PGS Exploration



# PROJECT MANUAL

## 2D SEISMIC SURVEY
## TASMANIA

## FOR

# BORAL ENERGY RESOURCES LIMITED

**JOB No. 60110**

**To be Acquired by :**
**M/V ODIN EXPLORER**

Prepared by:
PGS EXPLORATION AS
SINGAPORE

REVISION # 001 DATED 15TH JANUARY 1996

512002

| PGS Exploration | BORAL ENERGY RESOURCES LTD | PROJECT MANUAL | Vessel : Odin Explorer<br>Client. : Boral Energy<br>Project : 60110<br>Page: : 1 of 3<br>Dated : 15-Jan-96 |
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## 1. SURVEY DESCRIPTION

### 1.1 Scope Of Work

PGS Exploration A/S has been engaged by BORAL ENERGY RESOURCES LIMITED (hereinafter called Boral Energy) to carry out a 2D seismic survey in the Bass Basin offshore Tasmania in the period January - February 1996.

Reference is made to section 1.2.

Mobilisation of M/V Odin Explorer is scheduled to take place in Devonport on or about 16 January, 1996.

The survey area is located off the north coast of Tasmania in Blocks T/25P and T/18P. Water depths range from 70 to 90 meters.

The project is to be carried out in accordance with the parameter set-up contained in the Contract and Technical Specifications in this document.

## 1.2 Map Of Survey Area

## 1.3 Data Acquisition Specifications

The data acquisition parameters will be as follows:

**2D Definition:**

| | | |
|---|---|---|
| Acquisition mode | : | Single Streamer / Single Wide Array-75m |
| Point Source- | | |
| Shot Interval | : | 22.5 m |

| | | |
|---|---|---|
| **Energy Source** | : | **Bolt & Sleeve Gun..** |
| Array Separation | : | Not applicable |
| Gun string Separation | : | 25 m |
| Source type | : | Sleeve guns |
| Air pressure | : | 2000 psi |
| Volume | : | 2660 cu.ins. |
| Number of Subarrays | : | 4 |
| Source depth | : | 6 m |
| Source length | : | 18.00 m |
| Source layout | : | 18.00 m x 25.00 m |
| Peak-peak (out -218Hz/484dB ) | : | 104.49 b-m |
| P/b ratio (out - 218Hz/484dB) | : | 26.14 |
| Gun Synchronisation | : | +/- 1 msec |
| Drop-out spec. | : | 15% |

**Streamers:**

| | | |
|---|---|---|
| Number of Streamers | : | 1 |
| Streamer Length | : | 3750 m |
| Streamer Depth | : | 6.0m |
| Near Offset | : | 100 m |
| No. of Groups | : | 396 |
| Group Interval | : | 15 m |
| Group length | : | 15.09 m |
| Number of Compasses | : | 8 |
| Number of Depth Controllers | : | 20 |

**Data Recording:**

| | | |
|---|---|---|
| Record Length | : | 6 sec |
| Sampling Rate | : | 2 msec |
| Low-cut Filter | : | Out 3 Hz/6 dB/oct |
| Hi-cut Filter | : | 250 Hz/72 dB/oct (1ms) |
| Hi-cut Filter | : | 220 Hz/12 dB/oct (resample 2ms) |
| Format | : | SEGY D 3480 cartridges 8015/2.5 Byte |

**Noise Levels**

The noise levels will be derived based on ProMAX Marine QC Processing system, and compared against specifications given in the contract.

**Navigation systems**

| | | |
|---|---|---|
| Primary navigation control | : | DGPS, FUGRO STARFIX |
| Secondary Navigation | : | N.A. ( stand-alone nav. monitored) |
| Buoy positioning | : | RGPS |
| Gun floats | : | N.A. |
| **Data Shipment and Reporting** | **:** | |
| Data will be shipped to | : | Western Geophysical<br>9th Floor ANL House,<br>432 St Kilda Road<br>Melbourne, Vic |
| Navigation Data will be shipped to | : | PGS Exploration AS |

Final Acquisition reporting will be carried out onboard and finalised at PGS Singapore , supervised by the Project Manager.

## 1.4 Mobilisation

Mobilisation is scheduled to take place at Devonport on or about 16 January, 1996.

Our agent will be Tidewater, Port Jackson Marine , Melbourne , Australia.

## 1.5 Data Acquisition Schedule

### 1.5.1 Acceptance Trials

The following specific checks will be carried out during mobilisation in Devonport:

In Port

- Gyro compass calibration (One direction) if convenient.
- Verification of the DGPS (GEO-REF and Fugro Starfix)
- Verification of Relative GPS buoy tracing system (GEO-TRACK)
- Consumables inventory check.

At Sea

- Towing configuration gun arrays and streamers.
- Comparison of GEO-REF and stand alone GPS.

### 1.5.2 Survey Planning

A detailed survey plan based on the given priorities will be worked out onboard the vessel.

## 1.6 Line Numbering

*Modifications to the outlined scheme might be agreed at the start-up meeting.*

Each sail line number will be of the type AAAAAAYYYYBX, where

AAAAA : an area identifier, in this case BHA96

YYY : line number

B : identifier for type of line, i.e. P for Prime line, R for Reshoot, I for Infill

X : pass number (in the listing; 0)

Example:

BHA96-100R2 states that it is the second pass on sail line 100, a Reshoot.

The sail line number corresponds to the first CMP column north of the sail line. Columns covered by a specific line will be from (Line #-9) to (Line #+10).

The column numbering represents the final processing grid, e.a. 12.5 crossline bin width.

Example:

Sail line #1010 covers CMP columns 1001 to 1020.

