AGSO FORMATS FOR MARINE SEISMIC & NAVIGATION DIGITAL DATA

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AUSTRALIAN
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Australian Geological Survey Organisation

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1. SEGY FORMAT FOR AGSO PROCESSED DIGITAL SEISMIC DATA

1.1 INTRODUCTION

This format description is designed to assist users of AGSO digital seismic data. In general the standard descriptions have been adhered to as specified by Barry et. al. (Recommended Standards for Digital Tape Formats, Geophysics, vol 40, No 2 (April 1975) pp 344-352).

Trace header mnemonics for many of the entries are as per used by CogniSeis in their DISCO software package, others have been defined by AGSO.

Variations to the standard trace header descriptions (bytes 1-180) are as follows. TRACEID has expanded codes which are applicable to unstacked data eg. reformatted field data. Static corrections and delays are defined to account for the field acquisition system.

In addition to the standard entries a number of optional entries are also used. Some of these are created by DISCO and others relate to AGSO data acquisition and processing. The most important of these are SHOT or SPN.

Please note that for AGSO data released prior to 1993 , a pseudo shot point number was used (SPN) as opposed to processing shot number (SHOT). The SPN was an assigned number generated from the stack data set and usually started at 100. This number has no direct relationship to the original field shot number (FFID) or processing shot number (SHOT) and may be considered to be a re-sequenced CDP. Therefore the first SPN on a line may not occur at full fold but the first live stack trace. To relate this vintage data to original field data either FFID if present, must be used or time values from the headers must be used. Its use was historical and primarily for the purposes of producing shot point maps which could be related to a section. Its use has been discontinued from 1993 and replaced by SHOT which in most cases will be identical to FFID. Exceptions occur when the line has been merged for acquisition or processing reasons and SHOT numbers have been re-sequenced to obtain a continuous numbering sequence.

The convention used for the SHOT annotation position is the mid-point of the source and the first active channel. Therefore the ship antenna position, which is Rig Seismic's firing navigation reference point, is corrected to relate to this point for all final navigation data.

Field data polarity is maintained throughout the processing sequence. The convention for AGSO data is that a compression wave is plotted as negative.

Some data sets may include bathymetry and geophysical data such as magnetics and gravity. These are also corrected to the mid-point location.

1.2 SUPPORTED MEDIA

The current supported media formats are 3480 data cartridges, 9 track tape at 1600 bpi PE or 6250 bpi GCR, and EXABYTE.

1.3 AGSO SEGY FORMAT SPECIFICATION

The standard used for AGSO SEGY data encoding is 32 bit IBM floating point ie. sample code = 1, in SEG defined standard.

It is AGSO's preference that all data be supplied in this format.

1.4 REELID HEADER

3200 bytes EBCDIC card image. An example is given below.

```
C1  AGSO MARINE GEOSCIENCE AND PETROLEUM GEOLOGY PROGRAM
C2  SURVEY NAME:        PHILIPPINES 1992  SURVEY NO:              109
C3  LINE NO:            109/50            SEGY TAPE PRODUCED:    JAN 1993
C4  START SHOT:         278               STOP SHOT:             951
C5  FILTERED STACK DATA
C6  RECORDING PARAMETERS
C7  VESSEL:             RIG SEISMIC       DATE RECORDED:         APRIL 1992
C8  SHIP SPEED:         5.0 KNOTS         SHOT INTERVAL:         9.7 SEC
C9  SOURCE:        20 x 110 CU. INCH AIRGUNS   SOURCE DEPTH:     6 METRES
C10 GROUP LENGTH:       13.5 METRES       NOMINAL CABLE DEPTH:   8 METRES
C11 NO. OF GROUPS:      192               LEADING GROUP:         1
C12 CMP SPACING:        6.25 METRES       COVERAGE:              48-FOLD
C13 NEAR OFFSET:        174.5 METRES      MAXIMUM OFFSET:        2562 METRES
C14 SAMPLE RATE:        2 MS              RECORD LENGTH:         7 SEC
C15 DATA RECORDING FORMAT - AGSO SEGY 6250        SHIP'S  HEADING: 055
DEGREES
C16
C17    PROCESSING SEQUENCE
C18 [1] GEOMETRY DEFINITION
C19 [2] FIELD TAPE TO DISCO INTERNAL WITH 4 MS SAMPLE RATE
C20 [3] SPHERICAL DIVERGENCE CORRECTION
C21 [4] FK FILTER IN THE SHOT DOMAIN
C22 [5] SHOT DESIGNATOR USING FOURIER DOMAIN ESTIMATION
C23 [6] PREDICTIVE DECONVOLUTION
C24 [7] SUM ADJACENT TRACES TO FORM 25 M GRP INT AFTER DIFFERENTIAL NMO
C25 [8] SORT TO COMMON MID-POINT, 48 FOLD
C26 [9] INTERACTIVE HORIZON BASED VELOCITY ANALYSIS
C27 [9] MULTIPLE ATTENUATION IN FK DOMAIN
C28 [10] DMO
C29 [11] INTERACTIVE HORIZON BASED VELOCITY ANALYSIS AND STACK
C30
C31
C32    HEADER ENTRIES AS PER SEGY STANDARD.
C33    REFER TO AGSO MARINE ARCHIVE STANDARDS FOR DESCRIPTIONS.
C34    EXTRA HEADER ENTRIES (2 BYTES INTEGER FORMAT UNLESS NOTED) :
C35    CDP-STAT 183, SHT-STAT 185, REC-STAT 187, SHOT 189, MSEC 201,
C36    SHINT 203, WDEPTH 205, GRINT 207 (4 BYTES IBMFP), ATS 211
C37
C38    PROCESSED BY : J.ASPIN, D.CATHRO, N.CLARK, C.LAWSON, R.PARUMS
C39
C40    COPYRIGHT COMMONWEALTH OF AUSTRALIA 1993                M109V050T
```

