

MARINE SEISMIC SURVEY
FOR
AMOCO AUSTRALIA PETROLEUM COMPANY
BASS BASIN SURVEY T-14/18/22-P
OFFSHORE TASMANIA
BY
M/V EUGENE MCDERMOTT II
GEOPHYSICAL SERVICE INC.
47 BURSWOOD ROAD
VICTORIA PARK WA 6100

RECORDING DATES: 17TH NOVEMBER, 1984 - 17TH DECEMBER, 1984



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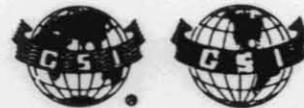
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Navigation Report
T14P, T18P, T22P

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SECTION I
INTRODUCTION



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SECTION I

INTRODUCTION

A marine seismic survey was carried out by Geophysical Service Inc using the M/V Eugene McDermott II in permit areas T-14, 18, 22P, within the Bass Basin located approximately 100 kms north of Tasmania in Bass Strait, as shown in Figure 1 (Location Map Bass Basin Permits T-14, 18,22P)

The survey commenced on the 17th November, 1984 and concluded on the 17th December, 1984.

The survey consisted of 79 lines, totalling 2363.55 kilometres, as shown in Figure 2 (Line Location Map - 1984 - Amoco Bass Basin Survey).

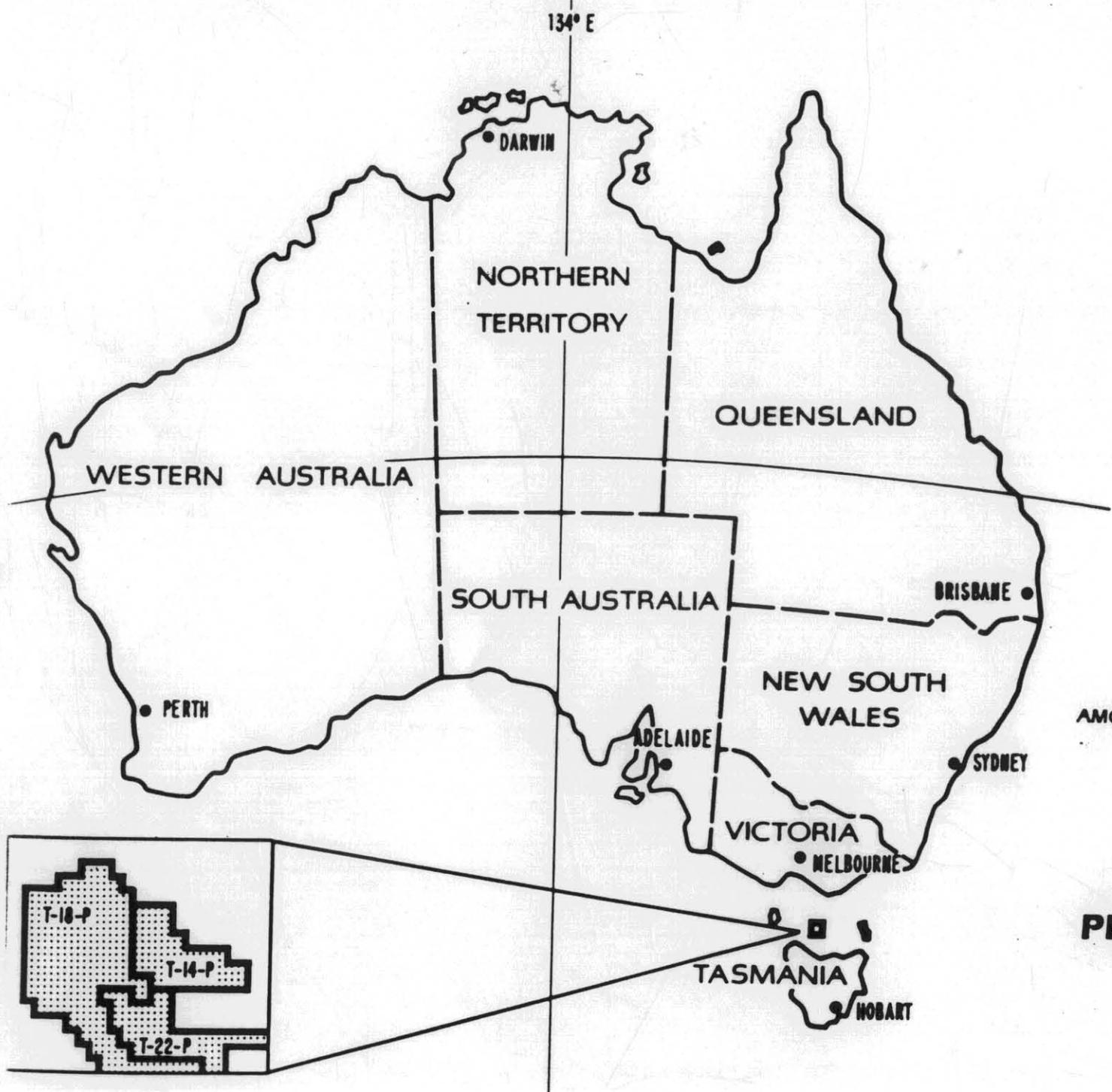
The data was recorded 60 fold utilizing a GSI manufactured 3600 m multiplex streamer under continuous tow in conjunction with pneumatic acoustic energy source (airguns). Operations were generally conducted 24 hours a day.

Recordings were made using a data acquisition unit in conjunction with a supervisory terminal, a trace sequential recorder with three 12.7mm tape transports and a streamer power panel. Records were made on 12.7mm magnetic tape in 9 trace, 6250 bpi SEG D digital format. (see Section II A., Instruments).

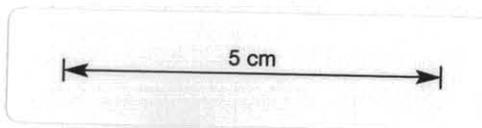
The ship's location was determined by the use of an ARGO (primary) or SYLEDIS (secondary) positioning system. (see section III A., Navigation Discussion).

Both Gravity and Magnetic data were recorded on all lines and a full discussion is contained within a separate report.

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LOCATION MAP
Offshore Tasmania

BASS BASIN
PERMITS T-14,18,22-P

Figure 1



SECTION II
EQUIPMENT



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SECTION II**EQUIPMENT****INSTRUMENTS**

A Trace Sequential Recording TSR system was used for seismic data acquisition. The TSR comprises of a Data Acquisition Unit, a Supervisory Terminal, a Data Recording Unit, 3 x 12.7mm telex transports and a streamer power supply. All data was recorded in SEG D tape format at 6250 bpi.

A complete description of the TSR system is contained in the following extract from the system handbook.

Flow diagrams at the end of the discussion summarise the recording sequence and interface with the multiplex streamer.



FUNCTIONAL SPECIFICATIONS FOR
THE TRACE SEQUENTIAL RECORDER (TSR)

1.0 PURPOSE

The basic purpose of the Trace Sequential Recorder (TSR) is to acquire seismic data from a marine streamer and to record these data on magnetic tape for subsequent processing and interpretation. Among the many functions required to perform the above effectively are the following:

- Controlling and monitoring streamer operations,
- Interfacing and interacting with other related marine systems.
- Processing, demultiplexing, and formatting data prior to recording.
- Displaying and outputting hard-copy logs for quality assurance purposes.
- Performing test and diagnostic functions to verify proper system performance.

These and other functions are addressed in the following sections of this specification.

TSR will provide several operational advantages over current recording systems. Principal of these are:

- (1) Improved tape efficiency afforded by high-density tape recording at 6250 bytes per inch (BPI). Efficiency increases of a factor of approximately four over 1600-BPI recorders will be realized. In addition, the group coded recording (GCR) method used at 6250 BPI provides improved error detection and correction, thus increasing recording reliability.
- (2) Elimination of processing center demultiplex formatting operations as afforded by this function now being handled by TSR. This greatly reduces input capacity requirements.

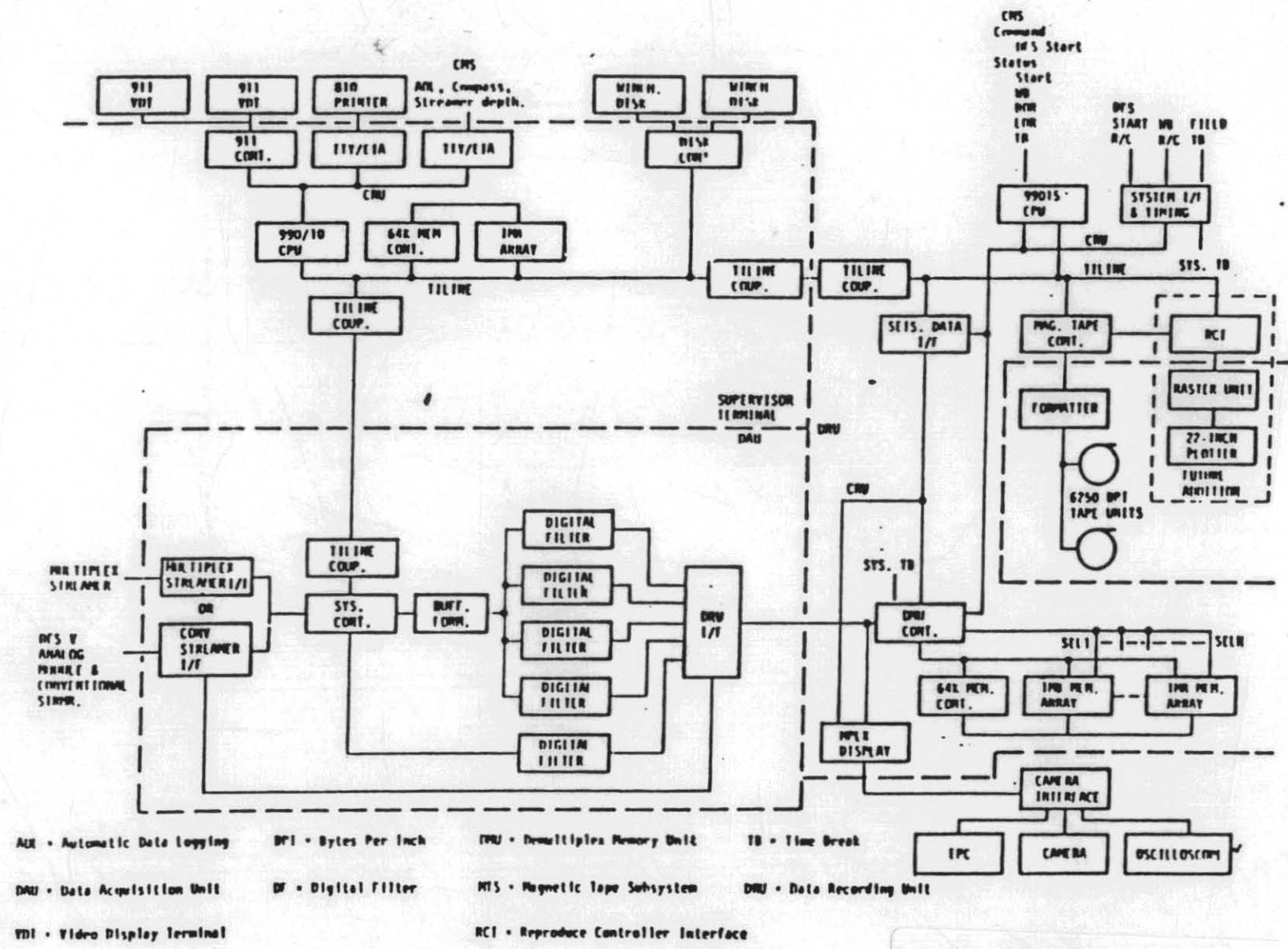
2.0 GENERAL DESCRIPTION

The overall block diagram of the TSR is shown in Figure 3. As previously stated, the purpose of the TSR is to perform all functions required to

Note: Vertical bars in outside margins denote lines of text changed from original specification.

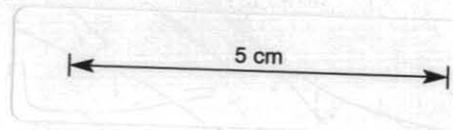


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- ALX - Automatic Data Logging
- DAU - Data Acquisition Unit
- VDI - Video Display Terminal
- DPI - Bytes Per Inch
- DF - Digital Filter
- CPU - Decultiplex Memory Unit
- MTS - Magnetic Tape Subsystem
- RCI - Reproduce Controller Interface
- TB - Time Break
- DRU - Data Recording Unit

Figure 3, TSR Block Diagram



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Geophysical Service Inc.



acquire seismic data from a marine streamer, demultiplex the data, and perform high-density recording on magnetic tape.

As shown in Figure 3, the TSR consists of three major logic units and associated ancillary devices. The major units are:

- (1) The Supervisor Terminal (ST), which contains a TI 990 mini-computer. It provides the operator interface to the system and performs system control/monitor functions.
- (2) The Data Acquisition Unit (DAU), which transmits command and control signals to the streamer and receives/distributes seismic data as well as status information from the streamer.
- (3) The Data Recording Unit (DRU), containing several micro-computer based controllers. These perform data demultiplexing and provide control for the magnetic tape and for the multiplexed display/camera interface subsystems.

System architecture is based on expansion of the high-speed parallel data bus (990 TILINE) from the Supervisor Terminal to the DAU and DRU units. All control and data transfer functions between units are performed via this link.

The remainder of this section provides additional details for the TSR system.

2.1 STREAMER DATA SOURCE

The streamer data source may be either a conventional analog streamer or a digital multiplexed streamer. In either case, TSR will generate necessary command and control signals for transmittal to the streamer. Conventional streamers will return seismic and auxiliary data in analog form via a dedicated wire-pair per channel. The multiplexed streamer will return seismic and auxiliary data and status information in digital multiplexed form over a single fiber-optic transmission channel.

For conventional streamers, analog signal enhancement (filtering, amplification, and multiplexing) and analog-to-digital conversion are performed by from one to four DFS V analog modules. For a typical two-module configuration, seismic trace capacity is 56 at 1-mil sampling or 120 at 2- or 4-mil sampling.



In the multiplex streamer, analog signal processing and conversion are performed by in-water streamer electronic modules (SEMs). Each SEM processes 12 seismic signals; current capacity is 20 SEMs or 240 seismic channels at a 1-mil sample rate. The digital outputs of the SEMs are multiplexed onto a fiber-optic data bus for transmission to the ship.

2.2 SUPERVISOR TERMINAL

The 990/10 processor and its associated video display terminals, printer, and disk drives form the central control function or Supervisor Terminal of the TSR system. The TSR software runs under control of the System Command Interface (SCI) portion of the DX10 operating system. After the operating system has been initialized, the TSR software may be started. All access to the software is keyboard controlled, with the VDT screen providing prompting for the operator. The first screen appearing is similar to that shown in Figure 4, containing a list of system commands. Test and other commands may be viewed by entering "TEST" on the supervisor terminal. This results in the display shown in Figure 4.

Trace Sequential Recorder

Commands

ITSR - Initialize System	CM - Change Mode
SSP - Save System Parameters	LSP - Load System Parameters
CMD - Configure Multiplex Display	SDSC - Show Depth Sensor Calibration
MRC - Modify Record Delay (on line)	SFC - Show Filter Configuration
MRA - Modify Reel Number (on line)	SHC - Show Header Configuration
RNT - Record noise Test	SSC - Show Streamer Configuration
STR - Streamer Trace Reproduce	SGP - Show General Parameters
DTR - DRU I/F Trace Reproduce	SRC - Show Reversed Channels
PB - Playback a File or Shotpoint	MTFC - Modify Tape File Count
MTL - Modify Tape Length	MDD - Modify Depth Display
TEST - Show Test Commands	
QTSR - Quit TSR Program	
R - Repeat Command	

Trace Sequential Recorder Tests

and Idle Mode Commands

Streamer:	
IT - Impulse Test (MUX)	CS - Configure Streamer
TSLO - Turn SEM light on/off (MUX)	CSC - Clear SEM Controller (MUX)
LT - Leakage Test (MUX)	PUS - Power Up SEMs (MUX)
SLAM - Set Last Active Module (MUX)	
Other DAU:	
CF - Configure Filters	CAU - Configure DAU
CH - Configure Headers	DAU1 - DAU Interface Test
EDS - Enter/Exit DAU Simulator	
DRU:	
CSD1 - Configure SD1/SIFT board	RRC - Restart Record Controller
TST - Tests for RC (990/5)	DECODE - Decode SEG-D Tape
TT - Tape Tester	
Other:	
IP - Initialize Parameters	CMST - Test CMS link
TIEDIT - TILINE Edit - Read & Write any address (DX10, SD1, DAU, 990/5)	

Figure 4. TSR Commands on VDT



Commands are separated into three types: initialization, control, and test/debug. Typically, the operator will first enter ITSR via the VDT keyboard to configure and initialize the system. A series of prompting screens will then appear, indicating operational parameters that may be accepted or modified by the operator.

After TSR initialization, the screen shown in Figure 4, reappears, and commands are used to enter the record or test/debug mode. Various displays are available, including system status, errors, and in the multiplex streamer case, raw depth data. Hard-copy output is also available using the system printer.

2.3 DATA ACQUISITION UNIT (DAU)

The DAU is a special-purpose logic unit consisting of 990-size logic cards in a 17-slot chassis.

The DAU provides the interface between the TSR and the streamer. Initially, configuration information from the Supervisor Terminal is converted to serial commands and transmitted to the streamer. The return data from the streamer are sorted into seismic channels, auxiliary channels, and streamer status. Streamer status and DAU internal status are made available to the 990/10 computer for status displays and reports.

The seismic data are processed by digital filters (DF) in the DAU. These filters provide operator-selectable functions such as dc offset removal or additional antialias filtering. Seismic data and auxiliary information are then passed on to the demultiplex memory.

2.4 DATA RECORDING UNIT (DRU)

The DRU is a special-purpose logic unit consisting of 990-type cards in a 17-slot chassis. The main functions of the DRU are to (1) receive data from the DAU, (2) demultiplex and format these data, and (3) output the data for recording and display. The DRU contains several microcomputer-based controllers that perform these functions.



2.4.1 DEMULTIPLEX MEMORY UNIT (DMU). The DMU consists of a microprocessor controller, mass memory, and TILINE interface. The primary function of the DMU is to demultiplex the seismic and auxiliary data received from the DAU. For a multiplexed streamer, multiplexed data at a continuous rate of 512,000 bytes per second are input to the DMU from the DAU. Demultiplexed data in bursts of 780,000 bytes per second are output from the DMU to the magnetic tape subsystem. These rates assume 240 seismic channels and 16 auxiliary channels at a 1-mil sampling rate.

A second function of the DMU is to provide resampling of multiplex streamer data if desired. That is, 1-mil data from the streamer may be decimated to 2- or 4-mil data.

The DMU utilizes a mass memory containing up to five megabytes of semiconductor memory. The memory is formed from one-megabyte 990-type memory cards, each capable of random addressing.

A 9900-based controller (DMUC) will receive configuration parameters from the Supervisor Terminal used in controlling address manipulations needed in demultiplexing memory data. DMU status will be transferred as required.

The Seismic Data Interface (SDI) provides interfaces between the DMUC and the extended DRU TILINE. The latter simulates a memory block on the TILINE.

2.4.2 MAGNETIC TAPE SUBSYSTEM (MTS). The MTS receives demultiplexed data from the SDI and records the information on magnetic tape. The MTS contains three major components: A CDD 990 MTC/125 tape controller, a TELEX 6850 formatter, and dual Telex 6253 high-speed, high-density magnetic tape units (a third tape drive is utilized as a standby spare).

The 990 MTC/125 is a microprocessor based tape controller that receives initialization and control parameters from either the Supervisor Terminal 990/10 or the DRU 990/5 (paragraph 2.4.3). It also returns status via the extended TILINE in the DRU. In response to write commands, the tape controller acquires header, seismic, and auxiliary data from memory and transfers these data to the Telex formatter along with appropriate control



signals. For read commands the direction of data transfer is reversed. The tape controller also provides an output port to the digital plotter subsystem to be added later.

The Telex tape formatter interfaces the tape controller to the tape unit. Write data are encoded in GCR (group coded recording) format. Read data are coded for the tape controller. Control commands are converted to the proper motion control signals to the tape drives. The formatter also performs error detection, correction and diagnostic functions.

The dual Telex tape drives are vacuum-column, computer-type transports. These units feature high-density recording at 6250 BPI and a constant speed of 125 inches per second.

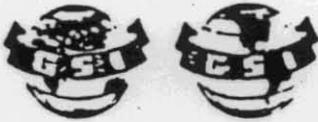
2.4.3 990/5 TSR CONTROLLER (CPU). A 990/5 microcomputer coordinates operations in the DRU during real-time operations (on-line shooting). Some of the functions performed are described below.

Initialization parameters are received from the 990/10 for distribution to the DMUC, SDI, MTC, and SIFT (System I/F and Timing) as required. Status from these units is also acquired and reported to the 990/10.

The 990/5 monitors the DMUC for a data ready condition signal for each seismic file. When such signals are detected, the 990/5 generates a series of write commands to the MTC, which are used in transferring the trace sequential seismic data onto tape. The 990/5 also stores the trace headers and supplies these during the recording process.

The 990/5 controls the SIFT logic and manipulates the DFS Start, Wire Blast, and Field Time Break signals. These manipulations effect coordination between TSR, CMS, and TIGER.

The 990/5 also controls the MDB logic, informing it which channels are to be displayed, e.g., PGC rate, initial gain, galvo gain, etc. These are static signals and can be changed only by operator request. The 990/5 directly controls MDB dynamic signals that control camera start/stop, file number, etc.



2.4.4 DISPLAY SUBSYSTEMS. TSR will provide two types of data display, each handling a different operational requirement as described below.

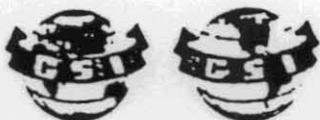
2.4.4.1 Plotter Subsystems (future development). The plotter subsystem will provide high-quality hard-copy displays for quality assurance and diagnostic purposes. In the normal operational mode, the plotter will receive demultiplexed digital seismic data, producing standard seismic displays. The displays, however, will offer increased versatility in display and annotation along with full 256-trace capability. It is anticipated that plotting speed will be at about one-third of real time. The plotter may also function in a nonseismic mode, e.g., producing graphics, alphanumerics, etc.

The plotter subsystem will consist of three major components: the Reproduce Controller Interface (RCI), an AMF/LSI HSR-11B Raster Unit, and a CalComp Model 5300 Plotter.

The RCI is a 9900 microprocessor-based controller. Initialization and control information is received from the 990/10 over the TILINE bus. Data may be received either from the TILINE or via a link to the magnetic tape controller. The RCI is capable of applying a form of true-amplitude-recovery compensation to data before passing it on to the raster unit. It also is capable of organizing commands and data for the raster unit control.

The HSR-11B Raster Unit is a high-speed, bit-slice processor that generates a digital raster along with necessary control signals for driving the plotter. The raster unit is capable of generating standard seismic formats, alphanumerics, and other graphic outputs.

The CalComp 5300 is an electrostatic plotter utilizing 22-inch-wide paper. An electrostatic plot image is produced by a stationary write head containing tiny styli that write on the moving paper. A visual image is subsequently developed as the paper passes through a toner where ink is deposited on charged areas. The plot resolution is 200 dots per inch horizontally and vertically.



2.4.4.2 Multiplexed Display Board (MDB). The MDB performs three major functions. It provides a multiplexed analog waveform (similar to the DFS V's DA output) that is displayed on an oscilloscope. It provides a single-trace display for the EPC. It also provides for the use of a standard 64-channel camera.

The MDB receives digital data words from the DMU. It applies D/A conversion to selected words, resulting in a multiplexed analog signal for display on an oscilloscope. It also inserts marker pulses at specified intervals, simplifying channel identification. It controls reproduce gain for real-time or playback operation.

The multiplexed analog signal is also sent to the Camera Interface along with demultiplexing addresses and camera control signals. Two DM cards (DFS V type) demultiplex this signal, providing up to 60 data channels to the camera (ERC-10).

The MDB also produces a single-channel display signal and TB sync for the EPC. Any of the 240 data channels or 16 auxiliary channels may be selected for display.

2.5 SYSTEM SOFTWARE

The TSR system software provides three main functions:

- It provides the operator interface to the TSR.
- It handles all movement of data, commands and status throughout the system.
- It provides system control and coordination.

2.5.1 OPERATOR INTERFACE. The operator may, through the 911 VDT keyboard, configure and control the streamer, digital filters, DMU, TSRC, tape drives, and reproduce controller. In addition, various logging and display tasks can be started or stopped. System status may be displayed or logged. Various hardware and software debug tasks can be initiated. The tape drives may be operated in a stand-alone mode.



2.5.2 DATA FLOW. Figure 2-3 shows the data flow in the TSR system. The software gathers data from the CMS, the streamer, the TSRC and the operator, all of which is used in building SEG-D formatted tape records. In addition, status and error information is displayed, logged, and sent back to the CMS.

2.5.3 SYSTEM CONTROL AND COORDINATION. As shown in Figure 5, the operator may send commands to any of the system's remote portions to change operational modes. The three primary modes of operation are Record, Test/ Debug, and Initialize. In the record mode the TSRC (990/5) is in control of the magnetic tape drives and all commands to the tape controller originate at the TSRC. In addition, the TSRC controls the recording sequence, sending the wire blast signal to the TIGER, updating trace headers, and sending status back to the supervisory terminal.

In record mode the supervisor terminal is responsible for future updating general and extended headers, displaying status to the operator, and sending data to the CMS. In the future, it will also control the plotter.

In the test mode, the supervisor terminal controls the tape drives directly through its TILINE Peripheral Control Space.

2.5.4 SOFTWARE ORGANIZATION. The TSR software is a series of programs designed to run under the System Control Interface (SCI) portion of the DX10 operating system. The operator executes DX10 SCI procedures to initiate the TSR programs. All the TSR programs are linked with a common area that contains system-wide parameters. These initialization parameters are saved at the end of a TSR session and restored when execution is resumed. The operator may then modify the configuration of the system or change default parameters to suit the current situation.

After the system is initialized, several tasks may be started and run in parallel. For example, the display and error logging tasks may be run with the recording task to give the operator updated system status in real time. To change recording parameters, the recording task must be halted.

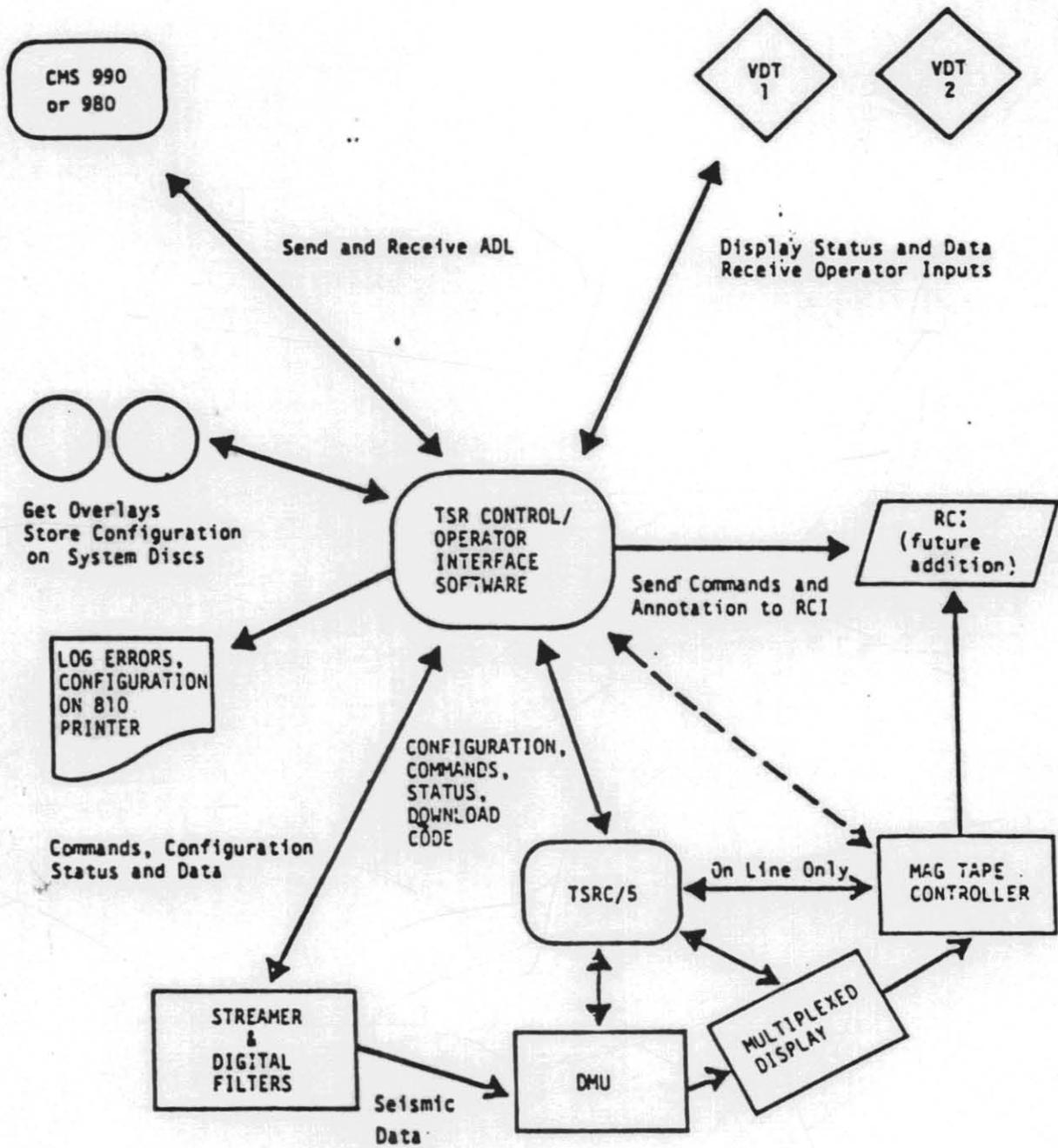


Figure 5. TSR System Control and Coordinator



All 990/10 software will be written in TI Pascal, while TSRC software will be developed using Micro Processor Pascal. The TSRC software is downloaded from the 990/10 at system initialization time.

2.6 TYPICAL OPERATING SEQUENCE

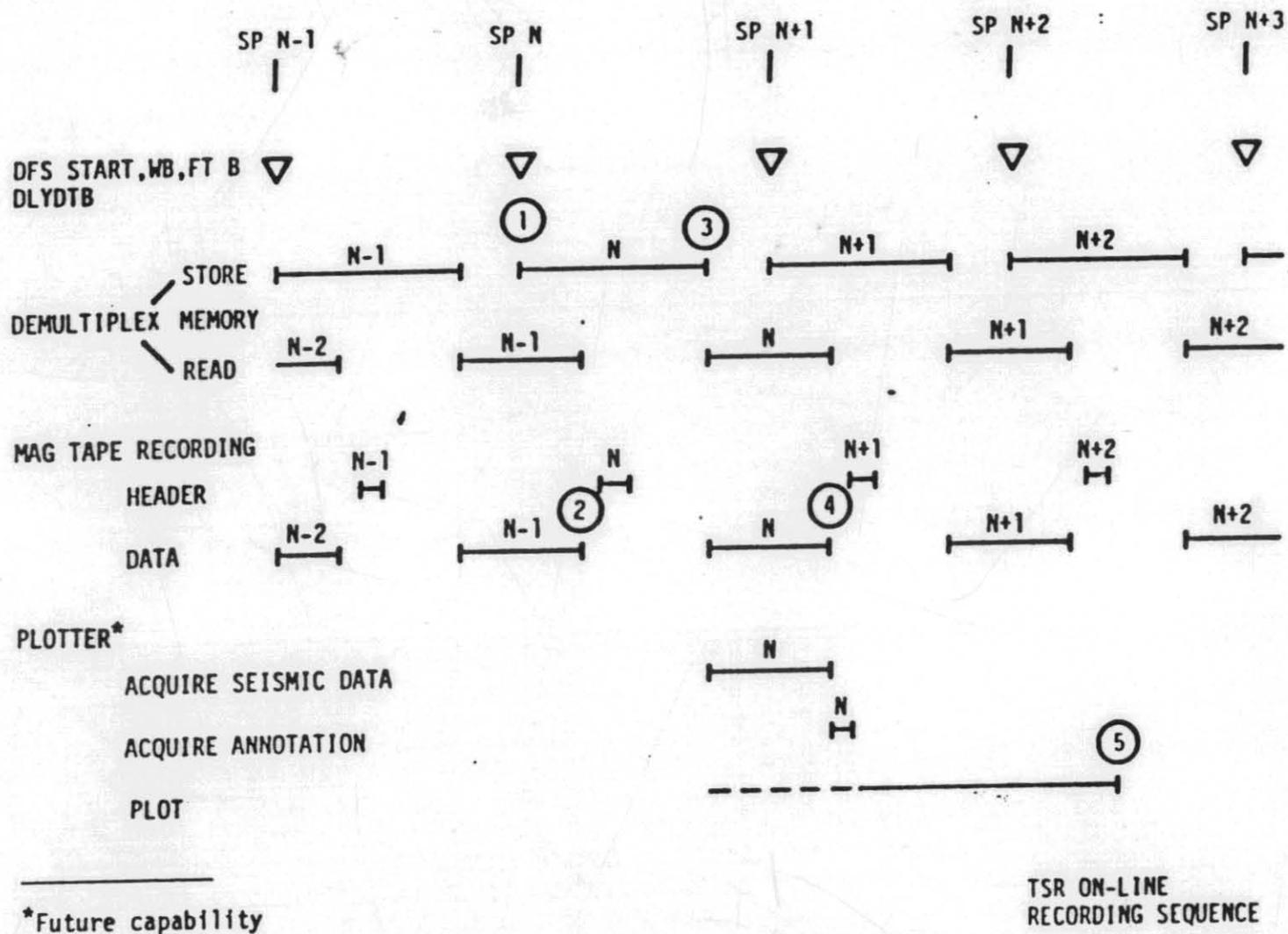
This section presents a typical on-line operating sequence with reference to the block diagram of Figure 3 and the system timing diagram of Figure 6. It is assumed that the properly initialized system is on line, shooting, and has arrived at Shotpoint N of Figure 6. The discussion refers to the events labeled one through five in Figure 6.

Time ①

As shotpoint N is reached, CMS starts the recording sequence by generating DFS START. The 990/5 TSR controller detects the START and commands the SIFT logic to output a Wire Blast (WB) relay closure to the TIGER air-gun controller. TIGER, detecting the WB closure, starts the air-gun firing sequence and returns a Field Time Break (FTB) signal to TSR. (Only a few milliseconds normally elapse between these events.) TSR then detects the FTB signal, which is used as the time zero reference for the shot, and commences all actions required to process and record data for shotpoint N.

When FTB is detected, the DMU Controller develops a delayed time break (DLYDTB). This time break takes into account (1) system propagation delays on the order of 7 milliseconds and (2) delayed recording delays that the system operator may enter.

At DLYDTB, the DMUC begins to store data for SP N in the demultiplex memory. Note that at the same time the DMUC is also outputting SP N-1 data to the magnetic tape subsystem, which is under control of the 990/5.



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Figure 6. On Line Timing Diagram

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During this time, the 990/10 performs various bookkeeping functions as follows:

- ADL transferring with CMS.
- Updating of the general header and ready notification of the 990/5.
- Updating plotter annotation.

Time ②

When the last data from SP N-1 have been recorded on tape, the 990/5 informs the 990/10 that end-of-recording has occurred and status is transferred. The 990/10 then commands the plotter subsystem to display the next file, which will be SP N.

The 990/5 next commands the MTC to record the general header record for SP N, and the magnetic tape subsystem acquires the header data from 990/10 memory for recording. The 990/5 updates the trace headers to be used with SP N seismic data.

Time ③

When the DMUC has stored the desired amount of data, a READY-TO-RECORD signal is sent to the SDI. The SDI then begins acquiring demultiplexed data for the first trace record from the DMUC, interrupting the 990/5 to inform it that data are ready.

The 990/5 now commands the MTC to record the first trace record on tape. The MTC then acquires and records a 20-byte trace header from 990/5 memory before acquiring and recording the trace data from the DMUC via the SDI. When the trace record is complete, the MTC reports status to the 990/5. This cycle is repeated for each trace.

As the MTC outputs trace data to the tape formatter, it also sends data to the RCI. (The latter is initialized in advance for plotting SP N data.) The RCI applies true-amplitude-recovery



compensation on the data, then sends it on to the raster unit and electrostatic plotter.

Time ④

End-of-recording occurs for SP N, and the 990/5 reports status to the 990/10. The 990/10 commands RCI to acquire annotation for the plot. The RCI reads annotation from 990/10 memory and sends it to the master.

Time ⑤

The plotter subsystem completes the SP N seismic plot, and the RCI reports status to the 990/10.

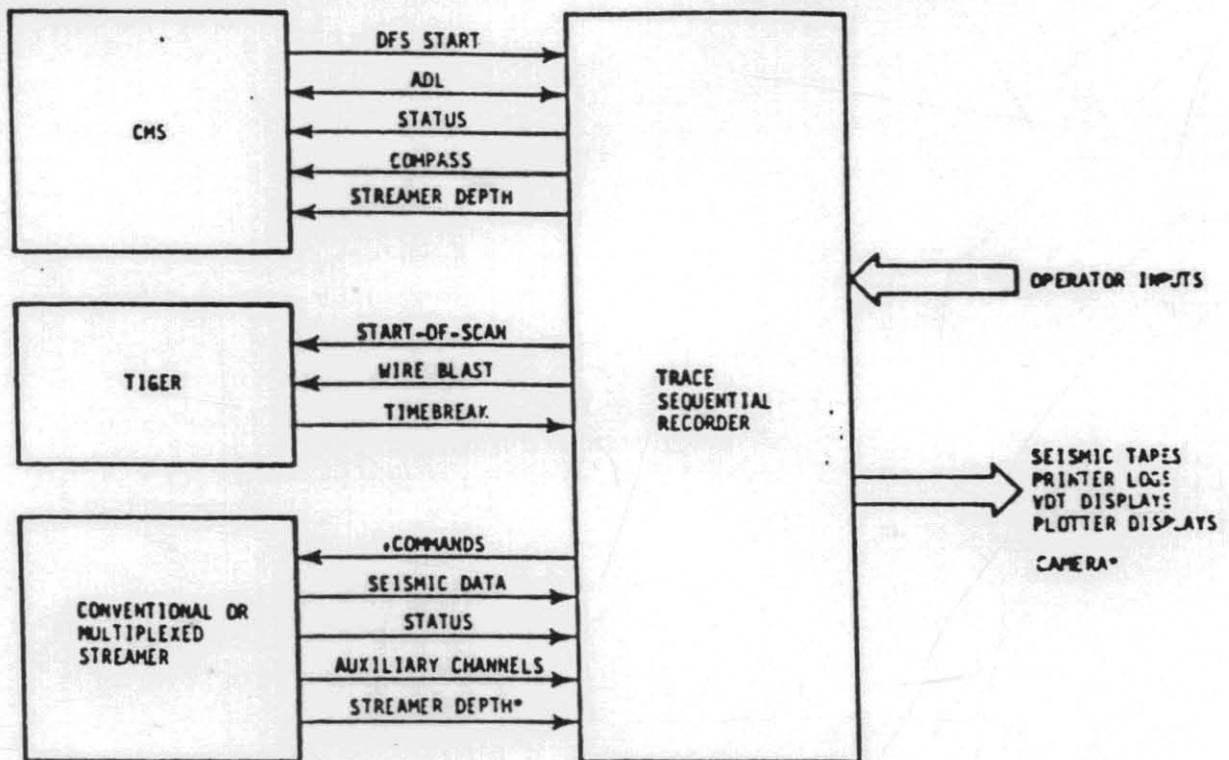
3.0 SYSTEM PERFORMANCE

This section contains a more detailed description of the performance characteristics of the Trace Sequential Recorder.

3.1 RELATIONSHIP TO OTHER SYSTEMS. Figure 7, illustrates the relationship of TSR to other portions of the marine system. TSR coordinates with CMS and with the TIGER to develop desired shotpoint sequence. The CMS controls the navigation function, while the TIGER manages the air-gun array. TSR must also control streamer functions of receiving and recording data.

3.1.1 STREAMER DATA SOURCES. TSR will interface to either a conventional streamer (via DFS V analog modules) or to the Multiplex Streamer. In the conventional case, a maximum of four analog modules may be utilized. This limits seismic channel sampling capacity to 56 at 1-mil and 240 at 2- or 4-mil sampling rates. For Multiplex Streamer, the current channel capacity is 240 at a 1-mil sample rate.

For either streamer type TSR will transmit commands for configuration and control purposes. Seismic data, status information, and various auxiliary data will be received from the streamer for appropriate disposition.



*Multiplexed Streamer only.

Figure 7. TSR Interfacing

3.1.2 SHOT CONTROL. TSR retains the conventional DFS type "handshaking" with the rest of the system and also provides additional capabilities for more versatility in shot control.

For distance-based shooting, the line control computer issues DFS Start at the shotpoint. DFS Start is received by TSR either as a relay closure or as a command via an EIA link. TSR responds with a Wire Blast, which is received by the TIGER air-gun controller. TIGER returns a Time Break and initiates gun firing. For Multiplex Streamer operation, the Time Break must be synchronized to the Start-of-Scan pulse, which occurs at a 1-millisecond interval and is derived from the data sampling interval in the streamer. For the conventional streamer, data sampling is effectively synchronized with Time Break.



Each of the above control signals — DFS Start, Wire Blast, and Time Break — may also be generated or simulated by TSR under internal software control. Such simulations allow TSR to (1) perform manual or time-interval shooting and (2) implement test and diagnostic functions.

TSR may also report status of the shot control signals to other systems over EIA data links.

3.1.3 AUTOMATIC DATA LOGGING. Currently, certain data are transferred between CMS and the DFS for recording by the respective magnetic tape units, and this capability is retained by the TSR. Shotpoint number, date, water depth, and time are transferred from the line control system to TSR for recording on the seismic tape. Seismic reel number, record number, and delayed recording time are transmitted from TSR to the CMS tape.

3.1.4 STREAMER TRACKING DATA. For both the conventional and digital streamers, STS III directs control in the interrogation and acquisition of compass and streamer depth data. For the multiplex streamer, depth data from the SEMs are available to the operator through the TSR. The data may also be logged on the system printer.

3.2 MODES OF OPERATIONS

This section describes the modes of operation selectable by the system operator via menus presented by the VDT.

3.2.1 INITIALIZATION MODE. When the system is started, the previously defined operational parameters are read from a disk file, and the system is initialized to its former state. To modify or update the system, one or more of the initialization programs should be run. The programs include:

- System configuration
- Select streamer type
- Set DAU filters



- General recording parameters (length of records, number of channels, etc.)
- Reproduce Unit configuration.

3.2.2 RECORD MODE. When record mode is entered, the software checks for proper initialization, then attempts to download and/or establish communications with the configured devices. If successful, a wait mode is entered in which the operator may enter commands to start or stop logging, change displays, etc. At the same time, the 990 gives control of the tape recorders to the TSRC for the duration of the recording cycle.

On the next external System start signal, the actual recording sequence takes place. During recording, the software reads ADL data from the CMS systems and builds the SEG-D tape headers. The TSRC in the meantime handles the system timing signals and directs the tape units to write when data become available. If the next shot is to be displayed on the camera, commands are sent to the MDB to select channels for display, display file number, and start the camera.

3.2.3 TEST MODE. All debugging and system testing operations are done in test mode. In addition, the following tape operations are available to the operator in test mode.

3.2.3.1 Record EOF. This command causes an end-of-file record to be recorded on tape.

3.2.3.2 Read Next File. Execution of this command causes the next tape file to be read, normally consisting of a header record and all associated trace data blocks (demultiplexed trace sequential records). The operator may elect that the data automatically be transmitted to the reproduce subsystem for display.



3.2.3.3 Search Tape. This command allows the operator to perform a tape search in one of the following manners:

- Search for desired file number.
- Search forward or reverse N files.
- Search for last file on tape.

3.2.3.4 Rewind. Causes the tape to rewind. Rewind time is approximately 60 seconds for a full 2400-foot reel.

3.2.3.5 Decode. Enables the operator to obtain a "pretty print" decoding of the SEG-D tape headers.

In test mode the 990/10 has the option of controlling and performing extensive testing to verify system operation. Individual controllers may be commanded to perform self tests and report status. Communication links are checked and peripheral devices exercised to ensure proper operation.

Many of the standard test functions provided in current field systems are available. A tape bypass mode for processing data through the system without recording on tape has been provided.

3.3 INPUT CHARACTERISTICS

The input data handling capabilities of the system are described in this section. Data consist of two types: seismic data and various auxiliary inputs.

3.3.1 SEISMIC CHANNEL CAPACITY. Seismic data as received from the streamer are in a digital, multiplexed format. Analog signal processing is performed external to the TSR system.

3.3.1.1 Multiplex Streamer Channel Capacity. The Multiplex Streamer provides up to 240 channels sampled at a 1-millisecond rate. Streamer electronic modules (SEMs) in the streamer each provide analog signal



processing and digital conversion for 12 channels; 20 SEMs may be accommodated currently.

3.3.1.2 Conventional Streamer Capacity. Seismic data are received from DFS V analog modules that perform analog signal processing and digital conversion. Channel capacity is as follows:

	<u>1 Box</u> <u>1 msec</u>	<u>1 Box</u> <u>2 msec</u>	<u>1 Box</u> <u>4 msec</u>	<u>2 Box</u> <u>1 msec</u>	<u>2 Box</u> <u>2 msec</u>	<u>2 Box</u> <u>4 msec</u>
Maximum channel capacity	28	56	60	56	120	120
Maximum channels/box	28	56	60	28	60	60

3.3.2 AUXILIARY CHANNELS

3.3.2.1 Multiplex Streamer Auxiliary Channels (future addition). A capacity of up to 13 analog auxiliary inputs will be processed and recorded utilizing the on-board equivalent of a streamer electronics module. These are Type 1 and Type 2 inputs as described on the following page. The same type of gain function, either IFP or fixed gain, will be applied to all analog inputs.

Several digitized auxiliary inputs will also be received from the streamer and processed as described in the following paragraphs.

3.3.2.1.1 Type 1 Analog. Eleven inputs will be provided, all of which will receive the same signal processing, both analog and digital, as the seismic data channels. Typical inputs will be as follows:

- Reference Oscillator — a calibration signal for noise measurement, etc.
- Air-Gun Array Hydrophone
- Air-Gun Far-Field Measurement System

3.3.2.1.2 Type 2 Analog. Two input channels will be provided that bypass the standard low-cut and high-cut analog filters in the SEM and also bypass



the digital filter functions. Digital delays will be provided for proper time alignment with the seismic data. Typical inputs will be as follows:

- Air-Gun Shuttle Signal
- Stretched Time Break

3.3.2.1.3 Water Breaks. Up to three digital water break signals from the streamer will be recordable. These signals will bypass the digital filters. Proper delays will be provided.

3.3.2.1.4 Streamer Heading and Depth. Each SEM is capable of supplying digitized data from an associated heading sensor (compass) and a depth sensor. These data are not recorded on seismic tape but are transferred to the Streamer Tracking System for processing. Depth data will also be processed by the system 990 and will be capable of being displayed on the VDT and/or logged by the printer.

3.3.2.2 Conventional Streamer Auxiliary Channels. For the conventional streamer, initial data acquisition functions are performed by DFS V analog modules. Two standard auxiliary channels and the auxiliary circuits, as described in the following table, will be available.

<u>Auxiliary Channel</u>	<u>Characteristics</u>
Gain:	Unity (2^0), 0 dB
Frequency Response Standard:	1.24 to 338 Hz
0.5-msec option:	2.48 to 723 Hz
DC Offset:	± 10 mv maximum
Crossfeed Isolation:	80 dB between any two channels, feeding one channel only

3.3.2.2.1 Auxiliary Circuit Characteristics. Special auxiliary circuits, which at option may connect to an auxiliary channel (within the above constraints), will include the following:



- Shotpoint Seis (up-hole) Amplifier: Maximum gain is 34 dB; gain is varied by an internal potentiometer. Squelch delays are variable from 50 to 400 msec or no squelch.
- Frequency Reference: A crystal clock independent of system timing provides 50 or 25 Hz, which may connect to an auxiliary channel and/or directly to a galvo as a check on system timing; 60 and 50 Hz are also provided for adjusting the notch filter. Frequency accuracy is ± 0.005 percent. An external select switch is provided; normal operation on REF.
- Time Break Lengthened: Stores the blaster time break on a capacitor which holds a charge long enough to assure digitizing and recording. Either polarity is available through an internal adjustment.
- Auxiliary Data Filter: A filter channel which duplicates data channel response.

3.3.3 INPUT DATA FORMATS. The system accepts the different input numeric formats from the two types of streamers and provides the proper output format for the magnetic tape records.

3.3.3.1 Multiplex Streamer Input Format

- Amplitude
 - Number of Bits: 13 (including sign)
 - Number system: Signed binary
 - MSB: 4096 mv
 - LSB: 2 mv
- Gain
 - Number of bits: 4-bit gain ranging amplifier exponent + 1-bit dual gain amplifier exponent
 - Method of gain control: binary floating point
 - Maximum gain: 84 dB



3.3.3.2 Conventional Streamer Input Format

- Amplitude
 - Number of bits: 15 (including sign)
 - Number system: Two's complement
 - MSB: 4096 mv
 - LSB: 0.5 mv
- Gain
 - Number of bits: 3-bit gain ranging amplifier exponent of four
 - Method of gain control: quaternary floating point
 - Maximum Gain: 84 dB

3.3.4 EXPANSION OF INPUT CAPACITY. An effort has been made in all design phases of this program to allow for expansion of system input capacity as future requirements dictate.

3.4 PRE-RECORD PROCESSING

This section summarizes various processing functions that may be applied to the streamer data before they are recorded on magnetic tape.

3.4.1 DIGITAL FILTERS. The DAU contains digital filters that perform the following functions:

3.4.1.1 DC Offset Removal. Offset is removed from the data in two stages, either or both of which are enabled or bypassed by the operator. The first offset filter operation removes DC offset of the analog multiplexer, IFP amplifier, and ADC. This is done by passing offset measurements from the streamer through digital high-cut filters and then subtracting filtered offset values from the data. The offset filter has a time constant of 1024 milliseconds; cutoff frequency is 0.155 Hz.

The second filter operation remove DC offsets of circuitry prior to the analog multiplexer. This is accomplished by passing each trace through a digital low-cut filter. The time constant of these filters is also 1024 milliseconds; cutoff is 0.155 Hz.



3.4.1.2 Antialiasing Filters. For the Multiplex Streamer, analog seismic data are passed through 1-mil analog antialiasing filters in the SEMs prior to sampling and analog-to-digital conversion. (Sampling occurs at a 1-mil rate.) Further digital filtering is performed in the DAU if the data are to be resampled prior to recording. Up to eight different digital filters are available for operator selection. Each is a 45-point convolution operator. Currently, 1-, 1.5-, 2-, 3-, and 4-mil filters are available. There is also a unit impulse filter to provide an effective bypass.

Antialiasing filters are partitioned to operate on blocks of 60 seismic channels each with multiple sampling rates possible. For example, the first 60 channels might be passed through 1-mil filters while the following 180 channels receive 2-mil filtering.

For the conventional streamer, the seismic signals may be passed through 1-, 2-, or 4-mil analog, antialiasing filters in the DFS V analog modules. The digital antialias filters are normally bypassed.

3.4.1.3 Trace Summing. A straight trace summing function is applied to reduce the quantity of recorded data. Two or four consecutive traces are summed.

3.4.1.4 Normalization. The digital filters normalize output values by performing double left shifts on the mantissa and by incrementing the corresponding quaternary gain exponent. This is done until (1) either or both of the two most significant bits differ with the sign bit, (2) the next four bits all differ with the sign bit, or (3) the exponent reaches maximum value.

3.4.2 RESAMPLING. One-mil sampled data from the streamer is decimated to 2- or 4-mil data before recording. Again, multiple sampling is accommodated in blocks of 60 channels — 60 channels at 1 mil and 180 channels at 2 mils, for example.



3.4.3 DEMULTIPLEXING. A major function of the TSR is to record seismic data on magnetic tape in demultiplexed or trace sequential form. The demultiplexing operation utilizes a large solid-state memory. Maximum record length is a function of the amount of mass memory in the system, sample rates, and number of channels as shown in paragraph 3.3.1.2.

3.5 MAGNETIC TAPE SUBSYSTEM CHARACTERISTICS

The magnetic tape recording subsystem represents a considerable departure from concepts employed in previous seismic field systems. The tape unit is a high-speed vacuum-column unit using high-density recording methods. Tape speed is constant, not varied as a function of system configuration. This is effected by buffering a complete record in the demultiplexing memory and then high-rate outputting to tape. SEG D format, a relatively new and very flexible format, is utilized. These and other basic characteristics are presented in this section.

3.5.1 MAGNETIC TAPE UNIT, FORMATTER, AND CONTROLLER. The magnetic tape subsystem contains dual Telex Model 6253 tape drives (a third drive may be used as a standby spare), a Telex Model 6850 Formatter, and a CDD Model 990 MTC/125 controller. This hardware operates as a conventional computer-driven tape subsystem interfacing to the 990 TILINE bus. Basic specifications are as follows:

Type of tape: 0.5 Inch
Number of tracks: 9
Speed: 125 ips
Recording density: 6250 bpi
Data rate: 781,250 bytes/sec, nominal
Recording method: Group-coded recording (GCR)
Autoload: Standard for 10-inch reels
Rewind time: 60 seconds
Automatic loading



3.5.2 TAPE FORMAT

3.5.2.1 Basic SEG-D Format. Data is recorded on magnetic tape in demultiplexed form in SEG-D format. Its format allows great flexibility in recording by permitting, for example, multiple sampling intervals and dynamic changes in recording parameters such as sample interval or filters. Because of built-in flexibility, SEG-D appears complex at first inspection. However, in typical applications its use is fairly straightforward, as the following example indicates.

Assume a system with four auxiliary channels (all with the same recording parameters), 240 seismic channels (ditto), and 2-millisecond sampling on all channels with 6-second records. The basic formats for the header record and for the demultiplexed data blocks are shown in Appendix 4 - SEG-D Tape Format.

For the header record, the general header is similar to SEG-B, containing file number, format code, general constants, etc. It is followed by one or more scan type headers. In our example, with no parameter changes during the record, there will be one scan type header. The scan type header in turn contains one or more channel set headers each of which describe the recording parameters of a channel set, a group of channels with identical recording parameters. In this example there will be two channel set headers, one for auxiliaries and one for seismic channels. The channel set headers are followed by a number of 32-byte fields describing sampling skew, thus completing the scan type header. Extended header and external header fields can then be added as appropriate. The makeup of our example header record is as follows:

General header	32 bytes
Scan type header	
Auxiliary channel set	32 bytes
Seismic channel sets	32 bytes
Sample skew	<u>256</u> bytes (244 used)
Total header record	352 bytes + extended and external headers

The demultiplexed data blocks then follow the header. Each data block consists of a 20-byte header followed by, in our example, 6 seconds of 2-mil data for a single channel. The first four blocks contain auxiliary data. These are followed by 240 blocks of seismic traces.



