

Project Summary

PHASE 1 OFFSHORE GUYANA - 3D SURVEY

CGG and BGP jointly signed a Government Contract with Guyana's Ministry of Natural Resources on for the supply of non-exclusive marine seismic data acquisition and processing/reprocessing services off the coast of Guyana as a consortium ;

BGP intends to subcontract PROSPECTOR PTE LTD, a Singapore corporation having a principal place of business at 10 Anson Road, No.27-06 International Plaza, Singapore 079903 ("**PROSPECTOR**") to perform acquisition activities concerning the Phase 1 Project, as defined below.

Both parties will be responsible to develop Phase 1 in accordance with the appendices attached to this document. Phase 1 involves the acquisition of approximately 2,740 sq km of 3D seismic Data offshore Guyana ("**Phase 1 Project**").

The Phase 1 Project is located offshore Guyana as described in map included in Appendix I to this document .

Name of Project: Offshore Guyana 3D Multi-Client Seismic Survey (Phase 1)

Name of Developer/Company: Consortium of CGG Services (U.S.) Inc. and BGP Offshore

- CGG Services (U.S.) Inc.: 10300 Town Park Drive, Houston, Texas 77072, USA; Contact: Joe Zhou (SVP EDA Americas), joe.zhou@viridiengroup.com, Tel: +1 832 360 3598
- BGP Offshore: 5th Floor, CNPC Building, No. 83 Second Avenue, TEDA, Tianjin 300457, China; Contact: Luke Davey (VP Multi-client), lokedavey@bgp.com.cn

Date Prepared: March 6, 2026.

Prepared By: Zhu Lianfeng. Project Manager of BGP Prospector.

1. Detailed Description of the Proposed Project

(i) Physical Location and Its Characteristics

GPS Coordinates: Phase 1 survey area (shallow water offshore Guyana) is defined by UTM21 and WGS84 geographic coordinates (detailed polygon coordinates per Appendix I of the Project Supplement).

Distances to Key Locations:

Closest town: Georgetown (shore base for logistics).

Distance to nearest indigenous communities: No direct coastal indigenous communities adjacent to the offshore survey area; nearest settlements are coastal towns outside the immediate survey vicinity.

Nearby waterways: The survey area is within Guyana's offshore marine environment, connected to the Atlantic Ocean; no major rivers discharge directly into the Phase 1 area.

Land Use: No existing residential, agricultural, or industrial land use in the offshore zone.

Sensitive Receptors: Potential indirect impacts on coastal fishing communities dependent on marine resources.

Natural Resources: Abundant marine biodiversity (including potential cetacean habitats), and inferred hydrocarbon resources (target of the seismic survey); the area is part of Guyana's offshore petroleum exploration zone.

Land Tenure: The survey area is owned by the Government of Guyana (GOG), with no disputed land/sea rights; the consortium holds exclusive rights to acquire and license seismic data under the Government Contract.

(ii) Feasible and Reasonable Alternatives

Alternative Survey Techniques: 2D seismic survey (rejected due to lower resolution insufficient for detailed hydrocarbon exploration); onshore seismic (not applicable for offshore target areas).

Alternative Vessel Configurations: Single-source or 4-streamer setup (rejected for lower data density; Phase 1 uses triple-source/8-streamer configuration to meet stakeholder requirements).

Alternative Timing: Delayed acquisition (rejected due to industry prefunding timelines and GOG's exploration promotion goals).

(iii) Existing Baseline Information

Physical Environment:

Landscape: Offshore shallow water (depth varying per survey block), with seabed composed of sedimentary deposits typical of Guyana's continental shelf.

Water: Marine water quality consistent with tropical offshore environments; no major pollution sources in the immediate area.

Air: Clean marine air quality with no industrial emissions near the survey area.

Natural Resources: Known legacy 3D seismic datasets (to be reprocessed and integrated) and inferred hydrocarbon reserves; marine fisheries are a key resource for coastal communities.

Ecological Environment:

Flora: Limited benthic vegetation in the shallow water zone; dominant marine flora includes phytoplankton and seagrass (where present).

Fauna: Potential presence of cetaceans (e.g., dolphins, whales), sea turtles, and commercial fish species; the area is not designated as a protected marine reserve but is subject to Guyana's fisheries and wildlife regulations.

Social Environment:

Economic: Coastal communities rely on fishing and tourism; the project supports GOG's hydrocarbon exploration goals to boost national revenue and employment.

Cultural: No cultural heritage sites in the offshore survey area; coastal communities have traditional fishing practices tied to the marine environment.

(iv) Project Layout Map

Scale: 1:50,000 (consistent with navigation and survey planning requirements).

Map Details:

- a. Proposed site position: Phase 1 3D survey polygon (2,740 sq km) within Lots 2-4, with red polygon boundary per Appendix I.
- b. Closest town: Georgetown (marked as the shore base).
- c. Access routes: Maritime access via the Port of Georgetown (primary) by support boat Moonrise G, Prospector is not able to alongside due to draft; Trinidad (alternative) for vessel mobilization, crew changes, and resupply.
- d. Receiving waterbodies: Atlantic Ocean (offshore Guyana).
- e. Intake/discharge structures: None (vessels use onboard water treatment systems for potable water).
- f. Effluent/emission discharge points: Vessel exhaust stacks (emissions) and onboard wastewater treatment systems (treated effluent discharge); locations marked on vessel layout diagrams.

2. Description of the Project Design

(i) Design/Construction Drawings and Specifications

Vessel Specifications:

Primary acquisition vessel: R/V BGP Prospector (DNV-classified, 100m LOA, 10732 GT, capacity for 66 crew); Support vessel: Moonrise-G (Panama-flagged, 59.9m LOA, 2170 GT); Chase vessel: 7 Stars (details per Appendix II).

Seismic equipment: Triple Bolt 1900 LLXT sources (3 sources, 2 sub-arrays each), 8 Sentinel® RD solid streamers (6000m active length each), DigiCOURSE compass birds, and DigiFin steering controllers (per Appendix IV).

Pollutant Volumes:

Air emissions: MGO fuel consumption (BGP Prospector: 25-35 tons/day; Moonrise-G: 12.5-15 m³/day); NO_x, SO_x, and CO₂ emissions consistent with marine vessel regulations.

Wastewater: Oily water (processed via 2.5 m³/hr separator, oil content <15ppm), sewage (treated via onboard systems), and domestic waste (stored and disposed at shore facilities).

(ii) Project Size

Capital Investment: Estimated joint costs shared 50:50 by CGG and BGP, including acquisition, processing, training, and logistics.

Employees:

Acquisition phase: 65 crew on BGP Prospector, 12 crew on Moonrise-G, 6 crew on 7 Star.

Processing phase: CGG's processing team (3-5 specialists) and BGP's gravity/magnetics processing team (1-2 specialists).

Production Rates: 3D seismic data acquisition of ~2,740 sq km over 82 days (acquisition phase); processing rate of ~228 sq km/month (12-month total processing duration).