1.5 BINARY REEL HEADER DESCRIPTION

Word	Description	Format
7	Number of seismic traces	I-16
9	Sample interval (microsecs) (for this tape)	I-16
11	Number of samples per data trace (for this tape)	I-16
13	Data format code 1. Floating point (4 bytes)	I-16

1.6 TRACE HEADER DESCRIPTION

240 bytes total length, bytes 1 to 180 standard entries, bytes 181 to 240 optional entries.

Name	Bytes	Description
LINETRC	1-4	Trace sequence number within line; numbers increase if additional reels are required on the same line.
REELTRC	5-8	Trace sequence number within each reel; each reel starts with trace number one.
FFID	9-12	Field shot point number.
CHAN	13-16	Channel no. within original shot.
ESPNUM	17-20	Not used.
CDP	21-24	CMP ensemble number.
SEQNO	25-28	Trace number within CMP ensemble; each ensemble starts with trace number one.
TRACEID	29-30	Trace identification code : 1 - seismic data 2 - dead 8 - water break 9 - oscillator test 10 - noise test 11 - cable/oscillator test 12 - airgun signature 13 - airgun shuttle sensor 14 - sonobuoy 15 - amplifier test 16 - low cut filter test 17 - high cut filter test 18 - amplifier impulse test 19 - amplifier cross talk test
VSTACK	31-32	Number of vertically summed traces yielding this trace.
FOLD	33-34	Number of horizontally stacked traces yielding this trace.
DATAUSE	35-36	Data use : 1 - production. 2 - test data
SOFFSET	37-40	Distance from source point to receiver group (negative if opposite to direction in which line is shot)
RELEV	41-44	Receiver group elevation - cable depth (m).
SELEV	45-48	Surface elevation at source (not used)
SDEPTH	49-52	Source depth below surface (m).
RDATUM	53-56	Datum elevation at receiver group. Sea level is 0
SDATUM	57-60	Datum elevation at source. Sea level is 0
WDEPTHSO	61-64	Water depth at source (m).
WDEPTHRC	65-68	Water depth at group (m).

ED-SCAL	69-70	Scalar to be applied to all elevations and depths specified in bytes 41-68 to give the real value. Scalar = 1, +/- 10, +/- 100, +/- 1,000 or +/- 10,000. If positive, scalar is used as a multiplier; if negative, scalar is used as a divisor.
CO-SCAL	71-72	Scalar to be applied to all co-ordinates specified in bytes 73-88 to give the real value. Scalar = 1, +/- 10, +/- 100, +/- 1,000 or +/- 10,000. If positive, scalar is used as a multiplier; if negative, scalar is used as a divisor.
SHT-X	73-76	Source co-ordinate - X. If the co-ordinate units are in seconds of arc, the X values represent longitude and the Y values latitude. A positive designates the number of seconds east of Greenwich Meridian or north of the equator and a negative value designates the number of seconds south or west. Bytes 73-88.
SHT-Y	77-80	
REC-X	81-84	
REC-Y	85-88	
COORUNIT	89-90	Co-ordinate units : 1 = length (feet or metres) 2 = seconds of arc
WVEL	91-92	Weathering velocity (not used)
SUBWVEL	93-94	Sub-weathering velocity (not used)
SHUPHOLE	95-96	Uphole time at source. (not used)
RCUPHOLE	97-98	Uphole time at group. (not used)
SHSTAT	99-100	Source static correction. sdc = source depth correction (ms)
RCSTAT	101-102	Group static correction. cdc = cable depth correction (ms)
STAPPLY	103-104	Total static applied. stapply = (sdc + cdc + rdc - 60 ms)
LAGTIMEA	105-106	Lag time A. time in ms between end of 240 byte trace identification header and time break. Positive if time break occurs after end of header, negative if time break occurs before end of header. Time break is defined as the initiation pulse which may be recorded on an auxiliary trace or as otherwise specified by the recording system. For this data it is the system recording delay. rdc = -5 msec for sample rate of 1 msec rdc = -10 msec for sample rate of 2 msec rdc = -21 msec for sample rate of 4 msec
LAGTIMEB	107-108	Lag time B. time in ms between time break and initiation time of the energy source. May be positive or negative. (ie gun delay = -60 ms)
DELAY	109-110	Recording delay in msec. Time between initiation time of energy source and time when recording of data samples begins. (for deep water recording)
MUTESTRT	111-112	Mute time : start
MUTEEND	113-114	Mute time : end
NSAMPLES	115-116	Number of samples in this trace.
SRATE	117-118	Sample interval in usec for this trace.
GAINTYPE	119-120	1 - fixed (preset) 2 - binary 3 - floating point 4-N - optional use
INGCONST	121-122	Instrument gain constant.
INITGAIN	123-124	Instrument early or initial gain (dB).
CORRFLAG	125-126	Correlated : 1 = yes. 2 = no (not used)
SWEEPSRT	127-128	Sweep frequency at start (not used)
SWEEPEND	129-130	Sweep frequency at end (not used)
SWEEPLNG	131-132	Sweep length in ms (not used)