3.5.2.2 Numeric Data Representation. Initially TSR provided only the 2-byte quaternary exponent output format with 16-bit data word as shown in Table III-1. However, the requirement for achieving the 2-1/2-byte binary exponent or 20-bit format involves increasing the word length in the demultiplex mass memory from the current 16 bits to 20 bits. This is considered a future enhancement, and Table III-2 illustrates the 20-bit word and its bit weights. More detailed descriptions of SEG-D formats may be found in the booklet Digital Tape Standards available from the SEG.

Table III-1
2-Byte Quaternary Exponent Data Recording Method

2 byte quaternary exponent
data recording method

The following illustrated the 16-bit word and the corresponding bit weights:

Bit	0	1	2	3	4	5	6	7
Byte 1	S	C ₂	C ₁	C ₀	Q ₋₄	Q ₋₃	Q ₋₂	Q ₋₁
Byte 2	Q ₋₈	Q ₋₇	Q ₋₆	Q ₋₅	Q ₋₄	Q ₋₃	Q ₋₂	Q ₋₁

S = sign bit. — (One = negative number).

C = quaternary exponent. — This is a three bit positive binary exponent of 4 written as 4^{CCC} where CCC can assume values from 0-7.

Q_{1-M} = fraction. — This is a 12 bit one's complement binary fraction. The radix point is to the left of the most significant bit (Q₋₄) with the MSB being defined as 2⁻⁴. The fraction can have values from

$-1 + 2^{-M}$ to $1 - 2^{-M}$. In order to guarantee the uniqueness of the start of scan, negative zero is invalid and must be converted to positive zero.

Input signal = $S.QQQQ.QQQQ.QQQQ \times 4^{CCC} \times 2^{MP}$ millivolts where 2^{MP} is the value required to de-scale the data sample to the recording system input level. MP is defined in Byte 8 of each channel set descriptor in the scan type header.

3.5.3 RECORDING PARAMETERS

3.5.3.1 Record Length, Sample Rate, Number of Channels. Maximum record length is a function of the amount of demultiplex system memory, and the number of channels and sample rate. Table III-3 shows some typical capabilities assuming a 16-bit output word. Also assumed are four megabytes of memory used to buffer each seismic record in the multiplexed streamer case or two megabytes in the conventional streamer case.

3.5.3.2 Multiple Sampling Intervals. The system comprehends multiple sample intervals in blocks of 60 seismic channels. For example, the first 60 channels may be sampled at 1 mil; the latter 180 channels at 2 mils. Digital delays must be equalized in the digital filters for this case.

corresponding bit weights:									
Bit	0	1	2	3	4	5	6	7	
Byte 1	C ₀	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	Exponent for samples 1 thru 4 ^a
Byte 2	C ₈	C ₉	C ₁₀	C ₁₁	C ₁₂	C ₁₃	C ₁₄	C ₁₅	
Byte 3	S	Q ₋₁₅	Q ₋₁₄	Q ₋₁₃	Q ₋₁₂	Q ₋₁₁	Q ₋₁₀	Q ₋₉	Sample 1
Byte 4	Q ₋₈	Q ₋₇	Q ₋₆	Q ₋₅	Q ₋₄	Q ₋₃	Q ₋₂	Q ₋₁	Sample 2
Byte 5	S	Q ₋₁₅	Q ₋₁₄	Q ₋₁₃	Q ₋₁₂	Q ₋₁₁	Q ₋₁₀	Q ₋₉	
Byte 6	Q ₋₈	Q ₋₇	Q ₋₆	Q ₋₅	Q ₋₄	Q ₋₃	Q ₋₂	Q ₋₁	Sample 3
Byte 7	S	Q ₋₁₅	Q ₋₁₄	Q ₋₁₃	Q ₋₁₂	Q ₋₁₁	Q ₋₁₀	Q ₋₉	
Byte 8	Q ₋₈	Q ₋₇	Q ₋₆	Q ₋₅	Q ₋₄	Q ₋₃	Q ₋₂	Q ₋₁	Sample 4
Byte 9	S	Q ₋₁₅	Q ₋₁₄	Q ₋₁₃	Q ₋₁₂	Q ₋₁₁	Q ₋₁₀	Q ₋₉	
Byte 10	Q ₋₈	Q ₋₇	Q ₋₆	Q ₋₅	Q ₋₄	Q ₋₃	Q ₋₂	Q ₋₁	

^aIn the demultiplexed format, Bytes 1 and 2 contain the exponents for the following four samples of the channel. The sample numbers are relative and are only to denote position in the four sample subset.

S = sign bit—(One = negative number).

C = binary exponent.—This is a 4 bit positive binary exponent of 2 written as 2^{CCCC} where CCCC can assume values of 0-15. The four exponents are in sample order for the four samples starting with the first sample in bits 0-3 of Byte 1.

Q₁₋₁₅ = fraction.—This is a 15 bit one's complement binary fraction. The radix point is to the left of the most significant bit (Q₋₁) with the MSB being defined as 2⁻¹. The sign and fraction can assume values from 1 - 2⁻¹⁵ to -1 + 2⁻¹⁵. Negative zero is invalid

and must be converted to positive zero.

Input signal = S.Q. QQQ. QQQQ. QQQQ. QQQ
2^{CCCC} × 2^{MP} millivolts where 2^{MP} is the value required to descale the data word to the recording system input level. MP is defined in Byte 8 of each of the corresponding channel set descriptors in the scan type header.

Note that in utilizing this data recording method, the number of samples per channel must be exactly divisible by 4 in order to preserve the data grouping of this method.

Table III-3
Recording System Capabilities

Sample Rate	Multiplex Streamer		Conventional Streamer	
	No. of Chs.	Rec. Length	No. of Chs.	Rec. Length
1 mil.	240	8	56	8
2 mil	240	16	56	16
2 mfl	480	8	120	8
4 mfl	480	16	120	16

3.5.3.3 Dynamic Parameter Changes. Dynamic parameter changes are not permitted. For example, sampling at 1 mil for the first 2 seconds of recording and then switching to 2-mil sampling will not be permitted.

3.5.3.4 File Number. Initial file number is an operator entry via the VDT keyboard. Automatic increment or decrement of file number is provided.



3.5.3.5 Reel Number. Reel number is entered at the VDT keyboard. Automatic incrementing is provided.

3.5.4 AUTOMATIC TRANSPORT SWITCHOVER AND REWINDING. To be provided.

3.6 ELECTROSTATIC PLOTTER SUBSYSTEM CHARACTERISTICS
(Future Development)

Implementation of the electrostatic plotter will provide significant differences in the reproduce subsystem of TSR as compared to present seismic field systems. Currently the technique is to perform digital-to-analog conversion on the data to be reproduced and then to display the data with a galvanometer-type camera, typically limiting the output record to about 60 traces. For TSR, the approach will be to output the data to a digitally driven electrostatic plotter. Increased trace display capacity and more versatility in display and annotation are the goals.

The Reproduce Display Subsystem consists of three major components: the Reproduce Controller Interface (RCI), and AMF/LSI HSR11B Raster Unit, and a CalComp Model 5300 Plotter.

3.6.1 MODES OF OPERATION. Three basic operational modes will be provided. Two additional modes of "initialization" and "test" will be provided.

3.6.1.1 Current Display Mode. This will be the normal operational mode. When operating in this mode, the RCI will receive seismic data from the magnetic tape controller as they are being loaded to the tape formatter. As the data are received, the RCI will perform the required digital processing, then present the data to the raster unit along with the appropriate commands.

3.6.1.2 Playback Mode. The playback mode will be used to plot seismic data previously recorded on magnetic tape. The operation of the playback mode will be similar to the current display mode, with the following exception: before each trace is plotted, trace data will be read into the RCI memory from the 990/10 computer memory. (It is assumed that the 990/10 computer has previously read the proper trace from magnetic tape.) The



digital processor unit in the RCI will then process the data from RCI memory and present it to the raster unit along with appropriate commands.

3.6.1.3 General Plotting Mode. The general plotting mode will be provided to produce plots not requiring the special digital processing provided on the RCI. The data to be plotted, along with raster commands, will be read out of the 990/10 memory into the RCI memory. The controller will then transfer these data to the raster unit.

3.6.2 BASIC PLOTTER SPECIFICATIONS

Model: CalComp Model 5300

Type: Electrostatic

Size: 22-inch, providing 20.5-inch effective plotting width

Speed: 2.5-ips minimum effective speed required on depth or time axis for 8-second record length

Resolution: 200 dots/inch on both axes

3.6.3 SEISMIC DISPLAY CHARACTERISTICS. Conventional seismic displays will be provided. Basic characteristics are described below.

3.6.3.1 Display Formats. The types of seismic displays to be provided are as follows:

- WT (wiggle trace)
- VA (variable area)
- WT/VA (wiggle trace plus variable area)

3.6.3.2 Data Formats. Input data to the display function consist of 16-bit (2 byte) or 20-bit (2-1/2 byte) floating point values. These will be reduced to 8-bit (including sign) fixed-point values for display. Input data are at a 1-, 2-, or 4-mil sample rate. Plotted data will be at a 2- or 4-mil rate.

3.6.3.3 Display Modes. Three methods will be provided to control the amplitude of displayed signals.

- Float — Only the input data mantissa will be displayed. Gain is disregarded.
- Defloat — Input data values will be converted to a common fixed-gain value that is operator selectable. The common gain ranges over 0-84 dB in 6-dB steps.
- True amplitude recovery (TAR) — This will be the standard mode for on-line data display. Initially, as in the Defloat mode, input data will be converted to a common initial gain base, selectable by the operator. Then, additional factors will be applied to compensate for spherical divergence of the shot energy and inelastic attenuation along the path of propagation. Compensation is accomplished by multiplying the data with the factor given by the following equation:

$$\text{TAR correction in dB} = 20 \log t + \alpha t,$$

where

$$\alpha = 0-12 \frac{\text{dB}}{\text{sec}} \text{ in } 1 \frac{\text{dB}}{\text{sec}} \text{ selectable steps.}$$

α may be held constant at α_{cutoff} after an operator-selected cutoff time, t_{cutoff}

3.6.3.4 Number of Traces. The capability of plotting up to 256 traces will be provided. Starting trace numbers and numbers of traces to be plotted will be specified.

3.6.3.5 Trace Spacing. Trace spacing will be specified in traces per inch, corresponding to an integer number of dot spaces (0.005-inch increments) between trace origins. For example, 12.5 traces per inch corresponds to 16 dot spaces between traces. Standard spacings are 25, 12.5, 6.25, and 3.125 traces per inch.

3.6.3.6 Time Scaling. The time scaling of the plot will be based on the seismic data sampling rate and the length of the desired plot. Table III-4 lists the maximum plot times for a data rate of 2 msec.



Table III-4
Time Scaling vs Maximum Plot Time

<u>Time Scale</u> (inches/second)	<u>Maximum Plot Time</u> (seconds)
2.5	8
5.0	4
10.0	2

3.6.3.7 Annotation. The following annotation items will be adhered to.

- Timing lines. Timing lines will be provided at 10-msec intervals, with discernibly different lines at 50-msec intervals. In addition, lines at 100-msec intervals should be annotated.
- Trace Number Lines. Each group of 10 traces will have a vector to designate each block of traces. They will be annotated as processing time permits.
- General Plot Information. The following annotation will constitute the minimum to define a shotpoint.
 - Line number
 - Shotpoint number
 - Record number
 - Field tape number
 - Approximate real time
 - Plot parameter values.

3.6.3.8 Plotting Speed. The time to produce a seismic plot is very much a function of display parameters such as number of traces, trace spacing, and complexity of annotation. The plotting function is normally slower than real time, so data from a single shotpoint must be stored until plotted. This means that under normal shooting conditions, every shotpoint cannot be plotted. It is believed that the maximum rate of plotting will be in the range of once per second or every fifth shotpoint for a typical survey operation.



3.7 MULTIPLEXED DISPLAY, SINGLE-TRACE RECORDER AND CAMERA INTERFACE

This function provides the TSR equivalent of the oscilloscope, EPC plotter, and camera displays utilized in current DFS systems. The multiplexed display is a D/A reconstituted display of time-multiplexed multichannel seismic data. The single-trace display selects any one channel for outputting to an EPC-type plotter. The camera interface demultiplexes the multiplexed display signal for a camera display of up to 60 data channels. Most of the control of this board is via the operator terminal. However, maximum analog signal levels are controlled by potentiometers, and switches control a base camera start delay, camera polarity, and board address.

3.7.1 MULTIPLEXED DISPLAY CHARACTERISTICS. There are four modes of operation.

3.7.1.1 Float. The mantissa of the data are converted to an analog signal and displayed without regard to the gain bits.

3.7.1.2 Defloat. The mantissa data are converted to an analog signal that is scaled by an amount dependent on the data GAIN WORD and the INITIAL GAIN.

3.7.1.3 PGC (Programmed Gain Control). Operation is identical to the Defloat mode before Trip Delay. After Trip Delay (as measured from Time Break), the gain increases at a constant dB-per-second rate until the Stop Delay time (also measured from Time Break) is reached or until the maximum gain has been reached. The PGC gain function is illustrated in Figure 8. Note that the PGC may be reset at either EOR or Time Break.

3.7.1.4 Galvo Gain. This is a fixed gain achieved by shifting the mantissa bits before D/A conversion. It can be used only when the system is operating in the FIXED GAIN mode. This is the gain used to monitor DRD tests that are normally run in FIXED GAIN, 0 dB.

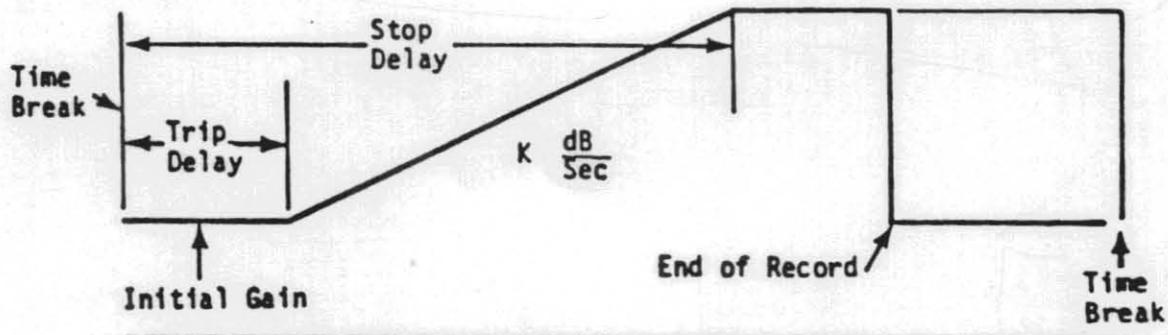


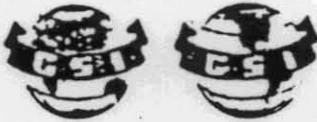
Figure 8. Sketch of Ramping Gain .

3.7.1.5 Channel Display Capacity. The MDB can produce multiplexed display signals composed of either 60 data channels or 136 channels (120 data channels, plus 16 auxiliary channels). There are several operator-selected display patterns of each type display.

3.7.1.6 Marker Pulses. To simplify channel identification, the MDB inserts Marker Pulses into the display signal at specified intervals. The amplitude of these pulses is operator-settable, allowing the operator to make quick signal-level checks, such as streamer noise.

3.7.1.7 Selectable Parameters. The following parameters are operator-selectable.

FLOAT/DEFLOAT:	As described above
DISPLAY SELECT:	Select one of 12 display patterns
GALVO GAIN:	0-60 dB in 12-dB steps (only allowed in FIXED GAIN mode)
INITIAL GAIN:	0-84 dB in 6-dB steps
PGC RATE:	0-12 dB/sec in 1-dB/sec steps
PGC RESET:	Select EOR or Time Break as the time to reset the PGC gain to the INITIAL GAIN value.
TRIP DELAY:	0-12.7 seconds in 0.1-second steps



STOP DELAY: 0-12.7 seconds in 0.1-second steps (normally greater than Trip Delay)

MARKER AMPLITUDE: 0-8,190 millivolts in 2-millivolt steps

3.7.1.8 Gain Overdrive. In the event that a gain overdrive occurs due to PGC operation, Initial Gain, or Galvo Gain, the MDB displays this condition via the GAINOVD signal. This signal is displayed on channel 2 of the same oscilloscope used to display the multiplexed signal. If a channel is overdriven, this signal will go high during the time the overdriven channel is being displayed.

3.7.2 SINGLE-TRACE RECORDER. The MDB provides an output to drive and sync an EPC-type plotter. The output channel may be any data or auxiliary channel as selected by the operator. It is presented in the same mode as that selected for the multiplexed display - Float, Defloat, PGC, or Galvo Gain. The EPC sync is simply a buffered Time Break signal.

NOTE:

This is not a high-quality reproduce signal. The MDB reproduces data at half the system sample rate. Thus, this signal should not be used for QC functions requiring a high-quality signal.

3.7.3 CAMERA INTERFACE CHARACTERISTICS. The Camera Interface is composed of logic on the MDB, a Camera Interface Cable, and the Camera Interface Chassis.

3.7.3.1 MDB Camera Operations. The MDB supplies all necessary signals for camera operation. It runs the Multiplexed Display Signal through a buffer (switch-controlled, inverting or noninverting) and outputs this signal, DAC, to the Camera Interface Chassis (CIC). Thus, the signals displayed on the Camera will be presented in the same mode as the Multiplexed Display Signal. The MDB generates demultiplexing addresses for the CIC. If a 60-channel display is selected, all channels in the multiplexed display will be displayed on camera. If a 136-channel display is selected, 60 of the 120 data channels will be displayed as determined by the display selected. The



MDB outputs an analog-encoded file number/display code signal for display on a camera auxiliary galvo and a buffered form of the Time Break signal for display on a data galvo. Also, the MDB generates a camera start relay closure and a 100-Hz timing-line signal for camera control. Most of the camera interface timing is initiated by EOR. If the CAMERAON bit is set when an EOR is detected, the next record will be displayed on camera. A camera start delay is provided to allow the operator to reduce the amount of paper wasted and to avoid camera timeouts (approximately 9 seconds after camera start if BOR not detected). This delay is available to the operator in two parts. A base camera start delay is selectable via switches on the MDB board, from 0.0 second to 22.4 seconds, in 3.2-second intervals. Also, a delay from 0.0 to 3.1 seconds in 0.1-second intervals is available via the keyboard. Thus, the starting of the camera can be set from 0.0 to 25.5 seconds following the end of the previous record.

3.7.3.2 Camera Interface Cable. The Camera Interface Cable runs from connector P3 of the MDB to the back of the CIC. It carries all signals used by the CIC as well as the Multiplexed Display and Single Trace signals and syncs. Also, it carries power to the CIC. Thus, this cable should not be connected or disconnected when DRU power is on.

3.7.3.3 Camera Interface Chassis (CIC). The CIC contains two DM cards (DFS V type) that are used to demultiplex the DAC signal according to the demultiplexing addresses received from the MDB. The start closure and the timing line clock are forwarded directly to the camera, along with the 60 demultiplexed analog signals from the DM cards via a standard camera cable. The DM card in the upper slot should be wired to place the TB signal on data galvo 4 and the File number/Display code signal on auxiliary galvo 3. The Multiplexed Display Signal, GAINOVD, and Sync for the oscilloscope display, as well as the Single Trace signal and Time Break sync for the single-trace display are available via BNCs on the front panel of the CIC.

NOTE:

As there is no power switch on the CIC, the DM cards should not be removed or installed with the DRU power turned on if the camera interface cable is installed.



3.8 SYSTEM TIMING ACCURACY

This section specifies the basic timing accuracy of the system and outlines a possible method for field-checking accuracy.

3.8.1 DATA SAMPLING RATE. Accuracy of the data sampling rate is of prime importance in the seismic data acquisition system. For the multiplex streamer, each SEM contains an oscillator that phase-locks to a reference frequency from the ship having an accuracy of $\pm 0.0025\%$. Sampling is performed at a 1-millisecond rate which, then, has a long-term accuracy of $\pm 0.0025\%$. Sample-to-sample jitter of ± 50 nanoseconds or $\pm 0.005\%$ is possible due to the nature of the phase-locked oscillator.

For conventional streamer operation, sampling is performed by DFS V analog modules that receive sampling control inputs from an interface in the TSR. Sample rate accuracy of $\pm 0.005\%$ is maintained.

3.8.2 REFERENCE TIMING OSCILLATOR. In current real-time galvo-camera systems, a reference timing signal or piper trace is developed from an independent oscillator for visual comparison to timing lines developed from the data playback rate. These are used to verify system timing accuracy. In a non-real-time digital plotter, playback system piper trace would be meaningless. Therefore, another method of verifying timing accuracy is required.

To verify timing accuracy in this system, a multiple period average of the 1-millisecond sample rate is taken. For example, by counting an independent 1-MHz clock over 1,000 sample periods, the sample period is measured to $\pm 0.001\% \pm$ reference accuracy. This reference count is analyzed by the 990 computer and recorded on tape along with appropriate error messages.

3.8.3 TIME BREAK WINDOW. This feature provides an integrity check on the Field Time Break. Prior to each shot, a counter is preset to an operator-selected time-break window value (in milliseconds), after which it is decremented at a 1-millisecond rate. Decrementing begins with the Wired Blast signal. If the Field Time Break is detected before the window count becomes zero, normal detection has occurred, and the residual count is stored



for use in the trace headers of data records. If the count decrements to zero, an internal time break (ITB) is generated, and zero is stored in the trace headers.

3.9 AUTOMATIC DATA LOGGING

Automatic data logging (ADL) is a system of recording survey parameters on seismic and navigation tapes. It allows for correlation between seismic records and navigation records during processing.

The following navigation data is recorded on the seismic tape via the header block:

- Julian Day
- Greenwich Mean Time (GMT)
- Shotpoint number
- Fathometer water depth

The following seismic data is recorded on the navigation tape:

- Record (File) number
- Reel number
- Delay Time (T-zero)

3.10 EXTENDED HEADER

An extended header is provided to allow the recording of user-defined data (i.e., ADL information) on seismic tape. The extended header for SEG D is recorded after the general header and scan type header. The extended header is recorded in blocks of 32 bytes. The number of blocks in the extended header is recorded in byte 31 of the general header.

3.11 DELAYED RECORDING

A delayed recording function is provided to allow a programmable delay between the firing of the air-gun array and the storage of seismic data in the demultiplex memory. The programmable delay is in 0.1-second increments from 0.1 to 9.9 seconds. The delay record value is made available to be recorded in the extended header.



TSR RECORDING SEQUENCE

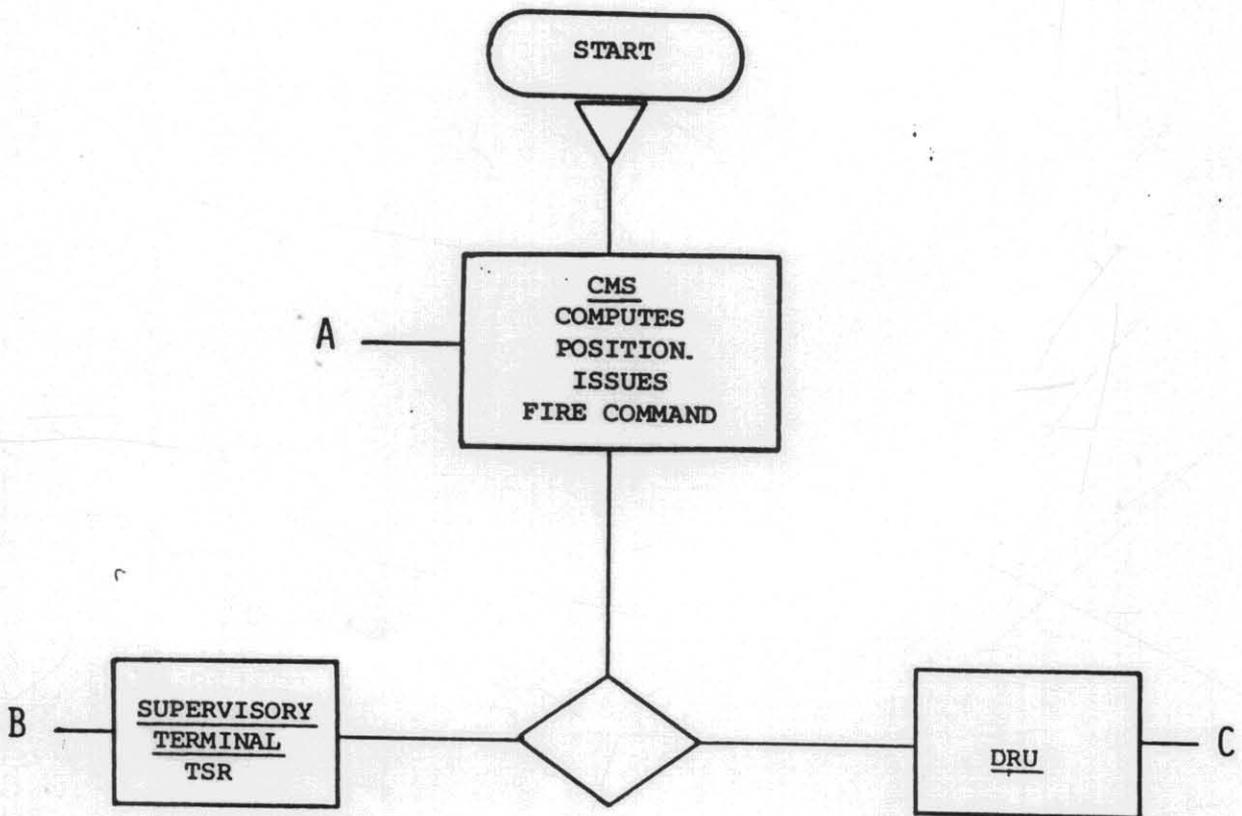


FIGURE 9A

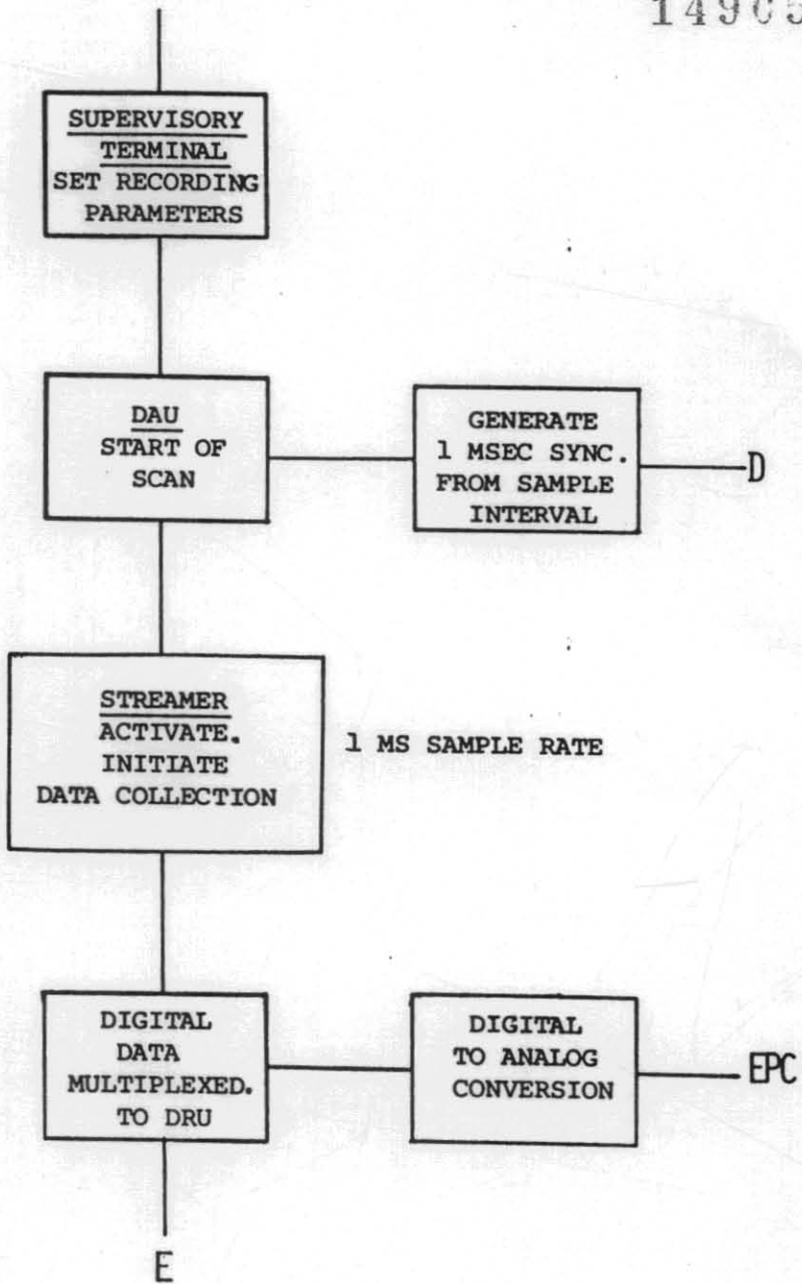


FIGURE 9B

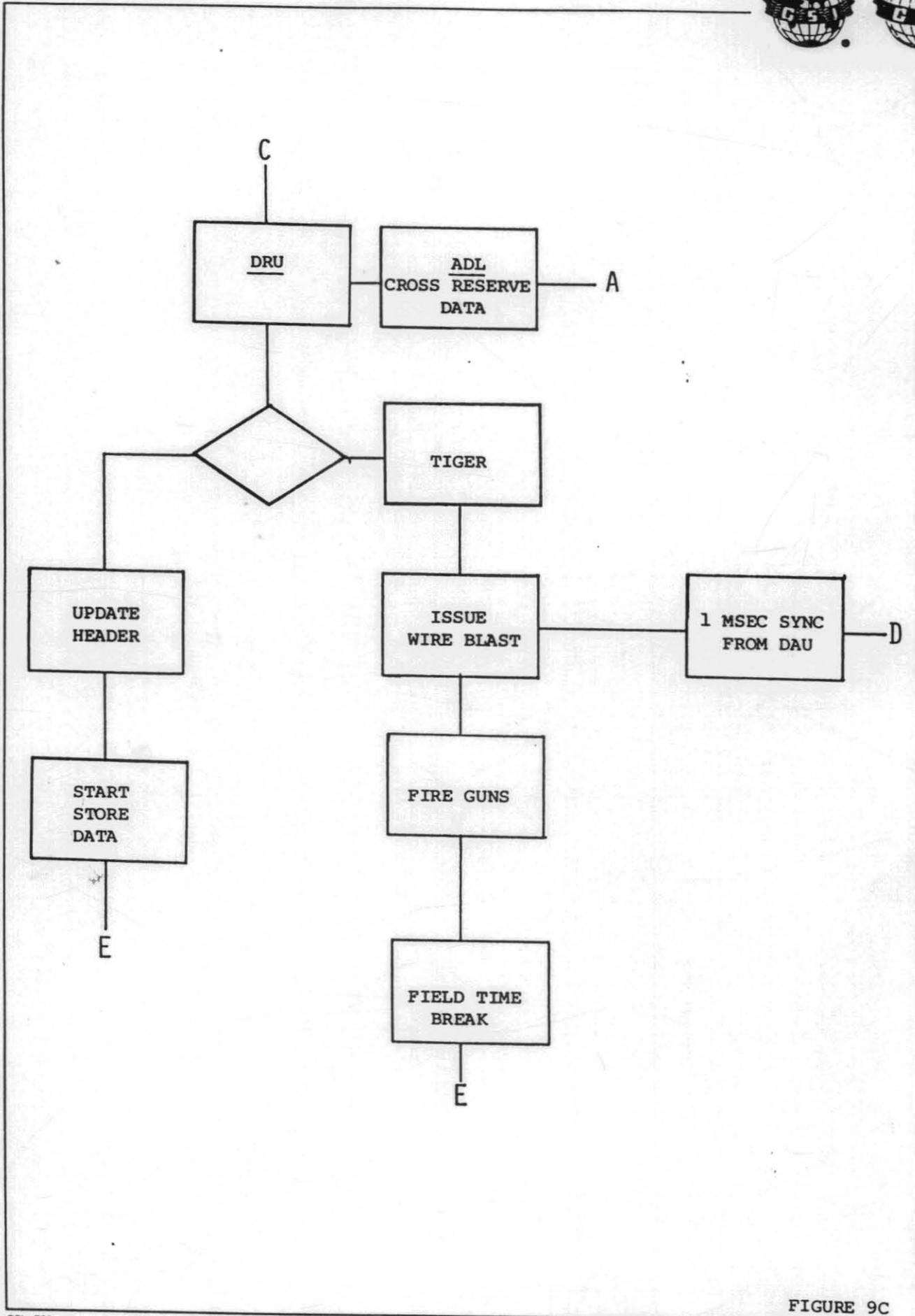


FIGURE 9C

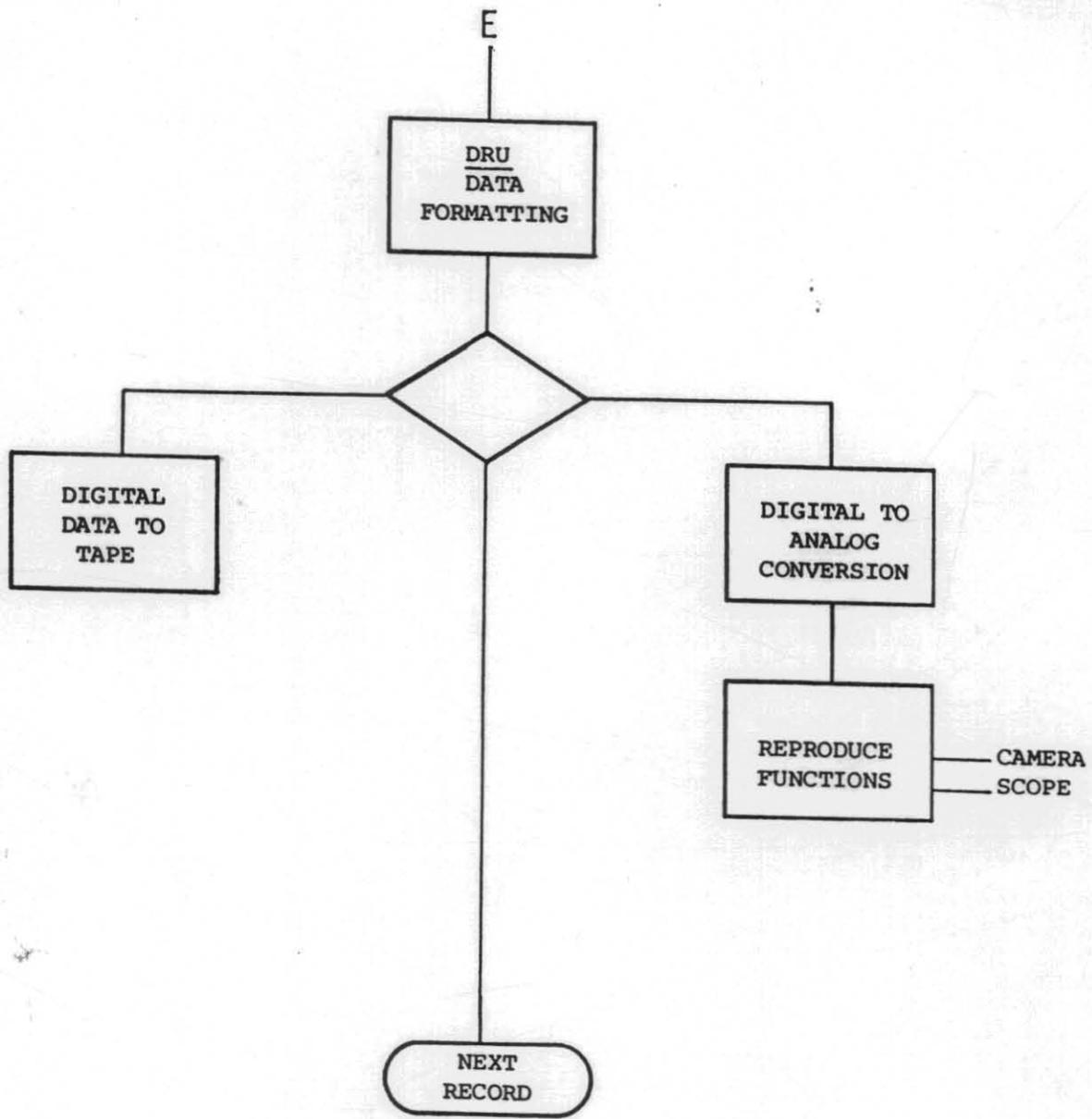
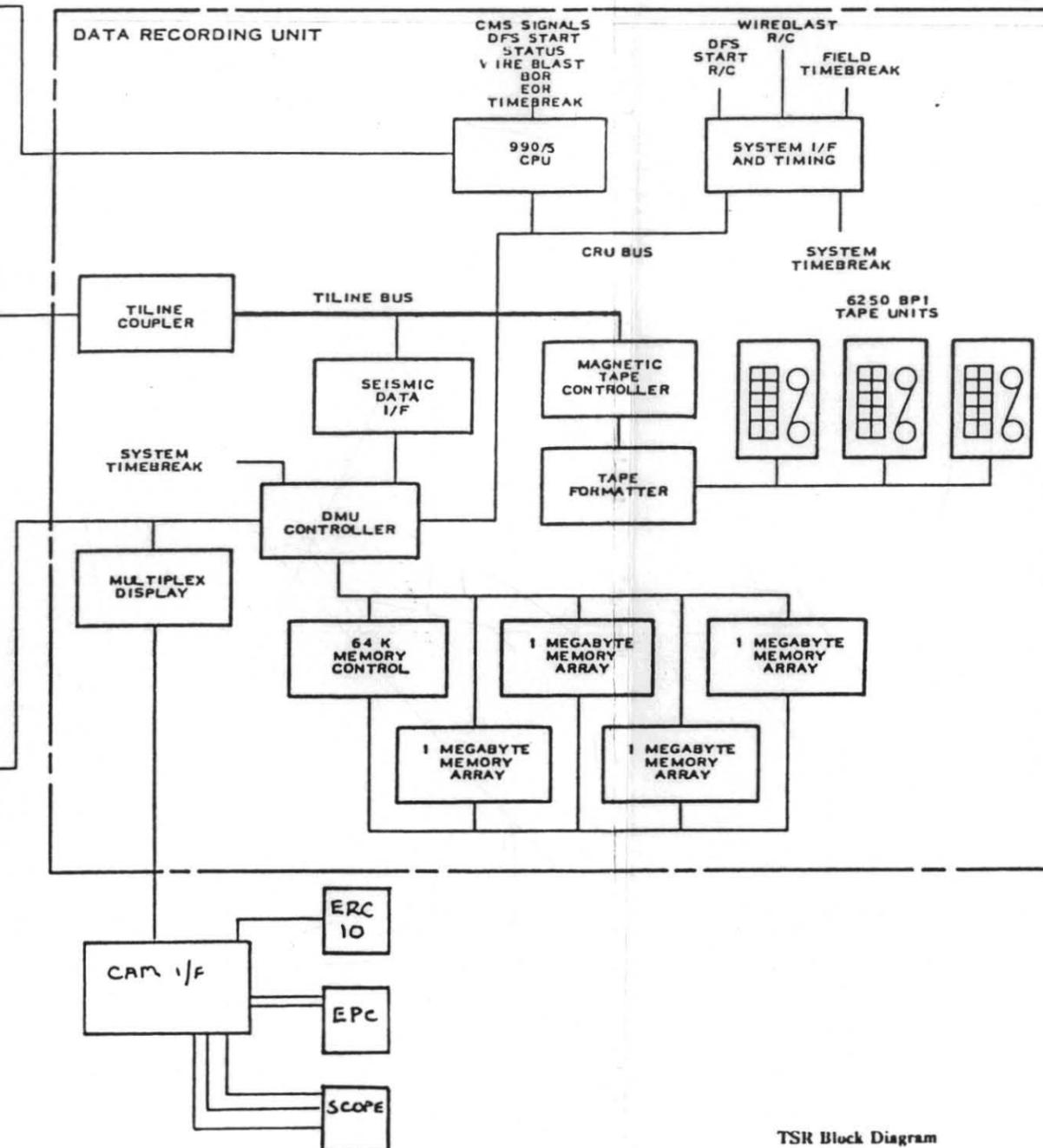
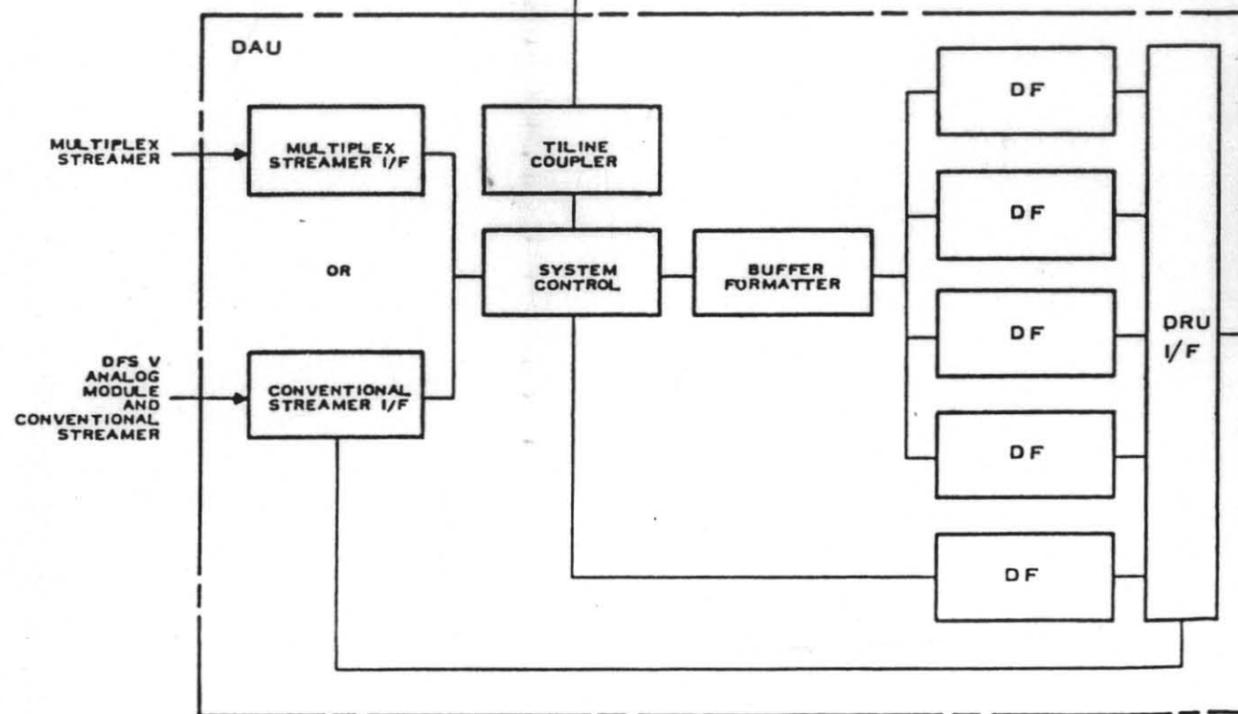
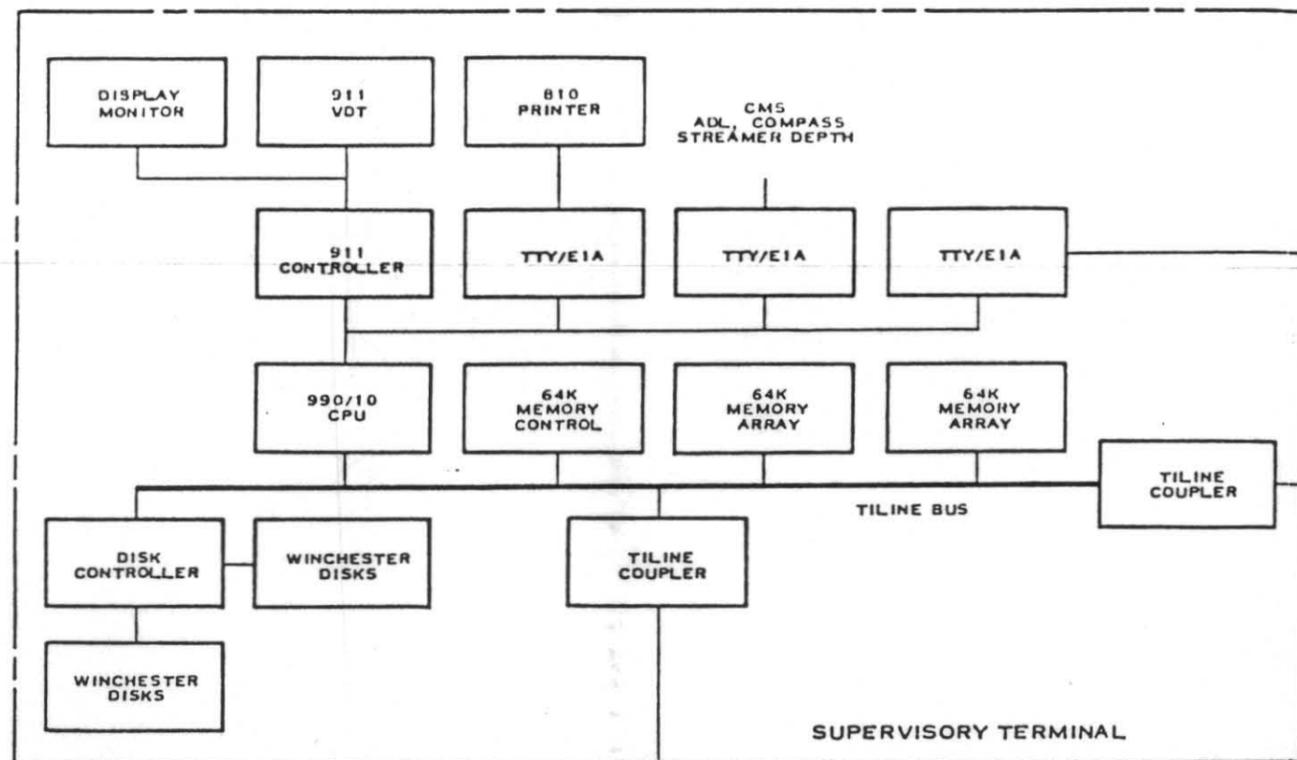
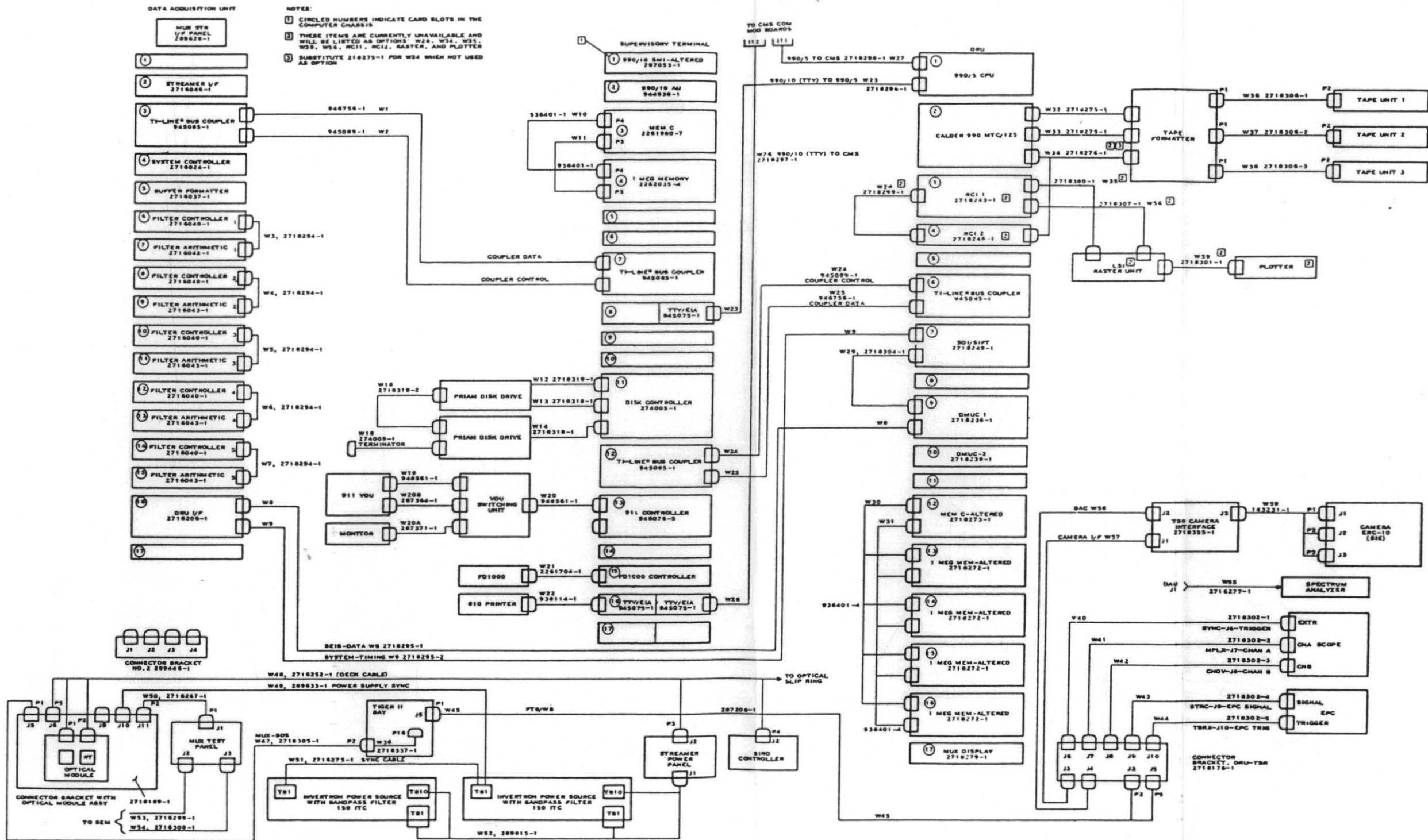


FIGURE 9D



TSR Block Diagram

FIGURE 10



*TRADEMARK OF TEXAS INSTRUMENTS

TSR With Multiplex Streamer

FIGURE 11



- 9 -

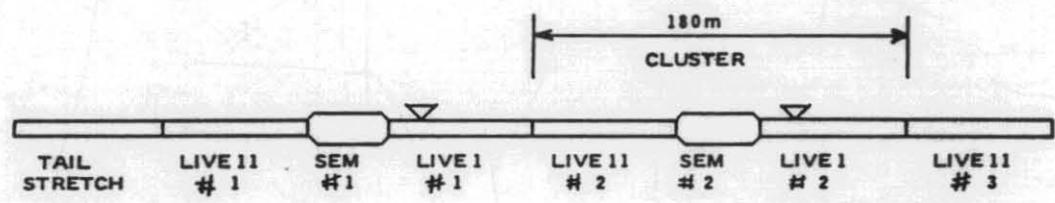
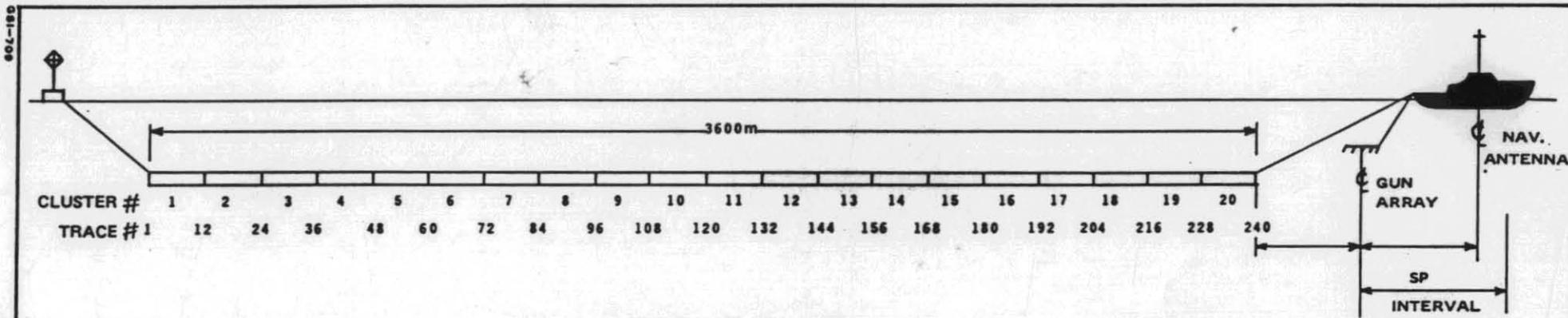
INSTRUMENTS (TSR System continued)**Tape Transports**

Tapes recorded on each transport were frequently replayed on an alternate transport as a confirmation of readability. All data was recorded on 3M brand 12.7mm magnetic tape.

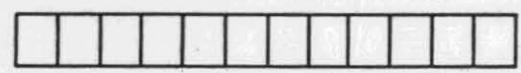
Prior to any Streamer Electronic Module (SEM) being deployed in the streamer, a set of tests is performed to ensure correct operation as defined by the manufacturer's specifications. This procedure was implemented on each occasion a SEM was replaced.

On a daily basis an impulse test is performed on the streamer. The results of this test will indicate correct phase and amplitude response of individual SEM channels and also a reduction in hydrophone group capacitance and resultant sensitivity degradation of that group.

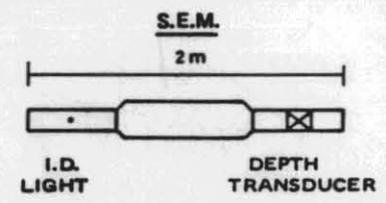
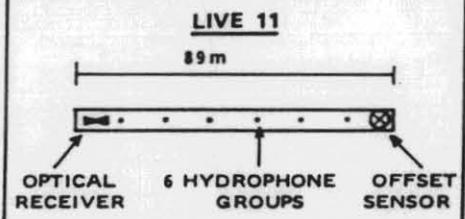
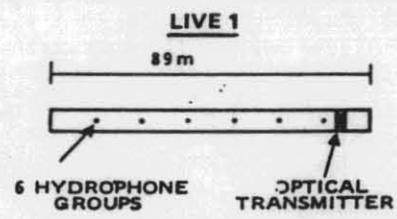
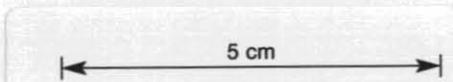
149056



DEPTH CONTROLLER AT (Marked ▽)
LIVE 1 NUMBERS



EACH 180m LONG CLUSTER
CONTAINS 12 x 15m LONG GROUPS



G.S.I. PARTY 2931

SHIP M/V "Eugene McDermott II"

CLIENT Amoco

CHANNELS 240

LENGTH 3600m

DATE 17/11/84 to 17/12/84



G.S.I. MARINE MULTIPLEX STREAMER DIAGRAM

FIGURE 12.