**Northeast-bound lines will have increasing shotpoint numbers (positive increment).**

**Southwest-bound lines will have decreasing shotpoint numbers (negative increment).**

## 1.7 Personnel

### 1.7.1 Personnel - Onshore

The office personnel allocated to this project from PGS Exploration A/S are as follows:

| | |
|---|---|
| Project Manager | Andy Cunningham |
| Deputy Project Manager | Bruce Harrick |
| HSE / QA Manager | Charles Jeffrey |
| Navigation Manager | Jon Falkenberg |
| Navigation Processing Supervisor | Gaius Hiscox |
| Geophysical Manager | Chris Walker |
| Technical Manager | Bruce Harrick |
| Personnel Administration | Lene Helgesen / Jenny Woon |
| Shore Administrator | Rick Shannon |

### 1.7.2 Personnel - Offshore

Personnel work on a 5 week on, 5 week off basis. Crew changes are provisionally planned around the middle of the week (Wednesday) but are kept flexible to take into account operational considerations. The normal working day will be 12 hours. Watch keeping personnel shall be employed on PGS Exploration A/S standard 12 hours on and 12 hour off system, or another system approved by Party Manager. The Party Manager shall not stand watches.

Crew lists for the vessel are provided in Appendix B

## 1.8 Communication Procedures

The Party Manager will provide a daily progress report by telefax or CCmail to the project manager as appropriate. In addition, a daily report signed by Client and Party Manager will be prepared and sent to both Boral Energy and PGS Exploration A/S by telefax. This daily report is to be received in both offices **not later than 0800 hrs the next day**.

### 1.8.1 Onshore Contacts

The Party Manager and Boral Energy will be advised weekly on the current duty officer for contact outside normal office hours. The following are onshore contact numbers which may be of use:

Client

BORAL ENERGY RESOURCES LIMITED, Adelaide, S.A. 08 - 235 3737 (Tel)

08 - 223 1851 (Fax)

Attn: Doug Roberts,

Stewart Thirlwell

| | |
|---|---|
| PGS Exploration A/S | |
| Singapore Office | 65-735 64 11 (Phone)<br>65-735 64 13 (Fax) |
| Charles Ramsden | 65-466 81 46 (Home)<br>65-96 37 02 52 (Mobile) |
| Andy Cunningham | 65-346 84 81 (Home)<br>65-96 34 09 11 (Mobile) |
| Oslo Office | 47-67 52 64 00 (Phone)<br>47-67 52 64 64 (Fax) |
| Magne Reiersgård | 47-67 52 64 28 (Office)<br>47-67 54 20 58 (Home)<br>47-94 33 65 17 (Mobile)<br>47-90 04 81 16 (Mobile-GSM) |
| Jon Falkenberg | 47-67 52 64 25 (Office)<br>47-67 53 07 60 (Home)<br>47-94 26 20 14 (Mobile)<br>47-90 14 93 06 (Mobile-GSM) |
| Fugro - Geodetic | 65 - 543 02 00 ( Tel )<br>65 - 543 05 00 ( fax ) |
| **SOS INTERNATIONAL** | **1-215-244 1500 (Phone)** |
| Philadelphia | 1-215-244 96 17 (Fax) |
| Singapore | 65 - 226 39 36 ( tel )<br>65 - 226 39 37 ( fax ) |
| Shore Administrator<br>Launceston | 61 03 34 22 33 (tel)<br>61 03 34 20 45 (fax)<br>TBA (Mobile) |

### 1.8.2 Boral Energy Emergency contact list

**Seismic Survey**

| Name | Office | Fax | Home | Mobile |
|---|---|---|---|---|
| Doug Roberts | 61 08 235 3757 | 08 223 1851 | 08 339 3632 | 018 816 475 |
| Stewart Thirlwell | 61 08 235 3763 | 08 223 1851 | 08 278 2191 | 019 676 231 |
| Mark Taylor | 61 08 235 3827 | 08 223 1851 | 08 370 9379 | |

## 2. PROJECT MANAGEMENT

### 2.1 Project Management Organisation

The project manager and in his absence the deputy project manager is responsible for all primary contact with Boral Energy for this project.

The project manager will set up all sub-contracts, deal with all major suppliers and control the financial aspects of the project. The project manager will set up all field procedures for the vessel and co-ordinate mobilisation plans. Actual vessel mobilisation and day to day co-ordination of the vessel operations will be supervised by the project manager.

Internally in PGS Exploration A/S the Project Manager reports to the Marine Operation Manager.

### 2.2 Project Management Routines

As part of the quality assurance program, PGS Exploration A/S has implemented effective Project Management routines. The following outlines are considered part of the Project Management requirements for this project:

- Preparation of detailed job instructions (i.e. Project Manual) which include reference to all relevant correspondence, specifications and agreements. This includes methods of operation, reference to significant objectives, known constraints (e.g. time/budget) and summary of known conditions.
- Project Briefing.
- Project Reporting. One document, signed by on-board Client Rep and Party Manager will be made up on a daily basis.

### 2.3 Work Definition and Contract Variation Procedures

It is essential that all the required definition of the work programme, variations to the specified scopes of work, or changes to the acceptance criteria are fully documented. For the avoidance of doubt and to avoid dispute, the following items (as a minimum) must be received in writing from the Client Representative and noted on the daily report:

a. Acceptance of survey vessel after sea trials.

b. Request to run infill lines.

c. Any wreck search or similar work.

d. Request to run additional lines.

e. Request to relocate to another part of survey area which exceeds normal length line changes.

f. Any relaxation in acceptance/operational criteria.

g. Final acceptance of all data and agree to demobilise

## 2.4 Operational Responsibilities and Project Management

The following responsibilities have been identified for the PGS Exploration as a company, the client, subcontractors and third parties plus individual members of the crew.