SWEEPTYP	133-134	Sweep type (not used)
SWEEPSTP	135-136	Sweep trace taper length at start in ms (not used)
SWEEPETP	137-138	Sweep trace taper length at end in ms (not used)
TAPERTYP	139-140	Taper type (not used)
ALIASFIL	141-142	Alias filter frequency, if used.
ALIASLOP	143-144	Alias filter slope.
NOTCHFIL	145-146	Notch filter frequency, if used
NOTCHSLP	147-148	Notch filter slope.
LOWCUT	149-150	Low cut filter frequency
HIGHCUT	151-152	High cut filter frequency
LOWCSLOP	153-154	Low cut filter slope
HICSLOP	155-156	High cut filter slope
YEAR	157-158	Shot instant - year
DAY	159-160	Shot instant - day
HOUR	161-162	Shot instant - hour
MIN	163-164	Shot instant - minute
SECOND	165-166	Shot instant - second
TIMEBASE	167-168	Time base code. 1 = local. 2 = GMT
TRWEIGHT	169-170	Trace weighting factor : defined as 2**(-N) volts for the least significant bit. (N=0,1...32,767)
RSTASWP1	171-172	Geophone group number of roll switch position one.
RSTATRC1	173-174	Geophone group number of trace number one within original field record.
RSTATRCN	175-176	Geophone group number of last trace number within original field record.
GAPSIZE	177-178	Gap size (total number of groups dropped)
OVERTRVL	179-180	Overtravel associated with taper at beginning or end of line. 1 = down, 2 = up

OPTIONAL INFORMATION BYTES 181-240

CDP-STAT	183-184	CDP station
SHT-STAT	185-186	Shot station
REC-STAT	187-188	Receiver station
SHOT	189-190	Processing shot point number, usually same as FFID.
SPN	191-192	Pseudo shot point number used for shot point maps.
MSEC	201-202	Shot instant - msec.
SHINT	203-204	Interval from previous shot (msec).
WDEPTH	205-206	Water depth used in processing corrected to mid-point of source and near channel (ms, positive number; m, negative number)
GRINT	207-210	Nominal group interval (m)
ATS	211-212	Distance from navigation antenna to mid-point of source (m)
ANGLE1	213-214	Angle of channel x compasses in 0.1 degree (if used)
ANGLE2	215-216	Angle of channel y compasses in 0.1 degree (if used)
ANGLE3	217-218	Angle of channel z compasses in 0.1 degree (if used)
MAG	219-222	Magnetic anomaly value in nT
GRAV	223-226	Free air gravity value in mgal

1.6 TRACE HEADER ENCODING TABLE

NOTE : The density stated of 6250 is used as a default for 3480 tapes in the DISCO implementation whereas the true density is that defined for the 3480 format.

LENGTH OF OUTPUT TRACE HEADER, IN BYTES	240
TYPE OF TRACE HEADER	ATTACH
NO. OF EOFS TO CLOSE OUTPUT REEL	2
BYTE INDEX OF FIRST DATA SAMPLE	241
OUTPUT DATA SAMPLE FORMAT	32IBMFL
FORMAT DEPENDENT CODE FLAG	YES
OUTPUT TAPE DENSITY	6250
TAPE IDENTIFICATION MESSAGE	SEGY OUTPUT TAPE

DEFINED OUTPUT HEADER ENCODING TABLE FOR SEGY FORMAT.