- 10 -

MULTIPLEX STREAMER THEORY OF OPERATION

The Texas Instruments multiplex streamer consists of four major in-water elements, live section I's, live section II's, Streamer Electronic Modules and repeater modules. Configured for 240 traces, the cable comprises of 20 "clusters", each cluster handling a group of 12 traces. The three components making up the cluster are live I, a live II and a Streamer Electronic Module (SEM). The SEM is located between a live I and a live II. Each live section contains six separate 15 metre groups, each group containing 40 acceleration cancelling hydrophones, wired in parallel.

Streamer configuration is shown in Figure 12 (GSI Marine Multiplex Streamer Diagram).

Data from the six traces in the live sections is passed to their associated SEM where low cut filtering is applied. The analog signals are then digitised, time multiplexed, and passed in serial phase encoded format back to the live I where it is converted to an optical signal and passed via a single optic fibre to the next cluster closest to the ship. The signal is then reconverted to an electrical signal in the SEM end of that cluster's live II for use in the SEM. The use of fibre optics minimises crossfeed, signal loss and noise pick up.

The sequence of data flow in the streamer begins at SEM No. 1 (furthest from the ship) with each subsequent SEM placing its data block behind the preceding SEM's information. Therefore, data from SEM 20 is the last to arrive at the ship.

A repeater module is placed between each lead-in section (including the stretch sections) for the purpose of retiming and resynchronising the optical stream as it travels between cluster 20 and the onboard electronics. Retiming and the resynchronisation of data is also a function performed by each SEM in the streamer. Both front and tail stretches are placed in the streamer to attenuate streamer jerk, reducing noise bursts.

All sampling of data in the streamer is performed at 1ms and subsequent resampling at 1, 2 or 4ms. Anti-alias filtering and quality control inspection is carried out in the onboard Data Acquisition Unit and Supervisory Terminal.

The Trace Sequential Recorder accepts the time multiplexed streamer data for each trace and reformats it to trace sequential data which is then recorded onto 12.7mm magnetic tape at 6250 bpi in SEG D format.

Full specifications on the Multiplex Streamer are contained in Appendix 3.



- 11 -

B. MULTIPLEX STREAMER THEORY OF OPERATION

The Texas Instruments multiplex streamer consists of four major in-water elements, live section I's, live section II's, Streamer Electronic Modules and repeater modules. Configured for 240 traces, the cable comprises of 20 "clusters", each cluster handling a group of 12 traces. The three components making up the cluster are live I, a live II and a Streamer Electronic Module (SEM). The SEM is located between a live I and a live II. Each live section contains six separate 15 metre groups, each group containing 40 acceleration cancelling hydrophones, wired in parallel.

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The Trace Sequential Recorder accepts the time multiplexed streamer data for each trace and reformats it to trace sequential data which is then recorded onto 12.7mm magnetic tape at 6250 bpi in SEG D format.



- 12 -

11) Navigation Data

The ship is steered using a Houston Instruments DPI trackplotter on the bridge which gives a graphic representation of both the downline and offline shotpoint position and shotpoint numbering. A second and identical trackplotter is situated in the instrument room for CMS operator monitoring.

The raw ranges of the radio positioning system(s) are recorded on one of two Digi-Data tape transports. The validity and reliability of the navigation data is checked by continually performing two or three way fixes on the stations in use, the results of which are displayed on a video terminal and recorded by the CMS automatic data logging (ADL) printer at approximately five minute intervals. Should any hardware error occur in the navigation system or, if the navigation signals become unstable, the CMS operator is alerted via a comprehensive error reporting system and corrective action can be taken.

A back up system utilising a Magnavox 1107 satellite receiver and the U.S. Navy Transit Satellite System (interfaced to the CMS) provides comparison of position fixes with the radio navigation system.



- 13 -

INSTRUMENT DISCUSSION

On certain lines, a hard copy of the depth printout was not produced. This was due a non fatal error on the TSR, or erasure of the correct file on disc. However the observers always monitored the depth of the streamer and every 100 shotpoints logged down the average cable depth. On other lines some shotpoints were missed due to noise strips being produced at the client's request. The relevant details are in the QA log and the observer's logs for all these particular lines.



- 14 -

STREAMER DISCUSSION

The streamer depth control was maintained by proper ballasting and the use of individually addressable remote controlled "Syntron" depth levellers (birds).

Reballasting of the streamer was necessary due to the colder temperature of the sea water. Approx 5 lt of kerosene was added to each section.

An offset of 281 m was altered after line TNK4-18 (later reshot) to a value of 386 m. This value was used for the whole prospect.

The streamer configuration remained constant throughout the prospect.

Any cable depth sensor that was non-functional during a line was recorded by the TSR and noted on the observer's logs.



- 15 -

OFFSET CALCULATION

The offset was calculated by firing a single gun at or close to the array centre and measuring the time (t) to the peak of the first break from the near group on the camera display. The formula used was:

$$\begin{aligned}\text{OFFSET} &= (t - \text{gun delay} - \text{filter delay}) \times \text{water sound vel.} \\ &= (325 - 51.0 - 13.0) \times 1.48 \\ &= 386.28 \text{ metres}\end{aligned}$$

An example calculation is shown on the following Figure 13.



OFFSET DETERMINATION

PHYSICAL MEASUREMENT

- | | | |
|--|---|-----------------------------|
| 1. Number of stretch sections | : | 2 x 100m x (3x6m repeaters) |
| 2. Total length of stretch sections | : | 218m |
| 3. Half group length (near group) | : | 7.5m |
| 4. Distance from boat to near group centre | : | (2 + 3) = 225.5 |
| 5. Distance from boat to centre of source | : | 30.37m |
| 6. Calculate offset (4 - 5 = 6) | : | 194.8m |

TIME MEASUREMENT

- | | | |
|---|---|------------|
| 1. Travel time from gun fired to waterbreak sensor | : | 253 msecs |
| 2. Time delay to Tiger | : | 51.2 msecs |
| 3. Speed of sound in water | : | 1.48 m/ms |
| 4. (- 2) x 3 = 4 | : | 298.66m |
| 5. Distance from gun fired to array centre | : | - 2.55m |
| 6. Distance from waterbreak hydrophone to near trace centre | : | - 96.1m |
| 7. Offset (4 + 5 + 6 = 7) | : | 200m |

Offset is computed and displayed on the multiplex streamer supervisory terminal after all relevant information is input and an offset shot is requested.

THE ABOVE IS AN EXAMPLE ONLY

FIGURE 13.



ENERGY SOURCE

An electro-pneumatic acoustic energy source known as airguns was used for reflection work. An airgun has only two moving parts. A shuttle and a solenoid. The airgun consists of an upper and lower air chamber connected by an air passage through a moveable shuttle. Another air passage links the upper chamber with the underside of the upper flange of the shuttle and this air passage is controlled by a solenoid valve. Air, at a pressure of 2000 psi (13.8 Mpa), enters the upper chamber through its inlet forcing the shuttle closed. The shuttle is held firmly closed because the area of its upper flange is greater than the area of its lower flange. The main volume of air passes through the channel in the shuttle into the lower chamber. To fire the airgun a command from the Texas Instruments airgun controller unit (Tiger II) activates the solenoids and retracts a plunger, this permits air to pass through a porthole to the underside on the lower shuttle. This neutralises the downward pressure of the shuttle leaving only the upward pressure on the lower flange from the lower air chamber. The rapid expulsion of air creates the bubble and resultant pulse. The air bubble collapses in a manner similar to that caused by explosives except that its period is controlled and is placed in the desired seismic frequency band.

The energy source used by the M/V Eugene McDermott II was a tuned array of 4075 cu. ins. total capacity. The array was designed for deep penetration and good resolution, having a broadband frequency output that extends below the normal low frequency band for seismic energy sources, the composition of the array is shown in Figure 14 - Array Performance, and further shown in Figures 15 and 16.

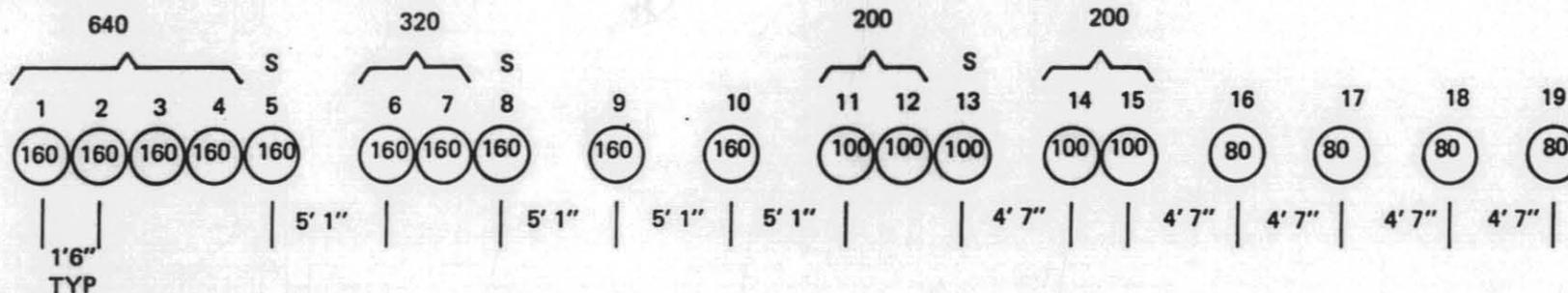
The array includes three low pressure ended air lines each side of the array so that the depth can be monitored by means of static air pressure at all times. The array was ballasted with the use of plastic Norwegian buoys to ride a depth of 10.0 m +/- 1 m.

The Texas Instruments airgun controller (Tiger II) monitored the firing of each airgun in the array. Individual gun firing times were continuously controlled to give phasing within +/- 1 ms for maximum pulse amplitude and front to back ratio.

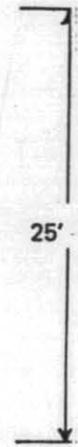
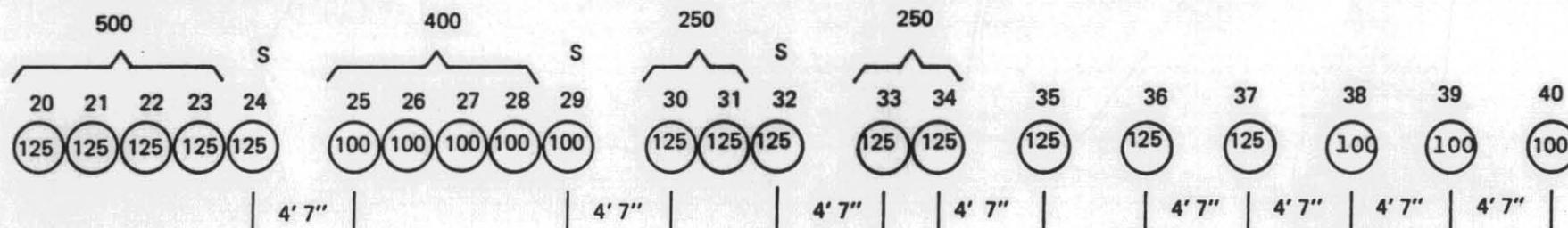
The Tiger II also performed a quality control function by indicating, with individual gun LED displays, the status of a gun if it was not operating correctly, either self fire or no fire. The airgun performances were logged on both the CMS navigation tape and printer log.

4075 -CUBIC-INCH AIR GUN ARRAY

STARBOARD STRING (56' 9", 19 GUNS)



PORT STRING (57' 9", 21 GUNS)



NOTES

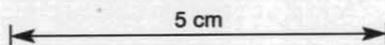
- GUN SIZE IN CUBIC INCHES
- GUN SPACING IN FEET AND INCHES; CENTERLINE-TO-CENTERLINE SPACING OF ALL COALESCED GUNS IS 1' 6"
- SPARE GUNS DENOTED BY "S"
- GUNS 1-10 ARE MOD 111 PC
GUNS 11-40 ARE MOD 11 PC
- MEASURED AVERAGE PERFORMANCE:
 $P_a = 68 \text{ BAR-M (P-P, 0-1.28HZ)}$
 $P_a / P_b = 10$

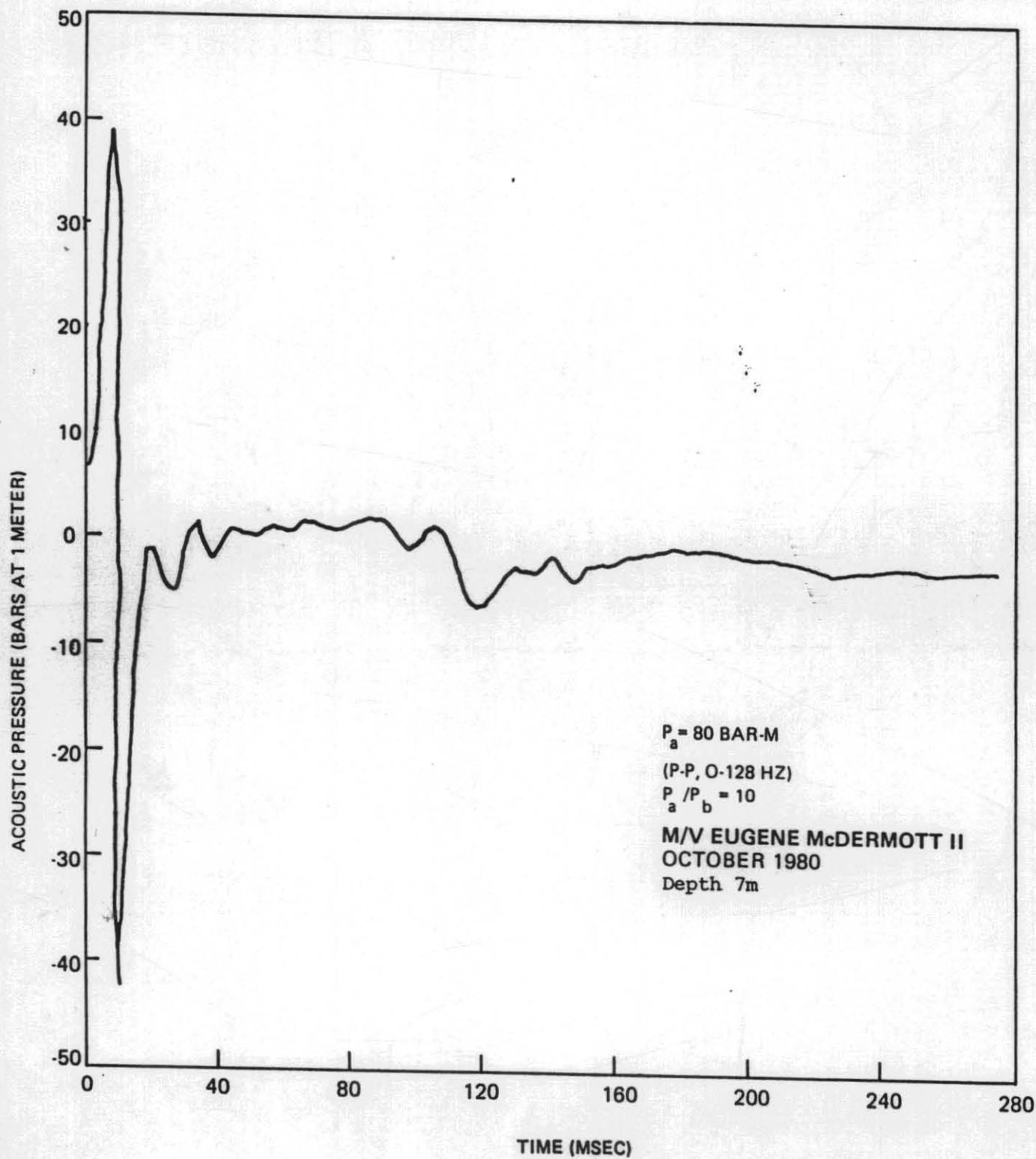
ARRAY COMPOSITION

1 x 640	2 x 160
1 x 500	2 x 125
1 x 400	<u>2 x 100</u>
1 x 320	770 SPARE
2 x 250	
2 x 200	
2 x 160	
3 x 125	
3 x 100	
4 x 80	

4075 ACTIVE

FIGURE 14.





$P_a = 80 \text{ BAR-M}$
(P-P, 0-128 HZ)
 $P_a / P_b = 10$
M/V EUGENE McDERMOTT II
OCTOBER 1980
Depth 7m

Farfield Signature of 4075 PNU-CON Array

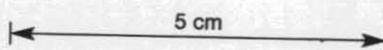
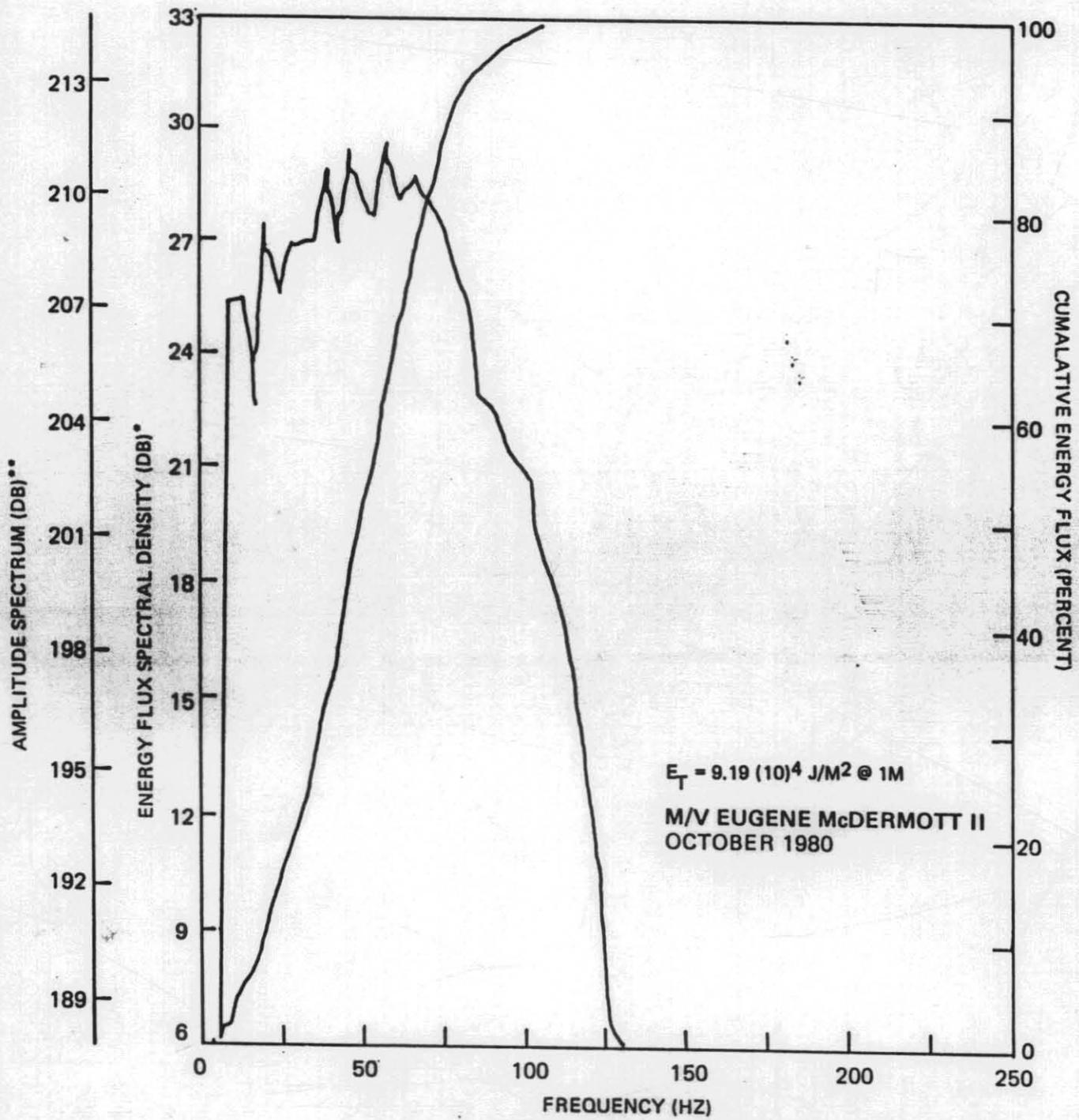


FIGURE 15.



*DB REFERRED TO 1 JOULE/M**2/HZ AT 1 METER

**DB REFERRED TO 1 MICROPASCAL/HZ AT 1 METER

Amplitude and Energy Spectra of 4075 PNU-CON Array

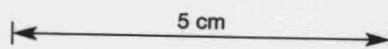


FIGURE 16.



- 17 -

The airguns were maintained by GSI personnel on line changes so that throughout the survey the airgun array was operating within specifications. Whilst recording 30m shotpoint interval two Le Roi and two Norwalk compressors were used.



SECTION III
OPERATION

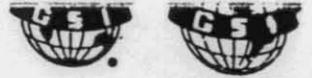
**SECTION III****OPERATION****NAVIGATION DISCUSSION**

The configureable marine system (CMS) III is comprised of a Texas Instruments 980B computer, three T.I. 990 computers, a system co-ordinator, Tiger II airgun controller, Magnavox satellite receiver, two Houston Instruments DPI trackplotters and two Digi-Data tape transports (800 bpi 1/2").

The CMS III's function is survey control and navigation data recording. Radio positioning systems used during this survey were ARGO (owned and operated by ONA) and SYLEDIS (owned and operated by GSI). Either one could be employed as the primary navigation system depending on signal quality and network geometry. Range data from both systems (as well as satellite data) is recorded on the CMS navigation tape at each s.p.

Line control is based on periodic position fixes from the primary system and dead reckoning, with the CMS triggering the TSR and Tiger II unit to fire the airguns at a 30 metre shotpoint interval down the preplotted survey lines.

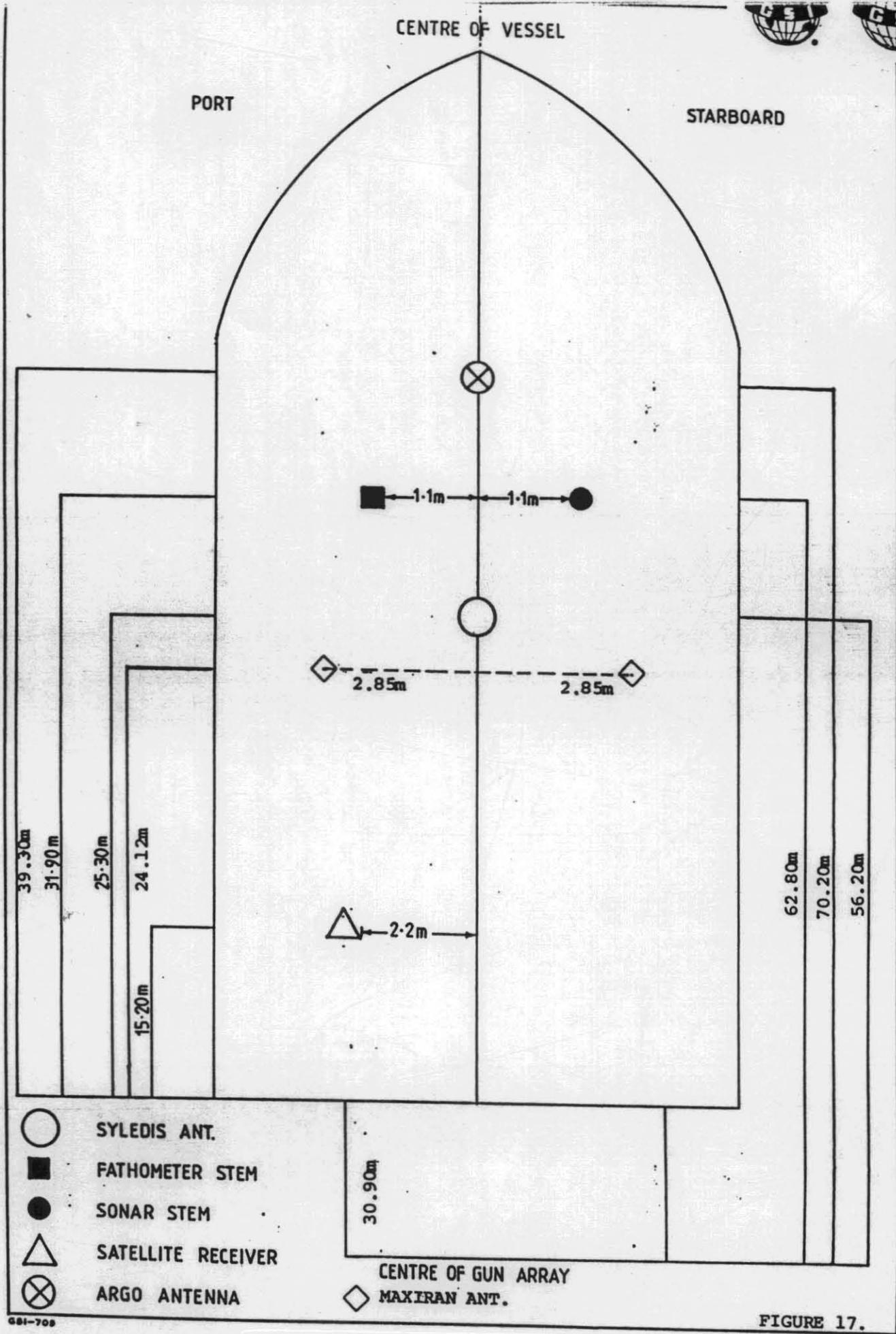
Location of antenna and their distance with respect to the centre of the gun array are shown on the following Figure 17 - (Antenna Location Diagram).



CENTRE OF VESSEL

PORT

STARBOARD

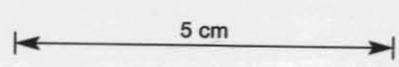


- SYLEDIS ANT.
- FATHOMETER STEM
- SONAR STEM
- △ SATELLITE RECEIVER
- ⊗ ARGO ANTENNA

30.90m

CENTRE OF GUN ARRAY
◇ MAXIRAN ANT.

FIGURE 17.





- 20 -

On the 17th November we carried out SYLEDIS baseline crossings. Results were satisfactory (see Baseline Crossings). We then proceeded to the prospect area where, in a position of good 3 way fix angles from SYLEDIS, the ARGO partials were calculated (see Base Station co-ordinates).

Prior to the start of the survey the original SYLEDIS beacon at Pt Sorell was replaced by beacon # 06.

The primary RPS system was ARGO and the signal quality was good to excellent throughout the whole survey. Syledis was used to verify ARGO lane count, but due to range and/or atmospheric conditions, the signal quality from Pt Sorell and Naracoopa ranged from poor to good. SYLEDIS mobile #27 was used throughout the survey.



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BASE STATION LOCATIONS

Applicable for the whole prospect

<u>Argo</u>				<u>Partials</u>
Stations		Position		
		Lat/Long		
Pt Sorell		041 07	23.62 S	0.15
		146 31	42.31 E	
The Nut		040 45	49.97 S	0.06
		145 18	11.87 E	
Naracoopa		039 55	29.05 S	0.02
		144 07	39.03 E	

<u>Syledis</u>				<u>Delays</u>
Stations		Position		
		Lat/Long		
Pt. Sorell		041 07	24.69 S	Beacon # 06 -245.68
		146 31	41.88 E	
The Nut		040 45	50.29 S	Beacon # 03 -394.01
		145 18	13.32 E	
Naracoopa		039 55	29.95 S	Beacon # 02 -246.27
		144 07	39.47 E	



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BASELINE CROSSINGS

17th November, 1984

SYLEDIS

<u>Stations</u>	<u>Pass</u>	<u>Computed</u>	<u>Observed</u>	<u>C-O</u>
Sorell/Nut	1	110579.43	110575.50	-4 m
	2	110579.43	110575.80	-4 m
	3	110579.43	110575.50	-4 m
Sorell/Naraccopa	1	243081.37	243098.00	16.63 m
	2	243081.37	243095.00	13.63 m
	3	243081.37	243096.00	14.63 m

21st November, 1984

ARGO

Sorell/Naracoopa (signals noisy)	1	243096.32	243117.58	21.26 m
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30th November, 1984

ARGO

Nut/Sorell	1	110612.37	110612.37	0.00 m
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11th December, 1984

ARGO

Naracoopa/Sorell	1	243096.32	243105.50	8.22 m
	2	243096.32	243103.50	6.22 m

**NAVIGATION TAPE SUMMARY**

Mag Tapes No.: Lines (all lines are prefixed TNK4-)

20126	18,18A,37,48,44,44A,26,36,103
20127	101,50,71,14,12,12A,8,27,33,35,37A,41,47,45,51
20128	55,4,63,10,29,2,2A,6,31,16,18B,26A
20129	77,77A,79,81,83,87,89,85,91,93,95,99,52
20130	75,75A,46,42,32,26B,26C,69,69A,73,75B,38,40,1
20131	3,3A,5,7,9,11,13,15,17,19
20132	21,23,25,34
20133	39,43,43A,49,53,59,4A,57,65,67,61,54,28,34A
20134	24,28A,20,22.



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GRAVITY AND MAGNETICSGRAVITY

Model Lacoste Romberg Gravity Meter

Serial No. S-60

See attached sheets for all readings and ship position.

Pen Colours	Green	Gravity
	Blue	Spring Tension
	Black	Total Correction
	Red	Ave. Beam or Cross Coupling

Time mark RHS GMT

All Gravity data was written to a 6200 DAU and tape transport. A malfunction of the Ave Beam pen, meant that Ave Beam reading on the graph was inaccurate, however this did not affect the readings logged on tape.

MAGNETICS

Model Geometrics G-803

Offset 264m Fish to CNP

Base Station Pt Sorell (offset)

All Magnetic data was written to the CMS Navigation tapes. On line TNK4-75A the first 56 sp's were noisy due to ingress of water to the connector. No other problems occurred.

Further and detailed discussions on both the Gravity and Magnetism will be discussed in a subsequent report.



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OPERATIONS DISCUSSION

20th November, 1984

At the start of the prospect, it was found that modifications to the gunstring tow assembly were required to enable the gun array to ride at the required depth of 10m. When weather conditions were such that recording could not take place, the boat returned to port for these modifications.

No further problems with the gun depths were witnessed.

Due to prevailing sea conditions and periods of bad weather it was decided by AMOCO that the noise specifications were to be relaxed from 5 and 8 ubars to 8 and 10 ubars. (Contract paragraph 1.2.2)

29th November, 1984

Gale force winds and a rough sea made recording impossible, so AMOCO requested a data drop in Devonport. When completed the McDermott returned to the prospect area.

12th December, 1984

A GSI crew change was carried out in Devonport.

14th December, 1984

Part of the way through line 57, the ST keyboard locked up and we were unable to access the cable depths. However at the end of the line it was found the streamer had not deviated from specs.

16th December, 1984

Please note that line 28A is a separate line to 28, it is not a reshoot of line 28.

WEATHER

The weather, during the prospect, was unfavourable for 80% of the time available. Lines were terminated and reshot and a lot of time was wasted due to searching for a "Recording Direction".



APPENDIX 1

PERSONNEL

**KEY PERSONNEL**

Party Manager	C Toner
Systems Engineers	T Rogers P Miller
Survey Operators	K Webber N Blake
System Operators	G Parise P Blake
Technical Co-ordinators	R George R Stanley
ONA Personnel	A Hogart
Compressor Mechanics	C Mann T Hughes
Airgun Mechanics	K Bakewell R Harding T Prentice
Master	C Grubba
Vessel Supervisor	B Lee
Client Representative	F Renton (ECL)
Visitors	J Taylor (Amoco) R Smith (SAOG) F Waldron (SAOG)



SHIPS CREW - 17.11.84 UNTIL 12.12.84

Master	:	Christopher Grubba
Mate	:	Graham Murray
Chief Engineer	:	Bruce Mordue
Second Engineer	:	Frederick Lonie
A.B. Seaman	:	Herbert Laurensen
A.B. Seaman	:	Michael Peterson
Motor Man	:	Samuel Hynd
Chief Steward	:	Dudley Draper
Assistant Steward	:	Ferdinand Vanbeijnum
Chief Cook	:	Patrick Boothe
Second Cook	:	Edward Ferns

SHIPS CREW - 17.11.84 UNTIL 12.12.84

Party Manager	:	Christopher Toner	
Systems Engineer	:	Paul Miller	2
Systems Engineer	:	Kevin Webber	2
Systems Engineer	:	Trevor Rogers	1
Systems Operator	:	Guiseppe Parise	2
Systems Operator	:	Nigel Blake	1
Systems Operator	:	Robert George	2
Systems Operator	:	Russell Stanley	1
Systems Operator	:	Peter Blake	1
Airgun Mechanic	:	Colin Mann	1
Airgun Mechanic	:	Kenneth Bakewell	2 *
Airgun Mechanic	:	Thomas Prentice	1
Airgun Mechanic	:	Robert Harding	2
Airgun Mechanic	:	Terence Hughes	2 *
Airgun Mechanic	:	R. Barnes	2
Argo Operator	:	A. Hoggart - Offshore Navigation Australia.	

* T. Hughes replaced K. Bakewell on 29th November Port Call.



SHIPS CREW - 12.12.84 UNTIL 17.12.84

Master	:	M. Gunterson
Mate	:	G. Neilson
Chief Engineer	:	D. Harrison
Second Engineer	:	S. Truscott
A.B. Seaman	:	N. Martin
A.B. Seaman	:	J. Lang
Motor Man	:	A. Whiting
Chief Steward	:	E. Kennedy
Assistant Steward	:	M. Hall
Chief Cook	:	W. Giles
Second Cook	:	R. Norris

SHIPS CREW - 12.12.84 UNTIL 17.12.84

Party Manager	:	C. Toner	
Systems Engineer	:	T. Rogers	1
Systems Engineer	:	K. Webber	2
Systems Operator	:	T. Manning	2
Systems Operator	:	S. Woods	2
Systems Operator	:	S. Dowling	1
Systems Operator	:	Q. Timmis	2
Systems Operator	:	K. Woolard	1
Airgun Mechanic	:	J. Vickery	1
Airgun Mechanic	:	D. Waugh	1
Airgun Mechanic	:	M. Jones	1
Airgun Mechanic	:	M. Eginton	2
Airgun Mechanic	:	T. Hughes	1
Airgun Mechanic	:	R. Barnes	2
Argo Operator	:	A. Hoggart - Offshore	
		Navigation Australia.	



APPENDIX 2
VESSEL SPECIFICATIONS



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SURVEY VESSEL - M/V EUGENE McDERMOTT II

Flag	Republic of Panama
Homeport	Panama
Trade	Foreign-going
Owners	Geophysical Service Inc.
Call Sign	HO 9376 (Telex: HOMC 1330706)
Length	52.73 metres L.O.A.
Breadth	12.19 metres B.O.A.
Depth	4.27 metres
Draft	3.05 - 3.24 metres
Official No.	7062-PEXT-1, 7685/77
Gross Tonnage	911.66 Tonnes
Nett Tonnage	244.21 Tonnes
Main Engines	2 x 1125 HP (D399 Cat.)
Elec. Power	2 x 250 KVA Cat D
Load Line	Lloyds Register



APPENDIX 3
INSTRUMENT DETAILS

**INSTRUMENT DETAILS**

Recording System	Trace Sequential Recorder Serial Number 001
Tape Format	SEG D. Group Coded Recording 6250 bpi
Tape Speed	125 ips
Channels (on tape)	243 (includes 3 auxiliary)
Gain Control Mode	I.F.P.
Sample Interval	2ms
Record Length	6 secs
Recording Delay	0 secs
Preamplifer Gain	12 dB
Final Gain	96 dB
Dynamic Range	115 dB (referred to input noise)
Filters	Lowcut 8 Hz @ 18 dB/8ve High cut 128 Hz @ 72 dB/8ve
Polarity	Positive Pressure Gives Positive Number on Tape


INSTRUMENT DETAILS Cont.
SEG D FORMAT

Each shot consists of;
 A 576 byte record plus 243 x 6164 byte data trace records.

576 byte record :-

general header	32 bytes
6 channel set descriptors	192 bytes (6 x 32)
8 sample skew headers	256 bytes (8 x 32)
3 extended headers	96 bytes (3 x 32)

	576 bytes

Data trace record :-

$$\# \text{ of bytes} = 20 + T_{\max} \times 1024 \times 2/DT$$

where : T = max recording time in seconds
 DT = sample period in milliseconds
 20 = # of bytes/trace header

$$\# \text{ of bytes} = 20 + 6 \times 1024 \times 2 \times 2$$

$$\# \text{ of bytes} = 6164 \text{ bytes}$$

**ANCILLARY EQUIPMENT**Servo Profiler

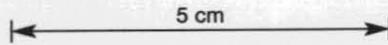
Manufacturer	EPC Labs
Model	4600
Serial Number	371
Source	Trace Number 232
Record length	4 secs
Gain Mode	PGC
Filters	Production Filters

The EPC worked well during the whole of the survey.

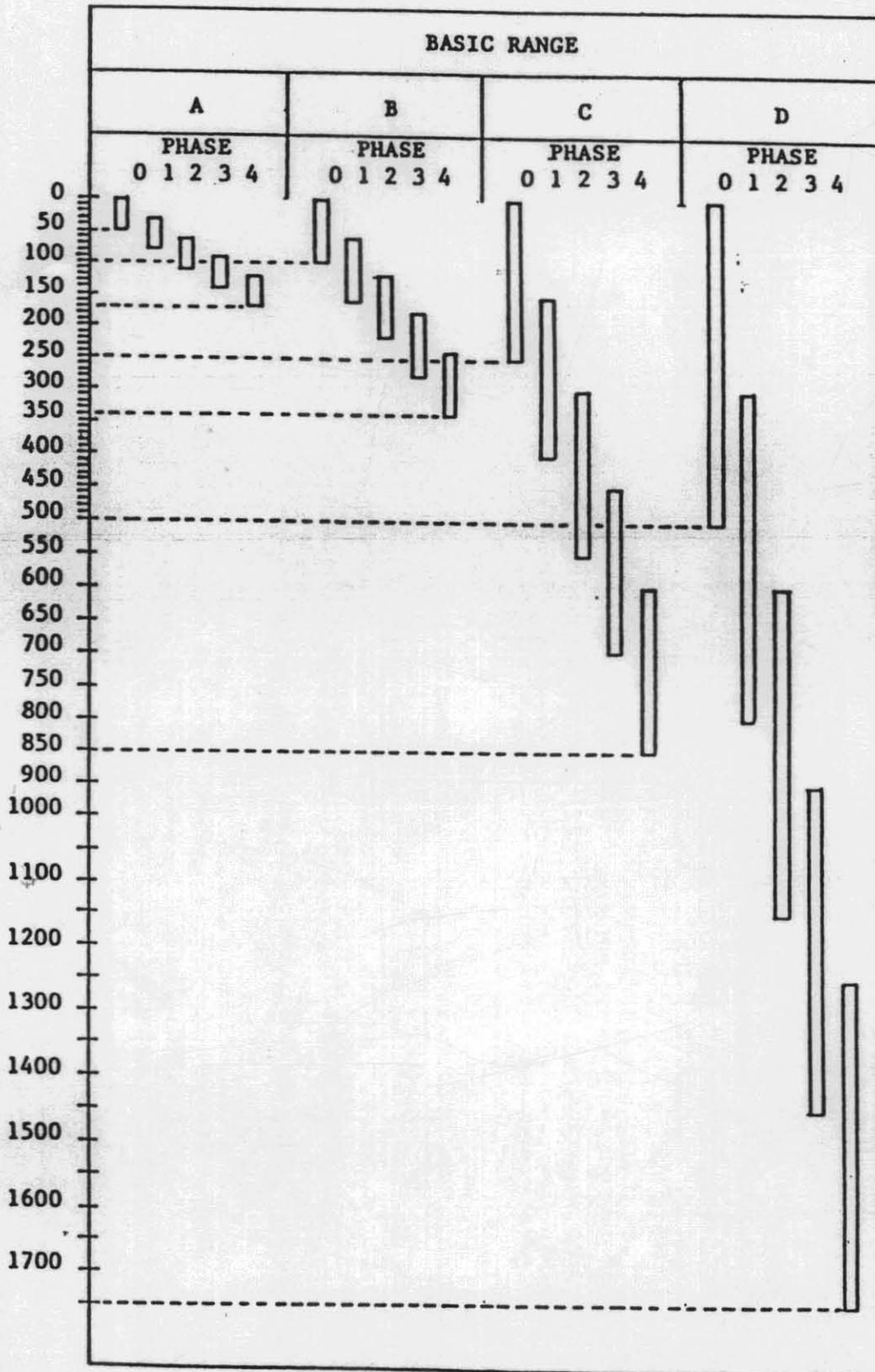
Fathometer

Manufacturer	Simrad
Model	EA
Water Velocity Value	1484 m/sec
Transducer Position with Respect to CNP .	16.7 m forward
Draft Correction	3.5 m
Calibrated	30th July, 1984

The Simrad worked well during the prospect.



SIMRAD MODEL EA FATHOMETER SCALE





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Camera

Manufacturer SIE
Model ERC-10C
Number of Channels 64, with 62 being used
Polarity Positive pressure at the hydrophones gives positive numbers on tape and a upbreak on the camera records

Camera records display 60 data channels and a record number with identification code as listed below.

Display CodeCamera Display

0	Traces 1, 2, 3, 4,	58, 59, 60
1	Traces 61, 62, 63,	119, 120
2	Traces 121, 122, 123,	179, 180
3	Traces 181, 182, 183,	239, 240
4	Traces 1, 5, 9,	233, 237
5	Traces 2, 5, 10,	234, 238
6	Traces 3, 7, 11,	235, 239
7	Traces 4, 8, 12,	236, 240
8	Traces 1, 3, 5,	117, 119
9	Traces 121, 123, 125,	237, 239
10	Traces 2, 4, 6,	118, 120
11	Traces 122, 124, 126,	238, 240

The camera performed satisfactorily during the whole of the prospect.



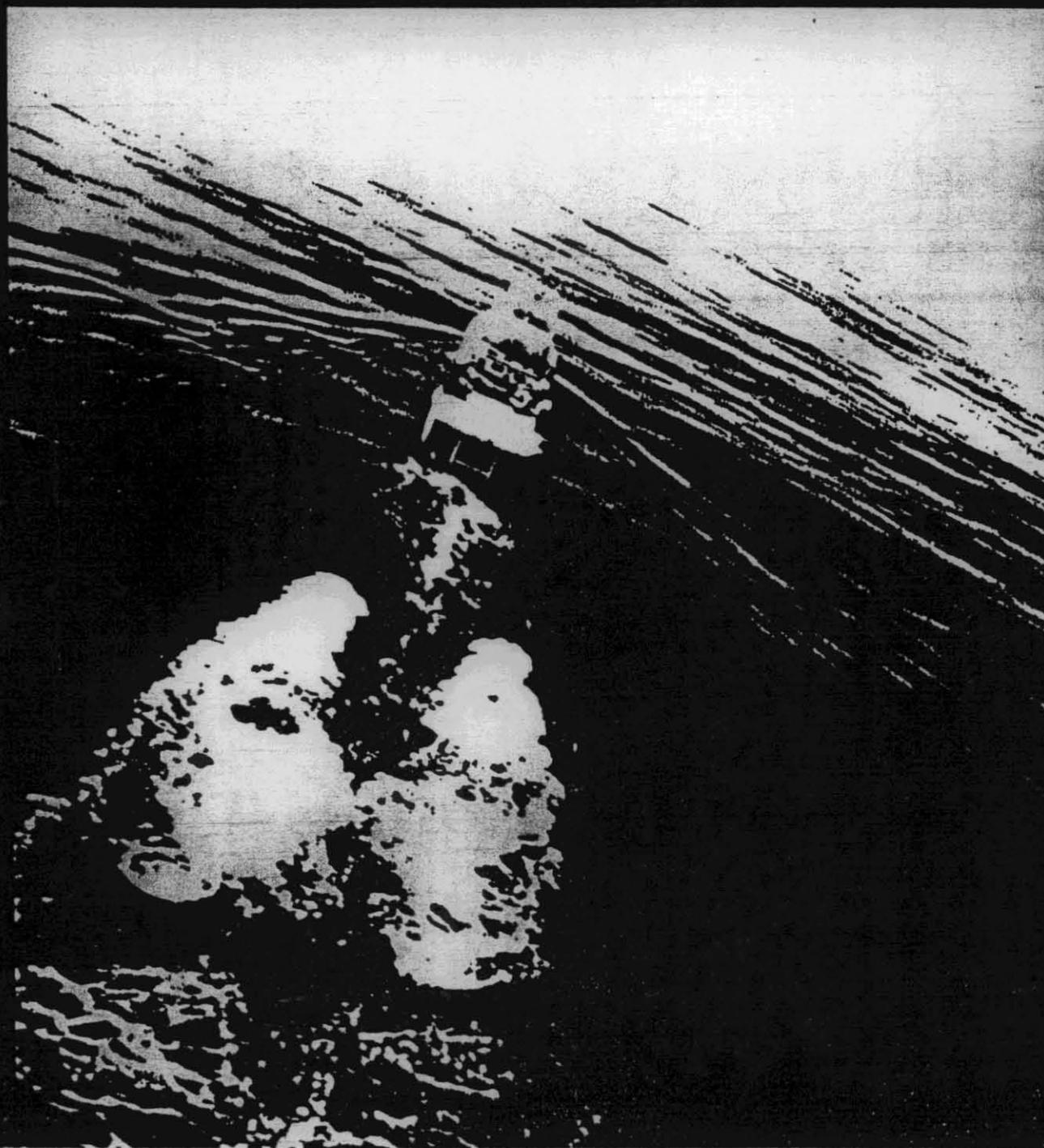
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STREAMER DETAILS

Length (centre to centre)	3585 m
Group Interval	15 m
Live Section Length	89.77 m
Stretch Section Length	100 m
SEM Module Length	0.46 m
Repeater Module Length	0.3 m
No. of Hydrophones per Group	40
Hydrophone Interval	0.375m
Hydrophone Type	TI - ACR
No. of Stretch Sections	4 Front, 1 Tail
Skin Type	PVC Tropical
Location of Depth Transducers on Sections	In all live I Sections
Location of Depth Controllers	7, 36/37, 60/61, 84/85, 108/109, 132/133, 156/157, 180/181, 204/205, 228/229, 240.
Near Group	240
Streamer Sensitivity	8.21 mv/mbar

DIGITAL FIBER OPTIC STREAMER

A better way to get better marine data.



TI's smaller, lighter digital streamer. Greater data resolution.



Texas Instruments Digital Fiber Optic Streamer provides the marine oil exploration industry with a remarkably advanced seismic tool.

The combination of digital data transmission and a fiber optic transmission line offers many inherent advantages over conventional analog streamers.

The TI Streamer makes possible the recording of data from a higher number of channels—240 currently, with 480 planned—and it permits the use of longer streamers and shorter groups.

Significant reduction in cable size and weight, along with improved ballasting ease, also make this TI streamer much easier to deploy and recover.

TI's innovative design approach has made the building and use of longer streamers practical for the first time.

Two Proven Technologies, Ideal for Seismic Streamers.

Digitizing the seismic signals in a streamer solves many of the most common marine geophysical problems. Higher frequencies, often lost in conventional surveys, are retained. Data density capacity is increased. Distortion, electrical leakage and cross-feed problems are virtually eliminated, with corresponding improvements in sensitivity and frequency response.

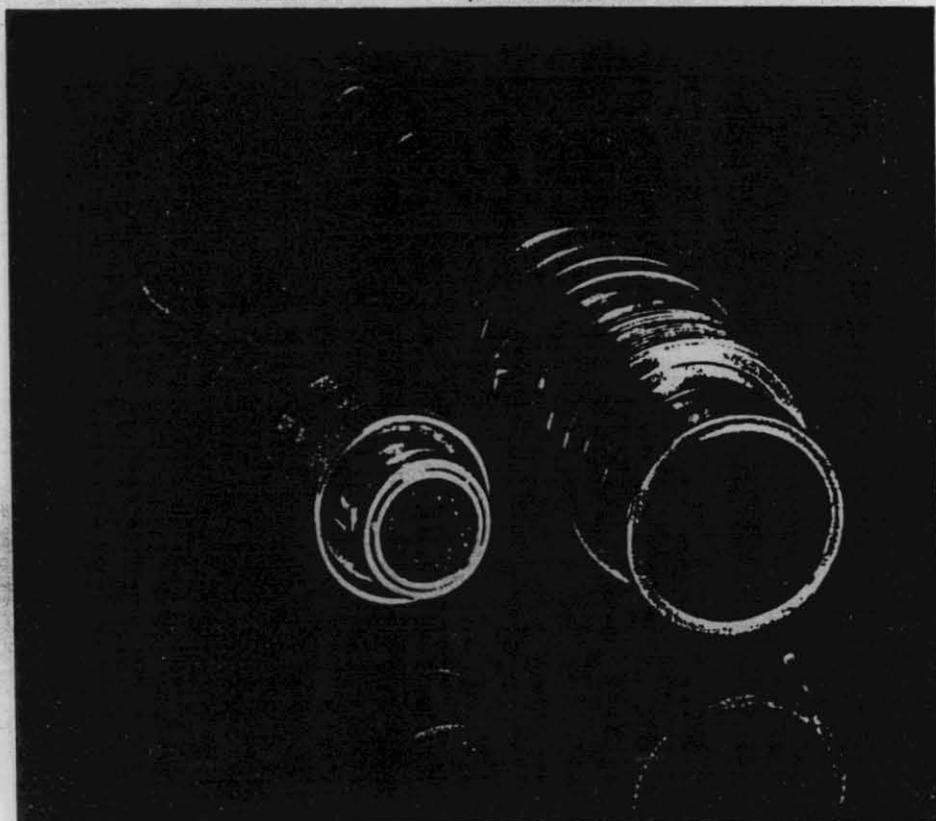
In order to digitize the seismic data reflected by the streamer field, TI has developed Streamer Electronic Modules (SEMs). Twenty of these SEMs, each of which measures 18 inches long by 3.5 inches in diameter, would be deployed in a full 240-channel streamer. Each SEM repeats the functions of a Digital Field System (DFS) unit, including anti-alias

filtering, digitizing at a 1 millisecond sample rate and IFP amplification.

Other distinct advantages of the TI Digital Fiber Optic Streamer include a reduction in the number of connections and an increase in overall system reliability. Plus, increasing the number of seismic channels is more easily achieved with the TI streamer design.

The use of fiber optics, the transmission mode of the future, means the data path will be unaffected by salt-water contact. Also, the bandwidth of fiber optic transmission line is much greater than copper wire of the same size. This permits the transmission of more data.

Fiber optic technology offers further improvement in data path performance by eliminating the numerous pickup and interference problems associated with electrical



TI quick-disconnect couplers—240-channel digital and conventional.

Increased coverage density. Improved reliability.

wires. This makes it possible to completely isolate electronic components in the streamer cables.

Precision, Quick-disconnect Coupler Protects Electronics.

A patented, quick-disconnect coupler is utilized in the TI streamer. This coupler was designed not only to ensure maximum data integrity but to make cable changeouts and replacement much faster and easier.

The TI 240 channel coupler contains only 40 high reliability connector pins. This compares with 256 pins in a typical 120-channel analog streamer connector. This dramatic reduction in pin count is a direct result of the digital fiber optic design. It overcomes the reliability and expansion problems encountered with twisted pair and coaxial transmission lines.

Coupler guide pins force correct alignment before mating. This eliminates connector damage during coupling. A positive locking ring prevents loosening while deployed.

Innovative Stress Member Design Reduces Cable Weight and Bulk.

Much of the size and weight of a typical streamer are determined by the wire bundle and steel stress members.

TI's digital fiber optic approach greatly reduces wire bundle bulk. And TI has also replaced heavy steel cables with three Kevlar™ stress members. These special cables are lighter than steel for the same strength. Overall, the weight per unit length of the TI streamer has been reduced by a factor of approximately three compared with conventional streamer sections.

The reduced weight, along with cable size reduction, quickly translates into improved handling ease aboard ship, as well as reduced shipping costs.

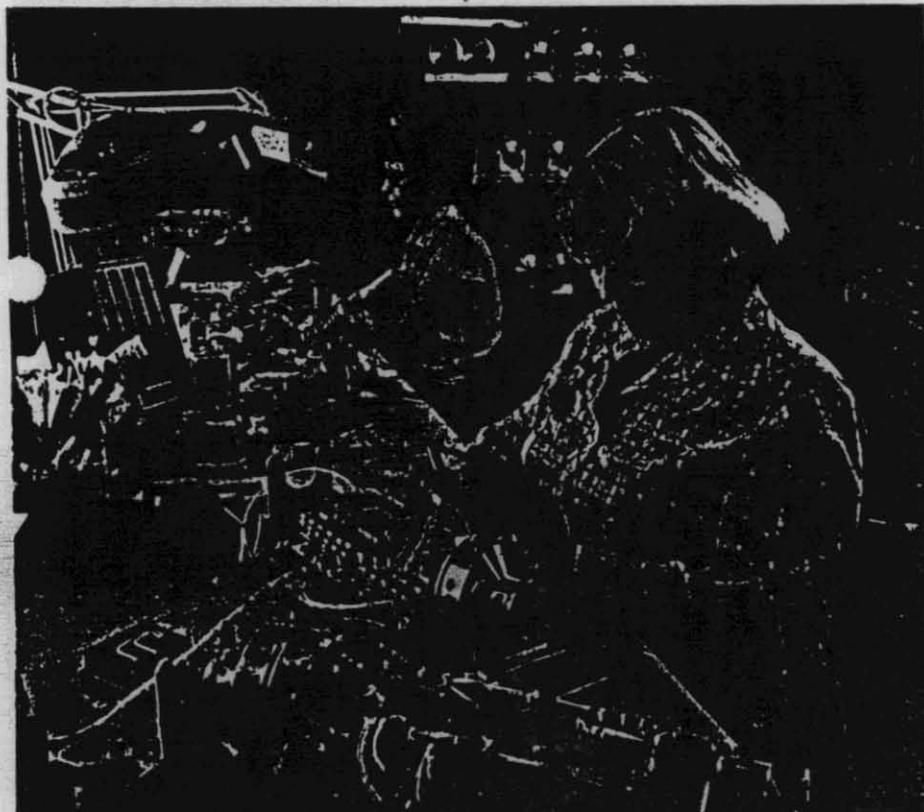
TI Quality—From the Leader in Technology.

Reliable, trouble-free operation is key to a cost-effective streamer operation.

Texas Instruments, a pioneer in geophysical exploration and one of the largest marine seismic contractors in the world, is acutely aware of the critical demand for reliable data and the extremely high cost of ship downtime.

TI has always been a leader in the quality and reliability of its products. Our customers rate the company high on both points, an extremely important buying consideration when you're choosing equipment as sophisticated as a digital seismic streamer.