### 2.4.1 PGS Exploration A/S

As in all contracts, PGS Exploration A/S remains an independent contractor. This has several very important implications which must be considered at all times.

1 All decisions on the conduct of the work must be taken by the Party Manager.

2 PGS Exploration A/S is responsible for ensuring that the work is carried out in accordance with the job instructions and to the quality standards specified.

3 Omission by a Client to check the quality standards of work does not relieve PGS Exploration A/S of any responsibilities for achieving the correct standard.

4 Any failure to meet the required quality standards must be notified in writing to the Client and PGS Exploration A/S office on the daily report.

5 Any changes in the job instructions must be received in writing and should be confirmed by PGS Exploration A/S office.

### 2.4.2 Client

The onboard Client Representative does not have the authority to alter job instructions. He will monitor the operation and advise compliance/ non-compliance to the specifications as laid down in this document. Boral Energy will provide PGS Exploration A/S with a specification of the authority of the onboard Client Representative. PGS Exploration A/S must confirm that all changes in job instructions or relaxation of quality standards (e.g. due to bad weather or time constraints) are fully documented and authorised by both the Client and PGS Exploration A/S representatives (see *Section 2.2.3*).

The Client or his representative has the right to carry out verification of PGS Exploration A/S or sub-contractor's quality assurance. This includes, for instance, the right to:

- carry out quality audits
- carry out inspection
- have access to all non-proprietary QA documents and records.

The right to verification is limited to those matters concerning the present contract and does not include matters which reasonably may be considered confidential to PGS Exploration A/S.

### 2.4.3 Duties of Party Manager

The Party Manager is responsible for the satisfactory completion of the project fieldwork according to all contractual commitments and specifications.

Liaison with the Client Representative onboard is of particular importance. However PGS Exploration A/S remains an independent contractor at all times and decisions on the survey work must be taken by the Party Manager with reference to this Project Manual and the Contract.

It is essential that the Party Manager and the department chiefs discuss the acceptance criteria throughout the survey period. Close liaison with the Client is very important.

If there is a conflict on operational or data acquisition procedures, then the Party Manager should contact the project manager or duty officer for clarification.

Party Manager duties specific to this contract will be detailed by the project manager during his briefing but may be summarised as follows:

- Monitor installation and calibration of all systems during mobilisation.
- Confirm completion of mobilisation and test procedures in port to the Client Representative's satisfaction before sailing.
- Control acceptance trials program and ensure satisfactory operation of all survey systems and familiarisation of all personnel.
- Demonstrate effective communications between instrument room, navigators, gun mechanics and helmsmen.
- Liaison with department chiefs regarding on-line QC.
- Complete sea trials program to the Client Representative's satisfaction.
- Proceed with the survey as per the survey order when first three lines is accepted by Client.

### 2.4.4 Duties of Chief Navigator

The Chief Navigator is responsible to the Party Manager for all survey aspects of the operation and for maintaining the professional standards of the other navigators onboard.

The Chief Navigator will organise and monitor all survey calibrations during mobilisation and fieldwork, and will be responsible for the navigation field reports.

Maintain the necessary high standards of on-line position fixing, data logging and communication with instrument room and helmsman.

Ensure rigorous quality control and detailed log keeping and bring any data outside the Client's specifications to the attention of the Party Manager. It is also the Chief Navigator's responsibility to ensure that the equipment has been installed safely and that it is operated in a safe manner throughout the survey.

### 2.4.5 Duties of Chief Observer

The Chief Observer is responsible for all data acquisition (streamers)and recording systems onboard. This includes the testing and quality control required during the mobilisation period and the daily operation of the equipment. It is also the Chief Observer's responsibility to ensure that the equipment has been installed safely and that it is operated in a safe manner throughout the survey.

### 2.4.6 Duties of Chief Gun Mechanic

The Chief Gun Mechanic is responsible for all gun and mechanical systems onboard. This includes the testing and quality control required during the mobilisation period and the daily operation of the equipment. It is also the Chief Gun Mechanic's responsibility to ensure that the equipment has been installed safely and that it is operated in a safe manner throughout the survey.

### 2.4.7 Subcontractor's Personnel

One engineer/operator from FUGRO will mobilise and operate the Starfix II system. He may not sail with the vessel or alternatively may join the crew for a short time only (2 weeks)

The operator's responsibility is to ensure that their equipment has been installed properly and that it is operated and maintained in a good manner throughout the survey. The operators will report to the Navigation Chief or directly to the Party Manager.