COUNT	NAME	FORMAT	ST	BYT	LN	FORMAT	MULTIPLY	ADDER	MULTIPLY
1)	(LINETRC)	INTEGER	1	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
2)	(REELTRC)	INTEGER	5	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
3)	(FFID)	INTEGER	9	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
4)	(CHAN)	INTEGER	13	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
5)	(ESPNUM)	INTEGER	17	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
6)	(CDP)	INTEGER	21	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
7)	(SEQNO)	INTEGER	25	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
8)	(TRACEID)	INTEGER	29	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
9)	(VSTACK)	INTEGER	31	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
10)	(FOLD)	INTEGER	33	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
11)	(DATAUSE)	INTEGER	35	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
12)	(SOFFSET)	INTEGER	37	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
13)	(RELEV)	INTEGER	41	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
14)	(SELEV)	INTEGER	45	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
15)	(SDEPTH)	INTEGER	49	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
16)	(RDATUM)	INTEGER	53	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
17)	(SDATUM)	INTEGER	57	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
18)	(WDEPTHSO)	INTEGER	61	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
19)	(WDEPTHRC)	INTEGER	65	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
20)	(ED-SCAL)	INTEGER	69	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
21)	(CO-SCAL)	INTEGER	71	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
22)	(SHT-X)	FLT. PT	73	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
23)	(SHT-Y)	FLT. PT	77	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
24)	(REC-X)	FLT. PT	81	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
25)	(REC-Y)	FLT. PT	85	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
26)	(COORUNIT)	INTEGER	93	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
29)	(SHUPHOLE)	INTEGER	95	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
30)	(RCUPHOLE)	INTEGER	97	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
31)	(SHSTAT)	INTEGER	99	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
32)	(RCSTAT)	INTEGER	101	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
33)	(STAPPLY)	INTEGER	103	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
34)	(LAGTIMEA)	INTEGER	105	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
35)	(LAGTIMEB)	INTEGER	107	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
36)	(DELAY)	INTEGER	109	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
37)	(MUTESTRT)	INTEGER	111	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
38)	(MUTEEND)	INTEGER	113	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
39)	(NSAMPLES)	INTEGER	115	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
40)	(SRATE)	INTEGER	117	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
41)	(GAINTYPE)	INTEGER	119	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
42)	(INGCONST)	INTEGER	121	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
43)	(INITGAIN)	INTEGER	123	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
44)	(CORRFLAG)	INTEGER	125	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
45)	(SWEEPSRT)	INTEGER	127	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
46)	(SWEEPEND)	INTEGER	129	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
47)	(SWEEPLNG)	INTEGER	131	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
48)	(SWEEPTYP)	INTEGER	133	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
49)	(SWEEPSTP)	INTEGER	135	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
50)	(SWEEPETP)	INTEGER	137	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
51)	(TAPERTYP)	INTEGER	139	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
52)	(ALIASFIL)	INTEGER	141	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
53)	(ALIASLOP)	INTEGER	143	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
54)	(NOTCHFIL)	INTEGER	145	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
55)	(NOTCHSLP)	INTEGER	147	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
56)	(LOWCUT)	INTEGER	149	2	INT	(X)	1.000 (+)	0.000 (X)	1.000

57)	(HIGHCUT)	INTEGER	151	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
58)	(LOWCSLOP)	INTEGER	153	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
59)	(HICSLOP)	INTEGER	155	2	INT	(X)	1.000 (+)	0.000 (X	1.000
60)	(YEAR)	INTEGER	157	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
61)	(DAY)	INTEGER	159	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
62)	(HOUR)	INTEGER	161	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
63)	(MINUTE)	INTEGER	163	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
64)	(SECOND)	INTEGER	165	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
65)	(TIMEBASE)	INTEGER	167	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
66)	(TRWEIGHT)	INTEGER	169	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
67)	(RSTASWP1)	INTEGER	171	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
70)	(GAPSIZE)	INTEGER	177	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
71)	(OVERTRVL)	INTEGER	179	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
72)	(CDP-STAT)	INTEGER	183	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
73)	(SHT-STAT)	INTEGER	185	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
74)	(REC-STAT)	INTEGER	187	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
75)	(SHOT)	INTEGER	189	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
76)	(SPN)	INTEGER	191	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
77)	(MSEC)	INTEGER	201	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
78)	(SHINT)	INTEGER	203	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
79)	(WDEPTH)	INTEGER	205	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
80)	(GRINT)	FLT. PT	207	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
81)	(ATS)	INTEGER	211	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
82)	(ANGLE1)	INTEGER	213	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
83)	(ANGLE2)	INTEGER	215	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
84)	(ANGLE3)	INTEGER	217	2	INT	(X)	1.000 (+)	0.000 (X)	1.000
85)	(MAG)	FLT. PT	219	4	INT	(X)	1.000 (+)	0.000 (X)	1.000
86)	(GRAV)	FLT. PT	223	4	INT	(X)	1.000 (+)	0.000 (X)	1.000

END OF OUTPUT HEADER ENCODE TABLE

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2. SEGY FORMAT FOR AGSO MARINE FIELD TAPES

2.1 PROCESSING OPTIONS

The AGSO field tapes are written in a modified SEGY format.

This format has been used for all Rig Seismic acquired data (ie. from survey 46)
Data up to and including survey 105 was recorded on 9 track tape then on 3480 data cartridges from survey 106. Some minor changes to the format were made for survey 115 and continued for subsequent surveys.