Complete repair service, fast turnaround on damaged cables, and other support can be provided from TI facilities around the world.



Streamer Electronic Module assembly.

TI Digital Fiber Optic Streamer Condensed Specifications

Streamer Configuration

Streamer Type:	Digital multiplexed
Mechanical Coupling:	Stainless Steel quick-disconnect with removable electrical connector insert with field replaceable pins
Signal Coupling:	Control signals on twisted pair wire. Power and depth control on separate wires. Data return via optical fiber. Hydrophone groups connected to each Streamer Electronics Module via individual twisted pairs. Common twisted pair for Syntron heading sensor system
Streamer Power:	240 Volts AC, 2000 Hz with automatic safety shutdown/leakage detection. Power distributed via quad redundant wire pairs
Number of Streamer Electronic Modules (SEMs):	20 Max.
S. Channels/SEM:	12 Max.
Streamer Length:	3600 meters standard, 4500 meters max
Seismic Group Length:	15.0 meters standard, other lengths may be pre-specified
Hydrophones:	GSI Dish type, acceleration cancelling
Hydrophone Spacing:	40 per group, linear spacing, 1 phone/0.375 meters
Group Sensitivity:	8.2 $\mu\text{V}/\mu\text{Bar}$, ± 2 dB
Heading/Depth Sensors:	Wiring and coils provided for Syntron compass/depth system. Individual depth sensors provided at every SEM
Depth Control:	Wiring provided for Syntron depth control units

Onboard Electronics

Data Acquisition Unit (DAU)	
Digital Filter Type:	45 point digital convolution. Minimum phase Butterworth response
Channels/Digital Filter Unit (DFU):	60
F _i Available:	64Hz, 90Hz, 128Hz, 180Hz, 256Hz.
F _i Slope:	72 dB/Octave
Filter Characteristics:	Filters designed to emulate conventional DFS V filters in phase and response
DC Offset Filters:	2
Offset Filter 1:	Removes gain dependent offset
Offset Filter 2:	Removes residual channel dependent offset

Sample Rates:	1, 2, 4 ms
Trace Summing Function:	Each DFU capable of independent selection of trace summing of 1, 2, 4 non-overlapping unweighted adjacent traces

Single Channel Analog Outputs:	2 available
--------------------------------	-------------

Streamer Electronics Module Specifications

Frequency Response:	4 to 256 Hz	
A/D Converter:	12-bit successive approximation plus sign, $\pm 0.05\%$, ± 0.5 LSB	
A/D Converter Dynamic Range:	66 dB	
Preamplifier type:	Differential input FET capacitive charge amplifier	
IFP Gain Range:	0 to 84 dB, 6 dB steps	
Equivalent Input Noise:	4 to 256 Hz, 55 nanofarad equivalent input capacitance as termination	
	Gain Constant	Input Noise ($\mu\text{V rms}$)
	LO	2.19
	MED	1.10
	HIGH	0.77

Dynamic Range of Input Signals Referred to Input Noise:	Better than 100 dB. Depends on gain constant
Distortion:	0.1 percent, 4 to 256 Hz (T.H.D measured to the 6th Harmonic)
Crossfeed Isolation:	> 60 dB to succeeding adjacent channel > 80 dB to all other channels Measured driving one channel only
Low Cut Filters:	OUT = 4 Hz Slope = 6 dB/Octave to 1.9 Hz 12 dB/Octave below 1.9 Hz IN = 8 Hz Slope = 18 dB/Octave to 4 Hz 24 dB/Octave below 4 Hz

For more information, contact
Texas Instruments Incorporated,
P.O. Box 1443, MS 6705,
Houston, Texas 77001. Telephone
(713) 778-6520. Telex 775937.

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Texas Instruments reserves the right to make specification changes at any time as required in supplying the best product possible.



TEXAS INSTRUMENTS

Creating useful products
and services for you.

ATTACHMENT III

240 CHANNEL DIGITAL STREAMER (PHASE II)
 WITH TRACE SEQUENTIAL RECORDER
 GENERAL SPECIFICATIONS

STREAMER CONFIGURATION

Streamer Type	Digital Multiplexed														
Mechanical Coupling	Stainless Steel quick disconnect with removable electrical connector insert with field replaceable pins														
Signal Coupling	Control signals on twisted pair wire Power and depth control on separate wires. Data return via optical fiber Hydrophone groups connected to each Streamer Electronics Module via individual twisted pairs. Common twisted pair for Syntron heading sensor system.														
Streamer Power	240 volts AC 2000 Hz with automatic safety shutdown/leakage detection. Power distributed via quad redundant wire pairs.														
System Channel Allocation	<table border="0"> <tr> <td>Seismic Channels</td> <td align="right">240</td> </tr> <tr> <td>D.C. Offset Channels</td> <td align="right">20</td> </tr> <tr> <td>Depth Channels</td> <td align="right">20</td> </tr> <tr> <td>Heading Channels</td> <td align="right">20</td> </tr> <tr> <td>Waterbreak Channels</td> <td align="right">20</td> </tr> <tr> <td>Config Status Channels</td> <td align="right">20</td> </tr> <tr> <td>Q.C./Test Channels</td> <td align="right">20</td> </tr> </table>	Seismic Channels	240	D.C. Offset Channels	20	Depth Channels	20	Heading Channels	20	Waterbreak Channels	20	Config Status Channels	20	Q.C./Test Channels	20
Seismic Channels	240														
D.C. Offset Channels	20														
Depth Channels	20														
Heading Channels	20														
Waterbreak Channels	20														
Config Status Channels	20														
Q.C./Test Channels	20														
Sels Channels/Streamer Electronics Module	12 max														
Number of Streamer Electronics Module	20 max														
Streamer length	3600 metres standard														
Seismic Group Length	15.0 metres														
Strain Member Type	Kevlar														
Streamer Diameter	1-7/8 Inches														

149096

Hydrophones	GSI Dish type, acceleration cancelling
Number Hydrophones/Group	40
Hydrophone Spacing	Linear, 1 phone/0.375 metres
Group Sensitivity	8.2 uV/uBar, +/- 2 dB
Heading/Depth Sensors	Hiring and coils provided for Syntron compass/depth system. Individual depth sensors are incorporated in Live.1 section adjacent to each Streamer Electronics Module
Depth control	Hiring provided for Syntron depth control units

STREAMER ELECTRONICS MODULE SPECIFICATIONS

Each Streamer Electronics Module (SEM) will conform to the following performance specifications:

Amplifier Type	Low noise charge preamplifier followed by unity gain low cut and anti alias filter stages, followed by an Instantaneous Floating Point (IFP) amplifier utilizing an extended range sample and hold amplifier.
Frequency Response	4 to 256 Hz
A/D Converter Type	12 Bit successive approximation + Sign
A/D Converter Accuracy	+/- 0.05% +/- 0.5 LSB
A/D Converter Dynamic Range	66 dB
Preamplifier Type	Differential input FET capacitive charge amplifier
Gain Constant	Remote programmed by operator through onboard electronics. Can be set to one of three settings, low, med or high. The actual gain value is determined by hydrophone group capacitance. For a group capacitance value of 55 nanofarads the nominal gain constants will be LOW=12dB, MED=24dB, HIGH=36dB NOTE: A fixed IFP Gain of 1.58 dB (x1.2) is included in the preamp gain calculation.
IFP Gain Minimum	0 dB
IFP Gain Maximum	84 dB
Resolution	6 dB steps (binary)
Maximum Gain	120 dB GC=HI
Minimum Gain	12 dB GC=LO

Gain Accuracy channel to channel & SEM to SEM	+/- 2 per cent		
Equivalent Input Noise	4 to 256 Hz, 55 nanofarad equivalent input capacitance as termination		
	Gain Constant	Input Noise (μ V rms)	
	LO	2.19	
	MED	1.10	
	HIGH	0.77	
Maximum Input Signal	Difference Mode, 55 nanofarad equivalent input capacitance		
	Gain Constant	Voltage (mVrms)	Peak (mV)
	LO	1310.72	1853.53
	MED	327.68	463.30
	HIGH	81.92	115.83
Dynamic Range of Input Signals Referred to Input Noise	Gain Constant	Dynamic Range (dB)	
	LO	115	
	MED	110	
	HIGH	100	
Distortion	0.1 per cent, 4 to 256 Hz (T.H.D. measured to the 6th Harmonic)		
Crossfeed Isolation	> 60 dB to succeeding adjacent channel > 80 dB to all other channels measured driving one channel only		
Low Cut Filters	Standard cutoff frequencies (3 dB points) remote programmed IN or OUT		
	OUT	= 4Hz	
	Slope	= 6dB/Octave to 1.9Hz 12dB/Octave below 1.9Hz	
	IN	= 8Hz	
	Slope	= 18dB/Octave to 4Hz 24dB/Octave below 4Hz	

	NOTE: Low cut filter response comprehends the streamer group response
High Cut (Anti-Alias) Filter	
6dB Corner	256Hz fixed
Slope	36dB/Octave
Type	6 pole Butterworth
	NOTE: Digital filter in onboard electronics provides an extra 36dB/Octave to slope at 256Hz. Filter also provides selectable filters with corners at 64,90,128, 180 Hz with slope of 72dB/Octave.
Input Line Filters	An input line filter is provided for each seismic channel to attenuate any effects of the streamer power and command transmission busses.
6dB Corner	700Hz fixed
Slope	12dB/Octave
Type	Differential inductive/capacitive PI-section high cut
Filter Phase Duplication	+/- 1.0 ms
Sample Rate	1 ms fixed
	NOTE: Decimation to 2 and 4 ms sample rates provided in onboard electronics after the digital filters.
D.C. Offset	Maximum of 1024 mv at input to A/D converter at 84 dB gain setting. (Approximately 64 uV at input to IFP)
Offset Correction	Dynamic offset correction applied in SEM IFP Amplifier. Gain related offset correction and individual channel offset correction is applied by onboard system.

SEM Channel Allocation

Seismic I/P	12
Depth	1
DC Offset	1
Analog Q.C.	1
Reserved	1

Sample Skew

Each SEM samples channel 1 simultaneously. Each succeeding channel is sampled 0.0625ms later eg. channel 12 is skewed 0.6875ms after channel 1. The maximum sample skew between any 2 seismic channels is 0.6925ms including propagation delays.

Remote Configuration Functions

Module Address
 Preamp Gain (Low, Med, High)
 Gain modes (fixed or floating)
 Fixed Gain (0 to 84 dB in 12 dB steps)
 Interrogate Heading Sensor
 Low cut filters (in or out)
 Perform Impulse test
 Perform Leakage test
 Module Identification LED On or Off
 Streamer Aft Power On or Off

NOTE:

The actual current configuration status is reported by the SEM to the onboard electronics each sample period.

Remote QC Functions

The following data quality status is reported by the SEM to the onboard electronics each sample period.

Command Buss Errors
 Command Buss in use
 Phase Lock
 Mantissa Conversion Error
 Analog Multiplexor Timing Error
 Data Buffer Overflow
 Data Buffer Underflow
 Streamer Power out of specs
 Data Errors

NOTE:

In order to provide the best possible product, GSI reserves the right to make changes in the above specifications at any time.

ONBOARD ELECTRONICS PERFORMANCE**Data Acquisition Unit (DAU)**

Provides operator interface to streamer and sorting, filtering and routing of streamer data to Recording System, Supervisory Terminal and Navigation System.

Manual Control	Redundant, via front panel switches
Software Control	Main control, via supervisory terminal
Maximum Number Seismic Channels	240
Digital Filter Type	45 point digital convolution. Minimum phase Butterworth response
Channels/Digital Filter Unit (DFU)	60
Number DFU's per DAU	5, one unit dedicated for aux filters
Filters available	64Hz, 90Hz, 128Hz, 180Hz, 256Hz. Each DFU independently selectable
Filter Slope	72 dB/Octave
Filter Characteristics	Filters designed to emulate conventional DFS V filters in frequency response. Filter coefficients programmed in PROM to permit flexibility.
D.C. Offset Filters	2

Offset Filter 1	Removes gain dependent offset
Offset Filter 2	Removes residual channel dependent offset
Sample Rates	1, 2, 4 ms
Trace Summing Function	Each DFU capable of independent selection of trace summing of 1, 2, 4, non-overlapping unweighted adjacent traces
Single Channel Analog Outputs	2 available
<u>Supervisory Terminal</u>	
Provides software control of all streamer functions and system configuration. Provides error reporting and system Q.C. functions and hardcopy logging function.	
<u>Recording System</u>	
Performs data recording and reproduce functions of 240 channel streamer system.	
System Type	Trace Sequential Recording
Tape Type	0.5 inch
Number of Tracks	9
Tape Speed	125 inches per second
Recording Density	6250 bpi
Data Transfer Rate	781,250 bytes/second nominal
Recording Method	Group Coded Recording (GCR)
Sample Interval	1, 2, or 4 msec
Timing Accuracy	+/- 0.005%
Recording Format	2 byte, quaternary exponent, SEG D, demultiplexed
Header Format Size	352 bytes plus extended and external headers

Maximum Record Length	
1 mil sample rate	8 seconds
2 mil sample rate	16 seconds
4 mil sample rate	16 seconds
	NOTE:
	Maximum record length is determined by capacity of demultiplex memory. Values given are for standard system
Reproduce Functions	
Monitor	Read-before-write data output to seismic QC system for analysis. All channels plotted with keyboard selected gain functions.
Playback	Tape output presented to seismic QC system as for Monitor above.
Gain Functions	Float, defloat, PGC
Display Format	Wiggle trace
Multiplexed Display	Multiplexed scope display presentation with float, defloat, PGC, and marker pulses
Single Trace Recorder Output	Provided with float, defloat, PGC gain control. Channel is Software selectable and independent of other displays
	NOTE:
	Keyboard selection of traces or groups of traces to be displayed is provided.
Delayed Recording	0.1 to 9.9 seconds Delay is recorded on extended header.
Extended Header	Provided
Auxilliary Data Recorded	Julian day GMT Shotpoint number Water depth Streamer depth
Shotpoint Data	Record (File) number Reel number Delay time (T-zero)



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ENERGY SOURCE DETAILS

	4075 cu in Airgun Array
Operating Volume	4075 cu. ins.
Total Spare Volume	770 cu. ins.
Operating Pressure	2000 psi
Operating Depth	10.0 m +/- 1.0 m
Timing Control	Tiger II
Firing Delay	51.2 ms
Compressors	3 Norwalk C600 3 Le Roi 750
Setback:	
Distance from CNP To Centre of Gun Array	54.57 m
Distance from Stern To Centre of Gun Array	39.37 m



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NAVIGATION SYSTEM DETAILS

Primary SystemArgo

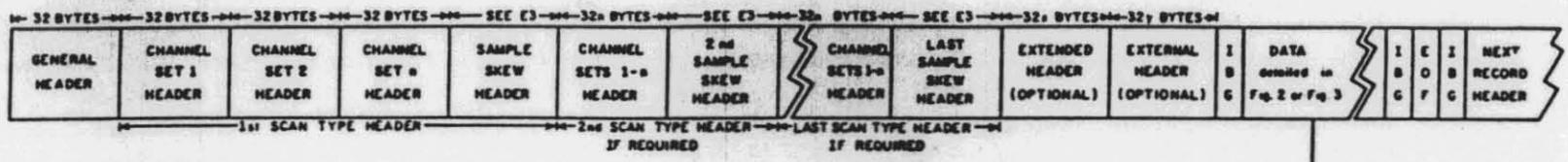
Type	Phase Comparison
Survey Company	ONA
Operating Frequency	1620 KHz
Ships Antenna Height (Above Sea Level)	10 m
Antenna Location from Stern	39.3 m
Antenna Location from Centre Line	0 m

Secondary SystemSyledis

Type	Range-Range, Pulsed
Survey Company	GSI
Operating Frequency	420 Mhz
Antenna Height (ASL)	10 m
Antenna Location from Stern	25.3 m
Antenna Location from Centre Line	0 m

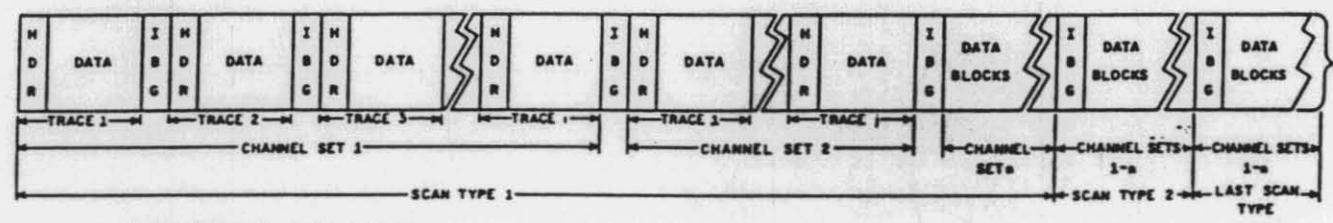


APPENDIX 4
SEG-D TAPE FORMAT



Record format

- SOS = START OF SCAN (4 BYTES)
- T = TIMING WORD (4 BYTES)
- HDR = TRACE HEADER (20 BYTES)
- IBG = INTER BLOCK GAP
- E3 = REFERENCE APPENDIX E3
- x AND y ARE GENERAL HEADER ENTRIES



Demultiplexed data blocks

SEG D TAPE FORMAT

PLATE 4A

149107





**2 byte quaternary exponent
data recording method**

The following illustrated the 16-bit word and the corresponding bit weights:

Bit	0	1	2	3	4	5	6	7
Byte 1	S	C ₂	C ₁	C ₀	Q ₋₁	Q ₋₂	Q ₋₃	Q ₋₄
Byte 2	Q ₋₅	Q ₋₆	Q ₋₇	Q ₋₈	Q ₋₉	Q ₋₁₀	Q ₋₁₁	Q ₋₁₂

S = sign bit. — (One = negative number).

C = quaternary exponent. — This is a three bit positive binary exponent of 4 written as 4^{CCC} where CCC can assume values from 0-7.

*Q*₁₋₁₂ = fraction. — This is a 12 bit one's complement binary fraction. The radix point is to the left of the most significant bit (Q₋₁) with the MSB being defined as 2^{-1} . The fraction can have values from

$-1 + 2^{-12}$ to $1 - 2^{-12}$. In order to guarantee the uniqueness of the start of scan, negative zero is invalid and must be converted to positive zero.

Input signal = $S.QQQQ.QQQQ.QQQQ \times 4^{CCC} \times 2^{MP}$ millivolts where 2^{MP} is the value required to de-scale the data sample to the recording system input level. MP is defined in Byte 8 of each channel set descriptor in the scan type header.



TRACK NO.

4	7	6	5	3	9	1	8	2
---	---	---	---	---	---	---	---	---

BIT NO.

P	0	1	2	3	4	5	6	7
---	---	---	---	---	---	---	---	---

BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB

FILE NUMBER	F ₁	F ₁	F ₁	F ₁	F ₂	F ₂	F ₂	F ₂	1
	F ₃	F ₃	F ₃	F ₃	F ₄	F ₄	F ₄	F ₄	2
FORMAT CODE	Y ₁	Y ₁	Y ₁	Y ₁	Y ₂	Y ₂	Y ₂	Y ₂	3
	Y ₃	Y ₃	Y ₃	Y ₃	Y ₄	Y ₄	Y ₄	Y ₄	4
GENERAL CONSTANTS	K ₁	K ₁	K ₁	K ₁	K ₂	K ₂	K ₂	K ₂	5
	K ₃	K ₃	K ₃	K ₃	K ₄	K ₄	K ₄	K ₄	6
	K ₅	K ₅	K ₅	K ₅	K ₆	K ₆	K ₆	K ₆	7
	K ₇	K ₇	K ₇	K ₇	K ₈	K ₈	K ₈	K ₈	8
	K ₉	K ₉	K ₉	K ₉	K ₁₀	K ₁₀	K ₁₀	K ₁₀	9
	K ₁₁	K ₁₁	K ₁₁	K ₁₁	K ₁₂	K ₁₂	K ₁₂	K ₁₂	10
	K ₁₃	K ₁₃	K ₁₃	K ₁₃	K ₁₄	K ₁₄	K ₁₄	K ₁₄	11
YEAR	YR ₁	YR ₁	YR ₁	YR ₁	YR ₂	YR ₂	YR ₂	YR ₂	11
DAY (DY)	0	0	0	0	DY ₁	DY ₁	DY ₁	DY ₁	12
	DY ₂	DY ₂	DY ₂	DY ₂	DY ₃	DY ₃	DY ₃	DY ₃	13
HOURL	H ₁	H ₁	H ₁	H ₁	H ₂	H ₂	H ₂	H ₂	14
MINUTE	MI ₁	MI ₁	MI ₁	MI ₁	MI ₂	MI ₂	MI ₂	MI ₂	15
SECOND	SE ₁	SE ₁	SE ₁	SE ₁	SE ₂	SE ₂	SE ₂	SE ₂	16
MANUFACTURER'S CODE	M ₁	M ₁	M ₁	M ₁	M ₂	M ₂	M ₂	M ₂	17
	M ₃	M ₃	M ₃	M ₃	M ₄	M ₄	M ₄	M ₄	18
MANUFACTURER'S SERIAL NUMBER	M ₅	M ₅	M ₅	M ₅	M ₆	M ₆	M ₆	M ₆	19
	B ₁	B ₁	B ₁	B ₁	B ₂	B ₂	B ₂	B ₂	20
BYTES PER SCAN	B ₃	B ₃	B ₃	B ₃	B ₄	B ₄	B ₄	B ₄	21
	B ₅	B ₅	B ₅	B ₅	B ₆	B ₆	B ₆	B ₆	22
BASE SCAN INTERVAL	I ₃	I ₂	I ₁	I ₀	I ₋₁	I ₋₂	I ₋₃	I ₋₄	23
POLARITY (P)	P	P	P	P	S/B ₁₃	S/B ₁₂	S/B ₁₁	S/B ₁₀	24
SCANS/BLOCK EXPONENT (S/B _n)	S/B ₇	S/B ₆	S/B ₅	S/B ₄	S/B ₃	S/B ₂	S/B ₁	S/B ₀	25
RECORD TYPE (Z)	Z	Z	Z	Z	R ₁	R ₁	R ₁	R ₁	26
RECORD LENGTH (R)	R ₂	R ₂	R ₂	R ₂	R ₃	R ₃	R ₃	R ₃	27
SCAN TYPES/RECORD	ST/R ₁	ST/R ₁	ST/R ₁	ST/R ₁	ST/R ₂	ST/R ₂	ST/R ₂	ST/R ₂	28
CHANNEL SETS /SCAN TYPE	CS ₁	CS ₁	CS ₁	CS ₁	CS ₂	CS ₂	CS ₂	CS ₂	29
SKEW BLOCKS	SK ₁	SK ₁	SK ₁	SK ₁	SK ₂	SK ₂	SK ₂	SK ₂	30
EXTENDED HEADER BLOCKS	EC ₁	EC ₁	EC ₁	EC ₁	EC ₂	EC ₂	EC ₂	EC ₂	31
EXTERNAL HEADER BLOCKS	EX ₁	EX ₁	EX ₁	EX ₁	EX ₂	EX ₂	EX ₂	EX ₂	32

General header



TRACK NO.

4	7	6	8	3	9	1	8	2
---	---	---	---	---	---	---	---	---

BIT NO.

P	0	1	2	3	4	5	6	7
---	---	---	---	---	---	---	---	---

BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB

SCAN TYPE NUMBER	ST ₁	ST ₁	ST ₁	ST ₁	ST ₂	ST ₂	ST ₂	ST ₂	1
CHANNEL SET NUMBER	CH ₁	CH ₁	CH ₁	CH ₁	CH ₂	CH ₂	CH ₂	CH ₂	2
CHANNEL SET START TIME	TF ₁₆	TF ₁₅	TF ₁₄	TF ₁₃	TF ₁₂	TF ₁₁	TF ₁₀	TF ₉	3
CHANNEL SET END TIME	TE ₈	TE ₇	TE ₆	TE ₅	TE ₄	TE ₃	TE ₂	TE ₁	4
DESCALE MULTIPLIER	MP ₃	MP ₄	MP ₃	MP ₂	MP ₁	MP ₀	MP ₋₁	MP ₋₂	5
NUMBER OF CHANNELS	C/S ₁	C/S ₁	C/S ₁	C/S ₁	C/S ₂	C/S ₂	C/S ₂	C/S ₂	6
CHANNEL TYPE (C)	C ₁	C ₁	C ₁	C ₁	0	0	0	0	7
SAMPLES/CHANNEL (S/C)	S/C	S/C	S/C	S/C	J	J	J	J	8
ALIAS FILTER FREQUENCY	AF ₁	AF ₁	AF ₁	AF ₁	AF ₂	AF ₂	AF ₂	AF ₂	9
ALIAS FILTER SLOPE (AS)	AF ₃	AF ₃	AF ₃	AF ₃	AF ₄	AF ₄	AF ₄	AF ₄	10
LOW CUT FILTER	0	0	0	0	AS ₁	AS ₁	AS ₁	AS ₁	11
LOW CUT FILTER SLOPE (LS)	AS ₂	AS ₂	AS ₂	AS ₂	AS ₃	AS ₃	AS ₃	AS ₃	12
FIRST NOTCH FILTER	LC ₁	LC ₁	LC ₁	LC ₁	LC ₂	LC ₂	LC ₂	LC ₂	13
SECOND NOTCH FILTER	LC ₃	LC ₃	LC ₃	LC ₃	LC ₄	LC ₄	LC ₄	LC ₄	14
THIRD NOTCH FILTER	0	0	0	0	LS ₁	LS ₁	LS ₁	LS ₁	15
	LS ₂	LS ₂	LS ₂	LS ₂	LS ₃	LS ₃	LS ₃	LS ₃	16
	NT ₁	NT ₁	NT ₁	NT ₁	NT ₂	NT ₂	NT ₂	NT ₂	17
	NT ₃	NT ₃	NT ₃	NT ₃	NT ₄	NT ₄	NT ₄	NT ₄	18
	NT ₁	NT ₁	NT ₁	NT ₁	NT ₂	NT ₂	NT ₂	NT ₂	19
	NT ₃	NT ₃	NT ₃	NT ₃	NT ₄	NT ₄	NT ₄	NT ₄	20
	NT ₁	NT ₁	NT ₁	NT ₁	NT ₂	NT ₂	NT ₂	NT ₂	21
	NT ₃	NT ₃	NT ₃	NT ₃	NT ₄	NT ₄	NT ₄	NT ₄	22
	0	0	0	0	0	0	0	Q	23
	0	0	0	0	0	0	0	0	24
	0	0	0	0	0	0	0	0	25
	0	0	0	0	0	0	0	0	26
	0	0	0	0	0	0	0	0	27
	0	0	0	0	0	0	0	0	28
	0	0	0	0	0	0	0	0	29
	0	0	0	0	0	0	0	0	30
	0	0	0	0	0	0	0	0	31
	0	0	0	0	0	0	0	0	32

Channel set descriptor



FILE NUMBER	F ₁	F ₁	F ₁	F ₁	F ₂	F ₂	F ₂	F ₂	1
	F ₃	F ₃	F ₃	F ₃	F ₄	F ₄	F ₄	F ₄	2
SCAN TYPE NUMBER	ST ₁	ST ₁	ST ₁	ST ₁	ST ₂	ST ₂	ST ₂	ST ₂	3
CHANNEL SET NUMBER	CN ₁	CN ₁	CN ₁	CN ₁	CN ₂	CN ₂	CN ₂	CN ₂	4
TRACE NUMBER	TN ₁	TN ₁	TN ₁	TN ₁	TN ₂	TN ₂	TN ₂	TN ₂	5
	TN ₃	TN ₃	TN ₃	TN ₃	TN ₄	TN ₄	TN ₄	TN ₄	6
FIRST TIMING WORD	T ₁₅	T ₁₄	T ₁₃	T ₁₂	T ₁₁	T ₁₀	T ₉	T ₈	7
	T ₇	T ₆	T ₅	T ₄	T ₃	T ₂	T ₁	T ₀	8
	T ₋₁	T ₋₂	T ₋₃	T ₋₄	T ₋₅	T ₋₆	T ₋₇	T ₋₈	9
SAMPLE SKEW	0	0	0	0	0	0	0	0	10
	SS ₋₁	SS ₋₂	SS ₋₃	SS ₋₄	SS ₋₅	SS ₋₆	SS ₋₇	SS ₋₈	11
TIME BREAK WINDOW	0	0	0	0	0	0	0	0	12
	TW ₁₅	TW ₁₄	TW ₁₃	TW ₁₂	TW ₁₁	TW ₁₀	TW ₉	TW ₈	13
	TW ₇	TW ₆	TW ₅	TW ₄	TW ₃	TW ₂	TW ₁	TW ₀	14
	TW ₋₁	TW ₋₂	TW ₋₃	TW ₋₄	TW ₋₅	TW ₋₆	TW ₋₇	TW ₋₈	15
	0	0	0	0	0	0	0	0	16
	0	0	0	0	0	0	0	0	17
0	0	0	0	0	0	0	0	18	
0	0	0	0	0	0	0	0	19	
0	0	0	0	0	0	0	0	20	

Demultiplexed trace header



HEADER BLOCK PARAMETERS

General header

All values are in packed BCD unless otherwise specified.

INDEX BYTE	ABBREVIATION	DESCRIPTION
1	F ₁ , F ₂	File number of four digits (0-9999) Format code: 0015 20 bit binary multiplexed 0022 8 bit quaternary multiplexed 0024 16 bit quaternary multiplexed 0042 8 bit hexadecimal multiplexed 0044 16 bit hexadecimal multiplexed 0048 32 bit hexadecimal multiplexed 8015 20 bit binary demultiplexed 8022 8 bit quaternary demultiplexed <u>8024 16 bit quaternary demultiplexed</u> 8042 8 bit hexadecimal demultiplexed 8044 16 bit hexadecimal demultiplexed 8048 32 bit hexadecimal demultiplexed 0200 Illegal, do not use 0000 Illegal, do not use General constants, 12 digits
2	F ₃ , F ₄	
3	Y ₁ , Y ₂	
4	Y ₃ , Y ₄	
5	K ₁ , K ₂	Last two digits of year (0-99) Julian day 3 digits (1-366) Hour of day 2 digits (0-23) (Greenwich Mean Time) Minute of hour 2 digits (0-59) Second of minute 2 digits (0-59) Manufacturer's code 2 digits Note: See Appendix B for the current assignments Manufacturer's serial number, 4 digits Bytes per scan 6 digits (1-999,999) are utilized in the multiplexed formats to identify the number of bytes (including data, auxiliary, sync, and timing bytes, etc.) required to make up a complete scan. In a demultiplexed record, this field is not used and is recorded as zeros. (See Appendix E2)
6	K ₃ , K ₄	
7	K ₅ , K ₆	
8	K ₇ , K ₈	
9	K ₉ , K ₁₀	
10	K ₁₁ , K ₁₂	
11	YR ₁ , YR ₂	
12	O, DY ₁	
13	DY ₂ , DY ₃	
14	H ₁ , H ₂	
15	MI ₁ , MI ₂	Base scan interval.—This is coded as a binary number with the LSB equal to 1/16 msec. This will allow sampling intervals from 1/16 through 8 msec
16	SE ₁ , SE ₂	
17	M ₁ , M ₂	
18	M ₃ , M ₄	
19	M ₅ , M ₆	
20	B ₁ , B ₂	
21	B ₃ , B ₄	
22	B ₅ , B ₆	
23	I ₁ thru I ₄	



GENERAL HEADER

INDEX BYTE	ABBREVIATION	DESCRIPTION																																				
24	P,	<p>in binary steps. Thus, the allowable base scan intervals are $1/16$, $1/8$, $1/4$, $1/2$, 1, 2, 4, and 8 msec. The base scan interval is always the difference between successive timing words. Each channel used will be sampled one or more times per base scan interval.</p> <p>Polarity.—These 4 binary bits are measured on the sensors, cables, instrument, and source combination and are set into the system manually. The codes are:</p> <ul style="list-style-type: none"> 0000 Untested 0001 Zero 0010 45 degrees 0011 90 degrees 0100 135 degrees 0101 180 degrees 0110 225 degrees 0111 270 degrees 1000 315 degrees 1001 1010 1011 1100 unassigned 1101 1110 1111* 																																				
25	, S/BX ₃ thru S/BX ₀ S/B ₇ thru S/B ₀	<p>This binary number (range 0 to 15) is an exponent of 2 and is used in conjunction with S/B (Byte 25). This binary number (range 0 to 255) is used in conjunction with S/BX (see Byte 24) to indicate the number of scans in a block. If it is 0, the data body is one continuous block. Otherwise, the data body is composed of multiple blocks, each block containing $S/B \times 2^{S/BX}$ scans. It is valid only for multiplexed data.</p>																																				
26	Z,	<p>Record type</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Test record</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>Parallel channel test</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>Direct channel test</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>Normal record</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Other</td> </tr> </tbody> </table>	Bits	0	1	2	3		0	0	1	0	0	Test record	0	1	0	0	0	Parallel channel test	0	1	1	0	0	Direct channel test	1	0	0	0	0	Normal record	0	0	0	1	0	Other
Bits	0	1	2	3																																		
0	0	1	0	0	Test record																																	
0	1	0	0	0	Parallel channel test																																	
0	1	1	0	0	Direct channel test																																	
1	0	0	0	0	Normal record																																	
0	0	0	1	0	Other																																	
27	, R ₁ R ₂ , R ₃	<p>Record length from time zero (in increments of 0.5 times 1.024 sec). This value can be set from 00.5 to 99.5 representing times from 0.512 sec. to 101.888 sec. A setting of 00.0 indicates the record length is indeterminate.</p>																																				

*Details of polarity codes and test methods are listed in the following reference: Thigpen, B. B., Dalby, A. E., Landrum, R., 1975, Special report of the subcommittee on polarity standards: Geophysics, v. 40, p. 694.



GENERAL HEADER

INDEX BYTE	ABBREVIATION	DESCRIPTION
28	ST/R ₁ , ST/R ₂	Scan types per record. This 2 digit code is the number of scan types per record (1-99). (Zero is invalid.)
29	CS ₁ , CS ₂	Number of channel sets per scan type (1-99). (Zero is invalid.) This 2 digit code is the number of channel sets per scan. If multiple scan types are used (such as in a switching sampling interval environment), this number is equal to the number of channel sets contained in the scan type with the largest number of channel sets. If scan types also exist with less than this maximum number of channel sets per scan type, dummy channel set descriptors will have to be recorded in the scan type header. This can be done by setting the number of channels in the dummy channel set descriptor to zero (reference Bytes 9 and 10 of the scan type header description). Example 6 illustrates this requirement.
30	SK ₁ , SK ₂	Number of 32 byte fields added to the end of each scan type header in order to record the sample skew of all channels (0-99). (See Appendix E3). Zero indicates that skew is not recorded.
31	EC ₁ , EC ₂	Extended header length. The extended header is used to record additional equipment parameters. An example of this would be parameters generated by the addition of a field stacker to the system. The two digits (0-99) in this field specify the number of 32 byte extensions.
32	EX ₁ , EX ₂	External header length. The external header is used to record additional user supplied information in the header. The two digits (0-99) in this field specify the number of 32 byte extensions.

Scan type header (channel set descriptor)

The scan type header is determined by the system configuration and consists of one or more channel set descriptors each of 32 bytes followed by a series of 32 byte sample skew fields. A channel set is defined as a group of channels operating with the same set of parameters and being sampled as part of a scan of data. A scan type header can be composed of from 1 to 99 channel set descriptors. If dynamic parameter changes are required during the recording, additional scan type headers must be added, each containing the channel set descriptors necessary to define the new parameters. Each scan type header must have the same number of channel set descriptors (see Appendix E4 for header length calculation).



CHANNEL SET DESCRIPTOR

INDEX BYTE	ABBREVIATION	DESCRIPTION
1	ST ₁ , ST ₂	These two digits (1-99) identify the number of the scan type header to be described by the subsequent bytes. The first scan type header is 1 and the last scan type header number is the same value as Byte 28 (ST/R) of the general header. If a scan type header contains more than one channel set descriptor, the scan type header number will be repeated in each of its channel set descriptors. If the system does not have dynamic parameter changes during the record, such as switched sampling intervals, there will only be one scan type header required.
2	CN ₁ , CN ₂	These two digits (1-99) identify the channel set to be described in the next 30 bytes within this scan type header. The first channel set is "1" and the last channel set number is the same number as Byte 29 (CS) of the general header. If the scan actually contains fewer channel sets than CS, then dummy channel set descriptors are included as specified in Byte 29 of general header.
3 4	TF ₁₆ thru TF ₉ TF ₈ thru TF ₁	Channel set starting time. This is a binary number where TF ₁ = 2 ¹ msec (2-msec increments). This number identifies the timing word of the first scan of data in this channel set. In a single scan type record, this would typically be recorded as a zero (an exception might be deep water recording). In multiple scan type records, this number represents the starting time, in milliseconds, of the channel set. Start times from 0 to 131,070 msec (in 2-msec increments) can be recorded.
5 6	TE ₁₆ thru TE ₉ TE ₈ thru TE ₁	Channel set end time. This is a binary number where TE ₁ = 2 ¹ milliseconds (2 millisecond increments). These two bytes represent the record end time of the channel set in milliseconds. In a multiplexed record, all channels of a channel set must be of the same length. TE may be used in a demultiplexed record to allow the termination of a particular channel set shorter than other channel sets within its scan type. In a single scan type record, Bytes 5 and 6 would be the length of the record. End times up to 131,070 msec (in 2-msec increments) can be recorded.
7 8	0, 0 MP ₂ , MP ₄ thru MP ₋₂	This sign magnitude binary number is the exponent of the base 2 multiplier to be used to descale the data on tape to obtain input voltage in millivolts. The radix point is between MP ₀ and MP ₋₁ . This multiplier has a range of 2 ^{31.75} to 2 ^{-31.75} . (See Appendix E7.)
9 10	C/S ₁ , C/S ₂ C/S ₃ , C/S ₄	This is the number of channels in this channel set. It can assume a number from 0-9999.



CHANNEL SET DESCRIPTOR

INDEX BYTE	ABBREVIATION	DESCRIPTION																																																																		
11	C ₁ , 0	<p>Channel type identification:</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>Other</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>External data</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td></td> <td>Time counter^d</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td></td> <td>Water break</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td></td> <td>Up hole</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td></td> <td>Time break</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td></td> <td>Seis</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td></td> <td>Unused</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td></td> <td>Signature, unfiltered</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td></td> <td>Signature, filtered</td> </tr> </tbody> </table>	Bit	0	1	2	3		0	1	1	1	1	Other	0	1	1	1	0	External data	0	1	0	1		Time counter ^d	0	1	0	0		Water break	0	0	1	1		Up hole	0	0	1	0		Time break	0	0	0	1		Seis	0	0	0	0		Unused	1	0	0	0		Signature, unfiltered	1	0	0	1		Signature, filtered
Bit	0	1	2	3																																																																
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0	0	0	1		Seis																																																															
0	0	0	0		Unused																																																															
1	0	0	0		Signature, unfiltered																																																															
1	0	0	1		Signature, filtered																																																															
12	S/C,	This packed BCD number is an exponent of 2. The number (2 ^{S/C}) represents the number of subscans of this channel set in the base scan. Possible values for this parameter (2 ^{S/C}) are 1 to 512 (2 ⁰ to 2 ⁹). Reference Byte 23 of the general header.)																																																																		
12	, J	<p>Channel gain control method.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Gain mode</th> </tr> <tr> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>- (1) Individual AGC</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>- (2) Ganged AGC</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>- (3) Fixed gain</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>- (4) Programmed gain</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>- (8) Binary gain control</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>- (9) IFP gain control</td> </tr> </tbody> </table>	Bits	Gain mode	4	5	6	7		0	0	0	1	- (1) Individual AGC	0	0	1	0	- (2) Ganged AGC	0	0	1	1	- (3) Fixed gain	0	1	0	0	- (4) Programmed gain	1	0	0	0	- (8) Binary gain control	1	0	0	1	- (9) IFP gain control																													
Bits	Gain mode																																																																			
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1	0	0	1	- (9) IFP gain control																																																																
13	AF ₁ , AF ₂	Alias filter frequency. It can be coded for any frequency from 0 to 9999 Hz.																																																																		
14	AF ₃ , AF ₄	Alias filter slope in dB per octave. It can be coded from 0 to 999 dB in 1-dB steps. A zero indicates the filter is out (see Appendix E5 for definition).																																																																		
15	0, AS ₁	Low-cut filter setting. It can be coded for any frequency from 0 to 9999 Hz.																																																																		
16	AS ₂ , AS ₃	Low-cut filter slope. It can be coded for any slope from 0 to 999 dB per octave. A zero slope indicates the filter is out. (See Appendix E5 for definition.)																																																																		
17	LC ₁ , LC ₂	Notch frequency setting. It can be coded for any frequency from 0 to 999.9 Hz. The out filter is written as 000.0 Hz.																																																																		
18	LC ₃ , LC ₄																																																																			
19	0, LS ₁																																																																			
20	LS ₂ , LS ₃																																																																			
21	NT ₁ , NT ₂																																																																			
22	NT ₃ , NT ₄																																																																			

^dIllegal code for this format because the timing counter is part of the start of scan and cannot be identified as part of a channel.



CHANNEL SET DESCRIPTOR

INDEX BYTE	ABBREVIATION	DESCRIPTION
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The following notch filters are coded in a similar manner:

23	NT ₁ , NT ₂	Second notch frequency
24	NT ₃ , NT ₄	
25	NT ₁ , NT ₂	Third notch frequency
26	NT ₃ , NT ₄	
27		
28		
29	Unused. Written as zeros.	
30		
31		
32		



APPENDIX C—GLOSSARY

Base scan interval The time between timing words. A base scan interval usually contains one scan but under some conditions may contain multiple subscans.

Block The data between gaps on tape.

Channel set One or more channels sampled at the same sampling interval and containing the same filter, fixed gain, and other fixed parameter information.

Channel set descriptor A unit of the scan type header describing the parameters of a channel set.

Data recording method The arrangement of bits to represent samples on tape.

File All data recorded from a single energy impulse or sweep. It may also be the sum of a number of energy impulses or sweeps. Literally, it is all of the blocks between file marks.

Format Data recording method combined with a multiplexed/demultiplexed indicator (see general header Bytes 3 and 4).

General header The first header in the header block. It contains information common to the entire record.

Index byte The byte number of some particular parameter within the general or scan type header.

Packed BCD Binary coded decimal digits represented by four data bits.

Sample skew The fraction of the base scan interval between the timing word and the actual time the sam-

ple was taken in a base scan interval (not related to position on tape).

Sampling interval The interval between readings such as the time between successive samples of a digital seismic trace.

Scan One complete sequence of events, such as sampling all channels. Data recorded during a base scan interval.

Scan interval The interval between readings of all samples contained in a scan type.

Scan type One complete set of channel sets which make up a scan. A seismic record contains multiple scans, and may or may not contain more than one scan type.

Scan type header A header containing one or more channel set descriptors and the skew information.

Subscan A set of samples containing one sample for each channel in a channel set.

Time break window Time interval in which time break is expected. If time break does not occur by the end of the window, internal time break is generated.

Trace A record of one seismic channel within a scan type. A collection of a sequential set of points from one seismic channel.

Trace block A block containing the data of one trace or a part of a trace with constant parameters.



HEADER DESCRIPTORS

G = general header

S = scan type header (channel set descriptor)

ABBREVIATION	HEADER	BYTE NO.	DESCRIPTION
AF	S	13, 14	ALIAS FILTER FREQUENCY
AS	S	15, 16	ALIAS FILTER SLOPE
B	G	20, 21, 22	BYTES PER SCAN (MULTIPLEXED ONLY)
BCD	—		BINARY CODED DECIMAL
BOT	—		BEGINNING OF TAPE MARK
C	S	11	CHANNEL TYPE IDENTIFICATION
CN	S	2	CHANNEL SET NUMBER
CS	G	29	CHANNEL SETS PER SCAN TYPE
C/S	S	9, 10	CHANNELS IN THIS CHANNEL SET
DP	—		DYNAMIC PARAMETER CHANGE BIT (SEE THE MULTIPLEXED DATA BLOCK, SOS BYTE 4)
DY	G	12, 13	DAY OF YEAR
EC	G	31	EXTENDED HEADER LENGTH
EOF	—		END OF FILE MARK
EOT	—		END OF TAPE MARK
EX	G	32	EXTERNAL HEADER LENGTH
F	G	1, 2	FILE NUMBER
H	G	14	HOUR OF DAY
HDR	—		HEADER FOR DEMULTIPLEXED TRACE
HL	—		HEADER LENGTH (SEE APPENDIX E4)
I	G	23	BASE SCAN INTERVAL
IBG	—		INTERBLOCK GAP (ALSO GAP)
ITB	—		INTERNAL TIME BREAK (SEE THE MULTIPLEXED DATA BLOCK, SOS BYTE 4)
J	S	12	GAIN CONTROL METHOD
K	G	5 THRU 10	GENERAL CONSTANTS
LC	S	17, 18	LOW CUT FILTER FREQUENCY
LS	S	19, 20	LOW CUT FILTER SLOPE
LSB	—		LEAST SIGNIFICANT BIT
LSD	—		LEAST SIGNIFICANT DIGIT
M	G	17 THRU 19	MANUFACTURER'S CODE AND SERIAL NUMBER
MI	G	15	MINUTE OF HOUR
MP	S	8	DESCALING EXPONENT
MSB	—		MOST SIGNIFICANT BIT
MSD	—		MOST SIGNIFICANT DIGIT
NT	S	21 THRU 26	NOTCH FILTER FREQUENCY
P	G	24	POLARITY
R	G	26, 27	RECORD LENGTH
S	—		SIGN BIT
S/B, S/BX	G	24, 25	NUMBER OF SCANS PER BLOCK



HEADER DESCRIPTORS

ABBREVIATION	HEADER	BYTE NO.	DESCRIPTION
S/C	S	12	EXPONENT OF SAMPLES PER CHANNEL IN THE BASE SCAN
SE	G	16	SECOND OF MINUTE
SK	G	30	NUMBER OF 32 BYTE SKEW FIELDS
SOS	—		START OF SCAN (MULTIPLEXED DATA BLOCK)
SS	—		SAMPLE SKEW
S/S	—		SAMPLES/SCAN
ST	S	1	SCAN TYPE NUMBER
ST/R	G	28	SCAN TYPES PER RECORD
T	—		TIMING WORD (MULTIPLEXED DATA BLOCK)
TF	S	3, 4	FIRST TIMING WORD IN THIS CHANNEL SET
TE	S	5, 6	END TIME OF THIS CHANNEL SET
TN	—		DEMULPLEXED TRACE NO. (SEE TRACE HEADER)
TW	—		TIME BREAK WINDOW (SEE DEMULTI- PLEXED DATA BLOCK, TRACE HEADER BYTES 13, 14 AND 15)
TWI	—		TIME BREAK WINDOW INDICATOR (SEE MULTIPLEXED DATA BLOCK, SOS BYTE 4)
Y	G	3, 4	FORMAT CODE (DATA RECORDING METHOD)
YR	G	11	YEAR (LAST TWO DIGITS)
Z	G	26	RECORD TYPE

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APPENDIX 5
STATISTICS

**STATISTICS**

First Recording Day	:	18th November, 1984
Last Recording Day	:	17th December, 1984
Number of Lines	:	79
Number of Kilometres	:	2363.55 Kms
Number of Shotpoints	:	78785
Percentage of misfires	:	0.42%
Average Kilometres per Prospect day	:	86.0 Kms
Magnetic Kilometres	:	2363.55 Kms
Gravity Kilometres	:	2363.55 Kms

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APPENDIX 6
PRODUCTION DETAILS

PRODUCTION DETAILS (AS RECORDED)

AMOCO BASS BASIN SURVEY T-14/18/22-P EUGENE MCDERMOTT II NOV/DEC 84

LINE ID.	FSP	LSP	TOT SP	TOT KMS	CHG SPS	CHG KM	COMMENTS
TNK4- 48	1	2176	2176	65.280	2176	65.280	COMPLETE
TNK4- 44A	1	941	941	28.230	941	28.230	COMPLETE
TNK4- 26	1	943	943	28.290	943	28.290	T.B.C.
TNK4- 36	1	953	953	28.590	953	28.590	COMPLETE
TNK4-103	1	662	662	19.860	662	19.860	COMPLETE
TNK4-101	1	633	633	18.990	633	18.990	COMPLETE
TNK4- 50	1	703	703	21.090	703	21.090	COMPLETE
TNK4- 71	1	822	822	24.660	822	24.660	COMPLETE
TNK4- 14	1	814	814	24.420	814	24.420	COMPLETE
TNK4- 12A	1	903	903	27.090	903	27.090	COMPLETE
TNK4- 08	1	1333	1333	39.990	1333	39.990	COMPLETE
TNK4- 27	1	493	493	14.790	493	14.790	COMPLETE
TNK4- 33	1	493	493	14.790	493	14.790	COMPLETE
TNK4- 35	1	683	683	20.490	683	20.490	COMPLETE
TNK4- 37A	1	623	623	18.690	623	18.690	COMPLETE
TNK4- 41	1	763	763	22.890	763	22.890	COMPLETE
TNK4- 47	1	1003	1003	30.090	1003	30.090	COMPLETE
TNK4- 45	1	763	763	22.890	763	22.890	COMPLETE
TNK4- 51	1	1975	1975	59.250	1975	59.250	COMPLETE
TNK4- 55	1	1774	1774	53.220	1774	53.220	COMPLETE
TNK4- 63	1	573	573	17.190	573	17.190	COMPLETE
TNK4- 10	1	1456	1456	43.680	1456	43.680	COMPLETE
TNK4- 29	1	603	603	18.090	603	18.090	COMPLETE
TNK4- 02A	1	323	323	9.690	323	9.690	COMPLETE
TNK4- 06	1	473	473	14.190	473	14.190	COMPLETE
TNK4- 31	1	613	613	18.390	613	18.390	COMPLETE
TNK4- 16	1	744	744	22.320	744	22.320	COMPLETE
TNK4- 18B	1	573	573	17.190	573	17.190	COMPLETE
TNK4- 26A	3000	4105	1106	33.180	1106	33.180	T.B.C.
TNK4- 77A	1	1123	1123	33.690	1123	33.690	COMPLETE
TNK4- 79	1	1125	1125	33.750	1125	33.750	COMPLETE
TNK4- 81	1	1063	1063	31.890	1063	31.890	COMPLETE
TNK4- 83	1	1074	1074	32.220	1074	32.220	COMPLETE
TNK4- 87	1	863	863	25.890	863	25.890	COMPLETE
TNK4- 89	1	1285	1285	38.550	1285	38.550	COMPLETE
TNK4- 85	1	1043	1043	31.290	1043	31.290	COMPLETE
TNK4- 91	1	954	954	28.620	954	28.620	COMPLETE
TNK4- 93	1	573	573	17.190	573	17.190	COMPLETE
TNK4- 95	1	933	933	27.990	933	27.990	COMPLETE
TNK4- 97	1	562	562	16.860	562	16.860	COMPLETE
TNK4- 99	1	933	933	27.990	933	27.990	COMPLETE
TNK4- 52	1	383	383	11.490	383	11.490	COMPLETE
TNK4- 75A	1	1260	1260	37.800	1260	37.800	T.B.C.
TNK4- 46	1	1052	1052	31.560	1052	31.560	COMPLETE
TNK4- 42	1	1615	1615	48.450	1615	48.450	COMPLETE
TNK4- 32	1	1393	1393	41.790	1393	41.790	COMPLETE
TNK4- 26C	944	1157	214	6.420	214	6.420	COMPLETE
TNK4- 69A	1	884	884	26.520	884	26.520	COMPLETE
TNK4- 73	1	814	814	24.420	814	24.420	COMPLETE

TNK4- 75B	1261	1423	163	4.890	163	4.890	COMPLETE
TNK4- 38	1	543	543	16.290	543	16.290	COMPLETE
TNK4- 40	1	1764	1764	52.920	1764	52.920	COMPLETE
TNK4- 01	1	523	523	15.690	523	15.690	COMPLETE
TNK4- 03	1	635	635	19.050	635	19.050	T. B. C.
TNK4- 03A	636	1403	768	23.040	768	23.040	COMPLETE
TNK4- 05	1	1444	1444	43.320	1444	43.320	COMPLETE
TNK4- 07	1	1443	1443	43.290	1443	43.290	COMPLETE
TNK4- 09	1	1434	1434	43.020	1434	43.020	COMPLETE
TNK4- 11	1	1435	1435	43.050	1435	43.050	COMPLETE
TNK4- 13	1	1375	1375	41.250	1375	41.250	COMPLETE
TNK4- 15	1	1353	1353	40.590	1353	40.590	COMPLETE
TNK4- 17	1	1335	1335	40.050	1335	40.050	COMPLETE
TNK4- 19	1	1187	1187	35.610	1187	35.610	COMPLETE
TNK4- 21	1	1324	1324	39.720	1324	39.720	COMPLETE
TNK4- 23	1	1055	1055	31.650	1055	31.650	COMPLETE
TNK4- 25	1	1004	1004	30.120	1004	30.120	COMPLETE
TNK4- 34	1	578	578	17.340	578	17.340	T. B. C.
TNK4- 39	1	772	772	23.160	772	23.160	COMPLETE
TNK4- 43A	1	704	704	21.120	704	21.120	COMPLETE
TNK4- 49	1	443	443	13.290	443	13.290	COMPLETE
TNK4- 53	1	523	523	15.690	523	15.690	COMPLETE
TNK4- 59	1	2053	2053	61.590	2053	61.590	COMPLETE
TNK4- 04A	1	413	413	12.390	413	12.390	COMPLETE
TNK4- 57	1	1015	1015	30.450	1015	30.450	COMPLETE
TNK4- 65	1	874	874	26.220	874	26.220	COMPLETE
TNK4- 67	1	903	903	27.090	903	27.090	COMPLETE
TNK4- 61	1	503	503	15.090	503	15.090	COMPLETE
TNK4- 54	1	873	873	26.190	873	26.190	COMPLETE
TNK4- 28	1	915	915	27.450	915	27.450	COMPLETE
TNK4- 34A	579	1064	486	14.580	486	14.580	COMPLETE
TNK4- 24	1	1074	1074	32.220	1074	32.220	COMPLETE
TNK4- 28A	1	643	643	19.290	643	19.290	COMPLETE
TNK4- 20	1	1312	1312	39.360	1312	39.360	COMPLETE
TNK4- 22	1	853	853	25.590	853	25.590	COMPLETE
TOTALS			78785	2363.55	78785	2363.55	