Transportation Routes: Vessel transit between mobilization port, survey area, and resupply ports (Georgetown); data delivery via secure USB/DVD and 3592 magnetic tapes.

(iii) Activities Across All Development Stages

a. Operation and Production Processes

Acquisition: Triple-source, 8-streamer 3D seismic acquisition (line directions: E-W & NE-SW) with gravity and magnetics data collection; shot interval 12.5m, streamer separation 90m (per Appendix IV).

Processing: Preprocessing (noise attenuation, de-multiple), velocity model building, TTI Kirchhoff PSDM migration, and post-stack enhancement (per Appendix V).

Interpretation: CGG-led interpretation of new and reprocessed data to identify hydrocarbon prospects.

Alternative Designs Considered: Reduced streamer count (rejected for lower fold coverage) and shorter recording length (rejected for insufficient subsurface imaging).

b. Raw Material to Finished Product Flow

Raw materials: MGO fuel, seismic equipment (sources, streamers), and navigation systems.

Intermediate products: Raw seismic data (SEG-D format), navigation data (UKOOA P1/90), and gravity/magnetics raw data.

Finished products: Processed 3D seismic data (SEG-Y format), velocity models, fold maps, and interpretation reports (licensed to third parties via CGG's master license agreement).

c. Technical Description and Process Flow Diagram

Acquisition Process: Vessel mobilization → Calibration (source/ADCP/depth sensors) → Line acquisition (shot firing, data recording, real-time QC) → Line change → Demobilization.

Processing Process: Data ingestion → Preprocessing → Velocity model building → Migration → Stacking → Post-processing → QC → Deliverable generation.

Process Flow Diagram: Includes acquisition workflow (vessel operations, data recording), processing workflow (per Appendix V), and data licensing flow (CGG-led marketing and third-party licensing).

(iv) Use of Natural Resources

Raw Materials and Sources:

MGO fuel: Sourced from Port of Uruguay or Georgetown (compliant with low-sulfur requirements).

Seismic equipment: BGP's existing fleet (BGP Prospector, streamers, sources) and CGG's processing software/hardware.

Water: Onboard desalination (BGP Prospector: 30 tons/day fresh water production).

Quantities:

Fuel: BGP Prospector fuel capacity 3400 m³ (endurance 80 days); Moonrise-G fuel capacity 994 m³ (endurance 60 days).

Seismic consumables: Spare streamer sections, gun components, Compass birds, Digi-Fin and Data tapes (stored onboard).

(v) Source of Utility Services

Water Supply: Onboard desalination systems (potable water) and treated seawater (non-potable uses); no external water intake.

Energy/Electricity: Vessel generators (BGP Prospector: 2 x 2880kW ABB generators; Moonrise-G: 1 x 800kW Leroy Somer generator) and emergency generators.

Communication Facilities: Satellite communications (SeaTel 9797 C/Ka VSAT, Inmarsat-F), VHF/UHF radios, and onboard email/network systems (per Appendix II).

(vi) Waste Production and Disposal

Waste Types and Quantities:

Domestic waste: ~50 kg/day (per vessel) – non-hazardous, stored in sealed containers.

Oily waste: ~0.5 m³/day (oily water separator sludge) – stored in dedicated tanks (5 m³ capacity).

Sewage: ~2 m³/day (treated via onboard wastewater treatment plant).

Hazardous waste: Used oil, batteries, and chemical containers – stored separately.

Effluent Composition: Treated sewage (BOD <20 mg/L, pH 6.5-8.5); oily water (oil content <15ppm) – compliant with Guyana's marine discharge regulations.

Disposal Methods:

Domestic/hazardous waste: Transported to shore via resupply vessels and disposed at licensed facilities in Georgetown.

Oily waste: Offloaded at shore-based waste management facilities (third-party contractors).

Treated effluent: Discharged offshore in compliance with EPA permit conditions (no discharge within 3 nautical miles of shore).

Recovery/Disposal Sites: Licensed waste management facilities in Georgetown (justification: proximity to shore base, compliance with Guyana's environmental regulations).

(vii) Project Duration per Phase

Acquisition Phase: April 2026 – July 2026 (82 days, subject to prefunding and permit approval).

Processing Phase: July 2026 – June 2027 (12 months);

Fast-Track processing complete by December 2027.

(viii) Decommissioning Plan

Vessel demobilization: Retrieval of all in-water equipment (streamers, sources) upon acquisition; Demobilization will be treated as completed after all equipment on board.

Waste disposal: Final offloading of all accumulated waste at licensed shore facilities.

3. Potential Impacts and Their Significance

(i) Extent of Impact and Area of Influence

Geographical Area: Direct impact limited to the 2,740 sq km survey area; indirect impact extends to 5 km beyond the survey boundary (acoustic propagation zone).

Impact on Environmental Aspects:

Physical: There will be no disturbance to seabed since the in-sea equipment will be installed with additional float to stay clear with seabed.

Ecological: Temporary acoustic disturbance to marine fauna (cetaceans, fish); potential short-term displacement of mobile species.

Social: No direct impact on coastal communities; potential indirect benefits via job creation and national revenue from hydrocarbon exploration.

(ii) Transfrontier Nature of Impacts

The survey area is within Guyana's exclusive economic zone (EEZ); no cross-border impacts.

(iii) Magnitude and Complexity of Impacts

Magnitude: Low – acoustic impacts are temporary; waste discharge is controlled and compliant with regulations; no permanent ecological or physical damage.

Complexity: Low – impacts are localized to the offshore survey area; no cumulative interactions with multiple environmental stressors (e.g., industrial pollution) in the zone.

(iv) Probability of Impacts

Acoustic disturbance: Moderate (inherent to seismic acquisition); mitigated by PAM (Passive Acoustic Monitoring) and marine mammal observer (MMO) protocols.

Waste discharge non-compliance: Low (vessels are equipped with certified treatment systems and undergo pre-mobilization inspections).

Seabed disturbance: Low (streamers are towed at targeted depth).

(v) Duration, Frequency, and Reversibility

Duration: Acoustic impacts last for the 82-day acquisition period.

Frequency: Seismic shots occur at 12.5m intervals (continuous during acquisition hours); waste discharge is continuous but controlled.

Reversibility: All impacts are fully reversible – marine fauna return to the area post-acquisition; no long-term contamination.

(vi) Cumulative Impacts with Other Projects

Existing projects: No active seismic surveys or oil drilling in the immediate Phase 1 area during acquisition.

Cumulative effect: Low – the consortium will coordinate with GOG to ensure no overlapping hydrocarbon exploration activities during Phase 1; additional assessments will be conducted if other projects are approved in the vicinity.

4. Environmental Management and Mitigation Measures

Physical Environment

Seabed Disturbance: Use of depth-controlled streamers (nominal 9-10m depth) to minimize contact with seabed; pre-survey seabed mapping to avoid sensitive habitats.

Air Emissions: Use of low-sulfur MGO fuel; regular engine maintenance to optimize efficiency; compliance with MARPOL Annex VI.