There are three significant distinctions users should be aware of :

(1) The reel identification header Part 1, the card image block, is written in ASCII rather than EBCDIC format. There are 40 card images of 80 bytes each.
This is not significant for processing since the information is for general description purposes only.

(2) Extensive use has been made of optional fields in the SEGY trace header.
The trigger times and firing errors for each gun in the arrays are logged.
Depths and wing angles of every depth controller are also saved here to provide information along the seismic streamer. Because of the limited space available in each trace header, the values for the first gun and depth controller are recorded in channel 1, the second in channel 2 etc. Compass angles are stored in a similar manner.

(3) The seismic data values are written in an efficient 16 bit binary floating point format which is described in more detail later. This provides a dynamic range of 120 dB.

The only significant task expected to be encountered by external users processing AGSO marine seismic field tapes is in converting the floating point numbers to the form specific to their own systems. AGSO can offer the following assistance in achieving this :

(a). Processing centres which use the Cogniseis DISCO system on a VAX or CONVEX platform can be provided with a software module to convert the data to DISCO internal format. This will make reading the data transparent.

(b). Those centres that use VAX platforms can be provided with an ASSEMBLER subroutine which will convert an array of AGSO format numbers to VAX internal floating point.

(c). Centres with other types of computer can be provided with a basic FORTRAN subroutine to convert to 32 bit integer or floating point format. The centre can then modify the software as necessary to a form appropriate to the conversion they require. A listing of this source is included in Appendix 1.

(d). Under certain circumstances AGSO could copy the tapes to SEGY standard 32 bit format. This would usually incur a copy charge per tape and may produce two output tapes per input tape due to less efficient data packing. The availability of this service is not guaranteed due to resource availability within the AGSO processing centre.

2.2 DATA RECORDING FORMAT

Data is recorded in demultiplexed form in modified SEGY.

Field data polarity is defined such that a compression wave is a negative number.

The first 3200 byte record is the reel identification header part 1, the card image block. It is written in ASCII rather than EBCDIC format.

The next 400 byte record is the reel identification header part 2, the binary coded block, written in the standard 16/32 bit fixed point format as described in the SEG report.

The 240 byte trace headers are in 16 bit fixed point format and is standard for the non-optional words.

Trace data values are recorded as binary floating point words of 16 bits length, consisting of a 12 bit mantissa and 4 bit exponent. The format is as follows :

```
 1 1 1 1 1 1
 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0
-----------------------------------------------------------------
| s | exponent |          mantissa                |
-----------------------------------------------------------------
```

The data word is in nominal 2's complement format. The 12 bit mantissa has the data bits in bits 0 to 10 of the word and the sign in bit 15, and is a 2's complement binary number. As the gain of the IFP converter is binary, the mantissa normally varies between 1024 and 2047 except when the exponent is zero when it can range from 0 to 2047.

The exponent varies between 0 and 9, and can only be a positive number.
To maintain compatibility with the general word structure, the exponent is inverted whenever the mantissa is negative. The exponent shows the gain of the binary Instantaneous Floating Point amplifier. An exponent of 0 represents a gain of 512, while an exponent of 9 represents a gain of 1. An exponent value above 9 is illegal.

The converted integer ranges of the floating point number for each exponent range, and the equivalent voltage ranges (for positive values) are :

Exponent	Integer	Volts
0	0 - 2047	0.0 - 0.01953125
1	2048 - 4095	0.01953125 - 0.0390625
2	4096 - 8191	0.0390625 - 0.078125
3	8192 - 16383	0.078125 - 0.15625
4	16384 - 32767	0.15625 - 0.3125
5	32768 - 65535	0.3125 - 0.625
6	65536 - 131071	0.625 - 1.25
7	131072 - 262143	1.25 - 2.5
8	262144 - 524287	2.5 - 5.0
9	524288 - 1048575	5.0 - 10.0

There are a total of 11264 IFP numbers possible for both positive and negative numbers.

2.3 BINARY REEL HEADER DESCRIPTION

Word	Description	Format
1-2	Survey number	I-32
3-4	Line number (max of one per tape)	I-32
5-6	Tape number	I-32
7	Number of seismic traces per shot	I-16
8	Number of auxiliary traces	I-16
9	Sample interval (microsecs) (for this tape)	I-16
10	Sample interval (microsecs) (for original recording)	I-16
11	Number of samples per data trace (for this tape)	I-16
12	Number of samples per data trace (for original recording)	I-16
13	Data format code 1. floating point (4 bytes) 2. fixed point (2 bytes) 3. floating point (2 bytes)	I-16
14	CDP fold	I-16
15	Trace sorting 1. as recorded (preset)	I-16
16	Vertical sum code 1. no sum (preset)	I-16
17-26	Unassigned	I-16
27	Amplitude recovery method 1. None (preset)	I-16
28	Measurement system 1. metres	I-16
29-200	Unassigned	