## 3. QUALITY ASSURANCE

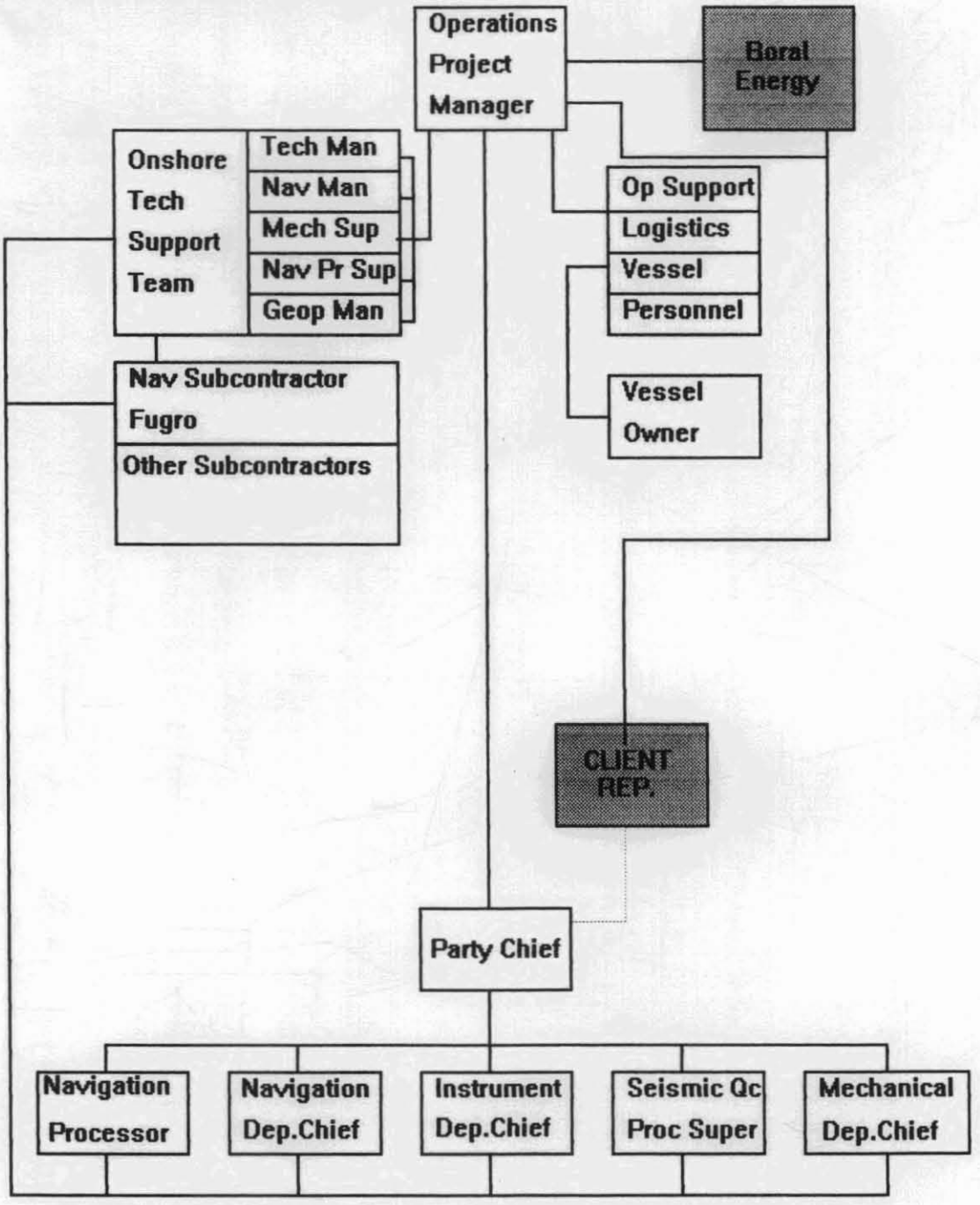
### 3.1 Quality Assurance Plan

The Quality Plan for this project is based on the following documents:

- PGS Exploration A/S Quality Assurance Manual.
- IAGC Safety Manual
- Project Manual (this document)
- PGS Exploration A/S, Technical Procedure Manual
- Contract between Boral Energy and PGS Exploration A/S
- All material referenced in these documents

### 3.2 Responsibilities & Organisation Charts

The quality plan will be implemented by the following organisation. The chart indicates the various interfaces within the process:



Responsibility for implementation of the quality assurance system for the fieldwork lies with the following personnel:

| | |
|---|---|
| Project Manager | Specific procedures for present project. Mobilisation, field operations and daily reporting. |
| Deputy Project Manager | As for Project Manager & all project logistics |
| Navigation Manager | Positioning performance, calibration routines and post processing. |
| Geophysical Manager | All aspects of seismic 2D QC |
| Party Manager | Overall responsibility for quality of fieldwork. |
| Chief Navigator | Positioning quality and navigation data recording. |
| Chief Observer | Vessel's acquisition and recording equipment performance, and operation. |
| Chief Gun Mechanic | Vessel's gun and mechanic equipment performance, and operation. |
| Seismic QC Supervisor | To ensure optimum use of ProMAX/Census for seismic QC and processing |
| All Personnel | Individual responsibility for all aspects of their own work. |

Primary data QC will be achieved by the on-line operators. The department chiefs are responsible for ensuring that all QC procedures are carried out and fully documented. They are responsible for ensuring that deficiencies in data quality (non-conformance) are brought to the attention of the Party Manager and Client Representative.

The Party Manager has final responsibility for overall data quality. In the event that the Party Manager considers inadequate data quality is being acquired (even with the Client Representative's approval) he must bring it to the attention of the Project Manager immediately. The line responsibility for quality is illustrated in the attached block diagram.

The quality plan will be implemented by:

- Detailed briefing instructions.
- Systematic calibrations.
- Specified operating procedures.
- Specified logging procedures.
- Specified data processing and reporting procedures.
- Documented acceptance of work.
- Documented non-conformance.
- Documented remedial action.
- Specified project reporting routines.

Work Instructions and Inspection Procedures

Detailed work procedures are given in the contract and this manual. In addition all activities will be in accordance with the PGS Exploration A/S Technical Procedures Manual.

The Party Manager is responsible for checking that all work instructions are carried out in accordance with the established procedures. Individual responsibilities for the inspection of instrumentation and data are detailed in Section 6.

In particular the personnel on duty must record instrument performance on the relevant log sheets. This must include any failures or adjustments required.

The navigators must record all position fixing performance on the Navigation 2D Log. This must include reference to poor quality data (non-conformance) on a line by line basis. This will form the basis for agreed reruns due to poor quality.

The Party Manager must evaluate all recorded data on a line by line basis. Acceptance of the data must be recorded on the Daily Report to the company and the office which must be countersigned by the Client Representative.