Wastewater Discharge: Routine testing of oily water separators and sewage treatment systems; daily log of discharge volumes and quality.

Ecological Environment

Marine Fauna Protection:

MMOs onboard during acquisition to monitor for cetaceans; shutdown of seismic operations if mammals are within 500m of the vessel.

PAM systems to detect underwater sounds and alert crew to presence of marine life.

Compliance with Guyana's Fisheries Act and protected species regulations.

Biodiversity Conservation: Avoidance of known fish spawning grounds (per GOG-provided data); no disposal of waste at sea except treated effluent.

Social Environment

Coastal Community Engagement: GOG-led consultations with fishing communities to share survey timelines and minimize disruption to fishing activities.

5. Summary of Public Consultations/Meetings

Consultations with key stakeholders, including:

Coastal fishing communities: Discuss survey timelines, fishing zone avoidances, and potential impacts on catches; commitments to share survey updates and minimize disruption.

Environmental NGOs: Address concerns about marine fauna protection; confirm implementation of MMO/PAM protocols.

Potential industry licensees: Provide input on survey design and data requirements to meet exploration needs.

Key Stakeholder Views: Support for the project as a driver of economic development; requests for strict adherence to environmental mitigation measures and transparent reporting.

6. Assumptions, Uncertainties, and Gaps in Knowledge

Assumptions

Environmental permits (from Guyana's EPA) will be issued in time after application.

Weather conditions (swell, wind) will not cause significant delays to acquisition.

Uncertainties

Variability in marine mammal presence (mitigated by MMO/PAM protocols).

Fluctuations in fuel prices (impact on project costs, addressed via fuel price adjustment clauses in the consortium agreement).

Delays in permit issuance.

Gaps in Knowledge

Long-term acoustic impacts on deep-sea species (mitigated by following international best practices for seismic surveys).

7. Non-Technical Summary

This project involves conducting a 3D seismic survey covering 2,740 square kilometers in shallow waters offshore Guyana (Phase 1 of a multi-client program). Led by a consortium of CGG and BGP, the survey aims to collect high-quality seismic, gravity, and magnetic data to help identify potential hydrocarbon resources.

The survey will use a specialized seismic vessel (BGP Prospector) and support vessels, which will tow equipment to send sound waves into the seabed – the reflected signals are recorded to create images of subsurface rock formations. All operations will follow strict environmental rules: trained observers will monitor for marine mammal (like dolphins and whales) and silence source if they are nearby, waste will be properly stored and disposed on land, and low-sulfur fuel will be used to reduce emissions.

The project will support Guyana's economic development by providing data for future oil and gas exploration. The consortium will work closely with the Guyanese government to ensure compliance with all laws and regulations, and consultations with coastal communities will minimize any disruption to fishing activities. The survey is expected to take about 3 months to collect data, with processing completed within a year, and the results will be licensed to energy companies to support responsible exploration in the region.

APPENDIX I
PHASE 1 PROJECT
DESCRIPTION

1. Phase 1 Project plan including size, scope and proposed execution timeline. (subject to prefunding as described on clause 2.5 of the Project Supplement)

1. Approximately 2,740 sq km of new 3D Data acquisition including gravity and magnetics data (“New 3D Data”).
2. Acquisition Duration: ~ 82 days
3. Processing Duration: ~ 12 months
4. Fast-Track: Available ~ 5 months after completion of acquisition

2. Phase 1

Area.

Location:

- Phase 1 3D Data is shown on the map below in the red polygon. The intended acquisition period will start from June until August 2026.



Guyana shallow water area phase 1

APPENDIX II
VESSEL AND TECHNICAL SPECIFICATIONS

1. Acquisition Vessel-BGP Prospector



| | |
|------------------------------------|--|
| Ship Name | R/V BGP Prospector |
| Call Sign | C6YF5 |
| Owner | Prospector Pte. Ltd |
| Flag State | Bahamas |
| Port of Registry | Nassau |
| Hull No. | 1198 |
| Official No. | 8001718 |
| Date of Build | 2011-09-02, Sekwang Heavy Industries |
| Classification Society and Class | DNV |
| Classification | DNV 1A1, ICE-C, E0, RP, HELDK-SH, CLEAN DESIGN, COMF-V (3) C (3), NAUT-AW, TMON, BIS |
| Class ID No. | 29868 |
| IMO Id No | 9545986 |
| MMSI No | 311030800 |
| Safe Manning Certificate (Minimum) | TBA |
| Gross Tonnage (ILC1969) | 10732 |
| Net Tonnage | 3220 |

| | |
|-------------------------------|--------|
| Length Over All (Loa) | 100m |
| Length Between Perpendiculars | 88.55m |
| Breadth (Moulded) | 24m |

| | |
|--------------------------------|-----------------------------|
| Depth (Moulded) 1st deck | 5.6/7m |
| Draft (Max) | 7.3m |
| Draft (Mean) | 6.4m |
| Air Draft (To Highest Antenna) | 31.3m at fully loaded draft |

Capacity and Endurance

| | |
|------------------------------------|-------------------------|
| Cable / Towpoints / Subarrays | Max. 12/14/8 |
| Pulling Capacity, 4-5 Knots | Approx. 100T |
| Capacity of accommodation | 60 Person |
| Fresh Water Capacity | 300m ³ |
| Fresh Water Maker Production | 30 Ton per day |
| Fuel Capacity, All Tanks Topped | 3400m ³ |
| Fuel, Useful For 100 % Consumption | 425 m ³ |
| Fuel Type | MGO |
| Max Speed (In Calm Sea) | 15Knots |
| Economy Speed, Ditto | 13Knots |
| Consumption of Fuel, Full Speed | Approx. 35 tons per day |
| Consumption of Fuel, Economy Speed | Approx. 25 tons per day |
| Operational Endurance | 80 days |
| Safety Equipment Certificate | For 66 persons |

Bridge Navigation Equipment

| | |
|-------------------|---------------------------------|
| Radar No 1 | K-Bridge ARPA RADAR S-Band 30KW |
| Radar No 2 | K-Bridge ARPA RADAR X-Band 25KW |
| ECDIS | K-Bridge ECDIS |
| Gyro Compass | NAVIGAT X MK I |
| Auto Pilot | K-Bridge and K-POS |
| GPS Receiver | Furuno GP-150 |
| Speed Log | Furuno DS-80 |
| Echo Sounder | SKIPPER GDS101 |
| Weather Facsimile | FAX-30 |
| Navtex Receiver | NX-700A |
| Anemoscope | HTA-1000 |
| AIS | FURUNO FA-150 |

Communication Equipment

| | |
|------------------------------------|--|
| Radio Station License No. | 29868 |
| GMDSS | FURUNO:RC-1800F(500W), RC-1800F (250W) |
| Transmitter / Receiver, Main (VHF) | 4xFURUNO FM-8800S |
| Transmitter / Receiver, Main (Dsc) | FURUNO IC-350 |

| | |
|---------------------------------------|-------------------|
| Radio, Portable, VHF | TRON TR20 |
| Booster Unit for Portable Radio (VHF) | MOSCOT 9881 |
| Emergency Radio Beacon (EPIRB) | Tron 40S Mk2 |
| Radar Transponder | SART 20 |
| Portable Radio's, VHF | 3xMotorola GP328 |
| Portable Radio's, UHF | 12xMotorola GP328 |
| Radio, Lifeboat, VHF | Motorola GP328 |