PRODUCTION DETAILS

LINE NUMERICAL LISTING

LINE	FSP	LSP	KMS	DATE RECORDED
TNK4- 01	1	523	15.690	6 DEC
TNK4- 02A	1	323	9.690	28 NOV
TNK4- 03	1	635	19.050	6 DEC
TNK4- 03A	636	1403	23.040	7 DEC
TNK4- 04A	1	413	12.390	14 DEC
TNK4- 05	1	1444	43.320	7 DEC
TNK4- 06	1	473	14.190	28 NOV
TNK4- 07	1	1443	43.290	7 DEC
TNK4- 08	1	1333	39.990	25 NOV
TNK4- 09	1	1434	43.020	7 DEC
TNK4- 10	1	1456	43.960	27/28 NOV
TNK4- 11	1	1435	43.050	7/8 DEC
TNK4- 12A	1	903	27.090	25 NOV
TNK4- 13	1	1375	41.250	8 DEC
TNK4- 14	1	814	24.420	24 NOV
TNK4- 15	1	1353	40.590	8 DEC
TNK4- 16	1	744	22.320	28 NOV
TNK4- 17	1	1335	40.050	8 DEC
TNK4- 18B	1	573	17.190	29 NOV
TNK4- 19	1	1187	35.610	8/9 DEC
TNK4- 20	1	1312	39.360	14 DEC
TNK4- 21	1	1324	39.720	9 DEC
TNK4- 22	1	853	25.590	16 DEC
TNK4- 23	1	1055	31.650	9 DEC
TNK4- 24	1	1074	32.220	16 DEC
TNK4- 25	1	1004	30.120	9 DEC
TNK4- 26	1	943	28.290	23 NOV
TNK4- 26A	3000	4105	33.180	29 NOV
TNK4- 26C	944	1157	6.420	5 DEC
TNK4- 27	1	493	14.790	25 NOV
TNK4- 28	1	915	27.450	15 DEC
TNK4- 28A	1	643	19.290	16 DEC
TNK4- 29	1	603	18.090	28 NOV
TNK4- 31	1	613	18.390	28 NOV
TNK4- 32	1	1393	41.790	4 DEC
TNK4- 33	1	493	14.790	25 NOV
TNK4- 34	1	578	17.340	9/10 DEC
TNK4- 34A	579	1064	14.580	16 DEC
TNK4- 35	1	683	20.490	25/26 NOV
TNK4- 36	1	953	28.590	24 NOV
TNK4- 37A	1	623	18.690	26 NOV
TNK4- 38	1	573	16.290	6 DEC
TNK4- 39	1	772	23.160	13 DEC
TNK4- 40	1	1764	52.920	6 DEC
TNK4- 41	1	763	22.890	26 NOV



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TNK4- 42	1	1615	48.450	4 DEC
TNK4- 43A	1	704	21.120	13 DEC
TNK4- 44	1	941	28.230	23 NOV
TNK4- 45	1	763	22.890	26 NOV
TNK4- 46	1	1052	31.560	4 DEC
TNK4- 47	1	1003	30.090	26 NOV
TNK4- 48	1	2176	65.280	22/23 NOV
TNK4- 49	1	443	13.290	14 DEC
TNK4- 50	1	703	21.090	24 NOV
TNK4- 51	1	1975	59.250	26/27 NOV
TNK4- 52	1	383	11.490	2 DEC
TNK4- 53	1	523	15.690	14 DEC
TNK4- 54	1	873	26.190	15 DEC
TNK4- 55	1	1774	53.220	27 NOV
TNK4- 57	1	1015	30.450	14 DEC
TNK4- 59	1	2053	61.590	14 DEC
TNK4- 61	1	503	15.090	15 DEC
TNK4- 63	1	573	17.190	27 NOV
TNK4- 65	1	874	26.220	15 DEC
TNK4- 67	1	903	27.090	15 DEC
TNK4- 69A	1	884	26.520	5 DEC
TNK4- 71	1	822	24.660	24 NOV
TNK4- 73	1	814	24.420	5 DEC
TNK4- 75A	1	1260	37.800	3 DEC
TNK4- 75B	1261	1423	4.890	6 DEC
TNK4- 77A	1	1123	33.690	30 NOV
TNK4- 79	1	1125	33.750	30 NOV
TNK4- 81	1	1063	31.890	1 DEC
TNK4- 83	1	1074	32.220	1 DEC
TNK4- 85	1	1043	31.290	1 DEC
TNK4- 87	1	863	25.890	1 DEC
TNK4- 89	1	1285	38.550	1 DEC
TNK4- 91	1	954	28.620	1/2 DEC
TNK4- 93	1	573	17.190	2 DEC
TNK4- 95	1	933	27.990	2 DEC
TNK4- 97	1	562	16.860	2 DEC
TNK4- 99	1	933	27.990	2 DEC
TNK4-101	1	633	18.990	24 NOV
TNK4-103	1	662	19.860	24 NOV
TOTALS		78785	2363.55	

149128



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APPENDIX 7
FIELD TAPE INVENTORY



FIELD TAPE INVENTORY

INVENTORY OF DIGITAL FIELD TAPES

PARTY 2931 M/V "EUGENE MCDERMOTT DATE: NOV/DEC 1984

CLIENT: AMOCO PROSPECT: BASS BASIN COUNTRY: AUSTRALIA

TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.		
0	19 NOV	809531	TNK4-18A	001 - 103	001 - 103		
1		809532		104 - 111	104 - 111		
0		809533		121 - 223	114 - 223		
1		809534		224 - 230	217 - 223		
0		809535		237 - 339	224 - 326		
1		809536		340 - 442	327 - 429		
0		809537		443 - 450	430 - 437		
1		809538		458 - 560	439 - 541		
0		809539		561 - 575	542 - 557		
0	20 NOV	809540	TNK4-37	001 - 112	001 - 112		
1		809541		113 - 122	113 - 122		
2		809542		130 - 234	124 - 228		
0		809543		235 - 282	229 - 276		
1		809544		289 - 400	277 - 388		
0		806545		513 - 529	501 - 517		
1		809547		NOISE STRIP ONLY			
0		22 NOV		809548	TNK4-48	001 - 115	001 - 115
1				809569		116 - 230	116 - 230
0	809550		231 - 345	231 - 345			
1	809551		346 - 460	346 - 460			
0	809552		461 - 575	461 - 575			
1	809553		576 - 690	576 - 690			
0	809554		691 - 805	691 - 805			
1	809555		806 - 920	806 - 920			
0	23 NOV		809556			921 - 1035	921 - 1035
1		809557	1036 - 1150		1036 - 1150		
0		809558	1151 - 1265		1151 - 1265		
1		809559	1266 - 1380		1266 - 1380		
0		809560	1381 - 1495		1381 - 1495		
1		809561	1496 - 1610		1496 - 1610		
0		809562	1611 - 1725		1611 - 1725		
1		809563	1726 - 1840		1726 - 1840		
0		809564	1841 - 1955		1841 - 1955		
1		809565	1956 - 2012		1956 - 2012		
0	809566	2019 - 2133	2013 - 2127				
1	809567	2134 - 2176	2128 - 2170				



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.	
0	23 NOV	809573	TNK4-44	001 - 115	001 - 115	
1		809574		116 - 230	116 - 230	
0		809575		231 - 345	231 - 345	
1		809576		346 - 460	346 - 460	
0		809577		461 - 575	461 - 575	
1		809578		576 - 690	576 - 690	
0		809579		691 - 805	691 - 805	
1		809580		806 - 920	806 - 920	
0		809581		921 - 941	921 - 941	
0		809582		TNK4-26	001 - 115	001 - 115
1		809583			116 - 240	116 - 240
0		809584			241 - 365	241 - 365
1		809585			366 - 490	366 - 490
0		809586			491 - 615	491 - 615
1		809587			616 - 740	616 - 740
0		809588			741 - 865	741 - 865
1	809589	866 - 943	866 - 943			
0	24 NOV	809590	TNK4-36		001 - 115	001 - 115
1		809591			116 - 230	116 - 230
0		809592		231 - 345	231 - 345	
1		809593		346 - 460	346 - 460	
0		809594		461 - 575	461 - 575	
1		809595		576 - 690	576 - 690	
0		809596		691 - 805	691 - 805	
1		809597		806 - 920	806 - 920	
0		809598		921 - 953	921 - 953	
0		809599		TNK4-103	001 - 115	001 - 115
1		809600			116 - 230	116 - 230
0		809601			231 - 345	231 - 345
1		809602			346 - 460	346 - 460
0		809603		461 - 575	461 - 575	
1		806604		576 - 662	576 - 662	
0		809605		TNK4-101	001 - 115	001 - 115
1	809606	116 - 230	116 - 230			
0	809607	231 - 345	221 - 345			
1	809608	346 - 460	346 - 460			
0	809609	461 - 575	461 - 575			
1	809610	576 - 633	576 - 633			
0	809611	TNK4-50	001 - 115	001 - 115		
1	809612		116 - 230	116 - 230		
0	809613		231 - 360	231 - 360		
1	809614		361 - 490	361 - 490		
0	809615	491 - 620	491 - 620			
1	809616	621 - 703	621 - 703			
0	809617	TNK4-71	001 - 115	001 - 115		
1	809618		116 - 245	116 - 245		
0	809619		246 - 375	246 - 375		
1	809620		376 - 505	376 - 505		
0	809621		506 - 635	506 - 635		



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
1		809622		636 - 765	636 - 765
0		809623		766 - 822	766 - 822
0		809624	TNK4-14	001 - 115	001 - 115
1		809625		116 - 245	116 - 245
0		809626		246 - 375	246 - 375
1		809627		376 - 505	376 - 505
0		809628		506 - 635	506 - 635
1		809629		636 - 765	636 - 765
0		809630		766 - 814	766 - 814
0	25 NOV	809631	TNK4-12	001 - 115	001 - 115
1		809632		116 - 191	116 - 191
0		809633	TNK4-12A	001 - 115	001 - 115
1		809634		116 - 230	116 - 230
0		809635		231 - 345	231 - 345
1		809636		346 - 460	346 - 460
0		809637		461 - 575	461 - 575
1		809638		576 - 591	576 - 591
0		809639		592 - 706	590 - 704
1		809640		707 - 821	705 - 821
0		809641		822 - 903	820 - 901
0		809642	TNK4-8	001 - 115	001 - 115
1		809643		116 - 230	116 - 230
0		809644		231 - 345	231 - 345
1		806645		346 - 460	346 - 460
0		809646		461 - 575	461 - 575
1		809647		576 - 690	576 - 690
0		809648		691 - 805	691 - 805
1		809649		806 - 935	806 - 935
0		809650		936 - 1035	936 - 1065
1		809651		1066 - 1195	1066 - 1195
0		809652		1196 - 1325	1196 - 1325
1		809653		1326 - 1333	1326 - 1333
0		809654	TNK4-27	001 - 115	001 - 115
1		809655		116 - 245	116 - 245
0		809656		246 - 375	246 - 375
1		809657		376 - 493	376 - 493
0		809658	TNK4-33	001 - 115	001 - 115
1		809569		116 - 245	116 - 245
0		809660		246 - 375	246 - 375
1		809661		376 - 493	376 - 493
0		809662	TNK4-25	001 - 115	001 - 115
2		809663		116 - 245	116 - 245
0		809664		246 - 375	246 - 375
2		809665		376 - 505	376 - 505
0	26 NOV	809666		506 - 635	506 - 635
2		809667		636 - 683	636 - 683
0		809668	TNK4-37A	001 - 115	001 - 115
2		809669		116 - 230	116 - 230
0		809670		231 - 360	231 - 360



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
2		809671		361 - 490	361 - 490
0		809672		491 - 620	491 - 620
2		809673		621 - 623	621 - 623
0		809674	TNK4-41	001 - 115	001 - 115
1		809675		116 - 245	116 - 245
0		809676		246 - 375	246 - 375
1		809677		376 - 505	376 - 505
0		809678		506 - 635	506 - 635
1		809679		636 - 763	636 - 763
0		809680	TNK4-47	001 - 115	001 - 115
0		809681		116 - 245	116 - 245
1		809682		246 - 375	246 - 375
0		809683		376 - 505	376 - 505
1		809684		506 - 635	506 - 635
0		806685		636 - 765	636 - 765
1		809686		766 - 895	766 - 895
0		809687		896 - 1003	896 - 1003
1		809688	TNK4-45	001 - 115	001 - 115
2		809689		116 - 240	116 - 240
1		809690		241 - 365	241 - 365
2		809691		366 - 490	366 - 490
1		809692		491 - 615	491 - 615
2		809693		616 - 740	616 - 740
1		809694		741 - 763	741 - 763
1		809695	TNK4-51	001 - 115	001 - 115
2		809696		116 - 245	116 - 245
1		809697		246 - 375	246 - 375
2	27 NOV	809698	TNK4-51	376 - 505	376 - 505
1		809699		506 - 635	506 - 635
2		809700		636 - 465	636 - 465
1		809701		766 - 895	766 - 895
2		809702		896 - 1025	896 - 1025
1		809703		1026 - 1155	1026 - 1155
2		809704		1156 - 1285	1156 - 1285
1		809705		1286 - 1415	1286 - 1415
2		809706		1416 - 1545	1416 - 1545
1		809707		1546 - 1675	1545 - 1675
2		809708		1675 - 1805	1676 - 1805
1		809709		1806 - 1935	1806 - 1935
2		809710		1936 - 1975	1936 - 1975
0		809711	TNK-55	001 - 115	001 - 115
1		809712		116 - 245	116 - 245
0		809713		240 - 375	246 - 375
1		809714		376 - 505	376 - 505
0		809715		506 - 635	506 - 635
1		809716		636 - 765	636 - 765
0		809717		766 - 895	766 - 895
1		809718		896 - 1025	896 - 1025
0		809719		1026 - 1155	1026 - 1155



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
1		809720		1156 - 1285	1156 - 1285
0		809721		1286 - 1415	1286 - 1415
1		809722		1416 - 1545	1416 - 1545
0		809723		1546 - 1675	1546 - 1675
1		809724		1676 - 1774	1676 - 1774
0		809725	TNK4-4	001 - 115	001 - 115
1		809726		116 - 117	116 - 117
0		809727	TNK4-63	001 - 115	001 - 115
1		809728		116 - 245	116 - 245
0		809729		246 - 375	246 - 375
1		809730		376 - 505	376 - 505
0		809731		506 - 573	506 - 573
0		809732	TNK4-10	001 - 115	001 - 115
1		809733		116 - 245	116 - 245
0		809734		246 - 375	246 - 375
1		809735		376 - 505	376 - 505
0		809736		506 - 635	506 - 635
1		809737		636 - 765	636 - 765
0		809738		766 - 895	766 - 895
1		809739		896 - 1025	896 - 1025
0		809740		1024 - 1155	1024 - 1155
1		809741		1156 - 1285	1156 - 1285
0		809742		1286 - 1415	1286 - 1415
1	28 NOV	809743		1416 - 1456	1416 - 1456
1		809744	TNK4-29	001 - 115	001 - 115
2		809745		116 - 245	116 - 245
1		809746		246 - 375	246 - 375
2		809747		376 - 505	376 - 505
1		809748		506 - 603	506 - 603
1		809749	TNK4-2	006 - 57	001 - 42
1		809750	TNK4-2A	001 - 115	001 - 115
2		809751		116 - 230	116 - 230
1		809752		231 - 323	231 - 323
1		809753	TNK4-6	001 - 115	001 - 115
2		809754		116 - 245	116 - 245
		809755		246 - 375	246 - 375
		809756		376 - 473	376 - 473
		809757	TNK4-31	001 - 115	001 - 115
1		809788	TNK4-31	116 - 241	116 - 241
0		809759		242 - 367	242 - 367
1		809760		368 - 493	368 - 493
0		809761		494 - 613	494 - 613
0		809762	TNK4-16	001 - 115	001 - 115
1		809763		116 - 245	116 - 245
0		809764		246 - 375	246 - 375
1		809765		376 - 505	376 - 505
0		809766		506 - 635	506 - 635
1		809767		636 - 744	636 - 744



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
0	29 NOV	809768	TNK4-18B	001 - 115	001 - 115
1		809769		116 - 230	116 - 230
0		809770		231 - 345	231 - 345
1		809771		346 - 460	346 - 460
0		809772		461 - 573	461 - 573
0		809773	TNK4-26A	3000 - 3114	3000 - 3114
1		809774		3115 - 3339	3115 - 3339
0		809775		3240 - 3364	3240 - 3364
1		809776		3365 - 3489	3365 - 3489
0		809777		3490 - 3614	3490 - 3614
1		809778		3615 - 3739	3615 - 3739
0		809779		3740 - 3864	3740 - 3864
1		809780		3685 - 3989	3865 - 3989
0		809781		3990 - 4105	3990 - 4105
0		809782	TNK4-77	001 - 115	001 - 115
1		809783		116 - 221	116 - 221
0	809784	TNK4-77A	001 - 115	001 - 115	
1	809785		116 - 245	116 - 245	
0	809786		246 - 375	246 - 375	
1	809787		376 - 505	376 - 505	
0	809788		506 - 635	506 - 635	
1	809789		636 - 765	636 - 765	
0	809790		766 - 895	766 - 895	
1	809791		896 - 1025	896 - 1025	
0	809792		1026 - 1123	1026 - 1123	
1	809793	TNK4-79	001 - 115	001 - 115	
0	809794		116 - 245	116 - 245	
1	809795		246 - 375	246 - 375	
0	809796		376 - 505	376 - 505	
1	809797		506 - 635	506 - 635	
0	809798		636 - 765	636 - 765	
1	809799		766 - 895	766 - 895	
0	809800		896 - 1025	896 - 1025	
1	1 DEC	809801		1026 - 1125	1026 - 1125
0		809802	TNK4-81	001 - 115	001 - 115
1		809803		116 - 245	116 - 245
0		809804		246 - 375	246 - 375
1		809805		376 - 505	376 - 505
0		809806		506 - 635	506 - 635
1		809807		636 - 765	636 - 765
0		809808		766 - 895	766 - 895
1		809809		896 - 1025	896 - 1025
0		809810		1026 - 106	1026 - 106
0		809811	TNK4-83	001 - 115	001 - 115
1		809812		116 - 240	116 - 240
0		809813		241 - 365	241 - 365
1		809814		366 - 495	366 - 495
0		809815		496 - 625	496 - 625
1		809816		625 - 755	625 - 755



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
0	1 DEC	809817	TNK4-83	756 - 885	756 - 885
1		809818		886 - 1015	886 - 1015
0		809819		1016 - 1074	1016 - 1074
0		809820	TNK4-87	001 - 115	001 - 115
2		809821		116 - 245	116 - 245
0		809822		246 - 375	246 - 375
2		809823		376 - 505	376 - 505
0		809824		506 - 635	506 - 635
2		809825		636 - 765	636 - 765
0		809826	TNK4-89	766 - 863	766 - 863
0		809827		001 - 115	001 - 115
1		809828		116 - 245	116 - 245
0		809829		246 - 375	246 - 375
1		809830		376 - 505	376 - 505
0		809831		506 - 635	506 - 635
1		809832		636 - 765	636 - 765
0		809833		766 - 895	766 - 895
1		809834		896 - 1025	896 - 1025
0		809835		1126 - 1155	1126 - 1155
1	809836	TNK4-85	1156 - 1285	1156 - 1285	
0	809837		001 - 115	001 - 115	
1	809838		116 - 245	116 - 245	
0	809839		246 - 375	246 - 375	
1	809840		376 - 505	376 - 505	
0	809841		506 - 635	506 - 635	
1	809842		636 - 765	636 - 765	
0	809843		766 - 895	766 - 895	
1	809844		896 - 1025	896 - 1025	
0	809845		1026 - 1043	1026 - 1043	
0	2 DEC	809846	TNK4-91	001 - 115	001 - 115
1		809847		116 - 245	116 - 245
0		809848		246 - 375	246 - 375
1		809849	376 - 505	376 - 505	
0		809850	506 - 635	506 - 635	
1		809851	636 - 765	636 - 765	
0		809852	766 - 895	766 - 895	
1		809853	896 - 954	896 - 954	
0		809854	TNK4-93	001 - 115	001 - 115
1		809855		116 - 245	116 - 245
0		809856		246 - 375	246 - 375
1		809857	376 - 505	376 - 505	
0		809858	TNK4-95	506 - 573	506 - 573
0		809859		001 - 115	001 - 115
1		809860		001 - 115	001 - 115
1		809860		116 - 245	116 - 245
0		809861		246 - 375	246 - 375
1		809862		376 - 505	376 - 505
0		809863		506 - 635	506 - 635
1		809864	636 - 765	636 - 765	
0		809865	766 - 895	766 - 895	



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
1		809866		896 - 933	896 - 933
0		809867	TNK4-97	001 - 115	001 - 115
1		809868		116 - 245	116 - 245
0		809869		246 - 375	246 - 375
1		809870		376 - 505	376 - 505
0		809871		506 - 562	506 - 562
0		809872	TNK4-99	001 - 115	001 - 115
2		809873		116 - 245	116 - 245
0		809874		246 - 375	246 - 375
2		808875		376 - 505	376 - 505
0		809876		506 - 636	506 - 636
2		809877		636 - 765	636 - 765
0		809878		766 - 895	766 - 895
2		809879		896 - 933	896 - 933
1		809880	TNK4-52	001 - 115	001 - 115
2		809881		116 - 230	116 - 230
1		809882		231 - 345	231 - 345
2		809883		346 - 383	346 - 383
0		809884	TNK4-75	001 - 115	001 - 115
1		809885		116 -	116 -
1	3 DEC	809886	TNK4-75A	001 - 115	001 - 115
2		809887		116 - 230	116 - 230
1		809888		231 - 360	231 - 360
2		809889		361 - 490	361 - 490
1		809890		491 - 620	491 - 620
2		809891		621 - 750	621 - 750
1		809892		751 - 880	751 - 880
2		809893		881 - 1010	881 - 1010
1		809894		1011 - 1144	1011 - 1138
2		809895		1145 - 1259	1139 - 1253
1		809896		1260 - 1374	1254 - 1368
2		809897		1375 - 1423	1369 - 1417
1	4 DEC	809898	TNK4-46	001 - 115	001 - 115
2		809899		116 - 240	116 - 240
1		809900		241 - 370	241 - 370
2		809901		371 - 500	371 - 500
2		809902		501 - 630	501 - 630
2		809903		631 - 760	631 - 760
2		809904		761 - 890	761 - 890
2		809905		891 - 1020	891 - 1020
1		809906		1021 - 1052	1021 - 1052
2		809907	TNK4-42	001 - 115	001 - 115
2		809908		116 - 245	116 - 245
1		809909		246 - 375	246 - 375
2		809910		376 - 505	376 - 505
1		809911		506 - 635	506 - 635
2		809912		636 - 765	636 - 765
1		809913		766 - 895	766 - 895
2		809914		896 - 1025	896 - 1025



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
1		809915		1026 - 1155	1026 - 1155
2		809916		1156 - 1286	1156 - 1285
1		809917		1286 - 1415	1286 - 1415
2		809918		1416 - 1545	1416 - 1545
1		809919		1546 - 1615	1545 - 1615
0		809920	TNK4-32	001 - 115	001 - 115
1		809921		116 - 245	116 - 245
0		809922		246 - 375	246 - 375
1		809923		376 - 505	376 - 505
0		809924		506 - 635	506 - 635
1		809925		636 - 765	636 - 765
0		809926		766 - 895	766 - 895
1		809927		896 - 1025	896 - 1025
0		809928		1026 - 1055	1026 - 1055
1		809929		1056 - 1285	1056 - 1285
0		809930		1286 - 1393	1286 - 1393
0	5 DEC	809931	TNK4-26B	821 - 935	821 - 935
1		809932		935 - 978	936 - 977
0		809933	TNK4-26C	821 - 935	821 - 935
1		809934		936 - 1065	936 - 1065
0		809935		1066 - 1195	1066 - 1195
1		809936		1196 - 1325	1196 - 1325
0		809937		1326 - 1365	1326 - 1365
0		809938	TNK4-69	001 - 115	001 - 115
1		809939		116 - 245	116 - 245
0		809940		246 - 255	245 - 255
0		809941	TNK4-69A	001 - 115	001 - 115
1		809942		116 - 245	116 - 245
0		809943		246 - 375	246 - 375
1		809944		376 - 505	376 - 505
0		809945		506 - 635	506 - 635
1		809946		636 - 765	636 - 765
0		809947		766 - 884	766 - 884
2		809948	TNK4-73	001 - 115	001 - 115
1		809949		116 - 245	116 - 245
2		809950		246 - 375	246 - 375
1		809951		376 - 505	376 - 505
2		809952		506 - 635	506 - 635
1		809953		636 - 765	636 - 765
2		809954		766 - 814	766 - 814
2	6 DEC	809955	TNK4-75B	1140 - 1254	1140 - 1254
1		809956		1255 - 1384	1255 - 1384
2		809957		1385 - 1423	1385 - 1423
2		809958	TNK4-38	001 - 115	001 - 115
1		809959		116 - 245	116 - 245
2		809960		246 - 375	246 - 375
1		809961		376 - 505	376 - 505



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
2	6 DEC	809962	TNK4-38	506 - 543	506 - 543
1		809963	TNK4-40	001 - 115	001 - 115
2		809964		116 - 245	116 - 245
1		809965		246 - 375	246 - 375
2		809966		376 - 505	376 - 505
1		809967		506 - 635	506 - 635
2		809968		636 - 765	636 - 765
1		809969		766 - 895	766 - 895
2		809970		896 - 1025	896 - 1025
1		809971		1026 - 1155	1026 - 1155
2		809972		1156 - 1285	1156 - 1285
1		809973		1286 - 1415	1285 - 1415
2		809974		1416 - 1545	1416 - 1545
1		809975		1546 - 1675	1546 - 1675
2		809976		1676 - 1764	1676 - 1764
1		809977	TNK4-1	001 - 115	001 - 115
2		809978		116 - 245	116 - 245
1		809979		246 - 375	246 - 375
2		809980		376 - 505	376 - 505
1		809981		506 - 523	506 - 523
1	809982	TNK4-3	001 - 115	001 - 115	
2	809983		116 - 245	116 - 245	
1	809984		246 - 375	246 - 375	
2	809985		376 - 505	376 - 505	
1	809986		506 - 635	506 - 635	
0	7 DEC	809987	TNK4-3A	515 - 629	001 - 115
1		809988		630 - 759	116 - 245
0		809989		760 - 889	246 - 375
1		809990		890 - 1019	376 - 505
0		809991		1020 - 1149	506 - 635
1		809992		1150 - 1279	636 - 765
0		809993		1280 - 1403	766 - 889
2		809994	TNK4-5	001 - 115	001 - 115
1		809995		116 - 245	116 - 245
2		809996		246 - 375	246 - 375
1		809997		376 - 505	376 - 505
2		809998		506 - 635	506 - 635
1		809999		636 - 765	636 - 765
2		810000		766 - 895	766 - 895
1		810001		896 - 1025	896 - 1025
2		810002		1026 - 1155	1026 - 1155
1		810003		1156 - 1285	1156 - 1285
2		810004		1286 - 1415	1286 - 1415
1		810005		1416 - 1444	1416 - 1444
1		810006	TNK4-7	001 - 013	001 - 011
2	810007		014 - 128	012 - 126	
1	810008		129 - 258	127 - 256	
2	810009		259 - 388	257 - 386	
1	810010		389 - 518	387 - 516	



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
2	7 DEC	810011	TNK4-7	519 - 648	517 - 646
1		810012		649 - 778	647 - 776
2		810013		779 - 908	777 - 906
1		810014		909 - 1038	907 - 1036
2		810015		1039 - 1168	1037 - 1166
1		810016		1169 - 1298	1167 - 1296
2		810017		1299 - 1428	1297 - 1426
1		810018		1429 - 1443	1427 - 1441
0		810019		TNK4-9	001 - 115
1		810020	116 - 245		116 - 245
0		810021	246 - 375		246 - 375
1		810022	376 - 505		376 - 505
0		810023	506 - 635		506 - 635
1		810024	636 - 765		636 - 765
0		810025	766 - 895		766 - 895
1		810026	896 - 1025		896 - 1025
0		810027	1026 - 1155		1026 - 1155
1		810028	1156 - 1285	1156 - 1285	
0		810029	1286 - 1415	1286 - 1415	
1	810030	TNK4-11	1416 - 1434	1416 - 1434	
1	810031		001 - 115	001 - 115	
0	810032		116 - 245	116 - 245	
1	810033		246 - 375	246 - 375	
0	810034		376 - 505	376 - 505	
1	810035		506 - 635	506 - 635	
0	810036		636 - 765	636 - 765	
1	8 DEC		810037	766 - 895	766 - 895
0			810038	896 - 1025	896 - 1025
1		810039	1026 - 1155	1026 - 1155	
0		810040	1156 - 1285	1156 - 1285	
1		810041	1286 - 1415	1286 - 1415	
0		810042	TNK4-13	1416 - 1435	1416 - 1435
0		810043		001 - 115	001 - 115
1		810044		116 - 245	116 - 245
0		810045		246 - 375	246 - 375
1		810046		375 - 505	375 - 505
0		810047		506 - 635	506 - 635
1	810048	636 - 765		636 - 765	
0	810049	766 - 895		766 - 895	
1	810050	896 - 1025		896 - 1025	
0	810051	1026 - 1155	1026 - 1155		
1	810052	1156 - 1285	1156 - 1285		
0	810053	TNK4-15	1286 - 1375	1286 - 1375	
1	810054		001 - 115	001 - 115	
2	810055		116 - 245	116 - 245	
1	810056		246 - 375	246 - 375	
2	810057		376 - 505	376 - 505	
1	810058		506 - 635	506 - 635	
2	810059	636 - 765	636 - 765		



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.		
1	8 DEC	810060	TNK4-15	766 - 895	766 - 895		
2		810061		896 - 1025	896 - 1025		
1		810062		1026 - 1155	1026 - 1155		
2		810063		1156 - 1285	1156 - 1285		
1		810064		1286 - 1353	1286 - 1353		
0		810065		TNK4-17	001 - 115	001 - 115	
1		810066			116 -	116 -	
2		810067			124 - 238	119 - 233	
1		810068			239 - 353	234 - 348	
1		810069			354 -	349 -	
0		810070			391 - 505	379 - 493	
1		810071			506 - 635	494 - 623	
0		810072			636 - 765	624 - 753	
1		810073			766 - 895	754 - 883	
0		810074			896 - 1025	884 - 1013	
1	810075	1026 - 1155	1014 - 1143				
0	810076	1156 - 1285	1144 - 1273				
1	810077	1286 - 1335	1274 - 1323				
0	9 DEC	810078	TNK4-19		001 - 115	001 - 115	
1		810079			116 - 245	116 - 245	
0		810080		246 - 375	246 - 375		
1		810081		376 - 505	376 - 506		
0		810082		506 - 635	506 - 635		
2		810083		636 - 765	636 - 765		
0		810084		766 - 895	766 - 895		
2		810085		896 - 1025	896 - 1025		
0		810086		1026 - 1155	1026 - 1155		
2		810087		1156 - 1187	1156 - 1187		
1		810088		TNK4-21	001 - 115	001 - 115	
2		810089			116 - 245	116 - 245	
1		810090			246 - 375	246 - 375	
2		810091			3769 - 505	376 - 505	
1		810092			506 - 635	506 - 635	
2		810093			636 - 765	636 - 765	
1		810094			766 - 895	766 - 895	
2		810095			896 - 1025	896 - 1025	
1		810096			1026 - 1155	1026 - 1155	
2		810097			1156 - 1285	1156 - 1285	
1		810098			1286 - 1324	1286 - 1324	
1		810099			TNK4-23	001 - 115	001 - 115
2		810100				116 - 245	116 - 245
1	810101	246 - 37	246 - 375				
2	810102	376 - 505	376 - 505				
1	810103	506 - 635	506 - 635				
2	810104	636 - 765	636 - 765				
1	810105	766 - 895	766 - 895				
2	810106	896 - 1025	896 - 1025				
1	810107	1026 - 1055	1026 - 1055				



TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
1		810108	TNK4-25	001 - 115	001 - 115
0		810109		116 - 245	116 - 245
1		810110		246 - 375	246 - 375
0		810111		376 - 505	376 - 505
1		810112		506 - 635	506 - 635
0		810113		636 - 765	636 - 765
1		810114		766 - 895	766 - 895
0		810115		896 - 1004	896 - 1004
1		810116	TNK4-34	001 - 115	001 - 115
0		810117		116 - 245	116 - 245
1		810118		246 - 375	246 - 375
0		810119		376 - 505	376 - 505
1		810120		506 - 635	506 - 635
0		810121		636 - 765	636 - 765
1		810122		766 - 781	766 - 781



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.	
0	13 DEC	810142	TNK4-39	001 - 115	001 - 115	
1		810143		116 - 245	116 - 245	
0		810144		246 - 375	246 - 375	
1		810145		376 - 505	376 - 505	
0		810146		506 - 635	506 - 635	
1		810147		636 - 765	636 - 765	
0		810148		766 - 772	766 - 772	
0		810149		TNK4-43	001 - 005	001 - 005
0		810150		TNK4-43A	001 - 115	001 - 115
1		810152		246 - 375	246 - 375	
1		810153		376 - 505	376 - 505	
0		810154		506 - 635	506 - 635	
1		810155		636 - 704	636 - 704	
0		14 DEC		810156	TNK4-49	001 - 115
1	810157		116 - 239	116 - 239		
0	810158		240 - 363	240 - 363		
1	810159		364 - 443	364 - 443		
0	810160		TNK4-53	001 - 115		001 - 115
1	810161		116 - 245	116 - 245		
0	810162		246 - 375	246 - 375		
1	810163		376 - 505	376 - 505		
0	810164		506 - 523	506 - 523		
0	810165		TNK4-59	001 - 115		001 - 115
1	810166		116 - 245	116 - 245		
0	810167		246 - 375	246 - 375		
1	810168		376 - 505	376 - 505		
0	810169		506 - 635	506 - 635		
1	810170		636 - 765	636 - 765		
0	810171		766 - 865	766 - 865		
1	810172		896 - 1025	896 - 1025		
0	810173		1026 - 1155	1026 - 1155		
1	810174		1156 - 1285	1156 - 1285		
0	810175	1286 - 1415	1286 - 1415			
1	810176	1416 - 1545	1416 - 1545			
0	810177	1546 - 1675	1546 - 1675			
1	810178	1676 - 1805	1676 - 1805			
0	810179	1806 - 1935	1806 - 1935			



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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
1		810180		1936 - 2053	1936 - 2053
0		810181		001 - 115	001 - 115
1		810183		116 - 245	116 - 245
1		810184		376 - 413	376 - 413
0		810185	TNK4-57	001 - 115	001 - 115
1		810186		116 - 245	116 - 245
0		810187		246 - 375	246 - 375
1		810188		376 - 505	376 - 505
0		810189		506 - 635	506 - 635
1		810190		636 - 765	636 - 765
0		810191		766 - 895	766 - 895
1		810192		896 - 1015	896 - 1015
0	15 DEC	810193	TNK4-65	001 - 115	001 - 115
1		810194		116 - 245	116 - 245
0		810195		246 - 375	246 - 375
1		810196		376 - 505	376 - 505
0		810197		506 - 635	506 - 635
1		810198		636 - 765	636 - 765
0		810199		766 - 874	766 - 874
0		810200	TNK4-67	001 - 115	001 - 115
1		810201		116 - 245	116 - 245
0		810202		246 - 375	246 - 375
1		810203		376 - 505	376 - 505
0		810204		506 - 685	506 - 635
1		810205		636 - 765	636 - 765
0		810206		766 - 895	766 - 895
1		810207		896 - 903	896 - 903
0		810208	TNK4-61	001 - 115	001 - 115
1		810209		116 - 245	116 - 245
0		810210		246 - 375	246 - 375
1		810211		376 - 503	376 - 503
2		810212	TNK4-54	001 - 115	001 - 115
0		810213		116 - 245	116 - 245
2		810214		246 - 375	246 - 375
0		810215		376 - 505	376 - 505
2		810216		506 - 635	506 - 635
0		810217		636 - 765	636 - 765
2		810218		766 - 873	766 - 873
0		810219	TNK4-28	001 - 115	001 - 115
2		810220		116 - 245	116 - 245
0		810221		246 - 375	246 - 375
2		810222		376 - 505	376 - 505
0		810223		506 - 635	506 - 635
2		810114		636 - 765	636 - 765
0		810225		766 - 895	766 - 895
2		810226		896 - 915	896 - 915
0		812027	TNK4-34A	459 - 573	439 - 573
1		810228		574 - 703	574 - 703

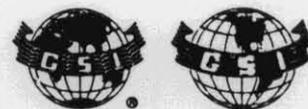


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TXP	DATE	TAPE NO.	LINE NO.	SHOT-POINTS	RECORD NOS.
0		810229		704 - 833	704 - 833
1		810230		834 - 963	834 - 963
0		810231		964 - 1064	964 - 1064
0	16 DEC	810132	TNK4-24	001 - 115	001 - 115
1		810233		116 - 245	116 - 245
0		810234		246 - 375	246 - 375
1		810235		376 - 505	376 - 505
0		810236		506 - 635	506 - 635
1		810237		636 - 765	636 - 765
0		810238		766 - 895	766 - 895
1		810239		896 - 1025	896 - 1025
0		810240		1026 - 1074	1026 - 1074
0		810241	TNK4-28A	001 - 115	001 - 115
1		810242		116 - 230	116 - 230
0		810243		231 - 360	231 - 360
1		810244		361 - 490	361 - 490
0		810245		491 - 620	491 - 620
1		810246		621 - 643	621 - 643
0		810247	TNK4-20	001 - 115	001 - 115
1		810248		116 - 245	116 - 245
0		810249		246 - 375	246 - 375
1		810250		376 - 505	376 - 505
0		810251		506 - 635	506 - 635
1		810252		636 - 765	636 - 765
0		810253		766 - 895	766 - 895
1		810254		896 - 1025	896 - 1025
0		810255		1026 - 1155	1026 - 1155
1		810256		1156 - 1285	1156 - 1285
0		810257		1286 - 1312	1286 - 1312
0		810258	TNK4-22	001 - 115	001 - 115
1		810259		116 - 240	116 - 240
0		810260		241 - 365	241 - 365
1		810261		366 - 490	366 - 490
0		810262		491 - 615	491 - 615
1		810263		616 - 740	616 - 740
0		810264		741 - 853	741 - 853



APPENDIX 8
DATA SHIPMENTS



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SHIPMENTS

Seismic Data : 2931/MISC/13/84 * 20/11/84
 Shipment Number 2931/MISC/14/84 * 29/11/84
 2931/MISC/16/84 12/12/84
 2931/MISC/18/84 17/12/84

Seismic Data Shipped to : Geocentral Inc.
 2 Northpoint drive, Suite 600
 Houston, Texas 77060 USA

Navigation Data : 2931/PER/44/84 29/11/84
 Shipment Number 2931/PER/48/84 12/12/84
 2931/PER/49/84 17/12/84

Navigation Data Shipped to : Geophysical Service Inc
 47 Burswood Road
 Victoria Park WA 6100

Gravity Data : 2931/MISC/15/84 * 29/11/84
 Shipment Number 2931/MISC/17/84 * 12/12/84
 2931/MISC/19/84 * 17/12/84

Magnetic Data : 2931/DAL/25/84 29/11/84
 Shipment number 2931/DAL/27/84 12/12/84
 2931/DAL/30/84 17/12/84

Magnetic Data Shipped to : Geophysical Service Inc.
 7800 Banner Drive
 Dallas, Texas , USA

NOTE * Shipments addressed to : AMOCO International Towers
 II Greenpoint Plaza
 16825 Northchase Drive
 Houston, Texas, USA



PRODUCTION LINE SUMMARY

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CLIENT : AMOCO.

AREA : BASS BASIN 1984.

DATE : NOVEMBER 1984

DATE	LINE No.	SP RANGE	KM'S	GRAVITY SP'S KM'S	MAGNETICS SP'S KM'S	COMMENTS
START OF SHIPMENT 2931/MISC/13/84						
19 NOV.	TNK4-18	001 - 0045	01.35	AS SEISMIC	AS SEISMIC	T. B. R.
19 NOV.	TNK4-18A	001 - 0575	17.25	- " -	- " -	T. B. R.
20 NOV.	TNK4-37	001 - 0538	16.14	- " -	- " -	T. B. R.
END OF SHIPMENT 2931/MISC/13/84						
START OF SHIPMENT 2931/MISC/14/84						
22 NOV.	TNK4-48	001 - 0871	26.13	AS SEISMIC	AS SEISMIC	M. S. P.
23 NOV.	TNK4-48	872 - 2176	39.15	- " -	- " -	COMPLETE
23 NOV.	TNK4-44	001 - 0528	15.84	- " -	- " -	T. B. R.
23 NOV.	TNK4-44A	001 - 0941	28.23	- " -	- " -	COMPLETE
23 NOV.	TNK4-26	001 - 0943	28.29	- " -	- " -	T. B. C.
24 NOV.	TNK4-36	001 - 0953	28.59	- " -	- " -	COMPLETE
24 NOV.	TNK4-103	001 - 0662	19.86	- " -	- " -	COMPLETE
24 NOV.	TNK4-101	001 - 0633	18.99	- " -	- " -	COMPLETE
24 NOV.	TNK4-50	001 - 0703	21.09	- " -	- " -	COMPLETE
24 NOV.	TNK4-71	001 - 0822	24.66	- " -	- " -	COMPLETE
24 NOV.	TNK4-14	001 - 0814	24.42	- " -	- " -	COMPLETE
25 NOV.	TNK4-12	001 - 0199	05.97	05.97	05.97	T. B. R.
25 NOV.	TNK4-12A	001 - 0903	27.09	AS SEISMIC	AS SEISMIC	COMPLETE
25 NOV.	TNK4-08	001 - 1333	39.99	- " -	- " -	COMPLETE
25 NOV.	TNK4-27	001 - 0493	14.79	- " -	- " -	COMPLETE
25 NOV.	TNK4-33	001 - 0493	14.79	- " -	- " -	COMPLETE
25 NOV.	TNK4-35	001 - 0406	12.18	- " -	- " -	M. S. P.
26 NOV.	TNK4-35	407 - 0683	08.31	- " -	- " -	COMPLETE
26 NOV.	TNK4-37A	001 - 0623	18.69	2.55	2.55	COMPLETE
26 NOV.	TNK4-41	001 - 0763	22.89	AS SEISMIC	AS SEISMIC	COMPLETE
26 NOV.	TNK4-47	001 - 1003	30.09	- " -	- " -	COMPLETE
26 NOV.	TNK4-45	001 - 0763	22.89	- " -	- " -	COMPLETE
26 NOV.	TNK4-51	001 - 0339	10.17	- " -	- " -	M. S. P.
27 NOV.	TNK4-51	340 - 1975	49.08	- " -	- " -	COMPLETE
27 NOV.	TNK4-55	001 - 1774	53.22	- " -	- " -	COMPLETE
27 NOV.	TNK4-04	001 - 0117	03.51	- " -	- " -	T. B. R.
27 NOV.	TNK4-63	001 - 0573	17.19	- " -	- " -	COMPLETE
27 NOV.	TNK4-10	001 - 1190	35.70	- " -	- " -	(SUBJECT TO FINAL PROCESSING) M. S. P.
28 NOV.	TNK4-10	1191- 1456	07.98	AS SEISMIC	AS SEISMIC	COMPLETE
28 NOV.	TNK4-29	001 - 0603	18.09	- " -	- " -	COMPLETE
28 NOV.	TNK4-02	001 - 0057	01.71	- " -	- " -	T. B. R.
28 NOV.	TNK4-02A	001 - 0323	09.69	- " -	- " -	COMPLETE
28 NOV.	TNK4-06	001 - 0473	14.19	- " -	- " -	COMPLETE
28 NOV.	TNK4-31	001 - 0613	18.39	- " -	- " -	COMPLETE
28 NOV.	TNK4-16	001 - 0744	22.32	- " -	- " -	COMPLETE
29 NOV.	TNK4-18B	001 - 0573	17.19	- " -	- " -	COMPLETE
29 NOV.	TNK4-26A	3000- 4105	33.18	- " -	- " -	T. B. C.

END OF SHIPMENT 2931/MISC/14/84



START OF SHIPMENT 2931/MISC/16/84						
30 NOV.	TNK4-77	001 - 0221	06.63	AS SEISMIC	AS SEISMIC	T. B. R.
30 NOV.	TNK4-77A	001 - 1123	33.69	- " -	- " -	COMPLETE
30 NOV.	TNK4-79	001 - 1125	33.75	- " -	- " -	COMPLETE
01 DEC.	TNK4-81	001 - 1063	31.89	- " -	- " -	COMPLETE
01 DEC.	TNK4-83	001 - 1074	32.22	- " -	- " -	COMPLETE
01 DEC.	TNK4-87	001 - 0863	25.89	- " -	- " -	COMPLETE
01 DEC.	TNK4-89	001 - 1285	38.55	- " -	- " -	COMPLETE
01 DEC.	TNK4-85	001 - 1043	31.29	- " -	- " -	COMPLETE
01 DEC.	TNK4-91	001 - 0141	04.23	- " -	- " -	M. S. P.
02 DEC.	TNK4-91	142 - 0954	24.39	- " -	- " -	COMPLETE
02 DEC.	TNK4-93	001 - 0573	17.19	- " -	- " -	COMPLETE
02 DEC.	TNK4-95	001 - 0933	27.99	- " -	- " -	COMPLETE
02 DEC.	TNK4-97	001 - 0562	16.86	- " -	- " -	COMPLETE
02 DEC.	TNK4-99	001 - 0933	27.99	- " -	- " -	COMPLETE
02 DEC.	TNK4-52	001 - 0383	11.49	- " -	- " -	COMPLETE
02 DEC.	TNK4-75	001 - 0126	03.78	- " -	- " -	T. B. R.
03 DEC.	TNK4-75A	001 - 1423	42.69	- " -	1367 41.01	T. B. C.
04 DEC.	TNK4-46	001 - 1052	31.56	- " -	AS SEISMIC	COMPLETE
04 DEC.	TNK4-42	001 - 1615	48.45	- " -	- " -	COMPLETE
04 DEC.	TNK4-32	001 - 1393	41.79	- " -	- " -	COMPLETE
05 DEC.	TNK4-26B	821 - 0978	04.74	- " -	- " -	T. B. R.
05 DEC.	TNK4-26C	821 - 1365	16.35	- " -	- " -	COMPLETE
05 DEC.	TNK4-69	001 - 0255	NIL	- " -	- " -	T. B. R.
05 DEC.	TNK4-69A	001 - 0884	26.52	- " -	- " -	COMPLETE
05 DEC.	TNK4-73	001 - 0814	24.42	- " -	- " -	COMPLETE
06 DEC.	TNK4-75B	1140- 1423	08.52	- " -	- " -	COMPLETE
06 DEC.	TNK4-38	001 - 0543	16.29	- " -	- " -	COMPLETE
06 DEC.	TNK4-40	001 - 1764	52.92	- " -	- " -	COMPLETE
06 DEC.	TNK4-01	001 - 0523	15.69	- " -	- " -	COMPLETE
06 DEC.	TNK4-03	001 - 0653	19.05	- " -	- " -	T. B. C.
07 DEC.	TNK4-03A	515 - 1403	26.67	- " -	- " -	COMPLETE
07 DEC.	TNK4-05	001 - 1444	43.32	- " -	- " -	COMPLETE
07 DEC.	TNK4-07	001 - 1443	43.29	- " -	- " -	COMPLETE
07 DEC.	TNK4-09	001 - 1434	43.02	- " -	- " -	COMPLETE
07 DEC.	TNK4-11	001 - 0741	22.23	- " -	- " -	M. S. P.
08 DEC.	TNK4-11	742 - 1435	20.82	- " -	- " -	COMPLETE
08 DEC.	TNK4-13	001 - 1375	41.25	- " -	- " -	COMPLETE
08 DEC.	TNK4-15	001 - 1353	40.59	- " -	- " -	COMPLETE
08 DEC.	TNK4-17	001 - 1335	40.05	- " -	- " -	COMPLETE
08 DEC.	TNK4-19	001 - 0074	02.22	- " -	- " -	M. S. P.
09 DEC.	TNK4-19	075 - 1187	33.39	- " -	- " -	COMPLETE
09 DEC.	TNK4-21	001 - 1324	39.72	- " -	- " -	COMPLETE
09 DEC.	TNK4-23	001 - 1055	31.65	- " -	- " -	COMPLETE
09 DEC.	TNK4-25	001 - 1004	30.15	- " -	- " -	COMPLETE
09 DEC.	TNK4-34	001 - 0581	17.34	- " -	- " -	T. B. C.
10 DEC.	TNK4-34	582 - 0757	NIL	- " -	- " -	T. B. C.
		758 - 0781	NIL	NIL	NIL	T. B. C.

END OF SHIPMENT 2931/MISC/16/84



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START OF SHIPMENT 2931/MISC/18/84

DATE	ITEM	QUANTITY	UNIT PRICE	STATUS 1	STATUS 2	STATUS 3
13 DEC	TNK4-39	1 - 772	23.16	AS SEISMIC	AS SEISMIC	COMPLETE
13 DEC	TNK4-43A	1 - 704	21.12	"	"	"
14 DEC	TNK4-49	1 - 443	13.29	"	"	"
14 DEC	TNK4-53	1 - 523	15.69	"	"	"
14 DEC	TNK4-59	1 - 2053	61.59	"	"	"
14 DEC	TNK4-04A	1 - 413	12.39	"	"	"
14 DEC	TNK4-57	1 - 1015	30.45	"	"	"
15 DEC	TNK4-65	1 - 874	26.22	"	"	"
15 DEC	TNK4-67	1 - 903	27.09	"	"	"
15 DEC	TNK4-61	1 - 503	15.09	"	"	"
15 DEC	TNK4-54	1 - 873	26.19	"	"	"
15 DEC	TNK4-28	1 - 915	27.45	"	"	"
16 DEC	TNK4-34A	579 - 1064	14.58	"	"	"
16 DEC	TNK4-24	1 - 1074	32.22	"	"	"
16 DEC	TNK4-28A	1 - 643	19.29	"	"	"
16 DEC	TNK4-20	1 - 1312	39.36	"	"	"
16 DEC	TNK4-22	1 - 853	25.59	"	"	"

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NAVIGATION REPORT

T14P, T18P, T22P

FOR

AMOCO AUSTRALIA PETROLEUM COMPANY

15 BLUE STREET

NORTH SYDNEY N.S.W. 2060

BY

GEOPHYSICAL SERVICE INC

47 BURSWOOD ROAD

VICTORIA PARK W.A. 6100

SURVEY DATE: 17TH NOVEMBER 1984 - 17TH DECEMBER 1984

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E	CALIBRATION PROCEDURE & RESULTS
F	BASE STATION DESCRIPTIONS
G	MAPPING PARAMETERS



PERSONNEL

Navigation Supervisor	:	P. Davies
Crew Chiefs	:	B. Field G. Puls
Client Representative	:	F. Renton
Boat Manager	:	B. Lee
Party Manager	:	C. Toner



SECTION A
INTRODUCTION



- 1 -

Geophysical Service Inc provided a Syledis radio positioning system to conduct a survey for Amoco Australia Petroleum Company in permits T14P, T18P and T22P, in the Bass Strait region of Australia.

Aboard the "Eugene McDermott II" the Syledis was interfaced to the CMS III (Configurable Marine System). The CMS III is a fully integrated, real-time instrumentation system for controlling and monitoring the navigation and survey functions necessary to meet the high accuracy requirements of marine geophysical exploration needs. The CMS was specifically designed by GSI to meet these needs. The CMS is designed around Texas Instruments models 980 and 990 minicomputers. One of the major responsibilities of the CMS is to provide an integrated navigation capability for seismic line control. The real-time multisensor navigation function, incorporated in CMS, derives positional data from a variety of sources including satellite, sonar, gyrocompass, range/range and hyperbolic radio positioning systems interfaced directly to the CMS hardware.

As well as providing for the magnetic tape recording of data for off-line post processing, the system performs automatic line and shot control based on distance measured equal shotpoint spacing along the great circle path between the required endpoints of a seismic line. In addition to the navigation function of the CMS, the system also includes the capabilities related to streamer tracking, airgun array monitoring and control as well as automatic data logging.

The basic vessel navigation subsystems functions of the CMS include integrated multirange radio positioning system navigation and a GEONAV (GEODETIC NAVIGATION) integrated satellite navigation system capability.

The integrated multi-range radio positioning system function of the CMS allows for the integration of up to a maximum of 12 multi-system range/range and/or hyperbolic range readings. Raw range readings are recorded on tape for each shotpoint for application in post processing. In addition, vessel velocity component computations, based on the rate of change of range readings are calculated and applied to the continuous line and shot control of the CMS for accurate steering of the vessel and on the desired seismic line. In order to maintain continuous positional accuracy quality control, the CMS automatically performs absolute multi-range position fixes at operator selective intervals of up to a maximum of 99 seconds to ensure that the inherent real-time accuracy of the primary radio navigation system(s) configuration is maintained.



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The GEONAV integrated satellite navigation function periodically establishes its absolute geographical location from information transmitted by satellites of the U.S. Navy Navigation Satellite System (TRANSIT). The continuous path of travel of the vessel, between satellite fixes, is computed by a dead reckoning system consisting of a velocity measurement system (VMS). The VMS can derive its velocity information from either an integrated radio positioning system as above or from a four beam doppler sonar compensated for the pitch and roll of the vessel and for variations in the propagation velocity of sound in water. The VMS consists of a gyrocompass externally compensated for the location and dynamics of the vessel.

The CMS is capable of providing a continuous primary system position derived from any available combination of fix, velocity and azimuth systems as well as a secondary system derived from satellite fixes combined with the primary system dead reckoning inputs. The designated primary inputs serve as navigation inputs to the line control routines. The primary and secondary system positions are output to magnetic tape at each shotpoint, along with the raw navigation data from all initialised systems. All of the navigation calculations are performed using a geodetic co-ordinate system defined in terms of latitude and longitudes.

The actual spheroid and datum employed by the line control program is under operator control. Co-ordinate transformations from a satellite datum position to the local datum is performed automatically.

The CMS provides for Automatic Data Logging (ADL) on magnetic tape of the survey parameters required to process the seismic data, thereby eliminating human error. The ADL data is recorded on magnetic tape at the shotpoint interval along with related navigation data and additional data from auxiliary equipment such as gravity, magnetics, streamer tracking and fathometer systems. An interface between CMS and the seismic recording system allows the CMS system to read and record the seismic record, reel number and tape at the shotpoint interval along with related navigation data and additional data from auxiliary equipment such as gravity, magnetics, streamer tracking and fathometer systems. An extender header device allows the CMS system to transfer the shotpoint number, Greenwich Mean Time (GMT), and Julian data for recording in the extended header of the seismic record thereby providing for a redundant cross check in data processing between the seismic and navigation data.