This will form the basis for agreed reruns due to poor quality data (non-conformance). Once rerun satisfactorily, the on-line information will be logged again, and signed off as accepted (remedial action completed).

## 3.3 Onboard Documentation and Quality Records

The following documentation is required:

| | |
|---|---|
| Calibration results as specified within the manual | during mobilisation |
| Navigation log | line by line basis |
| Observers log | line by line basis |
| Observers tape log | line by line basis |
| Daily report (fax/telex) | daily |
| Additional work instructions | as necessary |
| Final re-calibrations | prior to demobilisation |
| Master log defining data to be processed | line by line basis; to be supplied with every data shipment |

## 3.4 Master Project File

A Master Project File must be prepared onboard. This file should contain sections for all calibration data and all logs and other documents. This file must be available for inspection by the Client Representative. All logs are to be written/typed on spreadsheets.

# 4. PROJECT HEALTH, SAFETY AND ENVIRONMENT INFORMATION

## 4.1 Introduction

This section includes all project-specific HSE information that is available at the time of mobilisation. As situations may change, the hazards identified below may change. This project manual should be read in conjunction with the vessel safety case. The Safety Case documents the safety management system in operation within PGS Exploration and onboard the M/V Odin Explorer. Individual HSE responsibilities are identified within the safety case.

### 4.1.1 Reference documents

The PGS Exploration A/S HSE management system is based on the following document which should be read in conjunction with this project manual:

- E&P Forum / IAGC - Safety Training Guidelines for Geophysical Personnel
- E&P Forum - Health, Safety and Environmental Schedules for Marine Geophysical Operations, Report No. 6.34/206
- UKOOA - Guidelines for Offshore emergency training - Issue No. 2
- E&P Forum - Guidelines on Permit to Work (P.T.W.) Systems, Report No. 6.29/189
- IAGC - Marine Geophysical Operations Safety Manual, Seventh Edition 1991
- IMO - International Convention for the Prevention of Pollution from Ships 1973/78/92, known as "Marpol 73/78"
- IMO - International Convention for the Safety of Life at Sea, known as "SOLAS", 1992 (as amended).
- UK CAA - Offshore Helicopter Landing Areas: A Guide to Criteria, Recommended Minimum Standards and Best Practice, CAP 437, Dec. 1993 (as amended)

### 4.1.2 Client specific references and documents

The following references provided by the client have been referenced within the contract.

- Boral Energy Statement of Policy on Health, Safety and the Environment, Annexure 3 of Marine Geophysical Services Agreement.

### 4.1.3 Interface with client HSE organisation

The main interface with the Boral Energy HSE functions will be through the Seismic operations group based in Adelaide SA. This will be Doug Roberts, Manager of Exploration Operations, or Stewart Thirlwell, Seismic Operations Supervisor for Boral Energy.

#### 4.1.4 Interfaces with subcontractors

One subcontractor has been contracted to provide navigation services during the contract. Outline details of PGS Exploration's HSE policies have been forwarded to the subcontractors with which they can brief their personnel.

Fugro Geodetic will provide primary navigation services (Starfix II). This operation will be operated purely offshore using well established reference station at Melbourne. In addition a station in Adelaide will be available. All base stations can be "accessed" from a central control point by telephone modem link to check status and update software etc.; thus, under normal circumstances, these base stations require no manning or physical access.

No secondary navigation will be provided although it is always good practice to monitor stand alone GPS position.

Emergency / contingency contacts have been established as part of the overall PGS Exploration contingency plan.

### 4.2 Safety training and medical status

The following table shows the safety and medical status of the crew at the start of the project.

| JOB POSITION | MINIMUM TRAINING STANDARD | STATUS |
|---|---|---|
| All personnel | Basic offshore survival and fire fighting with Helicopter Under-water escape. (4 day course) - Refresher every 4 years | Completed |
| Marine crew | Offshore fire fighting (STCW) | Completed |
| HLO | HLO course (3 day) | Completed |
| HLO | Basic fire fighting course (4 day) | Completed |
| HLO | Helicopter fire fighting course (2 day) | Completed |
| FRC crew | FRC training to RYA level 3 | Completed |
| FRC coxswain | FRC training to RYA level 4 plus PGS search and rescue training requirements | Completed |
| Visitors (< 15 offshore days in any one year) | Combined offshore survival (1day) | To be checked for each visitor |
| Party Manager and/or Safety Representative | Safety delegates / management course (5 days) | Completed |
| Acquisition Manager / Operations Manager / HSE Manager | "Managing safety in the business" course (V2FA - 10 day course in HSE management) | Completed |
| Acquisition Manager / Operations Manager / HSE Manager | Contingency planning, crisis management and media handling (Dovre Hudson - total 4 days) | Completed |
| Acquisition Manager / Operations Manager / Vessel Supervisor / HSE/QA Manager | ISO 9000 awareness, ISO 9000 in the seismic industry | Completed |
| HSE / QA Manager | ISO 9000 Procedure writing course (2 days) | Completed |
| HSE / QA Manager | ISO 9000 auditors course (5 days) | Completed |

## 4.3 HSE Audit status

The vessel was last audited in August 1995 by Brian Thorne, Field Safety Supervisor for PGS Exploration. The audit points raised at this point and their current status at the time of mobilising the project are presented in appendix 8.3.

## 4.4 Project specific hazard analysis

### 4.4.1 Client provided hazard information

Field operations

Boral Energy have provided PGS Exploration with contact information within the field operations centre. This information is provided in the Project manual and the Contingency / Emergency plans and the Boral Energy interface document.