Satellite Communications

| | |
|------------------------------------|--|
| Inmarsat-F | FELCOM 500 |
| VSAT | 1xSeaTel 9797 C/Ka |
| VSAT | 1xCDS Ka/C |
| Inm.Sat.FTeleph. / Fax. No. | 00870 7732 02842/00870 7830 11055 |
| Norsat-C. Online Tele Link to Oslo | TBA |
| Telefax Machine | TBA |
| Internal E-Mail & Pc-Network | Yes, available |
| E-Mail Address to Vessel | pc.prospector@bgp.com.cn zhulianfeng@bgp.com.cn |

Safety Equipment Crew

| | |
|----------------------------------|------------------------------|
| Life rafts Type /Capacity | VIKING/ 20P |
| Life raft Davits | ARLD-20P, ARIM |
| Number of Life Rafts | 2 sets |
| Lifejackets | Inflatable Lifejacket PV9500 |
| Survival Suits, Thermo Insulated | VIKING Immersion Suit PS2004 |
| FRC | Norsafe Magnum 750 LC |
| Work Boat Type | 2 x NORPOWER 29 ft |
| Engine and Speed of Work Boat | 6068TFM50, 18-20 knots |
| Drive Type of Workboat | 800mm pitch propeller |
| Capacity of work boat | 7 men |
| Engine Power and Speed of Boat | 300HP w/2600rpm |

Fixed Fire Extinguisher System

| | |
|---------------------------------------|------------------------------------|
| Engine Room, ECR, Engine Work Shop | Fixed CO2 system, Local Water Mist |
| Switch Board and Converter Room | Fixed CO2 system |
| Incinerator Room | Fixed CO2 system, Local Water Mist |
| Kerosene Room | Fixed CO2 system |
| Galley Ducting | Fixed CO2 system |
| Harbor Generator Room. Separator Room | Local Water Mist |
| Streamer Repair Room | Fire hoses & fire extinguisher |
| Paint Store | Fixed Water Spray system |
| Chemical Store | Fixed Water Spray system |
| Helicopter Deck | Foam Fire-fighting System |
| Main Foam Pump, AFFF Foam Mixture | Movitec V10, 3500L/min |
| Main Fire Pump | 150m ³ /hr |

| | |
|----------------------------------|---------------------------|
| Emergency Fire Pump | 25m ³ /hr |
| Fire Detection Monitoring System | SG-FC CS4000/6L.Consilium |

Hull Outfitting

| | |
|--|-----------------------------------|
| Decks Crane 1, Capacity/Reach/Location | 12 tons at 20 m radius |
| Decks Crane 2, Capacity/Reach/Location | 12 tons at 20 m radius |
| Decks Crane 3, Capacity/Reach/Location | 3 tons at 12 m radius |
| Decks Crane 3, Capacity/Reach/Location | 3 tons at 12 m radius |
| Crew Accommodation, No of Bunks | 66+1 men |
| Single Berths Cabins | 28 |
| Double Berths Cabins | 19 |
| Conference and Training Room | 2x Conference, 1x Training Room |
| Hospital | 1 |
| Sauna and Fitness Room | Gym room, Sauna Room and SPA Bath |

International Oil Pollution Prevention (IOPP) Equipment

| | |
|--|--|
| Incinerator, Sludge and Waste Oil | Available |
| Bilge / Oily Water Separator | 2.5m ³ /hr, oil content less than 15ppm |
| Oily Water / Sludge Holding Tanks Cap. | 5 m ³ |
| Oil Spill Absorbent / Damage Control | As per SOLAS rules |

Machinery Equipment

| | |
|-------------------------------------|---------------------------------|
| Air Source, Compressors | LMF 62s/138-207-E60 |
| Air Capacity | 3 x 62 (m ³ /min) |
| HP Compressor Drive Motors | AC, Squirrel Cage Induction |
| Main Engine | 2 x RRM Bergen B32:40L8P CD |
| Auxiliary Engines (Generator Drive) | 2 x RRM Bergen C25:33L9A CD |
| Redundancy Propulsion | PTI 2x1500KW |
| Propeller Type, Main Propulsion | 2 x RRM Kamewa Ulstein |
| Propeller and Thruster Control | Bridge and Engine control room, |
| Propeller Blade, Spare | NA |
| Generators / Alternators | 2 x 2880kw ABB |
| UPS | MGE, 2x120KVA |
| Emergency & Harbour Gen. Engine | CUMMINS, 254KW |
| Emergency & Harbour Generator | NT855DM340, 175KW |
| Fuel Back-Up System for Aux. Eng. | Individual tanks |
| Cooling System for Aux. Engines | Air Cooling |
| Bow Thruster Motor | ABB M3LP 400LD6 |
| Bow Thruster type | R-R TT2200DPN CP |
| Fresh Water Generator (Fwg) | 2x15t/day, Alfa Laval |
| Steering Gear | Tenfjord SR662 FCP |

2. Support Vessel- Moonrise-G

GROEN

Offshore, Guard & Support

MOONRISE-G

Seismic Research Support Vessel



Specification Sheet

Main Particulars

| | |
|-----------------------|--------------------------|
| Builder: | Sealink Shipyard SDN BHD |
| Year built: | 2013 |
| Flag: | Panama |
| IMO Number: | 9628520 |
| MMSI: | 352432000 |
| Call Sign: | HPEW |
| Minimum Safe Manning: | 9 |
| Classification: | RINA |
| Notation: | C ⚡ SPS |

Dimensions

| | |
|---------------------|--------|
| L.O.A.: | 59.90m |
| Breadth: | 16.50m |
| Depth: | 6.80m |
| Draught: | 5.40m |
| Draught Adjustment: | 5m |
| Net Tonnage: | 651t |
| Gross Tonnage: | 2170t |

Performance

| | |
|------------------------------------|--------------------|
| Max Speed: | 12 knots |
| Approx. Consumption at Max Speed: | 15m ³ |
| Eco Speed: | 10 knots |
| Approx. Consumption at Eco Speed: | 12.5m ³ |
| Type(s) and Grade(s) of Fuel Used: | MGO low Sulphur |
| Endurance: | 60 days |

Machinery

| | |
|----------------------|--|
| Generators: | 1x Leroy Somer 800KW@1500RPM |
| Emergency Generator: | 1x Cummins 60KW/100KVA 240/415V 50HZ |
| Main engine: | 2x Cummins 2298.93BHP@1715KW at 1900RPM |
| Aux. Engines: | 2x Cummins 355HP/265kW |
| Propeller: | 2x CPP in Fixed Nozzles |
| Rudder: | 2x Becker Rudder |
| Bow Thruster: | 1x 8t Tunnel Thruster 600KW |