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SECTION B
FIELD NAVIGATION OPERATION SUMMARY



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- 9 Nov 84 Equipment for calibration picked up from Ansett at Burnie. Calibration range scouted.
- 10 Nov 84 Frank Renton (Client) arrived in Devonport.
- 11 Nov 84 Calibration carried out at range at Sulphur Creek, Tasmania. O.N.A. set Argo at Pt. Sorell.
- 12 Nov 84 Syledis station set at point Sorell.
- 13 Nov 84 Syledis and argo set on the "Nut" near Stanley. Station occupied by O.N.A. operator. Hookway aviation helicopter used to shuttle equipment from oval at Stanley to "Nut". (5 trips required).
- 14 Nov 84 Syledis and Argo set on King Island. Aust. Air charter "nomad" used to transport equipment to Island from Wynyard. Station occupied by O.N.A. operator. Bryan Field and O.N.I. operator accompanied flight.
- 15 Nov 84 Bryan Field arrived back from King Island. Geometrics Rep (Neil Ryan) arrived Devonport. Scouted suitable areas for magnetometer.
- 16 Nov 84 Geometrics equipment arrived. Equipment installed at Point Sorell. McDermott docked at 11.30 p.m. Syledis mobile, antenna and cable installed.
- 17 Nov 84 McDermott departed 9.30 a.m. Possible problem with Syledis on Sorell (indicated from base line crossings). Gravity meter reading taken at Devonport.
- 18 Nov 84 G.M. readings taken at Devonport and Launceston (Marker). Spare beacon 06 swapped for 07 for comparison then 07 put back on. Magnetometer readings dumped on tape (as they were done every day until conclusion of survey). Gravity Meter reading taken at #8 Bollard Devonport Wharf, then Launceston Airport then back at Wharf. (This was done every Sunday and Wednesday).



19 Nov 84 Beacon 06 has stronger signal - put on Point Sorell.

20 Nov 84 McDermott docked for repairs to guns at 8.30 p.m. Departed at 11.00 p.m.

21 Nov 84 Syledis tower on King Island blown down. McDermott not shooting due to bad weather. Gravity Meter readings taken at Devonport Wharf and Launceston Airport (Marker).

22 Nov 84 O.N.A. operator re-erected King Island Tower. Bryan Field to King Island to check. (Signals O.K.)

23 Nov 84 McDermott on Prospect.

24 Nov 84 McDermott on Prospect.

25 Nov 84 McDermott on Prospect. G.M. readings Devonport and Launceston.

26 Nov 84 McDermott on Prospect.

27 Nov 84 McDermott on Prospect.

28 Nov 84 McDermott on Prospect. G.M. readings Devonport and Launceston.

29 Nov 84 McDermott docked 22.10 hrs. Departed 23.10 hrs. 2 clients and 1 GSI person off, 1 client and 1 GSI person on. Data drop.

30 Nov 84 McDermott on Prospect. Problem with base magnetometer. Off between 3.10 p.m. back on at 6.30 p.m. (approx 1 and a half hours. McDermott line change during this period).

1 Dec 84 McDermott on Prospect.

2 Dec 84 McDermott on Prospect. G.M. readings taken.

3 Dec 84 McDermott on Prospect.

4 Dec 84 McDermott on Prospect.

5 Dec 84 McDermott on Prospect. G.M. readings taken.

6 Dec 84 McDermott on Prospect.



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7 Dec 84 McDermott on Prospect. Spare Magnetometer arrived from Geometrics.

8 Dec 84 McDermott on Prospect.

9 Dec 84 McDermott on Prospect.

10 Dec 84 McDermott on Prospect. Spare Magnetometer sent back to Geometrics. G.M. readings taken.

11 Dec 84 McDermott on Prospect.

12 Dec 84 McDermott docked in Devonport at 07.00 hrs for crew change and data drop. No magnetometer data (problems with sequences changing) G.M. readings taken.

13 Dec 84 No Magnetometer data (Mag. de-tuned). Re-tuned and started at 15.15 hrs. McDermott tried first line (after returning to Prospect after crew change) at 15.15 hrs.

14 Dec 84 McDermott on Prospect. Magnetometer would dump only one third of data.

15 Dec 84 McDermott on Prospect.

16 Dec 84 McDermott on Prospect.

17 Dec 84 McDermott docked at 14.00 hrs. Departed at 18.45 hrs. Last Gravity Meter readings taken.

18 Dec 84 "Nut" and King Island stations demobilised. Point Sorell Syledis demobilised. Magnetometer station demobilised - equipment left with agent for freighting back.

19 Dec 84 Post-Calibration of Syledis carried out at Sulphur Creek calibration range. Point Sorell Argo demobilised.

20 Dec 84 Last of equipment stacked in truck to await ferry.

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SECTION .C
SURVEY DISCUSSION



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SURVEY DISCUSSION

Initially, based on preliminary survey maps forwarded from Amoco - Houston, stations on the mainland of Australia were selected in order to provide optimum geometry and ranges. However, on review of the final program maps, stations were selected on Tasmania and King Island.

Eventually, a surveyor was employed to offset the Argo and Syledis stations on King Island, as all markers on the East side of the island were unsuitable for Argo.

When the vessel cut the Point Sorell/Nut baseline the results indicated a figure of 14m short. The spare beacon which had been calibrated into the system was placed as a replacement at Point Sorell and readings then proved accurate. No problem was actually found with the original beacon, as shown in the post calibration.

Throughout the survey both Argo and Syledis systems performed exceptionally well with accurate and consistent results.

A post calibration was conducted at the completion of the survey.



SECTION D
THEORY OF NAVIGATION SYLEDIS DISCUSSION



The title SYLEDIS was derived from "SYstem LEger de mesure de DISTances", a system manufactured in France by Sercel S.A. Syledis is a multi-user, range/range or hyperbolic geometry, pulse navigation and positioning system utilising a mobile interrogator and two more beacon stations at known fixed locations. The system determines distances from each fixed beacon station to the mobile unit by conversion of transmission time of an R.F. pulse at a given frequency into metres. The operating frequency for Syledis is selected from the 420 to 450 MHz frequency band. With its filter, 99% of the energy generated is within a 2.5 MHz (+/- 1.25) bandwidth. Making use of pulse compression, the Syledis can radiate a high energy at a low peak power. For practical application, the Syledis carrier frequency is phase modulated according to a (time limited) pseudo-random code as follows:

- number of elements of the pseudo-random series:

$$N = 2^7 - 1 = 127$$

- interval between elements (short pulse equivalent):

$$T = 0.52 \text{ sec.}$$

- digit/phase equivalent:

$$0/0, 1/11$$

- duration of the pseudo-random series:

$$T = 127 \times 0.52 = 66,666 \text{ microseconds}$$

- distance equivalent:

$$10 \text{ Km}$$

- number of random series transmitted:

$$40, 80 \text{ or } 160$$

- total pulse length:

$$2.66, 5.33 \text{ or } 10.66 \text{ ms}$$



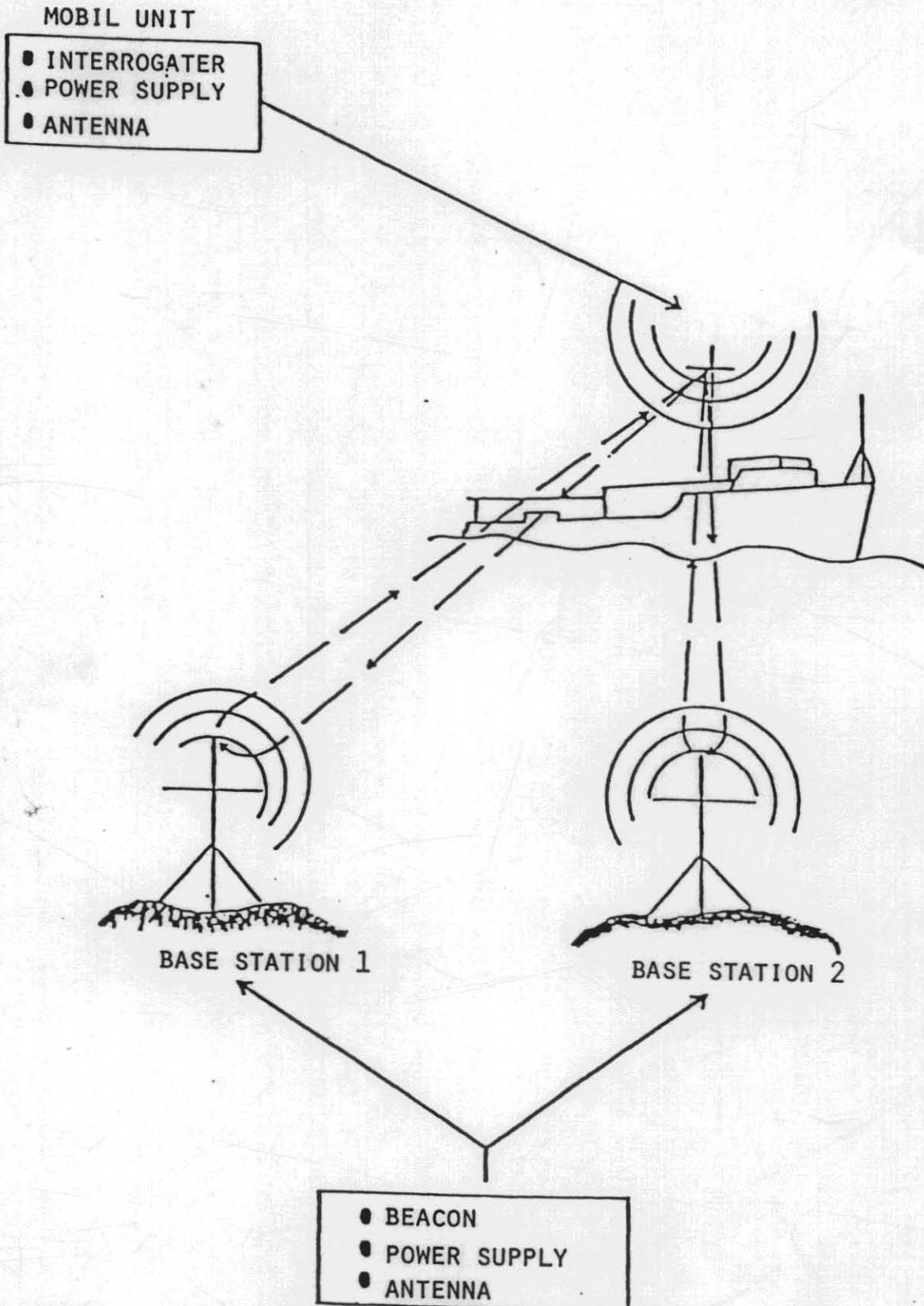
The advantages of short pulses exist in this pseudo-random code. Pulse compression affords an increased energy content and hence, an increased range for a limited peak power. Ranges that can be expected from the system are 80-100 Kms for detailed work or close grid and up to 200 Kms for large grid programs, dependent of weather and other conditions affecting propagation. Network precision of Syledis is +/- 5 metres out to ranges of 80-100 Kms after which it degrades somewhat as the range increases. Optimum system performance is dependent on proper selection of station sites, antennas and network geometry. Station sites should be adjacent to the shore. Transmission over dense foliage will degrade signal strength thus reducing range and accuracy.

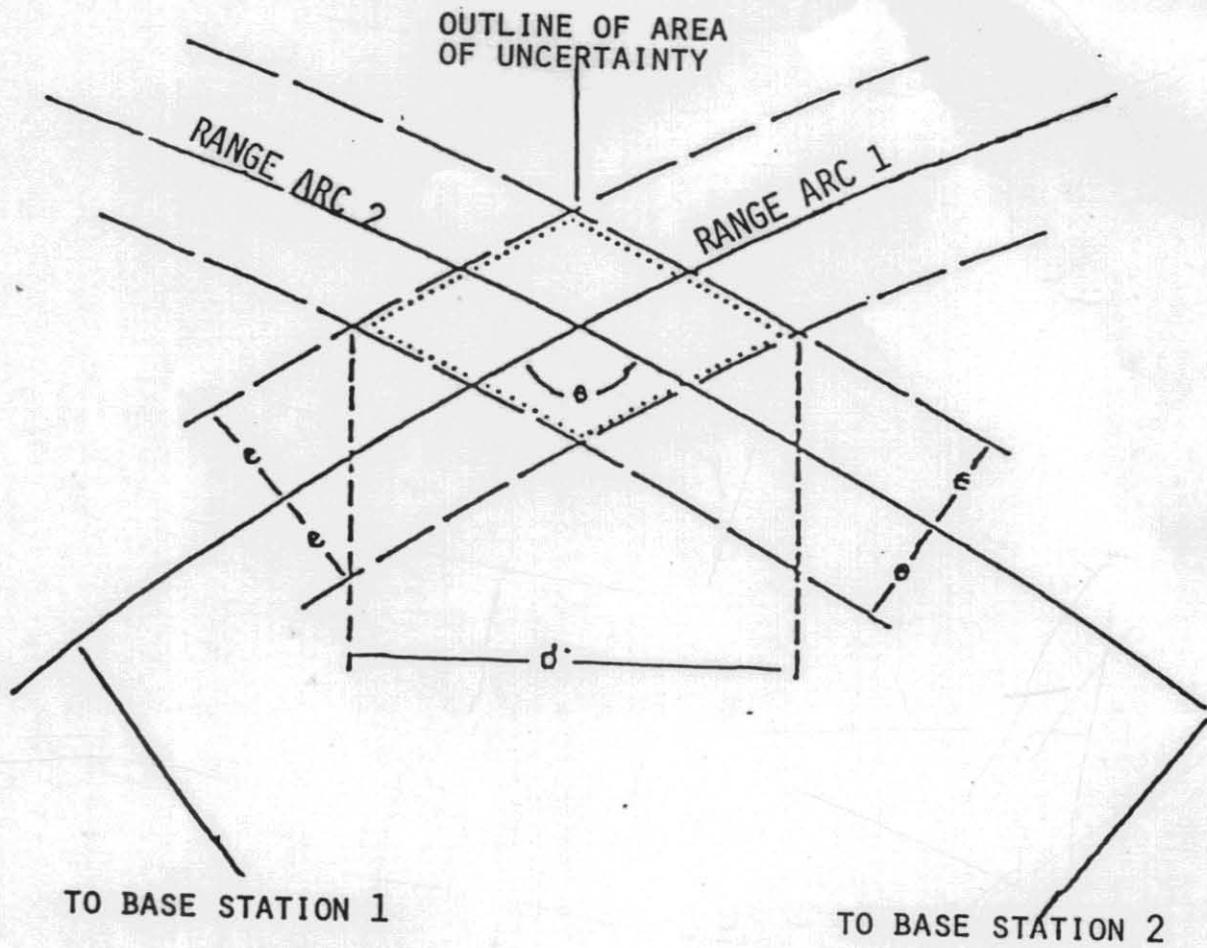
Syledis works in a time sharing mode. Each beacon or mobile of a same network, in turn, uses the same transmitting frequency and the same receiving frequency. One time slot lasts 5.33 milliseconds and there can be up to 30 slots. One of the transmitters must synchronise all the internal clocks of all other elements of the network. As they need not be accurate, the sync. pulse is a mere carrier with the same shape as the coded pulses. Such a time sharing system is very flexible. The sync. signal can be transmitted by any mobile or beacon according to the decision of the manager of the network. In the range/range mode of operation, a Syledis network can be utilised with 4 separate mobile units. Hyperbolic operation permits an unlimited number of mobile units.

The Syledis fixed station consists of a Syledis beacon with power supply and antenna as required for ranges or pattern of the program (see illustration for Syledis system). Mobile installation of Syledis is an interrogator which consists of the transmission and receiving sections plus electronics providing readouts, data access and capability for setting calibration.



SYLEDIS SYSTEM





FOR ANGLES LESS THAN 90°

$$d = \frac{2e}{\sin \frac{\theta}{2}} \text{ WHERE.}$$

FOR ANGLES MORE THAN 90°

$$d = \frac{2e}{\cos \frac{\theta}{2}} \text{ WHERE}$$

e = RANGE ERROR

θ = INTERSECTION ANGLE OF RANGE CIRCLES

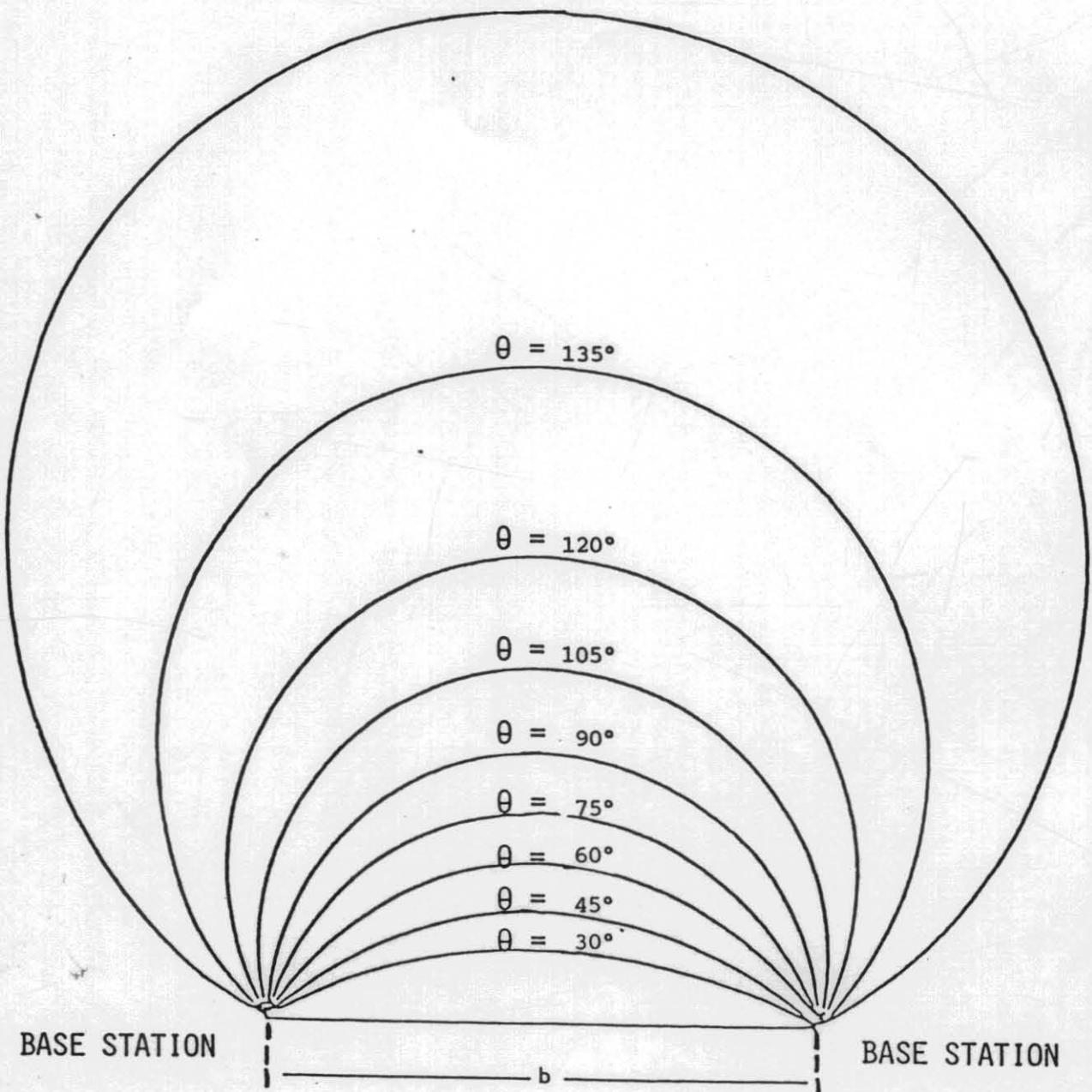
5 cm

AREA OF UNCERTAINTY OF POSITION
DUE TO ERROR IN RANGE MEASUREMENT



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$$\theta = 150^\circ$$



BASE STATION

BASE STATION

ALL ARCS ARE PORTIONS OF CIRCLES THROUGH BASE STATION
POSITIONS OF RADIUS GIVEN BY

$$r = \frac{b}{2 \sin \theta}$$

WHERE θ IS ANGLE OF INTERSECTION BETWEEN RANGE CIRCLES

RELATIVE AREA OF COVERAGE



ANTI-REFRACTION MODE

The use of automatic distance measurement devices such as Syledis can encounter difficulties when the communication range is greater than 2 to 3 times the radio electrical horizon. At very large distances the propagation that can be considered as normal is due only to the tropospheric diffusion phenomenon; the resulting signals are generally weak but useable.

In order to overcome this arrangement of antennae grouping, incorporated with a separate coherent processing of the signals at the receiver may be deployed. The signals are recombined after demodulation, but before time measurement, and enables an increase in stability of the communication.

A diagram of the base station configuration is given in figure A. The mobile configuration is as normal.

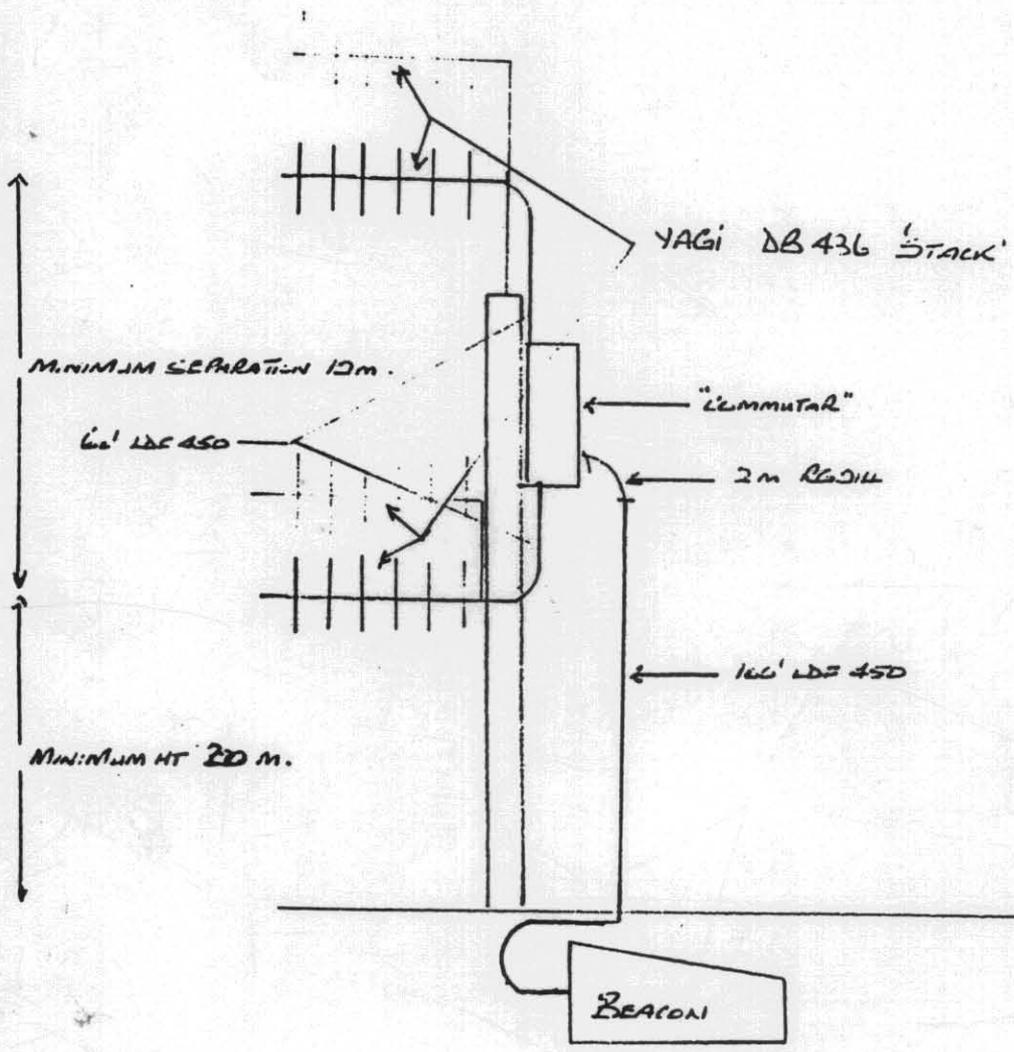
Changes to the electronic hardware of the system is comprising of two wiring changes, one each in both mobile and beacon. An antenna "commutator" or switch over box is deployed at the base station end; this effectively alternates the signal path between the two antennae.

At the mobile, circuitry is standard in the unit, the wiring change activating the relevant components.

Essentially, the mobile monitors both incoming signals from the separate antennae at the base station and evaluates the strongest signal for processing in the distance measured.



SYLEDIS "ANTI-REFRACTION" MODE BASE STATION CONFIGURATION



BASE STATIONS

Applicable for the whole prospect

		<u>Argo</u>					<u>Partials</u>	
Stations	!	Position						
	!	Lat/Long						
Pt. Sorell	!	041	07	23.62	S		0.15	
	!	146	31	42.31	E			
The Nut	!	040	45	49.97	S		0.06	
	!	145	18	11.87	E			
Naracoopa	!	039	55	29.05	S		0.02	
	!	144	07	39.03	E			

		<u>Syledis</u>					<u>Delays</u>	
Stations	!	Position						
	!	Lat/Long						
Pt. Sorell	!	041	07	24.69	S		Beacon # 06	
	!	146	31	41.88	E		-245.68	
The Nut	!	040	45	50.29	S		Beacon # 03	
	!	145	18	13.22	E		-394.01	
Naracoopa	!	039	55	29.95	S		Beacon # 02	
	!	144	07	39.47	E		-246.27	

**BASELINE CROSSINGS**17th Nov 84
-----**SYLEDIS**

Stations	Pass	Computed	Observed	C-0
Sorell/Nut	1	110579.43	110575.50	-4 m
	2	110579.43	110575.80	-4 m
	3	110579.43	110575.50	-4 m
Sorell/Naracoopa	1	243081.37	243098.00	16.63 m
	2	243081.37	243095.00	13.63 m
	3	243081.37	243096.00	14.63 m

21st Nov 84
-----**ARGO**

Stations	Pass	Computed	Observed	C-0
Sorell/Naracoopa (signals noisy)	1	243096.32	243117.58	21.26 m

30th Nov 84
-----**ARGO**

Stations	Pass	Computed	Observed	C-0
Nut/Sorell	1	110612.37	110612.37	0.00 m

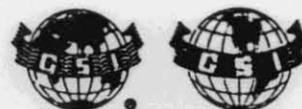
11th Dec 84
-----**ARGO**

Stations	Pass	Computed	Observed	C-0
Naracoopa/Sorell	1	243096.32	243105.50	8.22 m
	2	243096.32	243103.50	6.22 m

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SECTION E
CALIBRATION PROCEDURE & RESULTS



Syledis is a distance measuring device which calculates the delay created by propagation of a signal, from a transmitter to a receiver and back; this delay being directly proportional to the distance travelled.

Incorporated in this value are the delays incurred while the signal travels through system components and is processed within the system. To eliminate these, a calibration procedure is performed to evaluate their magnitude and compensate for them in order to display and output exact range readings.

Within the Syledis mobile the time measurement card is responsible for compensation of this delay. Located on the card are thumb wheel switches which may be set to an equivalent delay. Alternatively, an equal distance may be entered into the onboard navigation computer which will be subtracted from the range read out of the unit. This latter method was utilised for a better monitoring of values used. These delays are considered constant for a calibrated signal.

The suggested calibration procedure is to choose a range of approximately 3 - 10 kilometres, i.e. short enough that the propagation velocity variations may be considered negligible. The systematic delays are calculated and compensated for accordingly.

After installation of base stations a mobile may be placed at a convenient base station and the "long" baselines measured. Alternatively, baselines may be crossed by the vessel and distances checked.

For both cases any errors between calculated and observed distances may be categorised as a random error. This method also offers a verification of base station co-ordinates.

SYLEDIS CALIBRATION

The Syledis chain was calibrated over a distance of 6028.281 metres. Two trig points North West of the town of Penguin were used. The town of Sulphur Creek lies midway between these two points.

Trigs used were: Dial Point SPM 314 and SPM 338

EQUIPMENT

BEACON NO. 02 SERIAL NO. 372

LOCATION: Fraser Bluff Naracoopa - King Island

ANTENNA TYPE: Anti-Refraction - Yagi)

CABLE: 100' + 20' LDF 4-50 Andrews) 05 Serial No. 197

OTHER: Antenna Comutator) held on King Island

) as spare beacon.

)

BEACON NO. 03 SERIAL NO. 160

LOCATION: "The Nut"

ANTENNA TYPE: Anti-Refraction - Yagi

CABLE: 100' + 20' LDF 4-50 Andrews

OTHER: Antenna Comutator

BEACON NO. 06 SERIAL NO. 415

LOCATION: Point Sorell

ANTENNA TYPE: Anti-Refraction - Yagi

CABLE: 100' + 20' LDF 4-50 Andrews

OTHER: Antenna Comutator

BEACON NO. 07 SERIAL NO. 162

LOCATION: Point Sorell

ANTENNA TYPE: Anti-Refraction - Yagi)

CABLE: 100' + 20' LDF 4-50 Andrews) 06 replaced 07 as

OTHER: Antenna Comutator) output from 07 weak

) (130 km)

)



CALIBRATION RANGE
SULPHUR CREEK

POINT 1 **LANDS AND SURVEYS POINT 136/4**
Latitude: 41 Deg 04 Min 45.66 Sec South
Longitude: 145 Deg 59 Min 51.75 Sec East
Northing: 5451934 M
Easting: 415806 M
Elevation: 11 M

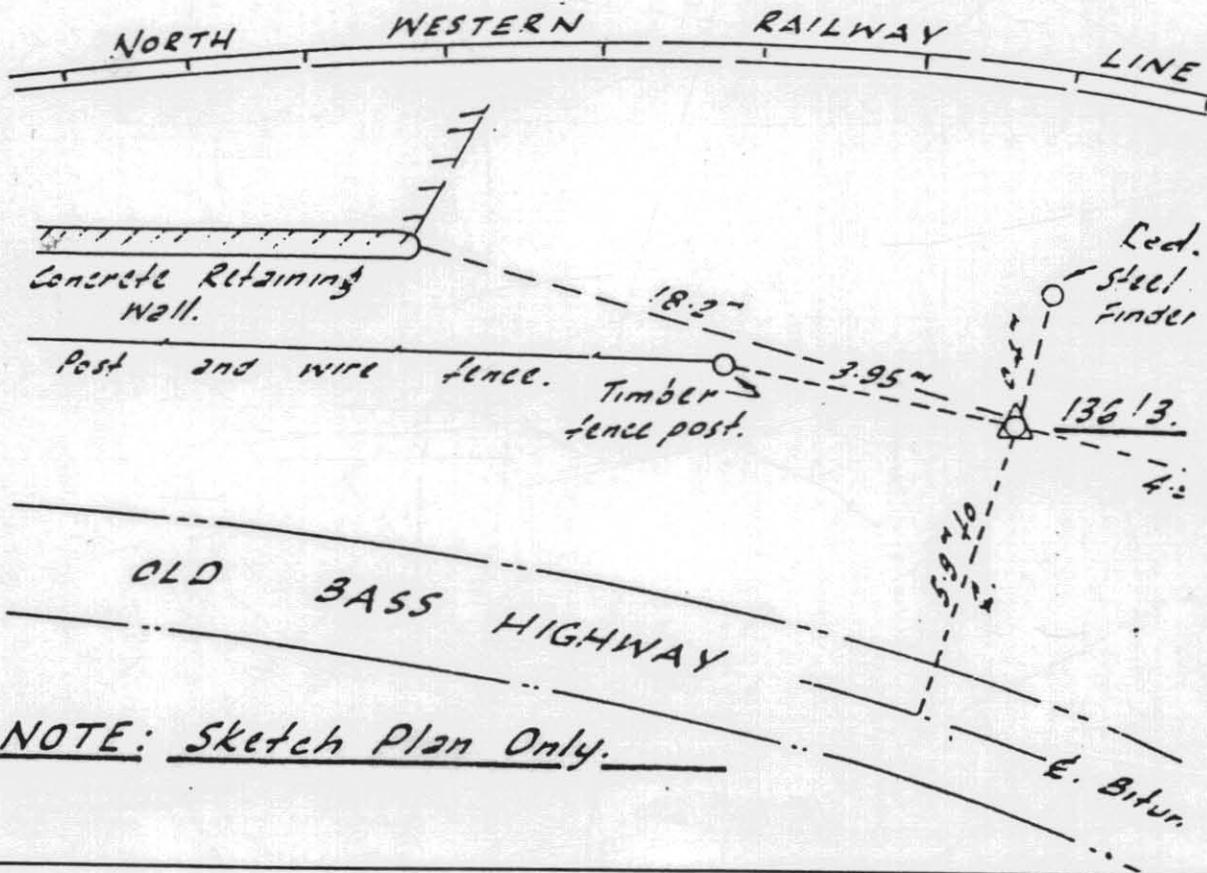
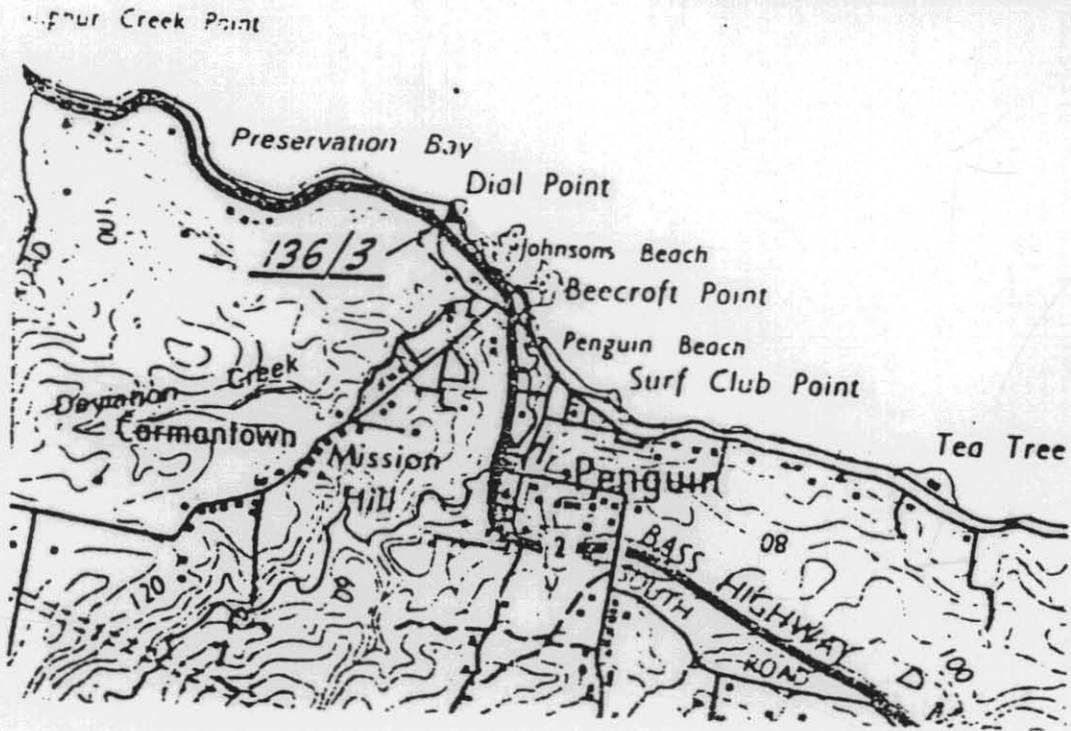
POINT 2 **DIAL POINT**
Latitude: 41 Deg 06 Min 16.82 Sec South
Longitude: 145 Deg 43 Min 39.90 Sec East
Northing: 5449182 M
Easting: 421168 M
Elevation: 11 M

Projection Parameters: A.N.S.
 A.G.D.
 UTM
 Zone 55
 CM 147 Deg East



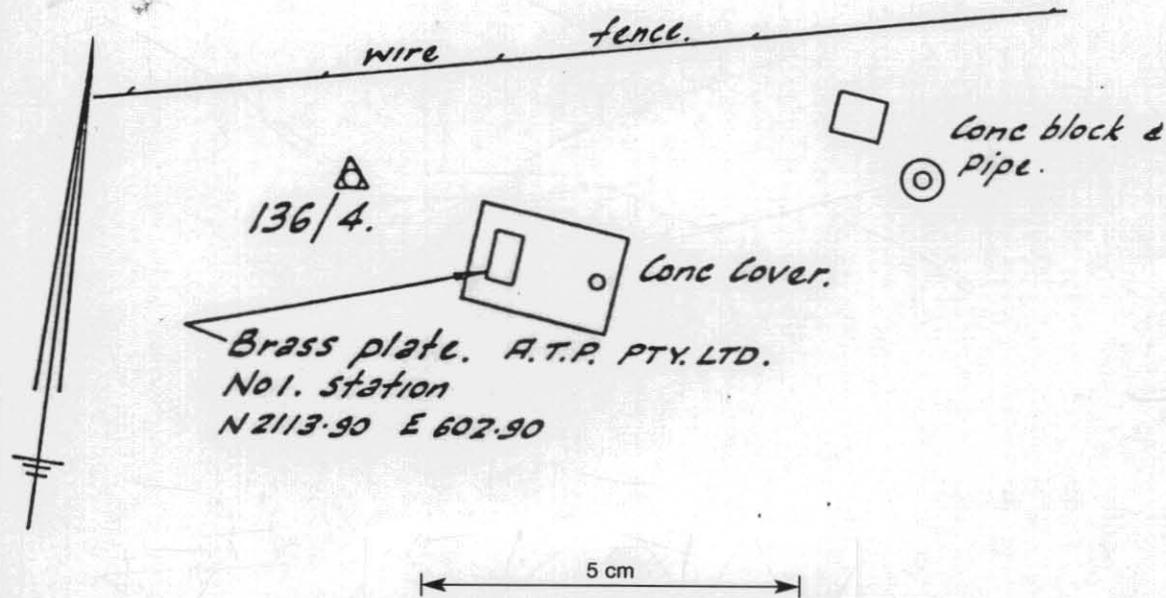
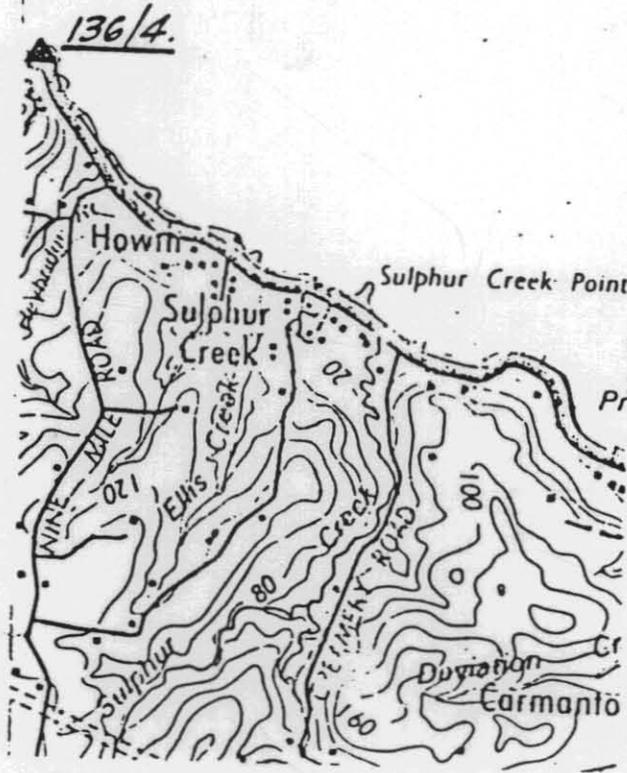
DIAL POINT

5 cm





CALIBRATION POINT 136/4



PRE CALIBRATION

DATE: 11 NOV 84

CLIENT: AMOCOPROSPECT: BASS BASIN 1984GSI SYLEDIS SYSTEM CALIBRATION RESULTS

MOBILE SERIAL NUMBER: 87/27 INTERROGATE SLOT: 01
 ANTENNA TYPE: SINCLAIR 10DB WHIP
 CABLE: 100' LDF 4-50 ANDREWS
 CALIBRATION RANGE: SULPHUR CREEK DISTANCE: 6028.28

BEACON NO.	02	05	03	06
SERIAL NO.	372	197	160	415
ANTENNA TYPE:	ANTI-REFRACTION	AS 02	AS 02	AS 02
CABLE:	100'+20 LDF 4-50	AS 02	AS 02	AS 02
REPLY SLOT	02	05	03	06
	AGC-8	AGC-7.8	AGC-7.2	AGC-8.1

READINGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	6274.4	6274.6	6274.9	6274.4	6274.9	6274.5	6274.1	6274.7	6274.4	6274.6	6274.4	6274.4	6274.0	6274.4	6275.2	6274.5	6274.3	6274.6	6274.7	6275.0
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6425.8	6425.9	6425.3	6425.3	6425.1	6425.8	6426.2	6425.8	6425.9	6425.7	6425.6	6425.6	6426.1	6426.2	6425.2	6426.2	6425.6	6426.0	6425.3	6425.7
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6421.6	6421.5	6420.3	6422.2	6422.0	6422.1	6422.4	6422.4	6422.0	6422.0	6422.3	6421.5	6422.4	6423.2	6422.6	6422.8	6421.6	6423.6	6423.0	6422.3
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6276.3	6275.5	6275.1	6275.6	6276.8	6276.3	6275.5	6275.7	6276.4	6275.9	6275.9	6275.9	6276.1	6275.4	6275.8	6275.9	6275.9	6276.0	6276.3	6275.4

AVERAGE	6274.55	6425.71	6422.29	6275.88
-CAL DISTANCE	6028.28	6028.28	6028.28	6028.28
=ERROR	246.27	397.43	394.01	247.60
DELAY=	246.27	397.43	394.01	247.60

PERSONNEL PRESENT BRYAN FIELD, GEOFF PULS, FRANK RENTON
 WEATHER CONDITIONS OVERCAST, 20 DEG INITIALLY, THEN CLOUD
 DECREASING AS WIND STRENGTHENED FROM NW
 COMMENTS _____

SYSTEM 427 M CHANNEL 74/9E/A6



PRE CALIBRATION

DATE: 11 NOV 84

CLIENT: AMOCO

PROSPECT: BASS BASIN 1984

GSI SYLEDIS SYSTEM CALIBRATION RESULTS

MOBILE SERIAL NUMBER: 87/27 INTERROGATE SLOT: 01
 ANTENNA TYPE: SINCLAIR 10DB WHIP
 CABLE: 100' LDF 4-50 ANDREWS
 CALIBRATION RANGE: SULPHUR CREEK DISTANCE: 6028.28

BEACON NO.	06	07	06 (SPARE)
SERIAL NO.	415	162	415
ANTENNA TYPE:	ANTI-REFRACTION	AS 06	AS 06
CABLE:	100'+20 LDF 4-50	AS 06	AS 06
REPLY SLOT	06	07	06
	AGC-7.6	AGC-8.0	AGC-8.0

READINGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	6273.1	6274.9	6274.1	6273.5	6273.6	6273.4	6273.8	6274.5	6273.4	6274.2	6274.5	6275.2	6275.2	6274.6	6273.8	6273.4	6272.8	6273.8	6274.1	6273.7
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6280.7	6281.2	6281.4	6281.3	6281.3	6282.0	6281.5	6281.6	6281.6	6281.4	6281.3	6281.7	6281.5	6281.4	6281.1	6282.2	6281.5	6281.6	6282.4	6281.5
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6278.9	6279.0	6278.9	6279.0	6278.3	6277.8	6278.3	6277.6	6277.8	6278.3	6278.2	6278.1	6278.5	6278.3	6277.3	6276.6	6277.3	6278.3	6277.7	6278.3
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!

AVERAGE	6273.96	6281.51	6278.12
-CAL DISTANCE	6028.28	6028.28	6028.28
=ERROR	245.68	253.23	249.84
DELAY=	245.68	253.23	249.84

PERSONNEL PRESENT BRYAN FIELD, GEOFF PULS, FRANK RENTON
 WEATHER CONDITIONS OVERCAST, 20 DEG INITIALLY, THEN CLOUD
DECREASING AS WIND STRENGTHENED FROM NW
 COMMENTS _____

SYSTEM 427 M

CHANNEL 74/9E/A6

PRE CALIBRATION

DATE: 11 NOV 84

CLIENT: AMOCOPROSPECT: BASS BASIN 1984GSI SYLEDIS SYSTEM CALIBRATION RESULTS

MOBILE SERIAL NUMBER: 182/113 INTERROGATE SLOT: 01
 ANTENNA TYPE: SINCLAIR 10DB WHIP
 CABLE: 100' LDF 4-50 ANDREWS
 CALIBRATION RANGE: SULPHUR CREEK DISTANCE: 6028.28

BEACON NO.	02	05	03	06
SERIAL NO.	372	197	160	415
ANTENNA TYPE:	ANTI-REFRACTION	AS 02	AS 02	AS 02
CABLE:	100'+20 LDF	4-50 AS 02	AS 02	AS 02
REPLY SLOT	02	05	03	06
	AGC-7.6	AGC-7.6	AGC-8.1	AGC-7.6

READINGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	6281.1	6281.4	6281.6	6281.2	6280.7	6281.2	6281.2	6281.4	6281.0	6281.8	6281.3	6281.1	6281.1	6281.3	6281.3	6281.5	6281.2	6281.1	6281.7	6281.0
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6431.9	6431.5	6432.3	6431.4	6431.1	6431.1	6431.3	6431.1	6431.5	6431.6	6431.8	6431.7	6432.3	6431.6	6431.1	6431.4	6431.7	6431.7	6431.5	6431.5
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6429.6	6429.9	6429.6	6428.9	6428.5	6429.2	6428.3	6429.8	6429.9	6429.5	6429.3	6430.1	6430.4	6429.7	6429.4	6428.7	6428.4	6428.9	6428.6	6429.1
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6283.0	6282.0	6281.6	6282.1	6282.6	6282.3	6281.9	6283.0	6282.0	6282.7	6282.5	6282.9	6283.5	6283.2	6283.3	6283.0	6281.7	6282.1	6282.4	6282.3

AVERAGE	6281.26	6431.55	6429.29	6282.49
-CAL DISTANCE	6028.28	6028.28	6028.28	6028.28
=ERROR	252.98	403.27	401.01	254.21
DELAY=	252.98	403.27	401.01	254.21

PERSONNEL PRESENT BRYAN FIELD, GEOFF PULS, FRANK RENTON
 WEATHER CONDITIONS OVERCAST, 20 DEG INITIALLY, THEN CLOUD
DECREASING AS WIND STRENGTHENED FROM NW

COMMENTS

SYSTEM 427 MCHANNEL 74/9E/A6



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PRE CALIBRATION

DATE: 11 NOV 84

CLIENT: AMOCOPROSPECT: BASS BASIN 1984GSI SYLEDIS SYSTEM CALIBRATION RESULTS

MOBILE SERIAL NUMBER: 182/113 INTERROGATE SLOT: 01
 ANTENNA TYPE: SINCLAIR 10DB WHIP
 CABLE: 100' LDF 4-50 ANDREWS
 CALIBRATION RANGE: DARWIN DISTANCE: 6028.28

BEACON NO.	06	07	06 (SPARE)
SERIAL NO.	415	162	415
ANTENNA TYPE:	ANTI-REFRACTION	AS 06	AS 06
CABLE:	100'+20 LDF 4-50	AS 06	AS 06
REPLY SLOT	06	07	06
	AGC-7.5	AGC-8.	AGC-7.8

READINGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	6281.2	6280.8	6280.0	6280.1	6280.1	6280.5	6280.8	6280.9	6280.5	6280.3	6280.1	6280.4	6280.3	6279.7	6279.7	6279.5	6280.1	6279.4	6279.0	6280.0
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6286.9	6287.4	6287.5	6287.5	6287.1	6287.5	6286.8	6286.9	6286.6	6287.1	6287.4	6287.4	6287.2	6287.3	6287.3	6287.2	6286.9	6287.1	6287.7	6287.2
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
	6284.9	6284.5	6284.8	6284.3	6284.7	6285.3	6284.9	6286.0	6285.5	6285.5	6285.2	6285.7	6286.6	6285.1	6285.4	6284.2	6284.5	6284.8	6286.0	6284.8
	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
AVERAGE	6280.17	6287.20	6285.14																	
-CAL DISTANCE	6028.28	6028.28	6028.28																	
=ERROR	251.89	258.92	256.86																	
DELAY=	251.89	258.92	256.86																	

PERSONNEL PRESENT BRYAN FIELD, GEOFF PULS, FRANK RENTON
 WEATHER CONDITIONS OVERCAST. 20 DEG INITIALLY THEN CLOUD
DECREASING AS WIND STRENGTHENED FROM NW.
 COMMENTS

SYSTEM FREQUENCY 427 M CHANNEL 74/9E/A6



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POST CALIBRATION

DATE: DEC 84

CLIENT: AMOCOPROSPECT: BASS BASIN 1984GSI SYLEDIS SYSTEM CALIBRATION RESULTS

MOBILE SERIAL NUMBER: 87/27 INTERROGATE SLOT: 01
 ANTENNA TYPE: SINCLAIR 10DB WHIP
 CABLE: 100' LDF 4-50 ANDREWS
 CALIBRATION RANGE: SULPHUR CREEK DISTANCE: 6028.28

BEACON NO.	02	03	06	07
SERIAL NO.	<u>372</u>	<u>160</u>	<u>415</u>	<u>162</u>
ANTENNA TYPE:	ANTI-REFRACTION	AS 02	AS 02	AS 02
CABLE:	100'+20 LDF 4-50	AS 02	AS 02	AS 02
REPLY SLOT	<u>02</u>	<u>03</u>	<u>06</u>	<u>07</u>

READINGS 1	6270.9	!	6421.5	!	6273.6	!	6282.5
2	6270.8	!	6421.2	!	6273.7	!	6282.6
3	6270.9	!	6421.3	!	6273.9	!	6282.7
4	6270.6	!	6421.4	!	6274.1	!	6282.6
5	6270.7	!	6421.4	!	6273.7	!	6282.8
6	6270.8	!	6421.4	!	6273.8	!	6282.9
7	6270.9	!	6421.2	!	6273.7	!	6283.0
8	6270.7	!	6421.0	!	6273.9	!	6282.9
9	6270.6	!	6421.0	!	6273.8	!	6283.1
10	6270.6	!	6421.1	!	6273.8	!	6283.0
11	6270.6	!	6421.4	!	6273.7	!	6282.5
12	6270.7	!	6421.5	!	6273.6	!	6282.6
13	6270.8	!	6421.4	!	6273.5	!	6282.6
14	6270.9	!	6421.2	!	6273.4	!	6282.9
15	6270.9	!	6421.2	!	6273.3	!	6283.1
16	6270.9	!	6421.4	!	6273.6	!	6282.6
17	6270.6	!	6421.3	!	6274.0	!	6282.7
18	6270.7	!	6421.3	!	6274.2	!	6282.8
19	6270.8	!	6421.2	!	6273.8	!	6282.8
20	6270.8	!	6421.0	!	6273.7	!	6282.5

AVERAGE	<u>6270.8</u>	<u>6422.7</u>	<u>6273.7</u>	<u>6282.9</u>
-CAL DISTANCE	<u>6028.28</u>	<u>6028.28</u>	<u>6028.28</u>	<u>6028.28</u>
=ERROR	<u>242.5</u>	<u>394.4</u>	<u>245.4</u>	<u>254.6</u>
DELAY=	<u>242.5</u>	<u>394.4</u>	<u>245.4</u>	<u>254.6</u>

PERSONNEL PRESENT PETER DAVCIES, GEOFF PULS,
 WEATHER CONDITIONS RAINING
 COMMENTS _____

SYSTEM FREQUENCY 427 M CHANNEL 74/9E A6

149184



SECTION F
BASE STATION DESCRIPTIONS

**STATION NAME:****POINT SORELL****SYLEDIS****LATITUDE:** 41 Deg 07 Min 24.69 Sec S**LONGITUDE:** 146 Deg 31 Min 41.88 Sec E**NORTHING:** 5447407.3 M**EASTING:** 460403.3 M**(SYLEDIS TOWER ON PRIME MARKER)****ARGO****LATITUDE:** 41 Deg 07 Min 23.62 Sec S**LONGITUDE:** 146 Deg 31 Min 42.31 Sec E**NORTHING:** 5447440.4 M**EASTING:** 460413.1 M**ELEVATION:** 30 Metres**PROJECTION:** Australian National Spheroid
Australian Geodetic Datum
UTM Projection
Central Meridian 147 Deg East



- 27 A -

BASELINE CROSSINGS

17th November, 1984

SYLEDIS

<u>Stations</u>	<u>Pass</u>	<u>Computed</u>	<u>Observed</u>	<u>C-0</u>
Sorell/Nut	1	110579.43	110575.50	-4 m
	2	110579.43	110575.80	-4 m
	3	110579.43	110575.50	-4 m
Sorell/Naraccopa	1	243081.37	243098.00	16.63 m
	2	243081.37	243095.00	13.63 m
	3	243081.37	243096.00	14.63 m

21st November, 1984

ARGO

Sorell/Naracoopa (signals noisy)	1	243096.32	243117.58	21.26 m
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30th November, 1984

ARGO

Nut/Sorell	1	110612.37	110612.37	0.00 m
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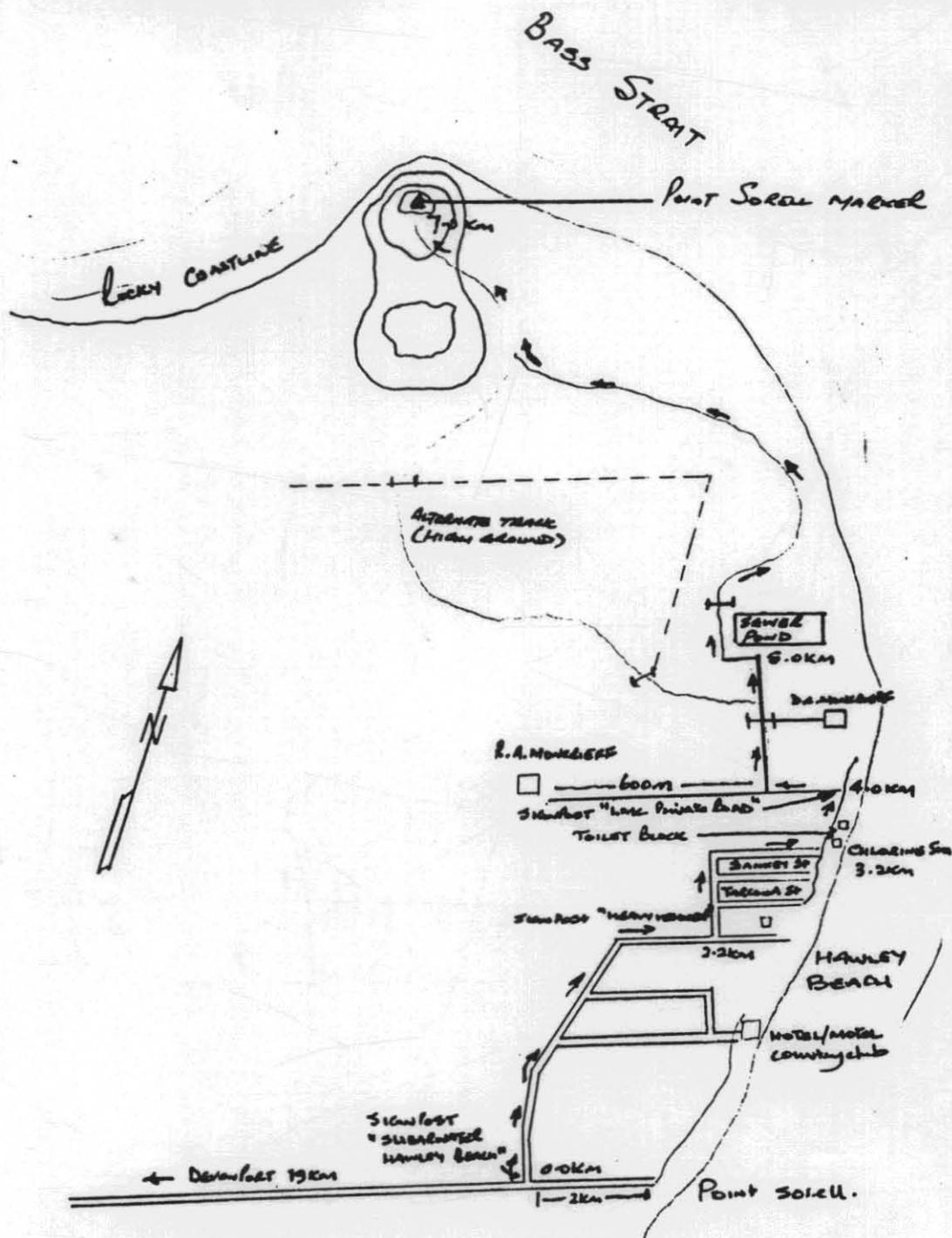
11th December, 1984

ARGO

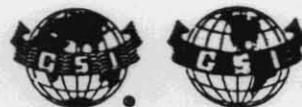
Naracoopa/Sorell	1	243096.32	243105.50	8.22 m
	2	243096.32	243103.50	6.22 m



POINT SORELL



5 cm



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STATION NAME:**POINT SORELL (ST 517)****LOCATION:**

This station is located on the highest point of Point Sorell, Tasmania, Australia, which is 4.8 kilometres from Hawley Beach, 1 kilometre from Port Sorell, and approximately 26 kilometres by road east of the city of Devonport. On a clear day Badger Head, on the Eastern entrance of Port Sorell, is visible from the station.