Fishing activity

Fishing activity is expected in the work area. The Fishing council has been advised of the dates and area for the survey and they are notifying the fishing industry.

Commercial Shipping Routes

Shipping activities can be expected as several shipping routes lie near the prospect .

Recreational activities

Boral Energy have advised that no recreational diving or fishing should be taking place in the survey area as it is a fair distance from shore.

### 4.4.2 Company hazard analysis / scouting reports

The following is a summary of the hazards and general operational factors affecting this operation, based on the discussions with the client, locally gathered information, and experience from operating in nearby areas.

Weather

The weather is a significant hazard in these waters. Severe storms can develop quickly and persist. The vessel is equipped with weather fax receiving equipment capable of proving long range prognoses of the weather. Deployment and recovery of equipment will be based upon the experience of the crew and these forecasts. Local coastal radio will also provide an accurate weather forecast throughout the day.

Sea conditions, tides and currents

The shooting plan will take tidal variations and currents into account; especially if transiting or shooting close to any platforms.he sea temperatures are approximately 12 deg C during the anticipated operating period. This presents a significant hazard should there be a man-over-board situation. All crew members will use approved floatation suits and life preservers according to PGS Exploration policy. Life lines will be used to prevent a man over board situation in adverse weather - see section 3.3.1

Hazard to shipping activity

The level of general shipping traffic is consistent with small but active ports located across the north of Tasmania, there are also daily ferries to Melbourne passing in the general vicinity.

Should in-sea equipment be lost or become detached from the towing arrangements, the vessel will search for the equipment and recover if feasible. During this time, navigation alerts will be broadcast on VHF channel 16.

Obstructions and shallows

There are no significant obstructions or hazards in the immediate area.

Environmental risks / hazards management

The area has commercial fish stocks. All precautions will be taken to avoid pollution and disruption to the normal fishing activity in the area. The vessel will apply strict pollution control procedures (Marpol).

For this survey it is required to start the gun arrays by means of "phasing them in". That is by starting individual guns in turn until the whole array is firing. This, in theory, provides time for fish and cetaceans to move away from the immediate area before the full force of the array is felt.

Aircraft and transportation

Only commercial aircraft will be used. Helicopters are available locally that are equipped with a winch should it be necessary to medivac anyone from the vessel.

Air travel to/from Devonport will only be by approved aircraft. No land transportation is envisaged except between airports and the quay side; this will be by local taxi or bus which are adequately regulated in Australia.

Health

The area presents no major health hazards. No personnel are expected to transit to, from or through areas of significant health risk.

Medical support / medivac route

A winch equipped helicopter rescue service is available and is incorporated into the Emergency plan. Australia has a Well established and efficient search and rescue service run by the Police.

Security

The area of operations does not present any security related risks beyond the normal shipping prevalent in the work area.

## 4.5 Project specific HSE objectives

### 4.5.1 Company HSE objectives for project

In summary the objectives of the company are:

- To provide a safe and healthy working environment in which employees and third parties may work.
- Promote the health and safety of company and sub-contractor employees.
- Protect the public from injury and prevent damage or loss of property.
- Health, Safety and Environment issues to be of equal importance as other business objectives.
- All operations to conform to relevant E&P forum and IAGC standards.
- All operations to be regularly audited with control of standards by external auditors.
- All (offshore) personnel to receive offshore survival and helicopter underwater escape training.
- To reduce the necessity to perform potentially hazardous operations by means of good engineering and procedures. In particular with respect to the use of small craft at sea.
- All personnel to receive training such that their competency to perform the job is ensured.
- To implement the safety case system on all vessels.
- No unreported incidents or dangerous occurrences.
- All incidents and occurrences to be analysed and corrective actions defined and followed up.
- All personnel to have safety goals against which their performance is gauged.
- Ultimate goal of zero lost time incidents.

### 4.5.2 Client HSE objectives for project

The following client objectives have been identified by Boral Energy:

Adhere to:

- Boral energy Policy for Health and Safety.
  (Smoke-free work place)
- Environmental Compliance.

## 4.6 Permitted operations matrix

The following matrix identifies controls which must be in place for identified safety critical activities to take place. These safety critical activities have been identified as posing a very high risk to the operation and/or personnel involved. The controls identified are not intended to be definitive; and each occurrence must be reviewed and appraised by those identified under "Controlled by" prior to commencement of the particular activity.

| Activity | Control | Control | Control | Controlled by |
|---|---|---|---|---|
| General welding in areas other than designated welding area | Permit to work | Fire watch established and maintained after welding operation | | Party Manager Master |
| Welding on streamer deck | Permit to work | Streamers not present | Fire watch established and maintained after welding operation | Party Manager Master |
| Helicopter operations - including winching operations | Pitch/roll/heave criteria acceptable (2 deg / 2 mtr)** | Chase boat and small boat present, ready and in close proximity | HLO present | Master, HLO |
| Small boat operations | Chase boat present and in close proximity | Second small boat available and ready state | Conditions set out in OSRM fulfilled | Party Manager Master |
| Night time launch of FRC (MOB) | Only in emergency MOB situation | Chase boat to be used in preference | | Master |
| Close approach to platform or other fixed installation | OIM and platform control informed per platform PTW system | Chase boat ready with towing warps etc. at the ready | Chief Engineer, Party Manager and Master on duty | Master, Chief Engineer |
| Deployment and recovery of in-sea equipment | Heave/roll/pitch within working limits at back deck ** | Lifelines used when working close to deck with no edge protection | | Party Manager Chief Observer Chief Mechanic |
| Data acquisition within 1500 m of any platform | Diving activities must stop | | | Party Manager, Master, OIM |
| Bunkering | Bunkering at shore facility only | Savealls and spill protection and control measures in place | Fire pumps tested and primed - Chief Engineer on watch | Master, Chief Engineer |
| In-sea tailbouy repairs | Streamer power switched off | Chase boat present and in close proximity and ready | Standard small boat procedures followed (OSRM) | Party Manager Chief Observer Master |
| Man aloft | Permit to work | Radars / nav / comms systems disabled as appropriate | If radars disabled, then chase boat must be in close proximity with working radar | Master, Chief Mate |
| Radars not working | Chase boat in close proximity with radar system functional | Post extra lookout | | Master, Chief Mate |
| Partial failure of propulsion or steering systems and within an oil field area | Keep chase boat in area with towing warps at the ready | Inform platforms. | | Master, Chief Mate, Chief Engineer |