Deck Equipment

| | |
|-----------------|-------------------------------|
| Deck Crane: | 10t@16.5m |
| Windlass: | 7.5t x 15m/min |
| Capsian: | 2x 5t aft PS & SS |
| Workboat Davit: | Vestdavit 12t SWL |
| Twin Hose Reel: | 2x 240m, 5" hose with 4" TODO |
| Cable Reel: | 1x 8000m |
| Reefers: | 3x 20ft, 15V/3ph/50Hz |
| Towing Hook: | 65t SWL |
| Yoko Fenders: | 2x 4.0 x 3.0 |

Special Features

| | |
|---------------|-----|
| Bollard Pull: | 50t |
|---------------|-----|

Communication Equipment

| | |
|-----------------|------------------|
| GMDSS: | A 1-A2-A3 |
| SBB Radio: | 1x FS-2575 |
| MF/HF Radio: | 1x FS-2575C |
| VHF Radio: | 3x FM8900S |
| Portable VHF: | 6x HT-644 Marine |
| Inmarsat Sat-C: | 2x Felcom 1B |
| IRIDIUM: | 881677765587 |
| AIS: | 1x FA-150 |
| E.P.J.R.B.: | 1x Class II |

Navigation Equipment

| | |
|--------------------|---------------------|
| Radars: | 2x FR-2117 ARPA |
| GPS Navigation: | 2x Furuno |
| Echo Sounder: | 1x FE-700 |
| Navtex: | 1x NX-700 |
| Gyre Compass: | CMZ900 YOKOGAWA |
| Magnetic Compass: | 1x Seistil SR4 |
| Auto Pilot Fwd: | 1x AP-70 |
| Auto Pilot Aft: | 1x AP-70 |
| Electronic Charts: | 1x Main, 1x Back up |
| Anemometer: | 1x YOUNG |

Bunker/Storage capacity

| | |
|----------------------------|---|
| MGO: | 449m ³ ('300m ³) |
| Cargo Fuel: | 994m ³ ('600m ³) |
| <i>*Draught Adjustment</i> | |
| Fresh Water: | 390m ³ |
| Dirty Oil: | 13.4m ³ |
| Lube Oil Storage: | 10.6m ³ |
| Sewage Holding: | 29.9m ³ |
| Grey Water: | 31.1m ³ |
| Sludge: | 19.1m ³ |
| Thermal Fluid: | 10.6m ³ |
| SW Ballast: | 893.7m ³ |

Storage capacity

| | |
|---------------|-------------------|
| Cool store: | 20' container |
| Freeze Store: | 20' container |
| Dry Storage: | 20' container |
| Clear Deck: | 300m ² |

Accommodation

| | |
|-----------|----|
| Berths: | 59 |
| Cabins: | 21 |
| Hospital: | 1 |

Safety Equipment

| | |
|--------------|--------------------------------------|
| Rescue Boat: | 6 Person Rigid-hull on A Frame Davit |
| Life Rafts: | 8x 25 persons |

All particulars believed to be correct but not guaranteed

Frederik Groen BV

website: www.sealinkgroup.nl // email: info@moongroen.nl // telephone: +31 70 356 25 35

Telex: 07472027

3. Chase Vessel- 7 Stars

|  | |  | |
|---|--|--|--|
| | | Specification Sheet | |
| Main Particulars | | | |
| Builder: | Maaskant Shipyards | | |
| Year built: | 2015 | | |
| Flag: | Panama | | |
| IMO Number: | 9721956 | | |
| MMSI: | 354742000 | | |
| Call Sign: | HP 6219 | | |
| Minimum Safe Manning: | 5 | | |
| Classification: | Lloyds Register | | |
| Notation: | ☞100A1, Seismographic Support Ship *IWS, Ice Class 1E, [☞] LMC, UMS | | |
| Navigation Equipment | | | |
| Radar's: | | 2x Furuno FAR-2117 | |
| Magnetic Compass: | | 1x Cassens & Plath | |
| Satellite Compass: | | 1x Furuno SC50 | |
| Automatic Pilot: | | 1x Simrad AP80 | |
| GPS Navigation: | | 1x Furuno GP-150 | |
| | | 1x Furuno GP-33 | |
| Echo Sounder: | | 1x Furuno FE 700 | |
| Navlex: | | 1x Furuno NX700B | |
| Electronic Charts: | | Maris ECDIS 900 dual | |
| Gyro Compass: | | 1x Anschütz BST 2233 | |
| Dimensions | | | |
| L.O.A.: | 35.00m | | |
| Breadth: | 8.7m | | |
| Dept: | 4.25m | | |
| Draught: | 3.60m | | |
| Nett Tonnage: | 101t | | |
| Gross Tonnage: | 338t | | |
| Performance | | | |
| Max Speed: | 12 knots | | |
| Approx. Consumption at Max Speed: | 7.2-7.5 m ³ | | |
| Eco Speed: | 10 knots | | |
| Approx. Consumption at Eco Speed: | 4.0 m ³ | | |
| Type(s) and Grade(s) of Fuel Used: | MGO low Sulphur | | |
| Endurance: | 100 -125 days | | |
| Bunker/Towing/Storage capacity | | | |
| Fuel Oil: | | 150m ³ | |
| Fuel Transfer: | | 4" TODO | |
| Fresh Water: | | 50 m ³ | |
| F.W. Maker: | | 5.3m ³ /day | |
| Storage capacity | | | |
| Cool store: | | 8m ³ | |
| Freeze Store: | | 4.3m ³ | |
| Clear Deck: | | 103.3m ² | |
| Accommodation | | | |
| Crew: | | 2 single berth cabins, 3 double berth cabins | |
| Passengers: | | 2x4 berth's cabins | |
| Total: | | 16 | |
| Safety Equipment | | | |
| Life rafts: | | 4x 16 persons (SOLAS) | |
| FIFI: | | 2x General service pump | |
| | | 25m ³ | |
| | | 1x Portable emergency fire pump | |
| Special Features | | | |
| Towing Hook: | | 1x Mampeay 18/25t | |
| Bollard Pull: | | 17.5t | |
| Machinery | | | |
| Generators: | 3x Caterpillar C18TA SCAC each 465 Kva | | |
| Bow Thruster(s): | Veth VT 80, 122 bhp | | |
| Propellers/Rudders: | 2x Thrusters 600 BHP (959.8kW) | | |
| Deck Equipment | | | |
| Deck Crane SWL/Length: | 2T@ 10.5m / 8T@ 2.8m | | |
| Communication Equipment | | | |
| Trading Area: | A1,A2,A3,A4 | | |
| GMDSS: | Sailor 6310 (DSC) | | |
| VHF Radio: | Sailor, 2x RT 6222 & 1x RT6248 | | |
| Portable VHF: | 4x Entel HT 644 | | |
| GMDSS Marine VHF Radio: | 2x Jotron TR 30 | | |
| Immarsat Sat-C: | 1x Sailor 6110 | | |
| AIS: | 1x Furuno FA-150 | | |
| EPIRB: | 1x Jotron Tron-40S MKII | | |
| Iridium: | Pilot open port | | |
| Internet Broadband | Starlink System | | |

APPENDIX III
GENERAL TECHNICAL SPECIFICATIONS FOR GUYANA 3D MARINE STREAMER ACQUISITION

Please refer to *General Technical Specifications for Guyana 3D marine streamer acquisition.docx* as attached.