The station marker is geographically located on a point, 150 metres from the water's edge (Bass Strait). Rocks lay about the station. Some of the rocks extend up to 1 foot above ground level. Vegetation in the area is mainly green grass and patches of tussock up to 1 metre high. On the landward side, the point slopes gradually with black soil pasture riddled with Mutton Bird burrows. Once on the flats, which are very wet during winter, vegetation ranges from scattered trees to patches of dense woods.

On a clear day, the city of Devonport can be seen 20 miles away, at a bearing of 260 degrees. Beach areas, separated by rocks, are located 900 metres from the station, at a bearing of 200 degrees. Small patches of trees are located 500 metres, at a bearing of 080 degrees from the station. An 80 metre by 30 metre island is located offshore, approximately 800 metres, at a bearing of 060 degrees, from the station.

ACCESS:

In dry weather a regular two wheel drive vehicle may be used but the grassy slopes on the approaches to the station site may become very slippery when wet and there are numerous boggy patches after heavy rains and a four-wheel drive vehicle is necessary.



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ACCESS:
(cont.)

If four-wheel drive vehicles are unavailable or it turns wet after the station is set, Roger Moncrieff has a tractor which is available to tow the vehicle to and from the station site. The tractor may also be required to tow even a four-wheel drive vehicle if it is heavily laden in extreme wet conditions.

From Devonport, drive on the Bass Highway towards Launceston for 2 kilometres past the East Devonport turnoff, and turn left at the Exeter/Port Sorell turnoff (B19) near the top of the rise. Follow this road towards Port Sorell (The Exeter road turns off to the right) for approximately 12 kilometres to a road intersection, located approximately 2 kilometres before entering Port Sorell. A wooden sign showing "Hawley Caravan Park" is on the left side of this intersection. Turn left at this intersection, and follow the road to Hawley Beach. Turn left at a "T" junction, located 50 metres before the Hawley Beach Store and Post Office. Just after making this left turn, a prominent sign to the right reads "Heavy Vehicles Only" (see sketch). Follow this sealed road to its end at a "T" junction with a chlorine station facing you on the other side of the road. Turn left at this junction. A right turn takes you on a foreshore track. Follow this road (it turns to gravel half-way along) for approximately 700 metres (passing a picnic spot and toilets on the right) to a white wooden gate. Immediately in front of the gate, the road veers to the right. A turn to the left is marked "LMC Private Road." Take this turn to the left (it is 3 kilometres to the station from this point). Follow the road for approximately 100 metres and turn to the right.



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ACCESS:
(cont.)

Straight ahead at this point is the residence of Mr. Roger Moncrieff, the son of the station site land owner. Drive for approximately 300 metres to a locked gate. At this gate, a track leads to the right to the residence of Mr. Don Moncrieff, the station site land owner, located approximately 100 metres from this gate. Obtain a key for this gate, or if opened, follow the road straight ahead to double gates, near the council sewerage pond, which are usually opened. The station marker will be visible from the double gates at a distance of approximately 2 kilometres. There is no defined road from this point to the marker. Seek the land owner's advice or follow the tracks shown on the sketch.

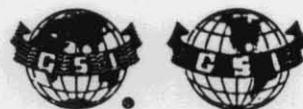
MARKER:

The station marker, located on a hill, consists of a brass mushroom S.P.M., which is not numbered. The marker is embedded in concrete at ground level, with stones surrounding the marker.

GENERAL:

Labour can be provided by Mr. Roger Moncrieff. Labour can also be obtained in Devonport, approximately 19 kilometres away. Fuel, oil, camping equipment and supplies are available at Devonport. Bulk fuel can be obtained from several depots located in Devonport. There is a service station in Port Sorell, and a reasonable selection of goods can be obtained at the Hawley Beach Store and Post Office. Drinking water can be obtained from the station property land owner or his son.

A caravan with heater is essential at this site. The winter months, June to September, can be very wet, windy and cold. Temperatures can range from several degrees below zero to a daily maximum of as low as 4 Degrees Centigrade. Extra rope and star stakes should be taken for tying down during this period.



GENERAL:
(cont.)

Penguins are very frequent visitors to the station site, particularly at night.

Caravans are available from Devon Coastavans, 116 Nicholls St., Devonport; telephone Ian Finch, 004-242829. Mr. Finch will deliver and pick up the vans to the station sites for a nominal fee (In August 1984, Point Sorell was A\$20.00, Doctors Rocks was A\$40.00. This fee includes delivery and pickup). The vans are well equipped, gas, approximately 60 litre water tank (full on delivery), crockery, cutlery, fridge etc. Mattresses are supplied, but there are no blankets, pillows, or sheets. The vans can be locked. The caravans must be left clean when vacating.

Four-wheel drive vehicles may also be obtained from Regent Filling Station, 57 Marine Terrace, South Burnie. This is the Shell Service Station past the paper mill on the Bass Highway, as you approach Burnie from Devonport. The contact at this place is Mr. Wayne Cross. The service station telephone number is 004-312131.

Permission to occupy the station must be obtained from the land owner, Mr. Don Moncrieff, Hawley Beach via Latrobe 7307, Tasmania. His phone number is 004-286193. Mr. Moncrieff was paid a daily rental fee of A\$25.00 for the use of his land. If Mr. Don Moncrieff is absent, permission may be obtained from his son, Roger Moncrieff; telephone 004-286587. Roger lives approximately 1 kilometre from Don Moncrieff. (See sketch).



GENERAL:
(cont.)

An 80' Anti-Refraction Syledis antenna was utilised on this site. The Syledis antenna was erected directly on the marker, after the L & S beacon was removed off site. (Permission required to occupy site was obtained from L & S Hobart - Mr. Tony Pritchard; telephone 002-302256) as well as local land holder Mr. Don Moncrieff.

ELEVATION:

30 metres



STATION NAME: NARACOOPA (FRASER BLUFF)

SYLEDIS

LATITUDE: 39 Deg 55 Min 29.95 Sec S

LONGITUDE: 144 Deg 07 Min 39.47 Sec E

NORTHING: 5576602.5 M

EASTING: 254528.1 M

ARGO

LATITUDE: 39 Deg 55 Min 29.05 Sec S

LONGITUDE: 144 Deg 07 Min 39.03 Sec E

NORTHING: 5576629.9 M

EASTING: 254516.8 M

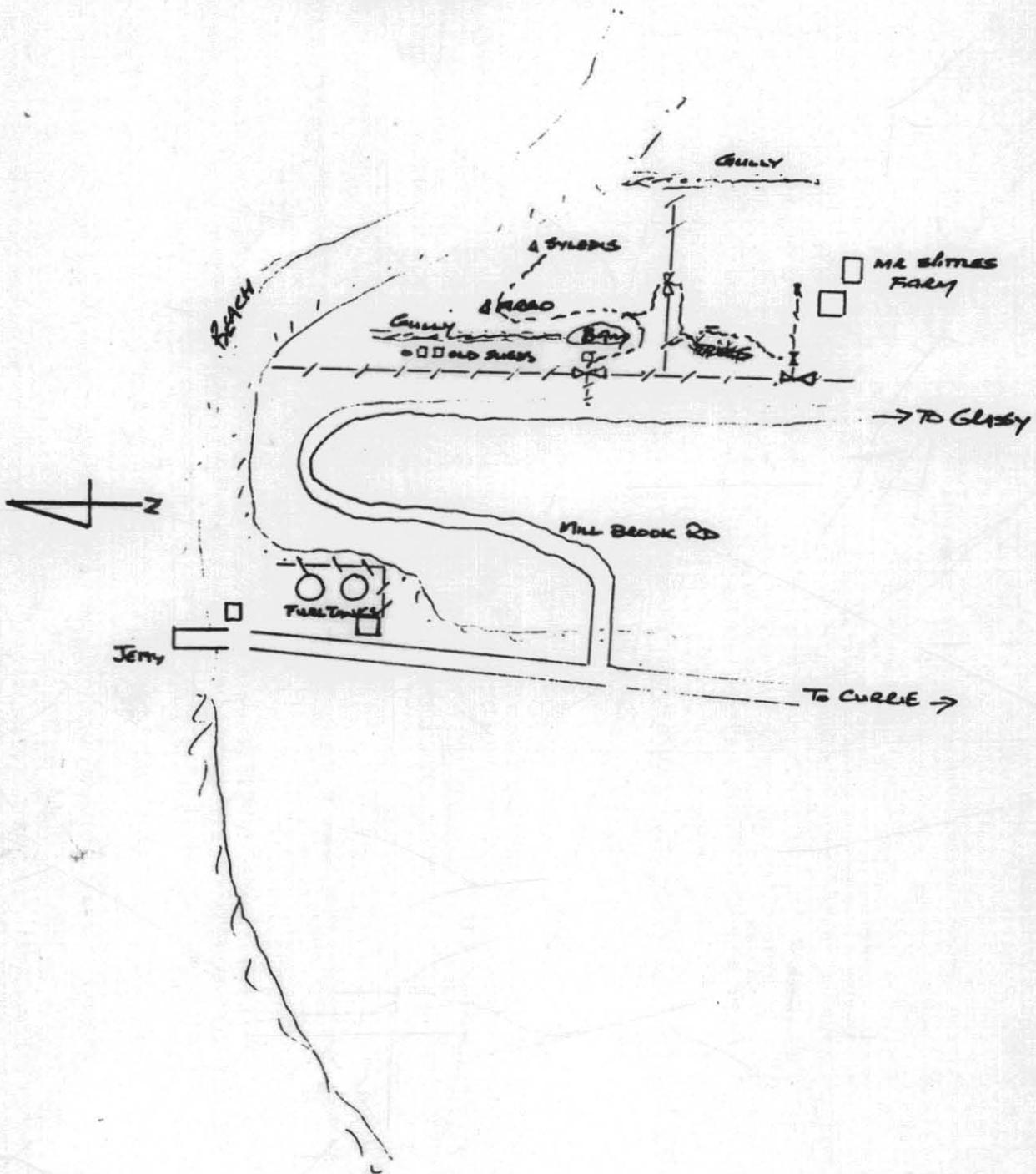
ELEVATION: 56 Metres

PROJECTION: Australian National Spheroid
Australian Geodetic Datum
UTM Projection
Central Meridian 147 Deg East



NARACOODA (FRASER BLUFF)

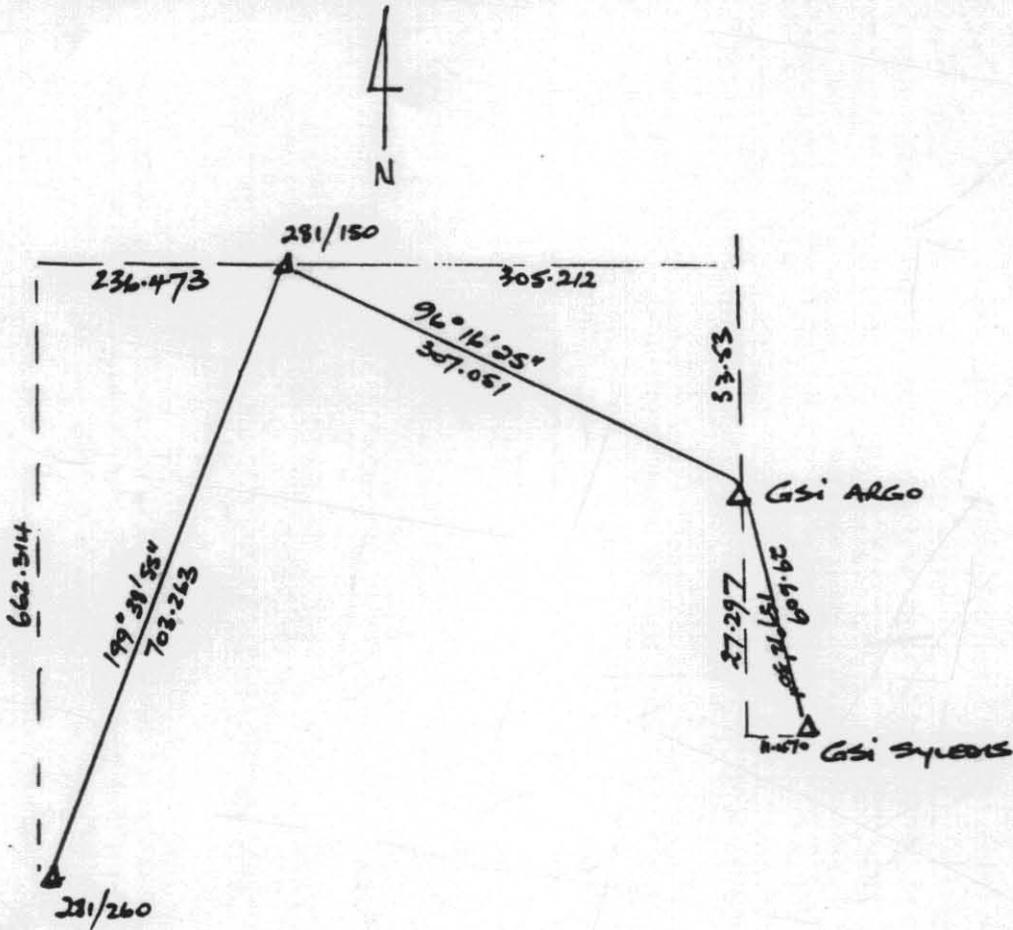
SLEDIS + ARGO OFFSETS



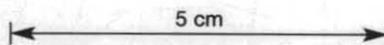
NOT TO SCALE.



OFFSET DIAGRAMS AND REFERENCES



BEARINGS ARE TRUE
DISTANCES IN METRES





STATION NAME: NARACOOPA (FRASER BLUFF)

LOCATED: This station is located on the East Coast of King Island on Fraser Bluff, overlooking the town of Naracoopa. Naracoopa is 21 Kms from the main town (& airport) of Currie, located on the West Coast of King Island. The station is geographically located in a paddock 45.7 metres above a beach with a clear vista from 50 to 120 degrees (An 80' tower would "see" further to the South).

ACCESS: In dry weather a 2 wheel drive can be used but in wet weather the area around the marker could become very wet and a check should be made before driving onto the site. A truck was used to transport all equipment from Currie and had no problem accessing the site in November 1984.

From Currie take road to Naracoopa. On reaching Naracoopa a 3 way intersection will be seen - 1 road into town and 1 up the side of a hill, this road is signposted Millbrook Road. Follow this road past a viewing lookout and take the first track to the left. A gate at the end of this track allows access into an area with 2 unused sheds. A track was cut, beginning on the right after entering gate. A small dam is skirted by this track which opens onto a large paddock. The station is located to the North on the edge of a large bluff.

An alternate access is through a Mr. Spittle's property, enquiries should be made from David Spittle on 004-611206. (No entry unless he is present).

**MARKER:**

2 markers (one Syledis, one Argo) were positioned by a local surveyor (Mr. Rodger Cleland - 004-611288) and consist of a piece of water pipe buried below ground level, a star stake with a fishing float on top was located within 1 metre as a witness post. The markers were translocated from an L & S survey point 281/150.

GENERAL:

Labour and transport were organised through Mr. Peter Robertson (Proprietor of Boomerang Motel - Currie). He is extremely helpful and appears to know everyone on the island. All equipment needs to be purchased in Currie as Naracoopa only has a deli. Gas is available on the island, but advanced notice may be required. An 80 ft Anti-Refraction Syledis tower was erected on this site along with an ONI operated Argo System. Extra ropes and star stakes are required on this site due to extreme winds and weather conditions.

Permission to occupy this site was obtained from Mr. John & Mrs. Gail Henderson. No fee was paid to occupy the site.

**STATION NAME:****THE NUT**SYLEDIS

LATITUDE: 40 Deg 45 Min 50.29 Sec S

LONGITUDE: 145 Deg 18 Min 13.32 Sec E

NORTHING: 5486044.3 M

EASTING: 356827.2 M

ARGO

LATITUDE: 40 Deg 45 Min 49.97 Sec S

LONGITUDE: 145 Deg 18 Min 11.87 Sec E

NORTHING: 5486053.5 M

EASTING: 356793.0 M

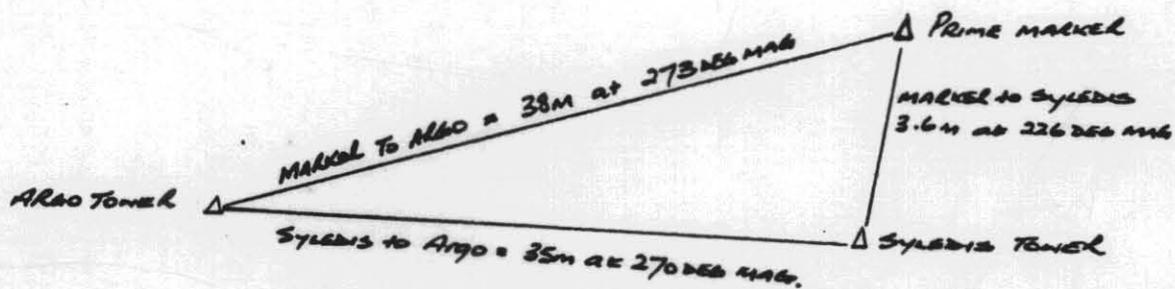
ELEVATION: 143 Metres

PROJECTION: Australian Natinal Spheroid
Australian Geodetic Datum
UTM Projection
Central Meridian 144 Deg. East



MARKERS "THE NUT"

BOTH ARGO AND SYLEDIS TOWERS WERE OFFSET FROM THE PRIME MARKER.



PRIME MARKER COORDINATES.

40 DEG 45 MIN 50.23 SEC SOUTH
145 " 18 " 13.45 SEC EAST

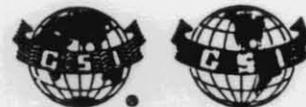
SYLEDIS TOWER COORDINATES

40 DEG 45 MIN 50.29 SEC SOUTH
145 " 18 " 13.82 " EAST

ARGO TOWER COORDINATES.

40 DEG 45 MIN 49.97 SEC SOUTH
145 " 18 " 11.87 " EAST

5 cm



- 43 -

STATION NAME: THE NUT (ST 674)

LOCATED: This station is located on a hill overlooking the town of Stanley, on the North coast of Tasmania, Australia. The hill is named "The Nut", and it's summit is flat to slightly rolling. This hill, as well as the historical town of Stanley, are very popular tourist attractions. The vegetation on this hill consists of grass and low native bushes. There is a tourist walk track around the perimeter of the top which is some 4 kilometres around. There are many mutton bird burrows along this track. The surrounding district, Circular Head, derives it's name from the distinctive shaped "Nut" which juts into Bass Strait. The station marker is on the Northern side of The Nut.

ACCESS: Access to the town of Stanley can be made from Burnie or Devonport. It must be noted that minor towns may not appear on road signs. When leaving Devonport, read "Smithton" for "Stanley". At times, only route numbers appear in lieu of town names. It is approximately 120 kilometres from Devonport to Stanley.

Drive North on the Bass Highway to the intersection with the Stanley Highway (B21). This intersection is 64 kilometres past Wynyard. Turn onto Stanley Highway and drive 7 kilometres to the town of Stanley. The Nut will be easily seen to the Northeast of Stanley, right beside the town. The road to the hill is signposted "Nut". A vehicle can be taken as far as the car park on the slopes of The Nut. A zig-zag 1 metre wide cement track with centre hand rail leads from the car park to the summit. Take the left hand track at the fork on top of the hill.



- 44 -

ACCESS:
(cont.)

The station marker is from 400 to 500 metres along this track. It is a walk of about 20 to 30 minutes (unburdened) from the base of the hill to the station.

MARKER:

The station marker consists of a brass mushroom S.P.M., which is not numbered. The marker is embedded in concrete which is at ground level, with a 1.26 metre high stone cairn built over it.

A 3.86 metre high quadropod has been erected over the marker. The quadropod has a 60cm diameter black disc attached to it's top.

GENERAL:

Food, fuel, oil and water is available in Stanley. Fuel and oil can be obtained from W.T. House, Inc. BP service station. Mr. House can also assist in obtaining labour. Labour may also be obtained at the Union Hotel. Emergency water may be obtained from a tank near the old telecom hut, which is located alongside the lookout, approximately 700 metres from the station site.

Although limited camping equipment is available in Stanley, this should be purchased in larger centres, such as Burnie or Devonport.

Hotel accommodation is available at the Union Hotel in Stanley. The nearest airport to this station is in Smithton, approximately 20 miles away.

The station site is completely exposed to weather. This should be taken into consideration when erecting the station. Ample bedding, tent pegs and spare rope should be taken. During the winter months (June through September), the site is very cold and damp. A heater is essential as the temperature frequently drops below zero.



- 45 -

GENERAL:
(cont.)

The station site is on land owned by the National Parks and Wildlife Service. Permission to occupy the site was obtained from Mr. P. Murrell, Director, in Sandy Bay, Tasmania 7005. His office address in Sandy Bay is Magnet Court or P O Box 210, Sandy Bay, Tasmania 7005. Telegrams, addressed "TASPAWS", will be received by the director. No rent was paid for the use of this property. The local inspector is Mr. Rex Gatenby, Launceston; telephone 003-415306.

The local ranger in charge is Mr. Brian Carson, telephone 004-581320. His residence is located near the rectory and old school in the old section of Stanley. Mr. Carson was very helpful in all matters. He can arrange for storage of empty equipment boxes at the car park house.

The site is to be kept clean and tidy during occupation. All rubbish is to be removed at the conclusion of a survey.

It will take two or three days with 4 or 5 labourers to carry the equipment to the station site. An average round-trip from the car park to the station site, walking up with a load and returning unburdened will take from 60 to 90 minutes, depending on the load. The cement track to the summit is very difficult to negotiate with heavy objects with the centre hand rail. When possible, a helicopter should be used to mobilize and demobilize this station. The Stanley Football Ground is used as a lift off and put-down point for the helicopter. Permission can be obtained to use the ground from the Football Club president, Mr. Graham Trenelly, Union Hotel, Stanley; telephone 004-581161. It is approximately a 5 minute flight from the football ground to the station site.

149205



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GENERAL:
(cont.)

It is approximately 50 kilometres from
the Wynyard Airport to The Nut.

ELEVATION:

143 Metres.

149206

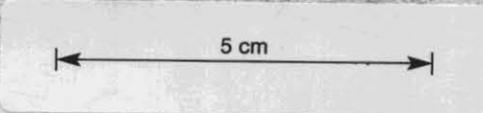
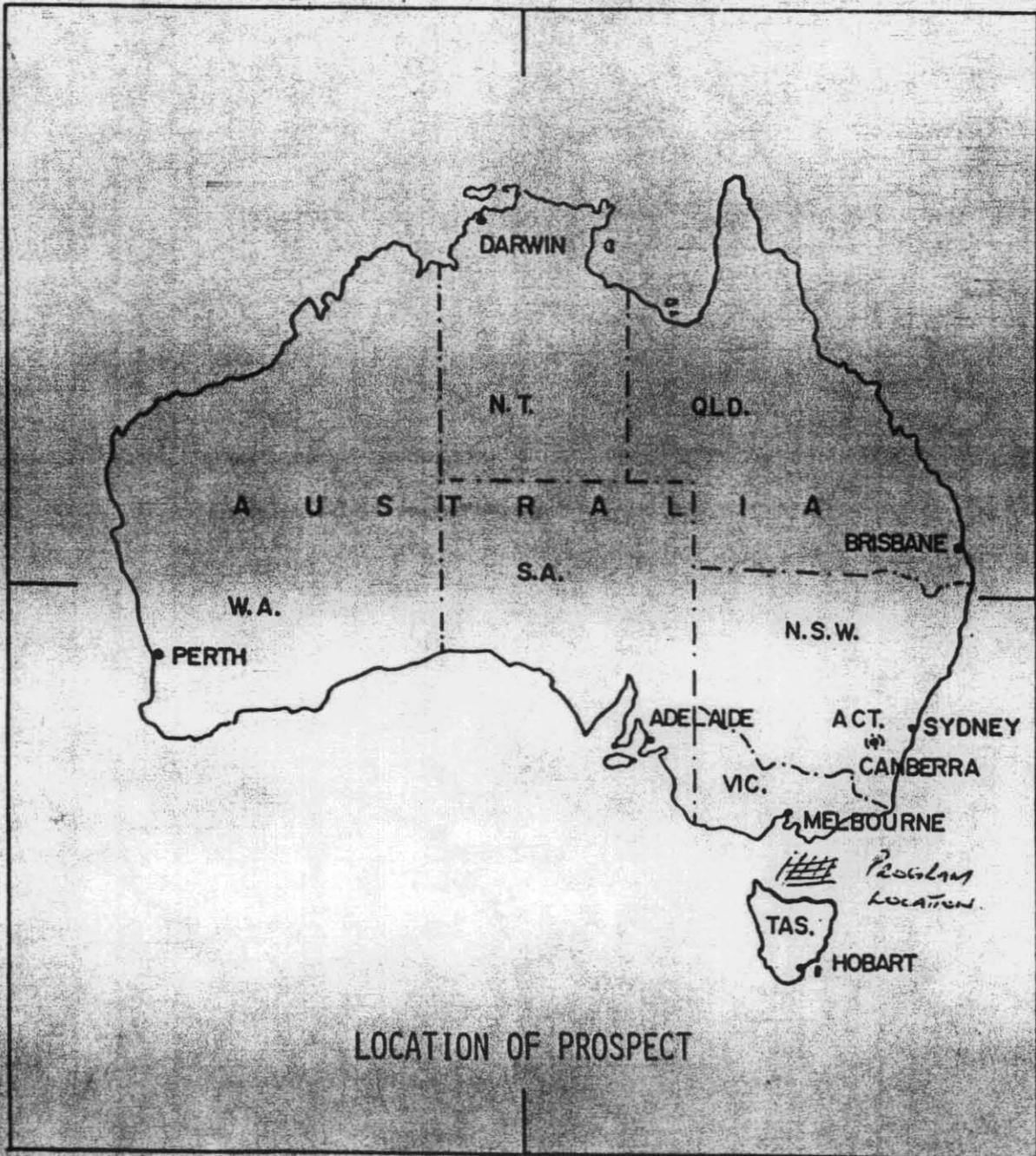


SECTION G
MAPPING PARAMETERS



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Prospect : T14P, T18P, T22P
Spheroid : Australian National
Spheroid
Datum : Australian Geodetic Datum
Central Meridian : 147 Deg. East
Position Plotted : CDP
Scale : 1:100,000
Plotting Frequency : Every 20th
Label Frequency : Every 200th
Navigation Data Processed : Wescom
38 Rowland Street



FINAL REPORT
OFFSHORE NAVIGATION (AUSTRALIA) PTY. LTD.
PROJECT 1521

FOR
GEOPHYSICAL SERVICE INTERNATIONAL
AMOCO

TASMANIA, AUSTRALIA
NOVEMBER - DECEMBER 1984

BASS BASIN SURVEY



FINAL REPORT
OFFSHORE NAVIGATION (AUSTRALIA) PTY. LTD.
PROJECT 1521

FOR
GEOPHYSICAL SERVICE INTERNATIONAL
PARTY 2931
AMOCO

BASS BASIN SURVEY

TASMANIA, AUSTRALIA

NOVEMBER - DECEMBER 1984

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Area of Operations Plat	29
The ARGO Radiopositioning System	30
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FIGURES

1. Illustration of master interrogations & Slave Replies
2. Typical Hyperbolic Net
3. Hyperbolic Line of Positions (LOP's)
4. Four Base Station Network

I. INTRODUCTION

Offshore Navigation (Australia) Pty. Ltd. (ONA), under contract to Geophysical Service International (GSI), provided an ARGO Radiopositioning System to a marine seismic survey that was conducted off the coast of Tasmania, Australia, in Bass Strait. The survey extended along the coast of Tasmania from Point Sorell to Stanley, and up to approximately 120 miles offshore. The survey was conducted for AMOCO and was designated as Bass Basin Survey.

GSI provided a Syledis Radiopositioning System and its Configurable Marine System (CMS) to this survey. The ARGO mobile equipment was interfaced to the CMS. ARGO positioning data was recorded by CMS.

ARGO was the prime navigation system for this survey. The ARGO mobile equipment was provided with a digital Printer and strip chart recorder. Positioning data was recorded on the printer and recorder throughout the survey.

I. INTRODUCTION (continued)

The ARGO mobile equipment was calibrated and updated to positions determined by the Syledis system. The ARGO lane count was checked to Syledis positions.

The ONA base of operation for this survey was established at Devonport, Tasmania on 9 November 1984.

II. FIELD OPERATIONS RECAP

ARGO base station equipment was installed at Stations Point Sorell, The Nut, and Naracoopa to control this survey.

ONA personnel necessary for this operation arrived in Devonport on 9 November 1984 and began preparation for the mobilization of the ARGO system. The ARGO base station equipment arrived at Burnie on 11 November. Installation of the ARGO base station equipment on the sites occupied to control the survey began on 11 November and was completed on 14 November 1984.

The recording vessel, M/V EUGENE McDERMOTT II, arrived in Devonport on 17 November 1984. The ARGO mobile equipment had been installed on board the vessel during a previous operation conducted under GSI control.

The M/V EUGENE McDERMOTT II departed Devonport at 0924 hours 17 November 1984. The ARGO mobile equipment was calibrated to Syledis position fixes that were recorded

II. FIELD OPERATIONS RECAP (continued)

between 1800 and 1930 hours 17 November 1984 in the prospect area. ARGO Delta Range Values derived from this calibration are as follows:

Station Point Sorell	0.15 lane
Station The Nut	0.06 lane
Station Naracoopa	0.02 lane

Geophysical operations began at 2032 hours 19 November 1984, and were completed at 2236 hours 16 December 1984. Some R.F. interference was noted during the survey period on the ARGO frequency of 1620 KHz. This interference was noted generally between dusk and up to approximately mid-night. It should be noted that this interference did not affect the operation or accuracy of the ARGO system. The maximum distance from the station required for this operation was 160 nautical miles.

On completion of the survey, ARGO baselines were crossed with the following results:

Stations Point Sorell/Naracoopa Baseline:
Observed Range 2628.50 lanes

Stations Point Sorell/The Nut Baseline:
Observed Range 1196.00 lanes

II. FIELD OPERATIONS RECAP (continued)

The ARGO system was secured at 1045 hours 17 December 1984, on completion of the above baseline crossings.

Dismantling of the ARGO base stations began on 17 December 1984 and was completed 19 December. The M/V EUGENE McDERMOTT II arrived in Devonport at 1340 hours 17 December, and the ARGO mobile equipment was dismantled and removed from the vessel. The ARGO base station and mobile station equipment was packaged and shipped to the ONA Perth, W.A. office by truck transport.

The ONA mobile operators were released from this survey on 17 November 1984. The ONA base operators were released on 24 December 1984 on which date personnel and the ARGO system arrived in Perth.

III. GENERAL INFORMATION

A. ARGO frequency used was:

Ranging Frequency	1620 KHz
Lane Identification	1773 KHz

B. Satisfactory radiotelephone communications between the mobile and base installations were maintained on the frequencies of 7840.0 and 4637.5 (SSB) kilocycles.

C. Three ARGO base station installations were provided by ONA for this survey.

D. Three Syledis base station installations were provided by GSI for this survey. This equipment was installed at the three sites occupied by the ARGO base equipment.

E. Three ARGO base station sites were occupied during this operation. They were:

STATION NARACOOPA

STATION POINT SORELL

STATION THE NUT

IV. PREPLOTING AND DATA ACQUISITION

ARGO preplots of the survey were provided to the field operations by WESTCOM. The interval between shotpoint locations was constant at 30 meters.

No final mapping was accomplished by ONA on this survey. All ARGO positioning data accumulated during this survey was recorded by GSI on CMS tape.

V. BASIC CONTROL

Coordinates of the Stations Point Sorell and The Nut were obtained from a Lands Department, Tasmania, Division of National Mapping summary sheet. Coordinates of Station Naracoopa were provided to ONA by GSI.

Universal Transverse Mercator Projection
 Australian National Spheroid
 Zone 55
 Central Meridian 147° East
 AUSTRALIAN GEODETIC DATUM

STATION NARACOOPA:

MARKER (281/150) COORDINATES

Latitude	39°55'27.64 S	N = 5,576,663 meters
Longitude	144°07'26.23 E	E = 254,211 meters

The ARGO tower was erected 307.051 meters, at an adjusted azimuth of 98.1204805551° from the marker.

ARGO TOWER OFFSET COORDINATES

Latitude	39°55'29.05 S	N = 5,576,630 meters
Longitude	144°07'39.03 E	E = 254,517 meters
Elevation	55.9 meters	

The Syledis tower was erected 29.609 meters, at an adjusted azimuth of 159.055202777° from the ARGO tower.

SYLEDIS TOWER OFFSET COORDINATES

Latitude	39°55'29.95 S	N = 5,576,603 meters
Longitude	144°07'39.47 E	E = 254,528 meters
Elevation	56 meters	

V. BASIC CONTROL (continued)

STATION POINT SORELL (ST 517):

MARKER COORDINATES

Latitude 41°07'24"69 S N = 5,447,407 meters
 Longitude 146°31'41"88 E E = 460,403 meters
 Elevation 30 meters

The Syledis tower was erected adjacent to the marker.

The ARGO tower was erected 34.4 meters, at a bearing of 005° Magnetic, from the station marker.

ARGO TOWER OFFSET COORDINATES

Latitude 41°07'23"63 S N = 5,447,440 meters
 Longitude 146°31'42"34 E E = 460,414 meters
 Elevation 30 meters

STATION THE NUT (ST 674):

MARKER COORDINATES

Latitude 40°45'50"23 S N = 5,486,046 meters
 Longitude 145°18'13"45 E E = 356,830 meters
 Elevation 143 meters

The ARGO tower was erected 38 meters, at a bearing of 270° Magnetic, from the station marker.

ARGO TOWER OFFSET COORDINATES

Latitude 40°45'49"97 S N = 5,486,053 meters
 Longitude 145°18'11"87 E E = 356,793 meters
 Elevation 143 meters

The Syledis tower was erected 3.6 meters, at a bearing of 226° Magnetic, from the station marker.

SYLEDIS TOWER OFFSET COORDINATES

Latitude 40°45'50"29 S N = 5,486,044 meters
 Longitude 145°18'13"32 E E = 356,827 meters
 Elevation 143 meters

VI. PERSONNEL

NAME	POSITION
Molloy, R.	Party Chief
Hoggart, A.	Mobile Operator
Brander, F.	Base Operator
Coe, P.	Base Operator
Ward, G.	Base Operator

VII. DISTRIBUTION

Geophysical Service International
47 Burswood Road
Victoria Park, W.A. 6100
AUSTRALIA

Attention: Mr. Peter Davies

Four copies

Offshore Navigation, Inc.
Post Office Box 23504
Harahan, LA 70183
U.S.A.

Two copies

Offshore Navigation (Australia) Pty. Ltd.
Post Office Box 291
Cloverdale, W.A. 6105
AUSTRALIA

One copy

BASE STATION DESCRIPTIONS AND PLATES

11

STATION: NARACOOPA

LOCATED: Station Naracoopa is located in a paddock in the village of Naracoopa, King Island, Tasmania, Australia. The station site overlooks the Mobil oil tanks and jetty. The paddock is of grass on top soil with an underfelt of clay. The two markers at this site are located on the north end of the paddock, on the edge of a hill.

ACCESS: Fraser Bluff is in the village of Naracoopa, approximately 20 kilometers from the main town of Curry on King Island. Just as you enter the village, there is an intersection with a sign post to the right towards "Millbrook". Turn onto Millbrook Road and drive 0.8 kilometer to a turn-off and gate to the left. Go through this gate and drive to the right around a small dam. Continue on through the scrub to the paddock. Drive through the paddock to the ridge and station site.

Heavy rain fall can be expected during June through September. In the event of a recent rain fall, a four-wheel drive vehicle or tractor will be needed to reach this site, as the paddock can become very marshy. Tractors can be obtained from Mr. D. Spittle, whose telephone number is 004-611206. If the ground is marshy and no tractor or four wheel drive vehicle is available, it is a distance of approximately 250 yards from the staging area to the site.

MARKER: The ARGO and Syledis markers consists of a brass plaque embedded in cement 3 inches below ground level. Both positions are marked by star pickets with a fishing float tied on each. The ARGO plaque is inscribed "ONI ARGO 1984", and the Syledis plaque is inscribed "GSI SYLEDIS 1984".

GENERAL: Local labor is not available unless prior arrangements are made in the village. Ian Whitehouse, who transported the station to the site in 1984, can make arrangements for labor from Curry.

STATION: NARACOOPA (continued)

All supplies for the site should be purchased in Curry. Websters Store has everything necessary in regard to hardware. Cars and caravans can also be obtained in Curry. A four-wheel drive vehicle or tractor must be leased from private sources.

There is a cafe in Naracoopa that is owned by Mr. and Mrs. Hoopwood. Limited food supplies can be obtained from there.

During dry season, there is limited water on the island, and water must be purchased in Curry.

There is no electricity in the area. However, power will be available within two years.

Heavy winds can be expected at this site from all directions. Winds from the southwest and east are the stronger, and can reach from 40 to 80 knots. A tent at this site would most likely not survive, especially during the winter months.

In the event a tent or caravan cannot be placed at this site, the operator may be able to stay in an empty house 150 to 200 yards from the site. The house and other out buildings nearby are owned by Mrs. Gail Henderson, who also owns the property on which the site is located. She lives in Curry.

Everyone on the island is helpful. However, prior arrangements must be made for any assistance that is required.

Permission to occupy the station site must be obtained from Mrs. Gail Henderson.

A 70-foot ARGO tower and 80-foot Syledis tower were erected at this site. A minimum tower height of 40 feet is required to clear

STATION: NARACOOPA (continued)

surrounding obstructions. Clear vista is from 120° to 340°. Star pickets were used to secure the towers. The anchors must be doubled and driven into the ground. Also, they must be taken out at the end of an operation as their remaining in the paddock will constitute a hazard for cattle and other live stock.

SKETCH: See next page

Coordinates of this station were provided to ONA by GSI.

UTM PROJECTION, AUSTRALIAN NATIONAL SPHEROID
ZONE 55, C.M. 147° EAST - - A.G.D.

MARKER (281/150) COORDINATES

Lat. 39°55'27"64 S	N = 5,576,663 meters
Long. 144°07'26"23 E	E = 254,211 meters

The ARGO tower was erected 307.051 meters, at an adjusted azimuth of 98.1204805551° from the marker.

ARGO TOWER OFFSET COORDINATES

Lat. 39°55'29"05 S	N = 5,576,630 meters
Long. 144°07'39"03 E	E = 254,517 meters
Elev. 55.9 meters	

The Syledis tower was erected 29.6091 meters, at an adjusted azimuth of 159.055202777° from the ARGO tower.

SYLEDIS TOWER OFFSET COORDINATES

Lat. 39°55'29"95 S	N = 5,576,603 meters
Long. 144°07'39"47 E	E = 254,528 meters
Elev. 56 meters	

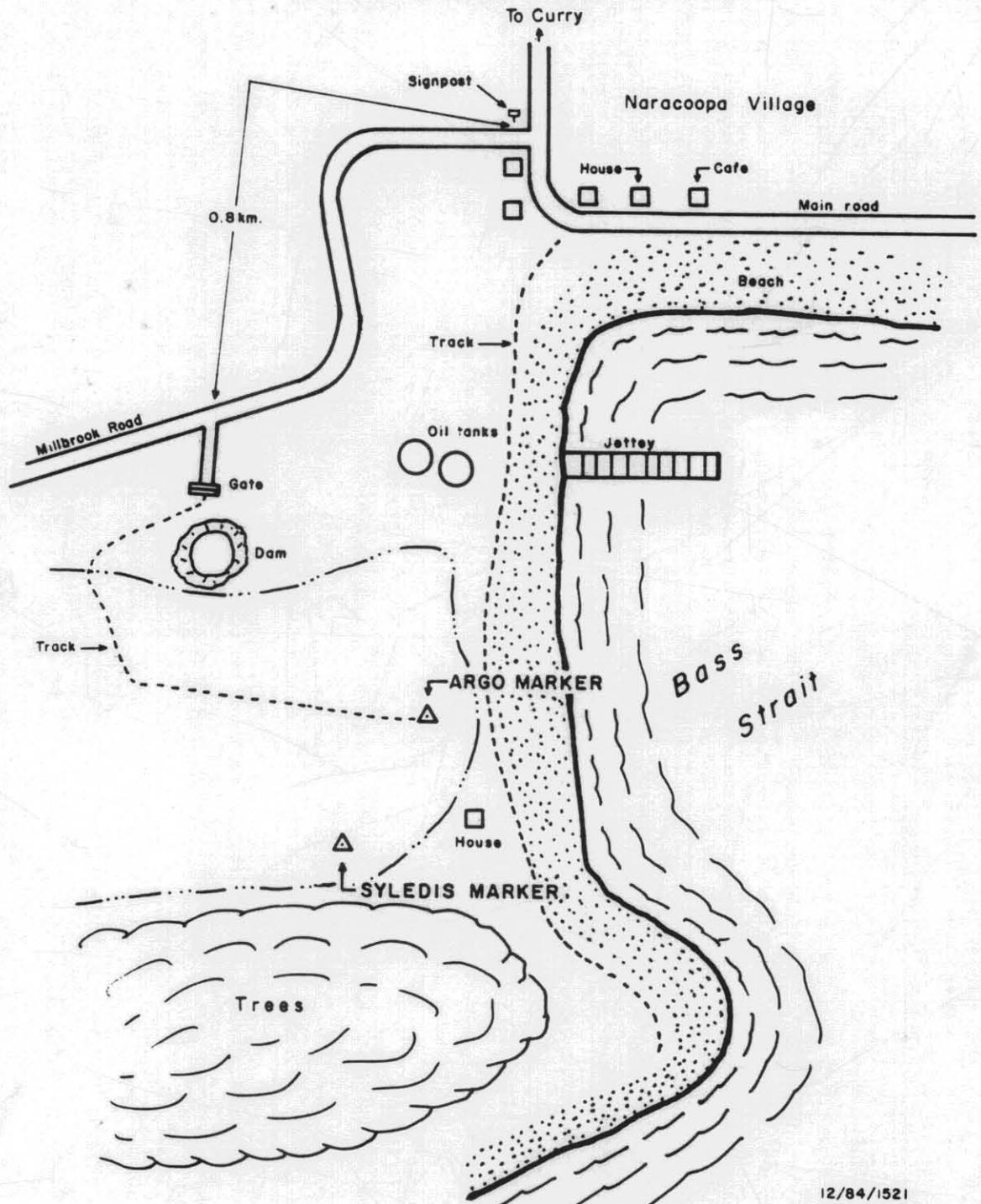
STA. NARACOOPA — AUSTRALIA

MARKER (281/150) COORDINATES

LAT. 39°55'27".64 S
 LONG. 144°07'26".23 E
 ELEV. Not reported

N 5,576,663 meters
 E 254,211 meters

UTM PROJ. — AUST. NAT. SPHEROID
 ZONE 55, C. M. 147° E — A. G. D.



12/84/1521

STATION: POINT SORELL (ST 517)

LOCATED: This station is located on the highest point of Point Sorell, Tasmania, Australia, which is 4.8 kilometers from Hawley Beach, 1 kilometer from Port Sorell, and approximately 26 kilometers by road east of the city of Devonport. On a clear day, Badger Head, on the eastern entrance of Port Sorell, is visible from the station.

The station marker is geographically located on a point, 150 meters from the water's edge (Bass Strait). Rocks lay about the station. Some of the rocks extend up to 1 foot above ground level. Vegetation in the area is mainly green grass and patches of tussock up to 1 meter high. On the landward side, the point slopes gradually with black soil pasture riddled with Mutton Bird burrows. Once on the flats, which are very wet during winter, vegetation ranges from scattered trees to patches of dense woods.

On a clear day, the city of Devonport can be seen 20 miles away, at a bearing of 260°. Beach areas, separated by rocks, are located 900 meters from the station, at a bearing of 200°. Small patches of trees are located 500 meters, at a bearing of 080° from the station. An 80-meter by 30-meter island is located offshore, approximately 800 meters, at a bearing of 060°, from the station.

ACCESS: In dry weather a regular two wheel drive vehicle may be used but the grassy slopes on the approaches to the station site may become very slippery when wet and there are numerous boggy patches after heavy rains and a four-wheel drive vehicle is necessary.

If four-wheel drive vehicles are unavailable or it turns wet after the station is set, Roger Moncrieff has a tractor which is available to tow the vehicle to and from the station site. The tractor may also be required to tow even a four-wheel drive vehicle if it is heavily laden in extreme wet conditions.

STATION: POINT SORELL (ST 517) (continued)

From Devonport, drive on the Bass Highway towards Launceston for 2 kilometers past the East Devonport turnoff, and turn left at the Exeter/Port Sorell turnoff (B19) near the top of the rise. Follow this road towards Port Sorell (The Exeter road turns off to the right) for approximately 12 kilometers to a road intersection, located approximately 2 kilometers before entering Port Sorell. A wooden sign showing "Hawley Caravan Park" is on the left side of this intersection. Turn left at this intersection, and follow the road to Hawley Beach. Turn left at a "T" junction, located 50 meters before the Hawley Beach Store and Post Office. Just after making this left turn, a prominent sign to the right reads "Heavy Vehicles Only" (see Sketch). Follow this sealed road to its end at a "T" junction with a chlorine station facing you on the other side of the road. Turn left at this junction. A right turn takes you on a foreshore track. Follow this road (it turns to gravel half-way along) for approximately 700 meters (passing a picnic spot and toilets on the right) to a white wooden gate. Immediately in front of the gate, the road veers to the right. A turn to the left is marked "LMC Private Road". Take this turn to the left (it is 3 kilometers to the station from this point). Follow the road for approximately 100 meters and turn to the right. Straight ahead at this point is the resident of Mr. Roger Moncrieff, the son of the station site land owner. Drive for approximately 300 meters to a locked gate. At this gate, a track leads to the right to the resident of Mr. Don Moncrieff, the station site land owner, located approximately 100 meters from this gate. Obtain a key for this gate, or if opened, follow the road straight ahead to double gates, near the council sewerage pond, which are usually opened. The station marker will be visible from the double gates at a distance of approximately 2 kilometers. There is no defined

STATION: POINT SORELL (ST 517) (continued)

road from this point to the marker. Seek the land owner's advice or follow the tracks shown on the Sketch.

MARKER: The station marker, located on a hill, consists of a brass mushroom S.P.M., which is not numbered. The marker is embedded in concrete at ground level, with stones surrounding the marker.

The Maxiran tower was erected 1 meter, at a bearing of 270° Magnetic, from the station marker. This offset was necessary due to a 3-meter high quadropod that is erected over the marker. The quadropod is painted white, and has a black disc, approximately 60cm in diameter, attached to the top. Rocks covers each leg of the quadropod. Coordinates are listed in this description for the station marker and the Maxiran tower offset.

GENERAL: Labor can be provided by Mr. Roger Moncrieff. Labor can also be obtained in Devonport, approximately 22 kilometers from the station, or Latrobe, approximately 19 kilometers away. Fuel, oil, camping equipment and supplies are available at Devonport. Bulk fuel can be obtained from several depots located in Devonport. There is a service station in Port Sorrel, and a reasonable selection of goods can be obtained at the Hawley Beach Store and Post Office. Drinking water can be obtained from the station property land owner or his son.

A caravan with heater is essential at this site. The winter months, June to September, can be very wet, windy and cold. Temperatures can range from several degrees below zero to a daily maximum of as low as 4°C. Extra rope and star stakes should be taken for tying down during this period.

STATION: POINT SORELL (ST 517) (continued)

Penguins are very frequent visitors to the station site, particularly at night.

Caravans are available from Devon Coastavans, 116 Nicholls St., Devonport; telephone Ian Finch, 004-242829. Mr. Finch will deliver and pick up the vans to the station sites for a nominal fee (In August 1984, Point Sorell was A\$20.00, Doctors Rocks was A\$40.00. This fee includes delivery and pickup.) The vans are well equipped, gas, approximately 60-litre water tank (full on delivery), crockery, cutlery, fridge, etc. Mattresses are supplied, but there are no blankets, pillows, or sheets. The vans can be locked. The caravans must be left clean when vacating.

Vehicles may be obtained from Hertz, Oldaker Street, Devonport (telephone 004-241013). Hertz representatives have been very helpful and can assist regarding fuel supplies from Mobil Devonport if required.

Four-wheel drive vehicles may also be obtained from Regent Filling Station, 57 Marine Terrace, South Burnie. This is the Shell Service Station past the paper mill on the Bass Highway, as you approach Burnie from Devonport. The contact at this place is Mr. Wayne Cross. The service station telephone number is 004-312131.

A 20-foot tower was erected at this site, the minimum height required to clear surrounding obstructions. Clear vista is from 200° (through north) to 060°. Star stakes were used to secure the tower.

Permission to occupy the station must be obtained from the land owner, Mr. Don C. Moncrieff, Hawley Beach via Latrobe 7307, Tasmania. His phone number is 004-286193. Mr.

STATION: POINT SORELL (ST 517) (continued)

Moncrieff was paid a daily rental fee of A\$25.00 for the use of his land. If Mr. Don Moncrieff is absent, permission may be obtained from his son, Roger Moncrieff; telephone 004-286587. Roger lives approximately 1 kilometer from Don Moncrieff. See Sketch.

SKETCH: See next page.

Coordinates of the station marker were obtained from a Lands Department, Tasmania, Division of National Mapping summary sheet.

UTM PROJECTION, AUSTRALIAN NATIONAL SPHEROID
ZONE 55, C.M. 147° EAST - - A.G.D.

MARKER COORDINATES

Lat.	41°07'24"69 S	N = 5,447,407 meters
Long.	146°31'41"88 E	E = 460,403 meters
Elev.	30 meters	

The Syledis tower was erected adjacent to the marker.

The ARGO tower was erected 34.4 meters, at a bearing of 005° Magnetic, from the station marker.

ARGO TOWER OFFSET COORDINATES

Lat.	41°07'23"63 S	N = 5,447,440 meters
Long.	146°31'42"34 E	E = 460,414 meters
Elev.	30 meters	

5 cm

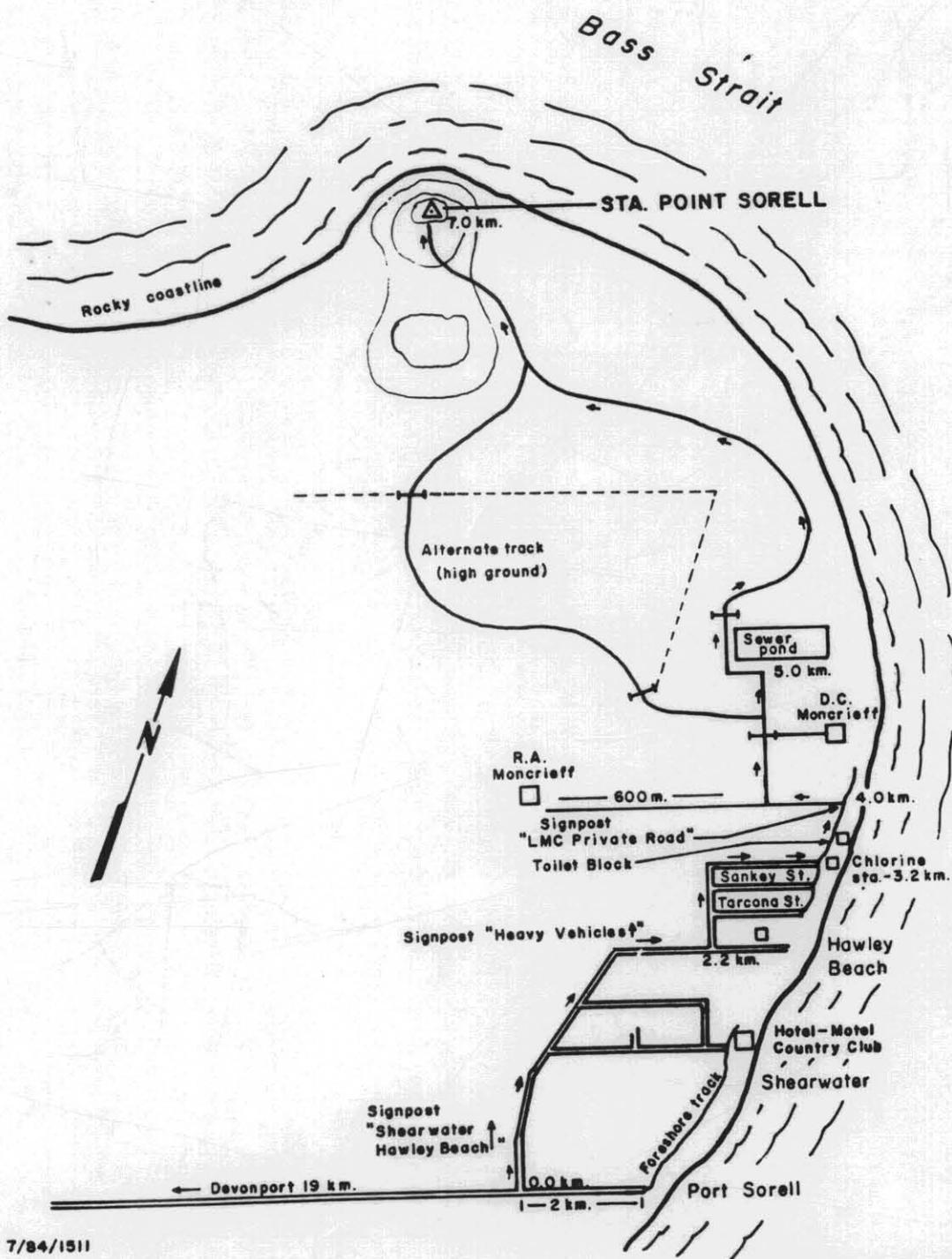
149231

STA. POINT SORELL (ST 517) — AUSTRALIA

LAT. 41°07'24".69 S
 LONG. 146°31'41".88 E (MARKER COORDS.)
 ELEV. 30 meters

N 5,447,407 meters
 E 460,403 meters

UTM PROJ. — AUST. NAT. SPHEROID
 ZONE 55, C.M.147°E — A.G.D.