** these limits are to be established during the operation based on the observed vessel behavior in various sea states.

### 4.7 PGS Exploration A/S Emergency Team Organisation and Responsibilities

insert plan

insert "Emergency Team" Excel table

insert HSE ORGANISATION AND RESPONSIBILITIES

### 4.8 PGS Exploration A/S Contingency / Medivac Plans

insert contingency plan & medivac procedures

# 5. POSITIONING SYSTEMS

## 5.1 Geodetic Reference

### 5.1.1 Datum

| | | |
|---|---|---|
| Survey Datum | : | AGD84 |
| Semi-major Axis | : | 6 378 160.000 m |
| 1/Flattening | : | 298.25 |

### 5.1.2 Map Projection

| | | |
|---|---|---|
| Projection | : | Transverse Mercator |
| Projection System | : | UTM |
| Scale Factor on Central Meridian | : | 0.99960 |
| Latitude of Origin | : | 0° |
| False Northing | : | 10 000 000 m |
| Central Meridian | : | 147° E |
| False Easting | : | 500 000 m |

### 5.1.3 Transformation Parameters (AGD84 to WGS 84)

| | | |
|---|---|---|
| dX | : | -116.00 |
| dY | : | -50.47 |
| dZ | : | +141.69 |
| Rx | : | -0.23" |
| Ry | : | -0.39" |
| Rz | : | -0.344" |
| Scaling Factor | : | +0.0983 PPM |

## 5.2 Primary Navigation System

| | | |
|---|---|---|
| System | : | STARFIX DGPS |
| Differential corrections via | : | Inmarsat |
| Reference stations at | : | Melbourne (Backup in Adelaide) |
| Sub-Contractor | : | FUGRO - GEODETIC |

## 5.3 Secondary Navigation System

| | | |
|---|---|---|
| System | : | N/A |
| Differential corrections via | : | N/A |
| Reference stations at | : | N/A |
| Sub-Contractor | : | N/A |

### 5.4 Magnetic Compasses

Not applicable.

### 5.5 Survey Echo Sounder Calibration

Verify the readings towards lead line readings. Check and log the vessel draught at start and end of survey and during any port calls. This is particularly important if vessel bunkers or takes on supplies of water.

## 6. SEISMIC ACQUISITION AND RECORDING SYSTEMS

### 6.1 Recording System (Syntrak 480)

The Syntrak 480 recording system consists of the following components; System Controller, Multiple Streamer Telemetry Processor, and the Tape Subsystem.

The test procedures for the recording system are well defined in the instrument manual and Technical Procedures Manual.

Some general Routine Procedures are listed below and must be performed:

- Field tapes must be run through the tension and cleaning device before being used in on-line operation.
- Random field tapes shall be reproduced on opposite tape decks from the one it was recorded on for read errors.
- Observer's log shall log any differences in shot point number and recorded file number.
- Camera records and near trace plots are to be provided with good contrast and quality to ensure good on-line QC. Details of which records to be made on-line and at end of line will be decided and documented between the Party Manager and Client Representative onboard.
- Recorded tapes are to be properly labelled, packaged and stored in a cool, dry and dust free place.

### 6.2 Streamer System (Teledyne)

The towing configuration of the hydrophone streamer is probably the single most important factor in the quality control of the received data. Factors which should be considered are described below.

Streamer leakage resistance should be in the order of 1 Megohm or better for each streamer group. A minimum acceptable value is 250 kohm.

One of the best controls on streamer noise is to carefully monitor the depth stability. Streamer balancing at specified depth should be conducted without automatic depth controllers, or by having depth controllers set at zero wing angle.

This is to ensure that the birds do not need to be working continuously to maintain the depth - which results in noise and also a looped affect on the streamer between the birds. In addition, the streamer depth detectors must be calibrated and battery voltage checked before the streamer is balanced. During shooting, the streamer depth should be kept steady and within contract specifications. The source-to-near trace offset should be as short as possible.

Noise strips are to be made under normal operating conditions immediately before the beginning and immediately after the end of every line. Noise must be measured on an ambient noise strip at a suitable fixed gain and the operating filters, with the input of a calibrated reference signal. Noise from other ships as well as noise from the survey ship itself is to be treated as any other noise source with the same limitations. No noise strips will be recorded on the recording instrument on line.

Noise from other ships, rigs or platforms must be logged with time, distance and direction relative to the survey area.

As part of the documentation required from the survey, the observer on watch must make up a file of camera records representing both noise records and normal operating conditions. As well as project identification details, the various elements of the record should be noted. This record must include but not be limited to:

- time break
- direct arrival
- polarity check
- offset measurement
- noise elements
- noise level measurements (noise strips only)

### 6.3 Gun Controller (Ref Tek RT-43)

The RT-43 controller is set up to tune up to 48 guns simultaneously. The SLEEVE guns are to be tuned on the digital peak of zero crossing. The gun quality control status being indicated on the screen is to be carefully monitored and any deviations must be recorded. The enabling guns and disabling guns is to be communicated to the Gun Mechanics on duty immediately, so that maintenance can be prepared and done on the next line change. All changes done to the source are to be logged carefully in the observer's log. Gun timing specification for this project is 1 ms or better.

