can determine these numbers by a computer search of the latitudes and longitudes within the MGD77 file.

VI. THE DATA RECORD – Legacy MGD77

The data record presents underway marine geophysical data in a correlative manner. Geophysical data (bathymetry, magnetics, and gravity) and line/point identification (e.g. seismic line and shot-point ids) are presented with a corresponding time and position. Documentation that is variable throughout the survey also is included within each data record. If primary navigation exists at a juncture where no geophysical data are present, this record should be included with the data parameter fields left unused (9s filled).

The logical record length is 120 characters a.

Format Conventions for the MGD77 Data Record:

1. All decimal points are **implied** (e.g. 1234 in 10ths of units signifies a value of 123.4)

2. Leading zeros and blanks are equivalent.

3. Unknown or unused fields are to be **9's filled**.

4. All "corrections", such as time zone, diurnal magnetics, and Eotvos, are understood to be **added** (e.g., time-zone correction is the number of hours which must be added to the recorded time to determine GMT).

The following is a detailed description of the Data Record. Fields can be of type integer, floating point or character. Fields that represent whole numbers are integers. Fields that contain a decimal component are float, and fields that are alphanumeric are character.

Character Nos.	Length of Field	Type	Description
1	1	int	DATA RECORD TYPE Set to "5" (data record.)
2-9	8	char	SURVEY IDENTIFIER Identifier supplied by the contributing organization, else given by NGDC in a manner which represents the data. Identical to that in header record.
10-12	3	int	TIME-ZONE CORRECTION In hours. Corrects time (in characters 13-27) to GMT when added: equals zero when time is GMT. Timezone normally falls between -13 and +12 inclusively.
13-16	4	int	YEAR including century (e.g. 1972)
17-18	2	int	MONTH (e.g. May is represented as 05)
19-20	2	int	DAY Day of month
21-22	2	int	HOUR Hour of day
23-27	5	float	MINUTES X 1000
28-35	8	float	LATITUDE X 100000

			+ = North; - = South Between -90 and 90 degrees
36-44	9	float	LONGITUDE X 100000 + = East; - = West Between -180 and 180 degrees
45	1	int	POSITION TYPE CODE Indicates how lat/lon was obtained: 1 = Observed fix 3 = Interpolated 9 = Unspecified
46-51	6	float	BATHYMETRY, 2- WAY TRAVELTIME In ten-thousandths of seconds. Corrected for transducer depth and other such corrections, especially in shallow water
52-57	6	float	BATHYMETRY, CORRECTED DEPTH In tenths of meters.
58-59	2	int	BATHYMETRIC CORRECTION CODE This code details the procedure used for determining the sound velocity correction to depth: 01-55 Matthews' Zones with zone 59 Matthews' Zones, no zone specified 60 S. Kuwahara Formula 61 Wilson Formula 62 Del Grosso Formula 63 Carter's Tables 88 Other (see Add. Doc.) 97 Computed using 1500 meters/sec 98 Unknown if Corrected 99 Unspecified
60	1	int	BATHYMETRIC TYPE CODE Indicates how the bathymetric value was obtained: 1 - Observed 3 - Interpolated (Header Seq. 12) 9 - Unspecified
61-66	6	float	MAGNETICS TOTAL FIELD, 1ST SENSOR In tenths of nanoteslas (gammas). For leading sensor. Use this field for single sensor.
67-72	6	float	MAGNETICS TOTAL FIELD, 2ND SENSOR In tenths of nanoteslas (gammas). For trailing sensor.
73-78	6	float	MAGNETICS RESIDUAL FIELD In tenths of nanoteslas (gammas). The reference field used is in Header Seq. 13.
79	1	int	SENSOR FOR RESIDUAL FIELD 1 - 1st or leading sensor 2 - 2nd or trailing sensor 9 - Unspecified
80-84	5	float	MAGNETICS DIURNAL CORRECTION -

			In tenths of nanoteslas (gammas). If 9-filled (i.e., set to "+9999"), total and residual fields are assumed to be uncorrected; if used, total and residuals are assumed to have been already corrected.
85-90	6	int	DEPTH/ALTITUDE OF MAGNETICS SENSOR In meters. + = Below sealevel - = Above sealevel
91-97	7	float	OBSERVED GRAVITY In tenths of milligals. Corrected for Eotvos, drift, and tares
98-103	6	float	EOTVOS CORRECTION In tenths of milligals. E = 7.5 V cos(phi) * sin(alpha) + 0.0042 V*V
104-108	5	float	FREE-AIR ANOMALY In tenths of milligals. Free-air Anomaly = G(observed) minus G(theoretical)
109-113	5	char	LINE/TRACK/SEGMENT ID Used, for example, to cross reference with seismic data.
114-119	6	char	SEISMIC SHOT-POINT NUMBER/POINT ID
120	1	int	QUALITY CODE FOR NAVIGATION - 5 - Suspected, by the contributor 6 - Suspected, by the data center 9 - No identifiable problem found (NOTE - Should the contributing institution code this field as 1 through 5, the data center will not contradict. The data center's quality control program, which performs (among other checks) a vectorial analysis of the navigation, is available in online or a printout form upon request.)

APPENDIX A 10-DEGREE-SQUARE IDENTIFIER CODE

A 10-degree-square area can be easily identified by constructing a four-digit number. The components of this number, in order of their construction are described as follows:

Quadrant - A one-digit number identifies the quadrant of the world with the following significance to each digit:

1st digit = Quadrant number

Qc Code	Latitude	Longitude
1	North	East
3	South	East
5	South	West
7	North	West

10-Degree Square - The next three digits identify a unique 10-degree square; thus the significant digits consist of:

2nd digit = Tens digit of degrees latitude
3rd digit = Hundreds digit of degrees longitude
4th digit = Tens digit of degrees longitude

	10-DEGREE SQ IDENT. CODE			
Example	Quad	Lat	Long	Long
37 deg 48'S, 4 deg 13'E	3	3	0	0
21.6 deg S, 14.3 deg W	5	2	0	1
34 deg 28'N, 143 deg 27'W	7	3	1	4
75 deg N, 43 deg E	1	7	0	4

APPENDIX B NGDC CONTACTS

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