7/84/1511

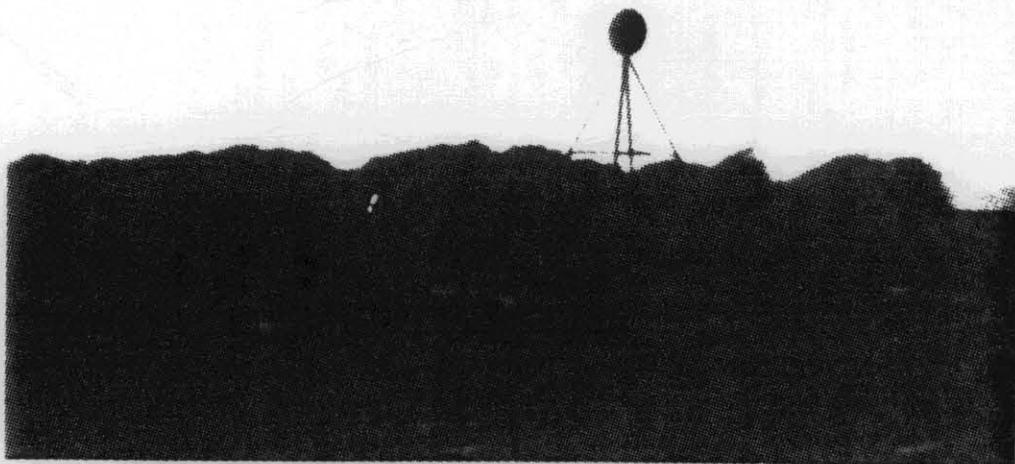
OFFSHORE NAVIGATION (AUSTRALIA) PTY. LTD.

149232

STATION POINT SORELL



SIGN AT TURNOFF TO LEFT ENTERING ROAD TO DON MONCRIEFF PROPERTY. POINT IS ABOUT 3 KILOMETERS FROM STATION.



QUADROPOD OVER MARKER

STATION POINT SORELL

SIGN AT TURNOFF FROM PORT SORELL ROAD. TURN LEFT TO REACH STATION, A DISTANCE OF APPROXIMATELY 7 KILOMETERS FROM THIS POINT.

STATION: THE NUT (ST 674)

LOCATED: This station is located on a hill overlooking the town of Stanley, on the north coast of Tasmania, Australia. The hill is named "The Nut", and its summit is flat to slightly rolling. This hill, as well as the historical town of Stanley, are very popular tourist attractions. The vegetation on this hill consists of grass and low native bushes. There is a tourist walk track around the perimeter of the top which is some 4 kilometers around. There are many mutton bird burrows along this track. The surrounding district, Circular Head, derives its name from the distinctive shaped "Nut" which juts into Bass Strait. The station marker is on the northern side of The Nut.

ACCESS: Access to the town of Stanley can be made from Burnie or Devonport. It must be noted that minor towns may not appear on road signs. When leaving Devonport, read "Smithton" for "Stanley". At times, only route numbers appear in lieu of town names. It is approximately 120 kilometers from Devonport to Stanley.

Drive north on the Bass Highway to the intersection with the Stanley Highway (B21). This intersection is 64 kilometers past Wynyard. Turn onto Stanley Highway and drive 7 kilometers to the town of Stanley. The Nut will be easily seen to the northeast of Stanley, right beside the town. The road to the hill is signposted "Nut". A vehicle can be taken as far as the car park on the slopes of The Nut. A zig-zag 1-meter wide cement track with center hand rail leads from the car park to the summit. Take the left hand track at the fork on top of the hill. The station marker is from 400 to 500 meters along this track. It is a walk of about 20 to 30 minutes (unburdened) from the base of the hill to the station.

STATION: THE NUT (ST 674) (continued)

MARKER: The station marker consists of a brass mushroom S.P.M., which is not numbered. The marker is embedded in concrete which is at ground level, with a 1.26-meter high stone cairn built over it.

A 3.86-meter high quadropod has been erected over the marker. The quadropod has a 60cm diameter black disc attached to its top.

The Maxiran tower was erected 2.76 meters, at a bearing of 217° Magnetic from the marker. A star stake, that was left on site with the approval of the local ranger, marks the position of the Maxiran tower. Coordinates are listed in this description for the brass mushroom marker, and the Maxiran tower offset.

GENERAL: Food, fuel, oil, and water is available in Stanley. Fuel and oil can be obtained from W.T. House, Inc. BP Service Station. Mr. House can also assist in obtaining labor. Labor may also be obtained at the Union Hotel. Emergency water may be obtained from a tank near the old telecom hut, which is located alongside the lookout, approximately 700 meters from the station site.

Although limited camping equipment is available in Stanley, this should be purchased in larger centers, such as Burnie or Devonport.

Hotel accommodations are available at the Union Hotel in Stanley. The nearest airport to this station is in Smithton, approximately 20 miles away.

The station site is completely exposed to weather. This should be taken into consideration when erecting the station. Ample bedding, tent pegs, and spare rope should be taken. During the winter months (June through September), the

STATION: THE NUT (ST 674) (continued)

site is very cold and damp. A heater is essential as temperatures frequently drops below zero.

A 20-foot tower was erected at this site. Star stakes were sufficient to secure the tower. Clear vista with a 20-foot tower is from 300° (through north) to 090°.

The station site is on land owned by the National Parks and Wildlife Service. Permission to occupy the site was obtained from Mr. P. Murrell, Director, in Sandy Bay, Tasmania 7005. His office address in Sandy Bay is Magnet Court or P.O. Box 210, Sandy Bay, Tasmania 7005. Telegrams, addressed "TASPAWS", will be received by the director. No rent was paid for the use of this property. The local inspector is Mr. Rex Gatenby, Launceston telephone 003-415306.

The local ranger in charge is Mr. Brian Carson, telephone 004-581320. His resident is located near the rectory and old school in the old section of Stanley. Mr. Carson was very helpful in all matters. He can arrange for storage of empty equipment boxes at the car park house.

The site is to be kept clean and tidy during occupation. All rubbish is to be removed at the conclusion of a survey.

It will take two or three days with 4 or 5 laborers to carry the equipment to the station site. An average round-trip from the car park to the station site, walking up with a load and returning unburdened will take from 60 to 90 minutes, depending on the load. The cement track to the summit is very difficult to negotiate with heavy objects with the center hand rail. When possible, a helicopter should be use to mobilize and demobilize this station. The Stanley Football

STATION: THE NUT (ST 674) (continued)

Ground is used as a lift off and put-down point for the helicopter. Permission can be obtained to use the ground from the Football Club president, Mr. Graham Trenelly, Union Hotel, Stanley; telephone 004-581161. It is approximately a 5 minute flight from the football ground to the station site. It is approximately 50 kilometers from the Wynyard Airport to The Nut.

SKETCH: See next page.

Coordinates of the station marker were obtained from a Lands Department, Tasmania, Division of National Mapping summary sheet.

UTM PROJECTION, AUSTRALIAN NATIONAL SPHEROID
ZONE 55, C.M. 147° EAST - - A.G.D.

MARKER COORDINATES

Lat. 40°45'50"23 S	N = 5,486,046 meters
Long. 145°18'13"45 E	E = 356,830 meters
Elev. 143 meters	

The ARGO tower was erected 38 meters, at a bearing of 270° Magnetic, from the station marker.

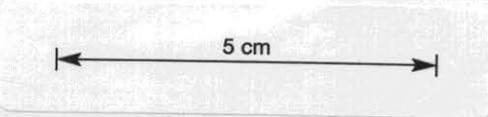
ARGO TOWER OFFSET COORDINATES

Lat. 40°45'49"97 S	N = 5,486,053 meters
Long. 145°18'11"87 E	E = 356,793 meters
Elev. 143 meters	

The Syledis tower was erected 3.6 meters, at a bearing of 226° Magnetic, from the station marker.

SYLEDIS TOWER OFFSET COORDINATES

Lat. 40°45'50"29 S	N = 5,486,044 meters
Long. 145°18'13"32 E	E = 356,827 meters
Elev. 143 meters	

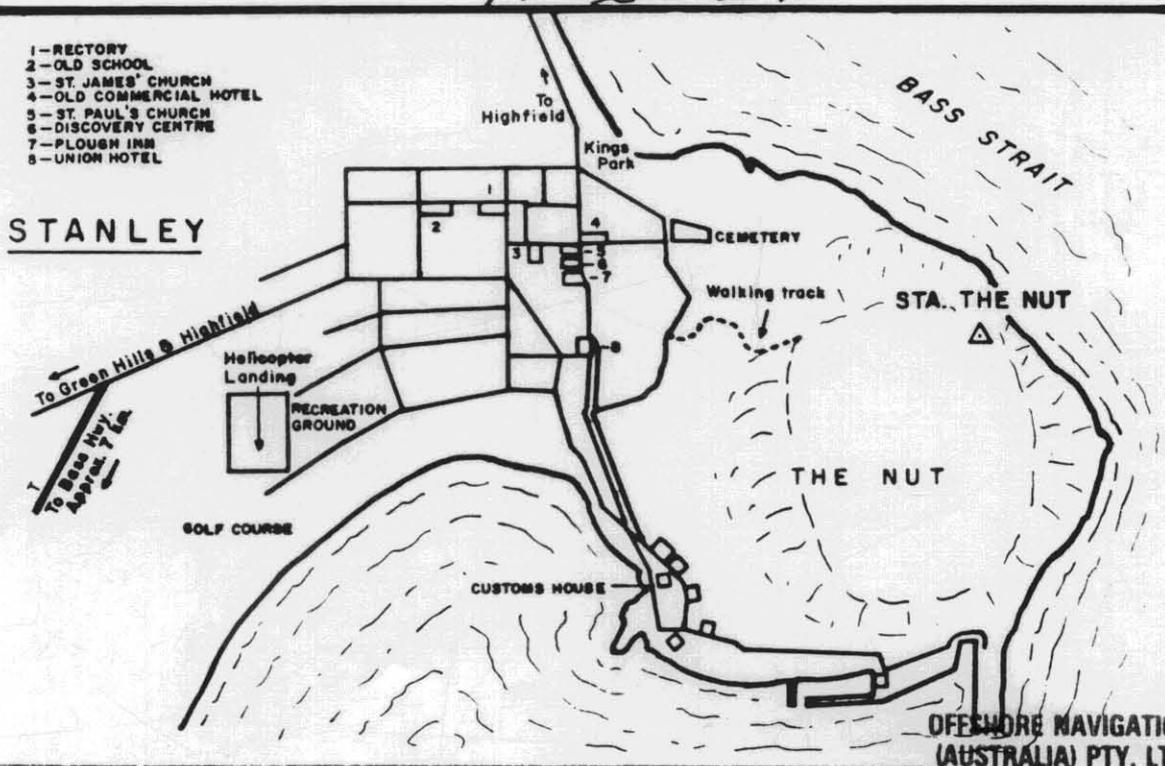
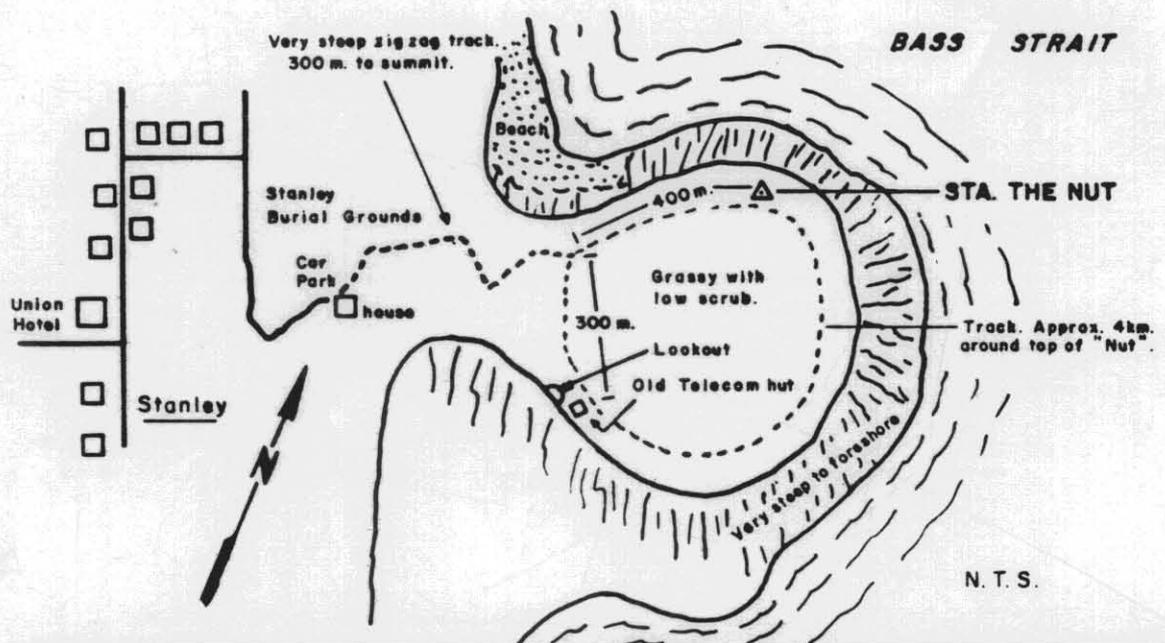


149238

STA. THE NUT (ST 674) — AUSTRALIA

LAT. 40°45'50".23 S (MARKER COORDS.) N 5,486,046 meters
 LONG. 145°18'13".45 E E 356,830 meters
 ELEV. 143 meters

UTM PROJ. — AUST. NAT. SPHEROID
 ZONE 55, C. M. 147° E — A. G. D.



149239

STATION THE NUT



FROM TURNOFF AT STANLEY BURIAL GROUND

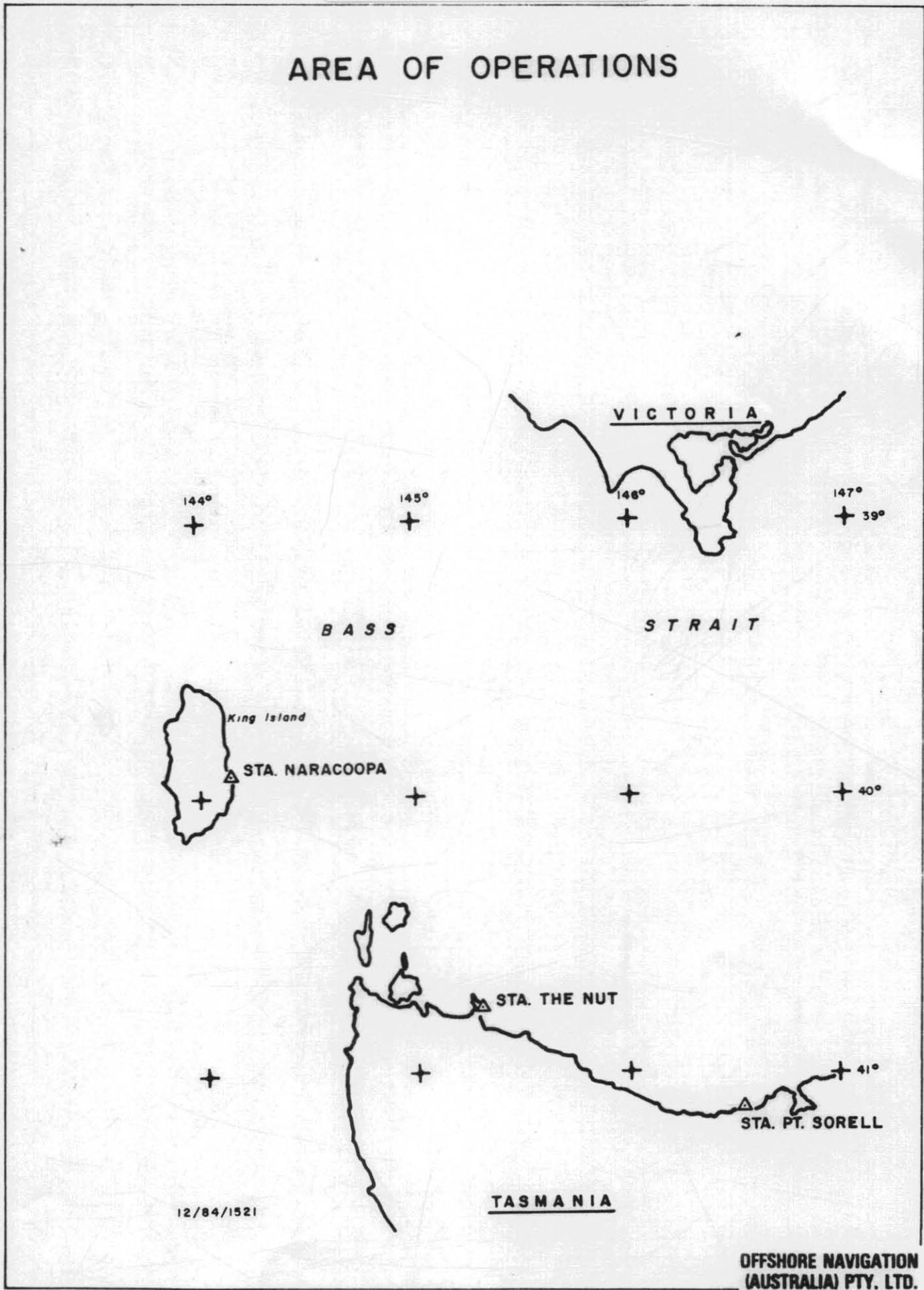


FROM THE OUTSKIRTS OF STANLEY. NOTE ZIG-ZAG TRACK UP MOUNTAIN. THIS IS THE ONLY ACCESS ROUTE BY FOOT.

5 cm

149240

AREA OF OPERATIONS



12/84/1521

OFFSHORE NAVIGATION
(AUSTRALIA) PTY. LTD.

THE ARGO RADIOPOSITIONING SYSTEM

ARGO is the acronym for Cubic Corporation's Automatic Ranging Grid Overlay navigation system. It operates on the principle that a medium frequency (MF) radio signal traveling along the earth's surface in the "ground wave" mode experiences a time (and hence phase) delay proportional to the distance travelled. ARGO utilizes a time multiplexed (RF) pulse to service up to seven mobile stations interrogating up to four fixed responders.

ARGO has multi-user capability in a Range-Range Mode for 12 mobile units with two base responders. ARGO's capability also allows unlimited user capacity in the Hyperbolic Mode of operation, with a reduced number of Range-Range users.

An ARGO fixed responder installation typically consists of a Range Processor Unit (RPU), Antenna Loading Unit (ALU), Power Source, and appropriate antenna and interconnecting cables. Two responder locations are required to determine the position of the mobile station. The Range Processor Unit receives an interrogation burst, processes it, and transmits a reply burst with the same carrier phase as that received from the mobile interrogator. In addition, the

THE ARGO RADIOPOSITIONING SYSTEM (continued)

station designated as Master Station generates system timing bursts which are transmitted to the other fixed land stations and all mobile interrogators to establish and maintain a common time synchronization.

The ARGO mobile interrogator installation typically consists of a Range Processor Unit, Antenna Loading Unit, Control Display Unit (CDU), Strip Chart Recorders, Power Source, and appropriate antenna and interconnecting cables.

The mobile Range Processor Unit processes the transmitted and received signals, and measures the phase delays. The Control Display Unit displays the range distance in units and fractions of lanes. The distance from each fixed station location to the mobile interrogator location is determined by an accumulation of lane counts and computing positions within lanes.

The mobile equipment can be interfaced with the proper equipment to simultaneously display, print, record and plot ranges. Since the ARGO system operates from ground waves, it will measure beyond the optical horizon. Skywave and

THE ARGO RADIOPOSITIONING SYSTEM (continued)

re-radiation effects are minimized by special filtering techniques.

Optimum system performance depends to a very large extent upon proper selection of base station sites on shore, and proper mobile antenna installation. For maximum range capability, the land stations must be located immediately adjacent to the coastline and on ground of good conductivity. Poor ground conductivity and overland transmission path will each reduce the maximum obtainable range. In addition, overland transmission can adversely effect the accuracy of the system.

RANGE-RANGE MODE OPERATION

This mode is a multi-user, multi-range circular geometry navigation and positioning system that uses active mobile interrogator stations and two to four active responder stations at known fixed locations. The system determines the distance from each fixed location to the mobile interrogator location by accumulating lane counts and computing positions within lanes. The lane width is related to the

THE ARGO RADIOPOSITIONING SYSTEM (continued)

frequency of the carrier burst transmitted between stations. It is equivalent to half the carrier wavelength. Therefore, since the ARGO operating frequency range is 1600 to 2000 KHz, the lane width is approximately 75 to 94 meters. The exact lane width for a particular operating frequency and operating area is determined by dividing (Propagation velocity in meters/second) by (2 X Operating frequency in Hertz). The resulting answer would be the lane width in meters. (NOTE: Propagation velocity is dependent on the characteristics of the operating area).

Position within a lane is determined by examining the phase relationship between a burst of RF energy transmitted from the interrogator and re-transmitted by a fixed responder station. Only one frequency is used for all the ranging functions within a single network.

The ARGO system also incorporates a lane identification feature. This permits verification of the proper lane count provided that the position of the mobile station is known within plus or minus five (5) lanes. The determination of the 10-lane sector can be accomplished by means

THE ARGO RADIOPOSITIONING SYSTEM (continued)

of a satellite receiver, dead reckoning or other means. The lane identification feature uses a second radio frequency separated from the primary ranging frequency by approximately ten (10) percent. The reliability of the lane identification feature is dependent, to a large extent, on such factors as man-made noise, propagation errors, and installation problems, such as guy wires, masts, powerlines, etc.

For each mobile station, an interrogation burst is transmitted to each responder every 2 seconds. Each 2-second period is initiated by the Master station (which is normally one of the fixed stations, but can be one of the mobile stations) and is divided into time slots. The first time slot is 120 milliseconds long, and is used for a timing burst from the Master station to synchronize all interrogators and responders. The remainder of the 2-second time frame is divided into time slots, the number and duration of which depends upon the number of base stations in the system. Each time slot is further divided into a 56 millisecond segment for the mobile station interrogation and two or more 44 millisecond segments, one for each fixed base

THE ARGO RADIOPOSITIONING SYSTEM (continued)

station in the system. The final time slot in a 2-second frame is used for the lane identification feature. Only one mobile station is assigned to each of the available time slots.

Up to twelve mobile stations can operate simultaneously from two fixed base stations. If the system includes three base stations, up to nine mobile stations can be used. Use of four base stations in a system reduces the number of permissible mobile stations to seven. All stations in a system must be set for the same system configuration; that is, set for two, three or four range operation.

HYPERBOLIC MODE OPERATION

The following equipment is required to convert the ARGOS System from the Range-Range Mode to the Hyperbolic Mode:

MOBILE STATION -	Hyperbolic Firmware	(V2.3 CDU)
		(V2.0B RPU)
	Antenna Coupler	
	Receiver/Coupler Cable	

THE ARGO RADIOPOSITIONING SYSTEM (continued)

BASE STATION - The Master (Center) station must have Firmware V2.OB installed in the RPU.

NOTE: If a second hyperbolic Center Station is to be utilized, it must also contain Firmware V2.OB (PROMS).

A marine operation may utilize either the Range-Range or Hyperbolic Mode of Operation. An aircraft operation preferentially utilizes the Hyperbolic Mode, as the basic hardware design of the ARGO System allows increased data rates for high speed operations.

In the Hyperbolic Mode, the ARGO mobile station does not initiate station interrogations. A fixed station (the "Master") generates the interrogation pulse and the other fixed stations (Slave) reply to the Master interrogation pulse. The mobile station receives pulses from the Master (Center) Station and each Slave in turn.

A normal 2-second timing/ranging sequence is illustrated in Figure 1. The Master/Center initiates a timing pulse

THE ARGO RADIOPOSITIONING SYSTEM (continued)

used for system timing, as with the Range-Range Mode. The Master/Center Station then interrogates the Slave Stations in time slots 1, 3, 5, and 7. (The Slave stations reply to the Master interrogations in these time slots). The mobile station measures the phase of the Master/Slave pulses, and the hyperbolic Line of Positions (LOP's) are displayed on the Range Displays. The formula for determining a LOP is shown in Figure 3.

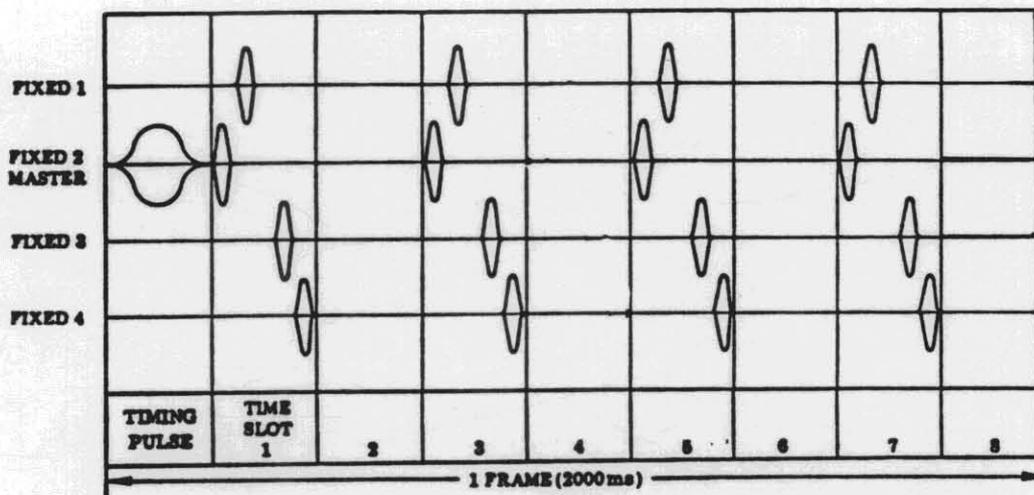
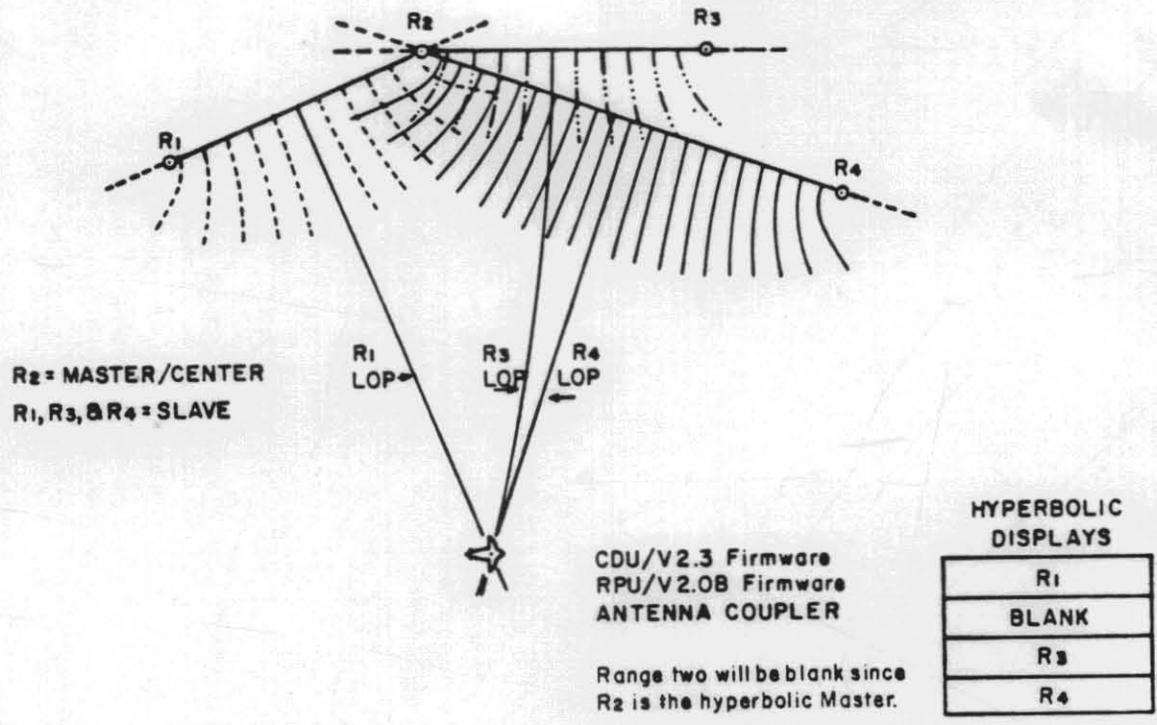


FIGURE 1

ILLUSTRATION OF MASTER INTERROGATIONS & SLAVE REPLYs

TYPICAL HYPERBOLIC NET



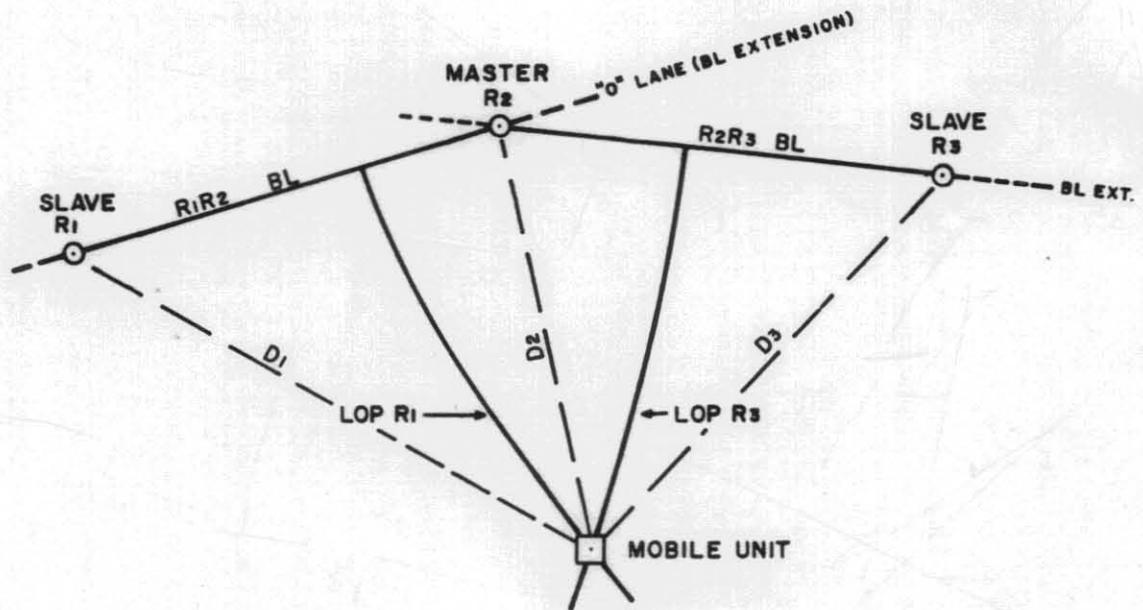
R₁, R₃, & R₄ can have standard V1.6B or V1.8 Firmware and operate as a hyperbolic Slave. These stations can also have V2.0B Firmware installed as long as the station is operated in the Slave or Relay Mode.

FIGURE 2

THE ARGO RADIOPOSITIONING SYSTEM (continued)

In a Hyperbolic Network, there are a fixed number of ARGO "Lanes" (Wavelengths) from the Master/Center Station to the Slave Stations. The number of lanes on a given baseline (that imaginary line which is the shortest distance between the Master/Center Station and Slave Station) can be determined by the formula: Twice the baseline length divided by the wavelength. "Zero" lane is located at the Master/Center Station, with the maximum number of lanes located at the Slave Station. Therefore, the baseline extension at the Master/Center Station is "Zero" lanes. This feature is used to conveniently calibrate the mobile unit. The mobile unit merely needs to circle the Master/Center Station, and adjust when the mobile display reaches its lowest reading. This indication will be at a point where the Master/Center Station is directly between the mobile unit and the Slave Station being calibrated. In addition, a check of the accuracy of the ARGO system can be accomplished by crossing the baseline extension at the Slave Station, and comparing this reading with the computed baseline length.

FIGURE 3



$$\text{HYPERBOLA } R_1 \text{ (Lanes)} = \frac{BL R_1 R_2 + D_2 - D_1}{\text{WAVELENGTH}}$$

Where: D_2 = Distance to Master
 D_1 = Distance to Slave R_1

$$\text{HYPERBOLA } R_3 \text{ (Lanes)} = \frac{BL R_2 R_3 + D_2 - D_3}{\text{WAVELENGTH}}$$

Where: D_3 = Distance to Slave R_3

$$\text{NUMBER OF LANES ON BASELINE (BL)} = \frac{2BL}{\text{WAVELENGTH}}$$

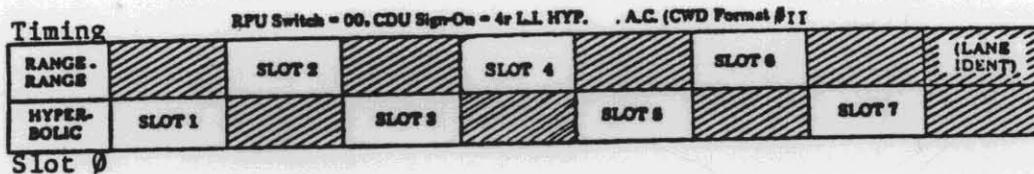
9/80

5 cm

THE ARGO RADIOPOSITIONING SYSTEM (continued)

The ARGO hyperbolic software allows for an unlimited number of hyperbolic users, and up to three range-range users when a four base station network is utilized, as indicated in Figure 4.

FIGURE 4



SW7	SW8	
7	8	
ON	ON	4R L.I. HYP. A.C.
OFF	ON	4R L.I. HYP. L.I.
ON	OFF	3R L.I. HYP. A.C.
OFF	OFF	3R L.I. HYP. L.I.

If Hyperbolic Lane Identification is desired, one of the Range-Range time slots must be reserved for this feature. Time Slot 4 is used for Hyperbolic Lane Identification (See Figure 4 for the Input/Output Ports Board Switch setting to activate this feature). Hyperbolic Lane Identification is not used in aircraft operation, since the high speed operation reduces the reliability of this feature greatly.

THE ARGO RADIOPOSITIONING SYSTEM (continued)

A Range Processing Unit with 2.OB software installed will operate as a normal Range-Range base station, as long as the Timing Switch is set to "Slave" or "Relay". Setting the Timing Switch to "Master" makes the station a Hyperbolic Master/Center Station.

149254

APPENDIX A
DAILY OPERATION LOGS

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
--	-------------------------------	------------------------------------	--------------------------------	--	--	--

Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 #036
 Mobile Peripheral Serial Nos. PDM: 013 #027 AWM-16: #009 ADM: 09A #081

From	To	Operations Log
0700		OPERATOR ON BOARD - CHECK SYSTEM
0800		NET ON IN OPERATE
0924		DEPARTED DEVONPORT.
1230	1325	SYLEDIS SORELL - NUT BASE LINES
1600	1715	SYLEDIS SORELL - NARACOOPA BASE LINES
1900	1930	TAKING FIXES WITH SYLEDIS TO CALIBRATE ARGO
2230		A RANGES COMPUTED AND PUT IN SYSTEM Pt SORELL = .15 THE NUT = .06 NARACOOPA = .02 3 WAY FIXES ON ARGO ARG GOOD
2400		G.S.I. WORKING ON GUN STRINGS

continue on back

Argo last calibrated: ΔR 1. 0.15 2. 0.06 3. 0.02 4. _____ Time Slot 01
 Place BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	Radio	Clients Time:	Commenced	Secured
1. <u>Pt. SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u> RPU # <u>034</u>	<u>1620 KHZ LI. 1773 KHZ</u>	<u>7840 KHZ</u>		
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u> " " <u>009</u>			<u>16h 0m</u>	<u>0800</u>
3. <u>NARACOOPA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u> " " <u>004</u>				<u>2400</u>
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____ " "				

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMIOCO Date: Nov 17th 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/>	No <input type="checkbox"/>
					Yes <input type="checkbox"/>	No <input type="checkbox"/>

Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 # 036

Mobile Peripheral Serial Nos. PDM-01B # 027 AWM-16 # 009 ADM-09A # 081

From	To	Operations Log
0001	0130	G.S.I. WORKING ON GUN STRINGS
0130	2400	G.S.I. WORKING ON CABLE
1100		NARACOOPA RPU Now # 046
0700		PT SORELL RPU Now # 006
2400		G.S.I. WORKING ON CABLE
continue on back		

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Base BASS BASIN Date Nov 18TH 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	ALU #	RPU #	Clients Time:	Commenced	Secured
1. <u>PT SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>1690 KHZ LI. 1773 KHZ</u>	<u>031</u>	<u>034</u>			
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<u>033</u>	<u>009</u>	<u>24h</u>	<u>0001</u>	<u>2400</u>
3. <u>NARA COOBA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<u>040</u>	<u>004</u>			
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						

First Operator: A. HOGGART Boat: E. M^C DERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / ANOCO Date: Nov 18TH 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
--	-------------------------------	------------------------------------	--------------------------------	--	--	--

Clients operating time lost by Argo NIL

Mobile Serial Nos.	ALU: 069	RPU: 041	CDU: 008	SSB: CTU-16 #036
Mobile Peripheral Serial Nos.	PDM-01B #027	AJM-16 #009	ADM-09A #081	

From	To	Operations Log
201	0400	G.S.I. WORKING ON CABLE
20	0610	G.S.I. WORKING ON GUN STRINGS
230		ABORTED LINE TNK 4-18 ON RUN IN DUE TO AIRGUN ERRORS
220	1000	G.S.I. WORKING ON GUN STRINGS
218	1017	FSP1 - LSP 45 LINE TNK 4-18 DIR N.E. LINE TERMINATED
230	1300	G.S.I. WORKING ON GUN STRINGS
210	1915	G.S.I. WORKING ON CABLE
232	2224	FSP1 - LSP 575 LINE TNK 4-18A DIR N.E.
245		LINE TNK 4-35 TERMINATED ON RUN IN - EXCESSIVE CABLE NOISE
	2400	LINE CHANGE

continue on back

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Location BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	Clients Time:	Commenced	Secured
PT. SORELL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u>	RPU # <u>006</u>	<u>1620 KHZ</u>			
THE NUT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u>	" " <u>009</u>	<u>LI 1773 KHZ</u>	<u>24h</u>	<u>0001</u>	<u>2400</u>
NARACOOPA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u>	" " <u>046</u>	<u>7840 KHZ</u>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" "	" "				

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: Nov 19th 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error	Yes <input type="checkbox"/> No <input type="checkbox"/>
				Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>

Clients operating time lost by Argo NIL

Mobile Serial Nos ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 # C36
 Mobile Peripheral Serial Nos. PDM-01B # 027 AWM-16 # 009 ADM-09A # 081

From To Operations Log

201		LINE CHANGE
20		ABORTED LINE TNK4-14 ON RUN IN - CABLE NOISE
234	0506	FSP 1 - LSP 538 LINE TNK4-37 DIR N.E. - TERMINATED
		INSTRUMENT TROUBLES
220		ABORTED LINE TNK4-35 ON RUN IN - CABLE NOISE
250		ABORTED LINE TNK4-37A ON RUN IN - CABLE NOISE
30		GUNS ON BOARD
45	1215	BRING IN CABLE
15	2030	EN ROUTE TO DEVONPORT
30	2305	ALONGSIDE IN DEVONPORT
05		LEFT PORT EN ROUTE FOR PROSPECT
100		EN ROUTE FOR PROSPECT
continue on back		

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot C1
 Base BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	Clients Time:	Commenced	Secured
PT SORELL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u>	RPU # <u>006</u>	<u>7840</u> KHZ			
THE NUT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u>	" " <u>009</u>		<u>24h</u>	<u>0001</u>	<u>2400</u>
NARACOOPA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u>	" " <u>046</u>				
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" "	" "				

First Operator: A. HOGGART Boat: E. M'DERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: Nov 20th 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/>	No <input type="checkbox"/>
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Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 # 036

Mobile Peripheral Serial Nos. PDM: 013 #027 AWM: 16 #009 AOM: 09A #081

From	To	Operations Log
0001	0358	SP 872 - LSP 2176 LINE TNK 4-48 DIR S.E.
0550		ABORTED TNK 6-46 ON RUN IN INSTRUMENT PROBLEMS
0900	1042	FSP 1 - LSP 529 LINE TNK 4-44 DIR N.W. TERMINATE - CABLE
1125	1300	G.S.I. WORKING ON CABLE
1406	1659	FSP 1 - LSP 941 LINE TNK 4-44A DIR S.E.
1847	2155	FSP 1 - LSP 943 LINE TNK 4-26 DIR NW TERMINATE WEATHER
2335		TERMINATE TNK 4-77 ON RUN IN - WEATHER
2400		LINE CHANGE
continue on back		

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01

Place BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	Radio	Clients Time	Commenced	Secured
1. <u>PT. SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u> RPU # <u>006</u>	<u>1620 KHZ I. 1773 KHZ</u>	<u>24h</u>	<u>0001</u>	<u>2400</u>
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u> " " <u>009</u>				
3. <u>NARACOOPA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u> " " <u>046</u>				
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____ " "				

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521

Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA

Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: Nov 23rd 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details) Boat Base Stn. Other Lane Count Error Does Error Effect Survey Yes No Yes No

Clients operating time lost by Argo NIL

File Serial Nos ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 # 036
 Mobile Peripheral Serial Nos. PDM-013 # 027 AWM-16 # 009 AOM-09A # 081

From To Operations Log

01		LINE CHANGE	
4	0408	FSP1 - LSP 953 LINE TNK4-36 DIR. S.E.	
39	0836	FSP1 - LSP 662 LINE TNK4-103 DIR. N.E.	
44	1134	FSP1 - LSP 633 LINE TNK4-101 DIR. S.W.	
45	1440	FSP1 - LSP 703 LINE TNK4-50 DIR. N.W.	
06	1835	FSP1 - LSP 822 LINE TNK4-71 DIR. N.E.	
17	2254	FSP1 - LSP 814 LINE TNK4-14 DIR. N.W.	
	2400	LINE CHANGE	
continue on back			

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Base BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	1620 KHZ LI.	1773 KHZ	Radio	7840 KHZ	Clients Time:	Commenced	Secured
Pt SORELL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU #	<u>031</u>	RPU #	<u>006</u>				
THE NUT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" "	<u>033</u>	" "	<u>009</u>		<u>244</u>	<u>0001</u>	<u>2400</u>
NARACOOPA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" "	<u>040</u>	" "	<u>046</u>				
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" "		" "					

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: Nov 26th 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error	Yes <input type="checkbox"/> No <input type="checkbox"/>
				Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>

Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 # 036

Mobile Peripheral Serial Nos. PDM-01B # 027 AWM-16 # 009 AOM-09A # 081

From To Operations Log

01	0050	FSP 1192 - LSP 1456	LING TNK4-10	DIR N.W.
53	0435	FSP 1 - LSP 603	LING TNK4-29	DIR N.E.
638	0648	FSP 1 - LSP 57	LING TNK4-2	DIR N.W. TERMINATE-NOISE
30			LING TNK4-31	ABORTED ON RUN IN - NOISE
52	1151	FSP 1 - LSP 323	LING TNK4-2A	DIR S.E.
39	1505	FSP 1 - LSP 473	LING TNK4-6	DIR N.W.
725	1916	FSP 1 - LSP 613	LING TNK4-31	DIR S.W.
81	2230	FSP 1 - LSP 764	LING TNK4-16	DIR S.E.
	2400	ON LING CHANGE		

continue on back

Argo last calibrated: ΔR 1. .15 2. .063 .02 4. _____ Time Slot 01

Base BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	Clients Time:	Commenced	Secured
Pt. SORELL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u>	RPU # <u>006</u>	<u>1620 KHZ</u>			
THE NUT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u>	" " <u>009</u>	<u>1773 KHZ</u>	<u>24h</u>	<u>0001</u>	<u>2400</u>
NARACOOPA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u>	" " <u>046</u>	<u>7840 KHZ</u>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____	" " _____				

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521

Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA

Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: Nov 28th 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/>	No <input type="checkbox"/>
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Clients operating time lost by Argo NIL

Mobile Serial Nos.	ALU: 069	RPU: 041	CDU: 008	SSB: CTU-16 #036
Mobile Peripheral Serial Nos.	PDM-01B #027		AWM-16 #009	AOM-09A #081

From	To	Operations Log
0001		ON LINE CHANGE
0017	0209	FSP1 - LSP 573 LINE TNK4-18 B DIR N.W.
0426	0746	FSP 3000 - LSP 4105 LINE TNK4-26A DIR S.E. - WEATHER
0845	1922	STEAMING TOWARDS SHELTER WITH CABLE OUT
1922	2026	BRINGING IN CABLE
2026	2218	EN ROUTE FOR DEVONPORT
2218	2304	ALONGSIDE IN DEVONPORT - DATA DROP
2304	2400	EN ROUTE FOR PROSPECT
continue on back		

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Place BASS BASIN Date Nov 17th 84 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	Clients Time:	Commenced	Secured	
1. <u>PT. SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u>	RPU # <u>006</u>	<u>1620 KHZ</u>	<u>LI. 1773 KHZ</u>	<u>Radio 7840 KHZ</u>		
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u>	" " <u>009</u>			<u>24h</u>	<u>0001</u>	<u>2400</u>
3. <u>NARACOOPA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u>	" " <u>046</u>					
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____	" " _____					

First Operator: <u>A. HOGGART</u>	Boat: <u>E. M^cDERMOTT II</u>	Party No: <u>1521</u>
Second Operator: _____	Area: <u>BASS BASIN</u>	Country: <u>AUSTRALIA</u>
Party Chief: <u>R. MOLLOY</u>	Client: <u>G.S.I./AMOCO</u>	Date: <u>Nov 29th 84</u>

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
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Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 008 SSB: CTU-16 #036

Mobile Peripheral Serial Nos. PDM-01B #027 AWM-16 #009 AOM-09A #081

From	To	Operations Log
0001		ON ROUTE FOR PROSPECT
0233	0244	BASING CROSSING SORGLL TO THE NUT
0244		SORGLL = 693.71 THE NUT = 502.23 ∴ B/L = 1195.94
0244	0630	EN ROUTE FOR PROSPECT
0630	1015	LAYING CABLE
1149	1230	FSP1 - LSP 221 LING TNK4-77 DIR NE. TERMINATED - INSTRUMENT
1500	1827	FSP1 - LSP 1123 LING TNK4-77A DIR N.E.
1941	2311	FSP1 - LSP 1125 LING TNK4-79 DIR S.W.
	2400	ON LINE CHANGE
continue on back		

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Place BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	Clients Time:	Commenced	Secured	
1. <u>PT. SORGLL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u>	RPU # <u>006</u>	<u>1620 KHz</u>	<u>LI. 1773 KHz</u>	<u>7840 KHz</u>		
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u>	" " <u>009</u>				<u>24h</u>	<u>0001 2400</u>
3. <u>NARA COOBA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u>	" " <u>046</u>					
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____	" " _____					

First Operator: A. HOGGART Boat: E. M^cDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: Nov 30th 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/>	No <input type="checkbox"/>
					Yes <input type="checkbox"/>	No <input type="checkbox"/>

Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: <u>069</u> RPU: <u>041</u> CDU: <u>014</u> SSB: <u>CTU-16 #036</u>
Mobile Peripheral Serial Nos. <u>PDM-01B #027</u> <u>AWM-16 #009</u> <u>ADM-09A #081</u>

From To Operations Log

0001		ON LINE CHANGE
0046	0141	FSP 1140 - LSP 1423 LINE TNK4-753 DIR N.E.
0400		ABORTED LINE TNK4-67 ON RUN IN - CABLE NOISE
0600	0740	FSP1 - LSP 543 LINE TNK4-38 DIR. N.W.
0921	1440	FSP1 - LSP 1764 LINE TNK4-40 DIR. N.W.
1722	1901	FSP1 - LSP 523 LINE TNK4-1 DIR S.W.
2043	2241	FSP1 - LSP 653 LINE TNK4-3 DIR N.E. TERMINATED - INSTS.
	2400	ON CIRCLE
continue on back		

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Place BASS BASIN Date Nov 17TH 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	ALU #	RPU #	Clients Time:	Commenced	Secured
1. <u>PT. SORREL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>1620 KHZ</u>	<u>LI. 1773 KHZ</u>	<u>Radio 7840 KHZ</u>	<u>031</u>	<u>006</u>			
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" "	" "	" "	<u>033</u>	<u>009</u>	<u>24h</u>	<u>0001</u>	<u>2400</u>
3. <u>NARACOOPA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" "	" "	" "	<u>040</u>	<u>046</u>			
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" "	" "	" "					

First Operator: A. HOGGART Boat: G. MCDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: DEC 6TH 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details) Boat Base Stn. Other Lane Count Error Does Error Effect Survey

Clients operating time lost

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 014 SSB:
 Mobile Peripheral Serial Nos. PDM-013 #027 AWM-16 #009 AD

From	To	Operations Log
2001		ON LINE CHANGE
2007	0129	FSP1 - LSP 443 LINE TNK4-49 DIR N.E.
2044	0429	FSP1 - LSP 523 LINE TNK4-53 DIR S.W.
2074	1437	FSP1 - LSP 2053 LINE TNK4-59 DIR N.E.
2055	1815	FSP1 - LSP 413 LINE TNK4-4A DIR N.W.
2011	2322	FSP1 - LSP 1015 LINE TNK4-57 DIR S.W.
	2400	ON LINE CHANGE

continue on back

Argo last calibrated: ΔR 1. 15 2. 06 3. 02 4. _____ Time
 Place BASS BASIN Date Nov 17th 84 1. _____ 2. _____ 3. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	ALU #	RPU #	Clients Time:	Comm
1. <u>PT. SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>1620 KHZ LI. 1773 KHZ R</u>	<u>031</u>	<u>006</u>		
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<u>033</u>	<u>009</u>	<u>24 h</u>	<u>OC</u>
3. <u>NARACOOPA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<u>040</u>	<u>046</u>		
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					

First Operator: A. HOGGART Boat: E. McDERMOTT II Pa
 Second Operator: _____ Area: BASS BASIN Cou
 Party Chief: R. MOLLOY Client: AMIGO Date

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error	Yes <input type="checkbox"/> No <input type="checkbox"/>
				Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>

Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 014 SSB: CTU-16 #036

Mobile Peripheral Serial Nos. POM-013 #027 AWM-16 #009 ADM-09A #081

From To Operations Log

0001		ON LINE CHANGE	
0114	0401	FSP1 - LSP 874	LINE TNK4-65 DIR S.W.
0526	0815	FSP1 - LSP 903	LINE TNK4-67 DIR N.E.
0952	1128	FSP1 - LSP 503	LINE TNK4-61 DIR S.W.
1350	1650	FSP1 - LSP 873	LINE TNK4-54 DIR N.W.
2052	2343	FSP1 - LSP 915	LINE TNK4-28 DIR N.W.
2400		ON LINE CHANGE	
continue on back			

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Place BASS BASIN Date NOV 17TH 84 1. _____ 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	LI	Radio	Client Time	Commenced	Secured	
1. <u>PT. SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u>	RPU # <u>006</u>	<u>1620 KHZ</u>	<u>LI. 1773 KHZ</u>	<u>Radio 7840 KHZ</u>		
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u>	" " <u>009</u>				<u>24h</u>	<u>0001</u>
3. <u>NARACOOSA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u>	" " <u>046</u>					
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____	" " _____					

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: DEC 15TH 84

OFFSHORE NAVIGATION, INC.

Argo Daily Operations Log

Breakdowns (show times and details)	Boat <input type="checkbox"/>	Base Stn. <input type="checkbox"/>	Other <input type="checkbox"/>	Lane Count Error Does Error Effect Survey	Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
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Clients operating time lost by Argo NIL

Mobile Serial Nos. ALU: 069 RPU: 041 CDU: 014 SSB: CU-16 # 036
 Mobile Peripheral Serial Nos. PDM-018 # 027 ANM-16 # 009 ADM-09A # 081

From To Operations Log

001	0100	BRINGING IN CABLE
0100		ENROUTE FOR DEVONPORT
0700	0912	PT SORELL - NARACOOBA BASE LINE CROSSING DIR 210°
0707		PT SORELL = 888.53 NARACOOBA = 1739.97 ∴ B/L = 2628.50
026	1038	PT SORELL - THE NUT BASELINE CROSSING DIR 200°
034		PT SORELL = 668.78 THE NUT = 527.22 ∴ B/L = 1196.00
1045		NET SECURED
	1340	ALONGSIDE IN DEVONPORT

continue on back

Argo last calibrated: ΔR 1. .15 2. .06 3. .02 4. _____ Time Slot 01
 Base BASS BASIN Date Nov 17th 84 2. _____ 3. _____ 4. _____

Base Stations	Master	Slave	Relay	Frequencies: Range	Radio	Clients Time:	Commenced	Secured
1. <u>PT. SORELL</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALU # <u>031</u> RPU # <u>006</u>	<u>1620 KHZ I. 1775 KHZ</u>	<u>7860 KHZ</u>		
2. <u>THE NUT</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>033</u> " " <u>009</u>			<u>10h 45m</u>	<u>0001</u> <u>1045</u>
3. <u>NARACOOBA</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	" " <u>040</u> " " <u>046</u>				
4. _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	" " _____ " "				

First Operator: A. HOGGART Boat: E. McDERMOTT II Party No: 1521
 Second Operator: _____ Area: BASS BASIN Country: AUSTRALIA
 Party Chief: R. MOLLOY Client: G.S.I. / AMOCO Date: DEC 17th 84