1. Scope

The objective of this document is to ensure that Consortium's requirements during the acquisition of a marine towed streamer seismic survey are met in terms of quality of the seismic and positioning data in order to fulfil the objectives of the seismic survey. All data shall be acquired in accordance with this technical specification, in a professional and cost effective manner and with regard for health, safety and the environment.

BGP is ultimately responsible of the quality of the acquired data.

2. Definitions and significance of expressions

Definitions of other terms used in this appendix are found below.

ISO 9001 International Standards Organisation 9001 - Quality Management System Requirements

CMP Common Mid Point between source and trace centres

DGNSS Differential Global Navigation Satellite System

DGPS Differential Global Positioning System

DNP Do Not Process

EOL End of Line

FGSP First Good Shot Point

GNSS Global Navigation Satellite System

GPS Global Positioning System

IERS International Earth Rotation Service

INS Integrated Navigation System

IOGP The International Association of Oil & Gas Producers

ITRF International Terrestrial Reference Frame

LGSP Last Good Shot Point

Line Acquisition Report Observer's Logs and Quality Control reports for every system in use

MDE Marginally Detectable Errors

P1/11 Format for recording post plot offshore position data, recommended by IOGP

P2/11 Format for recording raw offshore position data, recommended by IOGP

PDOP Position Dilution of Precision (satellite geometry indicator)

Project Quality Plan Document setting out the specific Quality practices, resources and sequence of activities relevant to the particular project. Must be part of the BGP GEO Project Plan.

QC Quality Control

Quality Audit A systematic and independent examination to determine whether Quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives

Quality Manual A document stating the Quality Policy, and describing the quality system of an organization

RINEX Receiver Independent Exchange Format

RMS Root Mean Square

Set back offset Distance between the navigation reference point and the near trace CMP

Surface positioning Positioning of elements located at the surface of the water (source floats, active buoys)

SOL Start Of line

SP Shotpoint

SSB Single Side Band

VHF Very High Frequency

WGS-84 World Geodetic System 1984

3. Data quality

3.1 Quality System

3.1.1 General

The Project shall be managed by an effective Quality System that ensures conformance to the Supplement requirements and provides adequate confidence that the product or service fulfils requirements for quality as per application of ISO 9001 Requirements. The Quality System shall comprise:

- The Quality Manual,
- The Management Procedures,
- Work Instructions (including those specific to the seismic survey),
- The Records, Reference and Support Documentation, - A Specific Project Quality Plan.

These shall be in the English language and available to CGG.

3.1.2 Quality audits

CGG shall reserve the right to assess the technical capacity and review the effectiveness of the Quality System implemented by BGP and subcontractors. This may be accomplished by means of surveillance, review and audit methods at the discretion of CGG.

BGP shall maintain similar methods to assess and review subcontractors. The records shall be made available to CGG.

3.1.3 Project Quality Plan

BGP's Specific Project Plan shall include a comprehensive Project Quality Plan, setting out the Quality practices, resources and activities relevant to all aspects of BGP services during the specific seismic survey.

The Project Quality Plan shall describe BGP's methods to ensure compliance to CGG's requirements for data quality and quality control. With close reference to BGP's general management procedures and

work instructions, it shall detail BGP's equipment, methods, techniques and general configuration by which the seismic survey objectives shall be met.

As a minimum, the Project Quality Plan shall contain:

- Detailed data flow, from raw data acquisition, to QC up to final deliverables.
- Description of BGP's organization which specifies those individuals responsible for achieving compliance with the technical and quality requirements of services.
- Documentation to be produced as evidence of achievement of the requirements.
- Criteria used to measure the acceptance of acquired data including reference to algorithms where applicable.
- Description of deliverable products, formats and media.
- services to be carried out by subcontractors and the methods used by BGP to assess and control these services.

All the specific requirements listed in the various sections of this appendix.

Any variation to this appendix shall be documented and technically justified.

The Project Quality Plan shall be submitted to Consortium:

- In its initial version, after Supplement Award,
- In its successive versions, for review by Consortium, during Preparation Phase.
- The final version approved by Consortium shall be available at mobilization.
- A reviewing process shall be in place all along the seismic survey.

A copy of all Quality System and Project Quality Plan documentation shall be on-board the vessel and be made available to Consortium.

3.2 Quality control and Consortium supervisor(s)

3.2.1 Generalities

Consortium reserves the right to perform independent quality control of the acquired data by Consortium supervisor(s) with the support of specialized QC systems on-board and/or onshore.

The presence of Consortium supervisor(s) and QC systems shall however in no way relieve BGP of any responsibility for seismic acquisition, navigation and positioning. Consortium's QC systems shall not be considered as a part of BGP's QC structure.

BGP shall offer all reasonable assistance to Consortium supervisor(s) in the execution of their tasks, including delivery of QC data that has not been foreseen in the Project Quality Plan but can be reasonably provided by BGP.

At the completion of each seismic line or segment of seismic line, BGP shall provide the data files detailed in Article 9.3 of this appendix. Data files shall be made available to Consortium supervisor(s) as shortly as possible after the completion of the seismic line and for the entirety of the seismic survey.

BGP shall inform Consortium supervisor(s) as soon as possible whenever any item of equipment or any acquisition parameter is out of specification.

In the same way, BGP shall inform Consortium supervisor(s) as soon as possible whenever data is out of specification due to external causes (barnacles, swell, ship, industrial noise, seismic interference etc.).

The detected anomalies shall also be clearly mentioned in the corresponding Line Acquisition Report.

All BGP operational reports, HSE reports and crew lists shall be transferred in the form of electronic files to Consortium's dedicated computer.

3.3 Other Reference documentation

The following documentation shall be available on-board to both Consortium and BGP personnel at any time during the seismic survey:

- Copies of signed final versions of Supplement 1, all Exhibits and appendices;
- Quality System documentation,
- Technical documentation, operation and maintenance manuals pertaining to the equipment used,

4. mobilization and demobilization

4.1 mobilization start-up meeting

At the beginning of mobilization, a start-up meeting shall be held on-board between Consortium REPRESENTATIVES, auditors, supervisor(s) and BGP key personnel to review the objectives of the seismic survey and the details of the services to be performed.

The technical information and documentation included in the Supplement shall be checked and reviewed together with the relevant seismic personnel, in particular operational and HSE constraints, technical parameters, invoicing procedures, Project Quality Plan and deliverables.

During this meeting, BGP shall confirm the procedures implemented for the start of survey calibrations, adjustments and checks.