2.4 TRACE HEADER DESCRIPTION

Name	Bytes	Description	Format
LINETRC	1-4	Trace sequence number within line	I-32
REELTRC	5-8	Trace sequence number within each reel	I-32
FFID	9-12	Field shot point number	I-32
CHAN	13-16	Channel no. within shot	I-32
	17-28	Unassigned	
TRACEID	29-30	Trace identification code 1 - seismic data * 2 - dead * 3 - dummy * 4 - time break 5 - uphole (land only) 6 - sweep 7 - timing 8 - water break * 10 - noise test * 11 - cable/oscillator test * 12 - airgun signature * 13 - airgun shuttle sensor * 14 - sonobuoy * 15 - amplifier test * 16 - low cut filter test * 17 - high cut filter test * 18 - amplifier impulse test * 19 - amplifier cross talk test * NOTE : * indicates implemented in this system	I-16
VSTACK	31-32	Number of vertically summed traces (preset to 1)	
FOLD	33-34	Number of horizontally stacked traces (preset to 1)	
DATAUSE	35-36	Data use 1 - production (default) 2 - test data	I-16
SOFFSET	37-40	Distance from source to receiver	I-32
RELEV	41-44	Group depth	I-32
SELEV	45-48	Surface elevation at source (preset to 1)	I-32
SELEV	49-52	Source depth	I-32
RDATUM	53-56	Datum elevation at receiver group.	I-32
SDATUM	57-60	Datum elevation at source.	I-32
WDEPTHSO	61-64	Water depth at source.	I-32
WDEPTHRC	65-68	Water depth at group.	I-32
ED-SCAL	69-70	Depth scalar (preset to -10)	I-16
CO-SCAL	71-72	Scalar to be applied to all co-ordinates (preset to 1)	I-16
	73-108	See Non-standard words	
DELAY	109-110	Recording delay in msec	I-16

	111-114	Unassigned	
NSAMPLES	115-116	Number of samples in record	I-16
SRATE	17-118	Sample interval in usec	I-16
GAINTYPE	119-120	Gain type 1 - fixed gain (preset) 2 - floating point gain	I-16
GAIN	121-122	Instrument early or initial gain Sonobuoy, water break & gun source gains stored within relevant channel header from survey 115 on	I-16
	125-148	Unassigned	
LOWCUT	149-150	Low cut filter frequency	I-16
HIGHCUT	151-152	High cut filter frequency	I-16
LOWCSLOP	153-154	Low cut filter slope Preset to 18 db/oct	I-16
HICSLOP	155-156	High cut filter slope Preset to 72 db/oct	I-16
YEAR	157-158	Shot instant - year	I-16
DAY	159-160	Shot instant - day	I-16
HOUR	161-162	Shot instant - hour	I-16
MIN	163-164	Shot instant - minute	I-16
SECOND	165-166	Shot instant - second	I-16
TIMEBASE	167-168	Time base code 1 - local 2 - GMT (preset) 3 - other	I-16
	169-180	Unassigned	

Non standard usable words - July 1991

NGUN	73-74	Number of source guns	I-16
	75-76	Gun trigger delays for "channel" gun in 0.1 msec	I-16
	77-78	Number of source guns	I-16
	79-80	Gun firing error for "channel" in 0.1 msec	I-16
NCD	81-82	No of cable bird depth sensors	I-16
CD	83-84	Depth of "channel" bird sensors in 0.1 metre	I-16
	85-86	No of cable bird wing angles	I-16
	87-88	Angle of "channel" bird wings in 0.1 degree	I-16
NANGLE	89-90	No of cable compasses	I-16
ANGLE	91-92	Angle of "channel" compasses in 0.1 degree	I-16
NSD	93-94	No of gun depths	I-16
SD	95-96	Depth of "channel" gun sensors in 0.1 metre	I-16
MSEC	181-182	Shot instant in msec	I-16
SHINT	183-184	Interval from last shot (msec)	I-16

3. AGSO UKOOA FORMAT FOR NAVIGATION AND GEOPHYSICAL DATA

Data is available as a sampled subset, usually every 10th shot point.
Shot positions are given at the mid-point of source and first receiver, unless otherwise stated.

The format used is a modified form of the UKOOA standard.

Media are either 3.5" floppy disk or 9 track or 3480 tape formats.

3.1 AGSO UKOOA FORMAT

Data is in ASCII format with 80 character records, each containing data in the following format :

Column		
01-16	Line number (left justified)	(A10)
17	Blank	
18-23	Shot point number (right justified)	(I6)
24-25	Blank	
26-34	Latitude (deg,min,sec.s(N/S))	(I2,I2,F4.1,A1)
35-44	Longitude (degminsec(E/W))	(I3,I2,F4.1,A1)
45-52	Gravity (μm/s**2)	(I8)
53-60	Blank	
61-65	Water depth (metres)	(I5)
66-74	Julian day(ddd) and UTC (hhmmss)	(I3,3I2,I6)
75-80	Total magnetic field (nT)	(I6)

4. AGSO PROCESSED SEISMIC DATA VELOCITY FILE FORMAT

These files are written in ASCII and are standard disco velocity definition files. They are usually written on a 3.5" floppy disc.