### 6.4 Source Systems

M/V Master Odin is equipped with a specially designed SLEEVE GUN SOURCE array. The source is based on 4 sub-arrays each containing 7 different elements. (See section 8.1.1/8.1.2)

The source specification for this project is enclosed in the technical specifications of the contract, and a separate drop out specification and deviation in array. Additional information will be supplied by the Project Manager, if requested.

Ref. drop out specifications are listed in Section 8.1.3

## 7. QUALITY CONTROL AND REPORTING SYSTEMS

### 7.1 Acquisition Logs and Reporting

#### 7.1.1 Observers and Navigators Logs

The observer's and navigator's log must be kept up to date and returned with the data on completion of the survey. It shall include the following information:

i) Serial numbers of all equipment in use.

ii) All records of calibration, instrument settings and any adjustments.

iii) Occurrences of system malfunction, downtime and the reasons for it.

iv) All patterns which have been used, delays, periods in use, when and why the pattern combination was changed.

#### 7.1.2 Project report

◊ At the end of the survey a written end of project report will be provided, containing the following items amongst others:

- outline of QC products,
- processing tests,
- processing sequence,
- hardware / software listing etc., personnel,
- acquisition configuration,
- sample copy of observers logs,
- a map,
- a list of lines,
- geological / geophysical objectives,
- general aims,
- problems and achievements.

### 7.2 PGS Standard QC Sequence

PGS Acquisition QA/QC sequence - 2D

The following notes outline the systems and structure of the Acquisition QA/QC carried out on the PGS 2D vessels. Clearly if a project involves final 2D processing, then different action should be taken.

**Generalised System set-up**

One IBM RS6000 systems configured with 128 Mb of local memory and disk storage of in the order of 28 Gb. The workstation has a dedicated exabyte drive and in addition to this there is

a 3480 cartridge drive and a thermal plotter. We are currently running ProMAX version 5.1 and AIX 3.2.5.

## Personnel

For standard 2D QC one geophysicist should be adequate to operate the ProMAX system.

## QC Processing Sequence

of the following type is then implemented, aimed in general, not at attenuating noise, but in showing the data either as recorded or as it would be presented to a shore or vessel based processing centre.

- -31 ms static for digital filter delay
- Adjacent trace summation with differential NMO if recording with 12.5 metre groups
- Gain recovery
- Pre-decon mute
- DBS
- NMO. Velocities should be picked on a grid no coarser than 2km
- Mute
- Stack
- Gun & cable static correction
- TVF
- Amplitude balancing
- Display

**QC displays** routine production of the following :-

- one shot every km
- near trace plots
- NMO corrected gathers or supergathers as dictated by fold
- stack section, all with appropriate scaling. N.B. AGC is not appropriate

**General** - In addition to this, where necessary, the QC system is available for detailed investigation of specific data areas.

## Archiving

**a. A 'Promax Line Archive'** will be taken for each line processed. This should include decimated shots ( if created ), various stack files and the near traces. Velocity and flow data are automatically captured by this method. The value of these datasets is for reloading on the vessel during the course of subsequent acquisition, and they have little long term value as a general archive.

**b. Stacks** - SEGY archive tape containing the raw stacks for each line.

**c. A velocity tape** containing the information for each line.

**d. ProMAX archive of master flows.**

**e. Archive of the near trace cube.**

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|---|---|---|---|

**Project report** - to include the following : -

Outline of QC products, processing tests, processing sequence, hardware / software listing etc., personnel, acquisition configuration, sample copy of observers logs, a map, a list of lines, geological / geophysical objectives, general aims, problems and achievements.

# 8. APPENDICES

## 8.1 Source configuration and drop out specifications

### 8.1.1 Source configuration - 2660 cu. in. array

Insert diagram of 2660 cu.in. array

### 8.1.2 Source signatures

Insert signatures S2660 at 6 metres.

## 8.2 Personnel - Master Odin

### 8.2.1 Crew list - Shift A

Period: 20 January 1996 to 21 February, 1996

| | |
|---|---|
| #Party Manager | Gunnar BRASTEIN |
| #Chief Observer | Runar WIERSDALEN |
| Senior Observer | Richard POWER |
| Observer | Harald HAUGE |
| Observer | Tore BULL |
| | |
| #Chief Navigator | Fred GOSSE |
| Senior Navigator | Allen HATCHARD |
| | |
| #Chief Gun Mech. | Bjorn THONHAUGEN |
| Gun Mech. | Finn WICHSTROM |
| Gun Mech. | Dorian DANIELS |
| | |
| Onboard Proc. | Stephen GRANT |

### 8.2.2 Crew list - Shift B

Period: 21 February to 27 March, 1995

| | |
|---|---|
| #Party Manager | Jan ASK |
| #Chief Observer | Andre TORRING |
| Senior Observer | Endre FIDJE |
| Observer | Asgeir SUNNANA |
| Observer | Ole FOSTAD |
| | |
| #Chief Navigator | Hakon OVERGARD |
| Senior Navigator | |
| | |
| #Chief Gun Mech. | Daniel MACDOW |
| Gun Mech. | Odd VAGE |
| Gun Mech. | Odd OSTERHOLT |
| | |
| Onboard Proc. | Gabriele Jones |

***** PLEASE NOTE: CREW LISTS ARE SUBJECT TO CHANGE WITHOUT NOTICE. THIS DOES NOT APPLY TO KEY PERSONNEL (MARKED ).**