4.2 FIELD UNIT mobilization and acceptance

During mobilization, calibrations, adjustments and checks of each vessel equipment shall be performed by BGP as detailed in 7.2 of this appendix and in the Project Quality Plan. The results of any check shall be promptly available to Consortium supervisor(s).

As soon as practically feasible, a mobilization report containing consolidated a forementioned items shall be provided.

Acceptance of the FIELD UNIT shall be dependent upon the successful completion of HSE and technical audits and approved by the Consortium supervisor. This acceptance shall be confirmed in two stages:

First stage:

- BGP's and Consortium's Health, Safety and Environmental Management Systems are proven to be in force and functioning.
- BGP's Quality System is proved to be in force and functioning.
- All information and documentation required by Consortium and all information and documentation to be contained in BGP GEO's Project Quality Plan have been provided by BGP GEO.

- BGP's Project Quality Plan has been validated by Consortium representative.
- The FIELD UNIT conforms to the requirements of the Supplement.
- equipment is correctly installed, calibrated, adjusted and operational. BGP has performed test and calibration procedures as described in 7.2 of this appendix and their results have been approved by Consortium supervisor.
- All the contractual spare parts are on-board, available and operational.
- The mobilization Report has been provided by BGP and accepted by Consortium supervisor. Second stage:

One complete seismic line or, in agreement with Consortium supervisor, seismic line segment has been acquired, controlled and accepted in accordance with the requirements of the Supplement.

The mobilization certificate signed by BGP and Consortium supervisor shall be dispatched for signature by BGP GEO representative and Consortium representative.

4.3 FIELD UNIT demobilization

From a technical point of view, demobilization shall be effective when:

- The last Line of the seismic survey (prime, infill or reshoot, according to the fold of coverage and technical requirements) has been acquired,
- All insea/subsea equipment (including non-seismic devices) has been retrieved,
- All production has been accepted,
- Deliverables workflow in place and agreed by Consortium supervisor,

The demobilization certificate is signed by all parties (same procedure as mobilization certificate). All data present in shared drives is protected from any external person not involved in the Supplement.

5. Seismic personnel requirements

The minimum seismic personnel requirement consists of:

- One PARTY MANAGER,
- One DEPUTY PARTY MANAGER,
- One Chief Observer and one Observer per 12 hour shift (Total 3 persons) for each recording vessel,
- One Chief Gun Mechanic and one Gun Mechanic per 12 hour shift. (Total 3 persons) for each source vessel,
- One Chief Navigator and one Navigators per 12 hour shift (Total 3 persons),
- One Chief Seismic Data QC Processor and one Seismic Data QC Processor per 12 hour shift (Total 3 persons).

The Chiefs shall be responsible for the management of their respective team, supervision of both shifts and liaison with Consortium supervisors.

DEPUTY PARTY MANAGER function can be taken by one person, and only one, selected out of the most senior personnel, and who shall be in charge when the PARTY MANAGER is off.

All senior seismic personnel shall be educated to a degree level or to an acceptable equivalent.

They shall be fluent in English and have at least 3 years experience in their current position.

They shall be conversant with the reference documents appropriate to their activity and listed as in Article 3.3 Other Reference documentation of this appendix.

They shall understand the requirements of the Supplement and be able to translate them into practice.

These personnel shall not be reassigned or substituted during the duration of the seismic survey without the prior approval of Consortium.

In case the services include a new technology never used previously by Consortium, BGP GEO shall mobilise a dedicated engineer for the duration of the seismic survey.

APPENDIX IV

A. SEISMIC PARAMETERS AND METHODS

| General | |
|--|---|
| Survey type | 3D Marine Seismic acquisition |
| Technique | Triple source, 8 streamers, separation 90 meters in between streamers |
| Line direction | E-W & NE- SW |
| Line change time | Nominal 3.8hrs, practically 3 - 5.5 hours due to unequal line lengths |
| Estimated Infill | 15% |
| Vessel speed online | Nominal 4.3knots (between 4.0-5.0) |
| Source Details | |
| Source type | Bolt 1900 LLXT |
| # of sources | 3 |
| # of sub-arrays in each source | 2 |
| Active length of the sources | 12.5m |
| Shot interval | 12.5m flip-flop-flap i.e. 37.5m per source |
| Source depth | Nominal 6m |
| Volume per source | Nominal 3060 cu.in |
| Air pressure | 2000 psi |
| *Crossline distance between adjacent sources | Nominal 30m |
| *Inline distance between adjacent sources | Nominal 0m |
| *Crossline distance between adjacent subarrays in a source | Nominal 10m |
| *Inline distance between adjacent subarrays in a source | Nominal 0m |
| Peak-peak | 110.2 barm (2Hz/6dB LC) |
| P/B ratio | 25.0 (2Hz/6dB LC) |
| Gun synchronization | ± 1.5ms, 1.0-1.5 to be logged |
| Drop test criteria | Pressure dropdown < 5% in 5 minutes |
| Gun controller system | Gunlink 4000 |
| Streamer Details | |
| Streamer type | Sentinel® RD Sentinel Solid Acquisition Section Reduced Diameter |
| Number of streamers | 8 |
| Active streamer length | 6000m |
| # of groups per streamer | 480 |
| Group interval | 12.50m |
| Group length | 12.95m |
| Crossline distance between adjacent streamers | Nominal 90 m at near offset |

| | |
|---|---|
| Crossline distance between outer streamers (1-10) | 810m |
| Inline distance between Streamers | Nominal 0m |
| Streamer depth | Nominal 9 or 10m |
| Near offset | Nominal 110m |
| Fan mode percentage | 125% of nominal at far offset, begins from the first lateral steering controller |
| Nominal fold | 80 |
| Compass bird | DigiCOURSE System3 5011E, every 300m, totally 29 compass birds |
| Steering controller | DigiFin9000-5120, distributed every 300-550m from tail forward, totally 16 DigiFins for each streamer + extra 2 at both inner streamers |
| Recording Details | |
| Recording type | Sercel SEAL 428 V2 |
| Sample rate | 2ms |
| Recording length | 8050ms, including 50ms before firing, ± 200 ms randomized firing, 4.0s clean record |
| Polarity | First Break Negative |
| Low cut filter | Inherent analog 2Hz @ 6dB/Oct, Digital out |
| High cut filter | 200 Hz 370 dB/Oct. |
| Pre-amplifier gain level | 0 |
| Data format | SEG-D 8058 rev2.1 |
| Noise evaluation | 5 records SOL/EOL with 6Hz / 18dB LC Filter |
| Seismic data media | IBM 3592 JC Cartridge |
| Native magnetic cartridge capacity | E07: 4TB = 3752GB, E08: 7TB = 6520GB |
| Near field recording length | 5120ms |
| Synthetic far field signal length | 512ms |
| NFH and FFS sample rate | 0.5ms |
| NFH and FFS data format | SEGD Rev 1.0 |
| Online QC processing system | SEAL eSQC / KLAGQC / GeoEast |
| Navigation Details | |
| Shooting Mode | Distance along the line to the nominal CMP |
| FSP (First Shot Point) | According to preplot |
| Run Out | 3000m |
| Run In | Minimum 3000 |
| Reshoot Overlap | 10 shots minimum |
| Velocity through water | Nominal 1500 m/s, or according to T/S Dip tests result |
| Primary Navigation System | Veripos Ultra |
| Diff. correction via | Spotbeam 25E |
| Backup Navigation System | Veripos Apex |