To interpret these files the following guide is given.

The *JOB and *GENRATE sections can be ignored, these are used in local batch jobs only.

The DEFINE card gives the primary key name (usually CDP), water velocity, if velocity inversions will be accepted (INV or balank to accept, NOINV to reject), and the name of the output velocity file database entry identifier.

The HANDVEL card gives the CDP number for the following time / velocity pairs.
After the HANDVEL card the time (twt in ms) and the stacking velocity (m/s) is given.

For example :

Line 3

CDP 300	Time (ms)	Velocity (m/s)
	150	1500
	450	2050
	850	2400
	1000	2650
	2150	3300
	6000	5000

Would be listed as :

```
*JOB        PERTHB      L3      DOUG        VELOCITY    FN      DEFINITION
*CALL       GENRATE     CDP     SEQNO       1000        4           1
KEYDEF      1           1       1           1           1       METRIC
ONES
*CALL       DEFINE      CDP     1500        INV         L3          VEL
HANDVEL     300
150   1500  450   2050  850   2400  1000  2650  2150  3300  6000  5000
*END
```

APPENDIX 1. FORTRAN SOURCE CODE TO REFORMAT AGSO SEGY FIELD DATA

```
      subroutine ifp_to_fp_array_fort( array, out, num, errors )
c
c++++++++++
c**
c**  ifp_to_fp_array_fort
c**
c**  Author:         Norm Johnston BMR Canberra, ph 06 2499361
c**
c**  This routine will convert an array of BMR Marine Instantaneous
c**  Floating Point (IFP) numbers into 32-bit floating point numbers.
c**  The IFP numbers have the format:
c**
c**    1  1  1  1  1  1
c**    5  4  3  2  1  0  9  8  7  6  5  4  3  2  1  0
c**   ------------------------------------------------------------
c**   | s|  exponent   |          mantissa                    |
c**   ------------------------------------------------------------
c**
c** The data is in 2's complement format with bits 0-10 the mantissa, bits
c** 11-14 the exponent and bit 15 the sign.
c** The mantissa normally varies between 1024 and  2047 except when the
c** exponent is zero.
c** The exponent can vary from 0 to plus or minus 9 only, a number is
c** illegal if it has an exponent with an absolute value greater than 9.
c**
c** The converted integer ranges of the floating  point  number  for  each
c** exponent range and the equivalent voltage ranges (for positive values)
c** are:
c**
c** Exponent              Integer Range          Voltage Range
c** ------------------------------------------------------------------------
c**  0                       0 -   2047          0.0       - 0.01953125
c**  1                    2048 -   4097          0.01953125 - 0.0390625
c**  2                    4098 -   8193          0.0390625 - 0.078125
c**  3                    8192 -  16383          0.078125  - 0.15625
c**  4                   16383 -  32767          0.15625   - 0.3125
c**  5                   32768 -  65535          0.3125    - 0.625
c**  6                   65536 - 131071          0.625     - 1.25
c**  7                  131072 - 262143          1.25      - 2.5
c**  8                  262144 - 524287          2.5       - 5.0
c**  9                  524288 - 1048575         5.0       - 10.0
c**
c**  Call this routine by:
c**
c**  call ifp_to_fp_array_fort( array, out, num, errors )
c**
c**  where:
c**  Input:
c**       array      (16-bit integer)  = array of IFP numbers
c**       num   (32-bit integer)  = number of values to convert
c**  Output:
c**       out   (32-floating point)     = array of FP values
c**       errors     (32-bit integer)  = number of exponent errors
```

```
c**
c**  NOTE:    This routine will NOT work on a VMS computer with raw
c**           SEG-Y data. The VMS system requires the bytes in the 16-bit
c**           input word to be swapped before this routine is called.
c**           Whether it works on another computer will depend on that
c**           computer's internal integer representation. However the
c**           the basic logic remains the same.
c--------
c
      implicit   none
c
      integer*2  array(*)
      real*4        out(*)
      integer*4  num,      errors
c
      integer*4  word,     exp,  mant,     i
c
c*       Loop through all values
c
      errors = 0            ! clear error counter
      do i = 1, num
        word = iabs(array(i))       ! transfer to local word
        exp = jiand(word,'7800'X)         ! mask out exponent in bits 11-14
        exp = jishft( exp,-11 )     ! shift to bit position 3-0
        if ( exp.gt.9 ) then        ! if > 9 then an error
          errors = errors + 1       ! bump error counter
          out(i) = 0.0      ! set output to 0
        else
          mant = jiand(word,'7FF'X)      ! mask out mantissa
          out(i) = mant*(2**exp)         ! get 32-bit F.P. representation
          if ( array(i).lt.0 ) then ! if input < 0 then
            out(i) = -out(i)! set result negative
          endif
        endif
      enddo
c
      return
c
      end
```

APPENDIX 2. EXAMPLE OF RECORDING GEOMETRY INFORMATION

AGSO Seismic Recording Geometry

Survey: SNOWS II **Survey No.** **110**

Group Length: GL =	25 m	Date: 13/6/92 to	
No. of Active Channels: N =	192	Gun Length: SCE =	13.5 m
Active Length: AL = (GLxN) =	4800 m	Gun Chain Length: GC	30 m
Stretch Length: SL =	150 m	Antenna to Stern: NS =	46 m

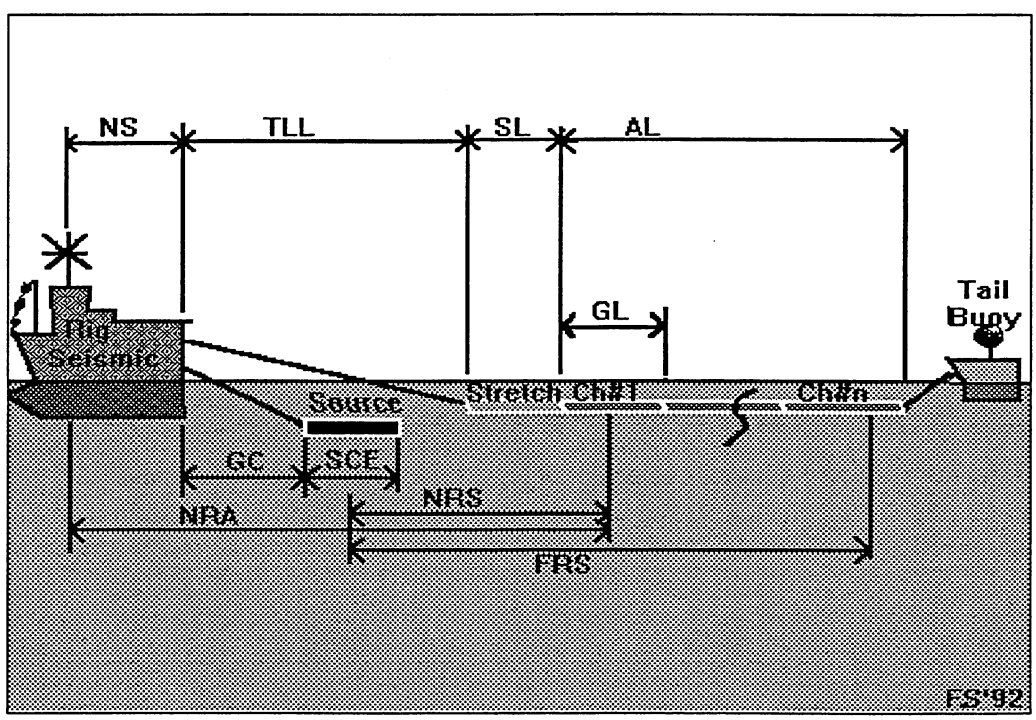
DT Birds located after Channels: 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192

Compass Birds located after channels: 24,72,120,168

Source Near Offset: NRS = TLL + SL + GL/2 - (GC + SCE/2) = TLL + 125.8 m

Source Far Offset: FRS = NRS + (N - 1)GL = NRS + 4775.00 m = TLL + 4900.75

Field Tape Format: BMR 16 BIT Floating Point SEG-Y, 3480 data cartridge



Channels

1-192 seismic data
193,194 dummy channels
195-198 Stbd gun sensors
199-202 Port gun sensors
203-206, 208 Cable waterbreak channels

APPENDIX 3. EXAMPLE OF LINE RECORDING PARAMETERS

AGSO Line Recording Parameters

Survey No: 110 **Line no: 110/01**

Survey Name: SNOWS II

Date: 13/6/92 **Observer:** Jim Bedford

Checked by:

Nominal Cable Depth:	10 m	Source:	20 x 150 cu. in. @ 2000 psi
Sample Rate:	2 ms	Nominal Source Depth:	10 m
Record Length:	16000 ms	Ship's Speed:	5 knots
CMP Spacing:	12.5 m	Shot Rate:	19.4 sec
Coverage:	48 fold	Shot Distance:	50 m
Tow Leader Length:	95 m, at SOL	Source Near Offset:	220.75 m, at SOL
Ship's Heading:	247 deg	Source Far Offset:	4995.7 m, at SOL 5

Line Length: 212.4 kms, 114.7 nmi

First Shot:	102			First Tape: 110/001
First Good Shot:	181	,time:	165.0148	Last Tape: 110/070
Last Good Shot:	5321	,time:	166.0602	
Last Shot:	5403			Recording Delay Changes? No

Loop? Yes TLL/Offset Change? Yes

1. Last Good Shot:	1206	1. TLL set to:	100 m
First Good Shot:	2002	at shot:	275 , time: 165.0218

Further Comments: nil