| | |
|--|--|
| Backup diff. correction via | Spotbeam IOR |
| Floating Positioning | RGPS Seatrack 220 for buoys, Seatrack 320 for gun floats |
| Integrated Navigation System | ION ORCA |
| GCS | WGS 1984 UTM 21N |
| Binning Details | |
| Bin Length (m) | 6.25 |
| Bin Width (m) | 15 |
| QC Processing Details | |
| QC processing system | GeoEast V4.1 |
| Processing LC filter | 6Hz @ 18dB/Oct. |
| Resample rate | 4ms (not involving Nav-merge SEGY and brute stack) |
| Raw shots display | Normally 3 shots respectively at SOL, EOL and mid of line |
| Water velocity for first break calculation | 1500m/s |
| Channel RMS windows | Before first break/Target Zone/Water Bottom/End of record |
| Data for source comparison calculation | Average RMS of traces from channel 11-210 of inner 4 streamers in a window hanging from water bottom with a length of 1000ms |
| Data for sensitivity test calculation | RMS in a window hanging from water bottom with a length of 1000ms of common channel stack of the first 1000 shots of each line |
| Sensitivity test criteria | Less than ± 3 dB from adjacent traces (1 reference section in each streamer) |
| Data for near trace cube | Traces from channel 11-20 of each streamer |
| Trace edit flags in Nav-merge SEGY header | 2=edit, 1=others |

B. GRAVITY AND MAGNETICS PARAMETERS AND METHODS

1 EQUIPMENT AND SPECIFICATIONS

The following information as listed below will be provided by CONSORTIUM with all the relevant documentation.

2.1 Onshore Gravity Base Station

Use of an existing Gravity base-tie in a nearest harbour or if not available, establish one in a location which will be described and marked as primary base for future use and recovery. The value of gravity in both 1930 Postdam datum and International Gravity System Network 1971 will be determined by performing gravity base ties to an available IGSN base using a LaCoste and Romberg model G or similar land gravity meter, or an absolute gravity meter FG-5 or similar.

2.2 Onshore Magnetometer and diurnal variation

One magnetometer will be installed in a site free from man-made magnetic or electric sources in an appropriate location in/on.

A spare magnetometer will be available in the event of failure of the primary magnetometer. Periods of unacceptable diurnal magnetic data (10nT linear gradient in a cord of 10 minutes) will be flagged by the contractor.

2.3 Specification of offshore Gravity meter

Specifications of DGS AT1M-8U Marine Gravity Meter




| Component | Variable | Specifications |
|-----------|----------|--------------------------------------|
| SENSOR | Range | Worldwide |
| | Drift | 3 mGal per month or less after aging |

| | | |
|---------------------|--|---|
| | Temperature Set point | Approx 55° (46 to 65°C) |
| STABILIZED PLATFORM | Platform Pitch | ± 25 degrees |
| | Platform Roll | ± 45 degrees |
| | Platform Period | 4 Minutes |
| | Platform Damping | 0.707 of Critical |
| CONTROL SYSTEM | Recording Rate | 1 to 10 Hz |
| | Serial Output | RS-232 ASCII |
| SYSTEM PERFORMANCE | Resolution | 0.01 mGal |
| | Static Repeatability | 0.05 mGal |
| | Accuracy At Sea | <0.7 mGal or better |
| | Dynamic Repeatability: | |
| | 50,000 mGal Horizontal Acceleration | 0.25 mGal |
| | 100,000mGal Horizontal Acceleration | 0.50 mGal |
| | 100,000 mGal Vertical Acceleration | 0.25 mGal |
| MISC | Operating Temperature | 5°Cto 40°C |
| | Storage Temperature | -10°Cto 50°C |
| | Power Requirements (INTO UPS) | 60 watts average, 150 watts max, 80-265 VAC |
| | Dimensions | 71 x 56 x 84 cm (28 x 22 x 33 in) |
| | Weight | Meter : 80 kg (175 lbs) |
| | | UPS : 30 kg (65 lbs) |
| GRAVITY UNITS | 1 Gal = 1cm/sec ² Earth's gravity varies from 978,000 mGals to 983,000 mGals at the surface. | |

2.4 Specification of offshore Magnetometer

Specifications of G-882 Cesium Marine Magnetometer

| G-882SX Cesium Marine Magnetometer | | |
|--|--|---|
|  | | |
| ITEMS | SPECIFICATIONS | |
| OPERATING PRINCIPLE | Self-oscillating split-beam Cesium Vapor | |
| OPERATING RANGE: | 20,000 to 100,000 nT | |
| CM-221 COUNTER SENSITIVITY: | <0.004 nT/ pHz rms. Up to 10 samples per second | |
| ABSOLUTE ACCURACY: | <3 nT throughout range | |
| OUTPUT: | RS-232 at 1,200 to 19,200 Baud | |
| MECHANICAL: | Sensor Fish: | Body 2.75 in. (7 cm) dia., 4.5 ft (1.37 m) long, 40 lbs. (18 kg) |
| | Tow Cable : | Kevlar Reinforced multiconductor tow cable. Breaking strength 3,600 lbs |
| OPERATING TEMPERATURE: | -30°F to +122°F (-35°C to +50°C) | |
| STORAGE TEMPERATURE: | -48°F to +158°F (-45°C to +70°C) | |
| WATER TIGHT: | O-Ring sealed for up to 9000 ft (2750 m) depth operation | |
| POWER: | 24 to 32 VDC, 0.75 amp | |

3 Offshore Gravity operation

3.1 Installation of Marine Gravity Meter

The stabilized platform carrying the gravity meter is to be mounted as near as practical to the point of intersection of the pitch and roll axes of the vessel, away from any source of radio-frequency energy and where it will not be exposed to extremes of temperature or be knocked or damaged.

3.2 Timing Synchronization of Marine Gravity Meter System

The DGS AT1M-8U Marine Gravity Meter Clock Synchronization with the master navigation clock (UTC time) is required to within three (3) seconds.

3.3 Data Record of Marine Gravity Meter System

There will be continuous on-line and off-line digital navigation directly to the gravity systems data loggers at a one second sampling interval. If operating conditions permit, the gravity DATA will be measured and recorded with relevant positions during Line changes. Gravimetric recording may be interrupted while off-line to accommodate DATA archive functions, daily checks or calibrations, system reconfiguration, testing and maintenance.

3.4 Calibration and Checks

The meter will be mobilized while the vessel is alongside and undergo a complete set of in-port checks as prescribed by the instrument manufacturer, including an absolute calibration in relation to an IGSN 1971 international gravity base station. These tests will be undertaken,

- After installation and at the time of MOBILISATION (if possible).
- During every port call.
- Before the equipment is demobilized at the end of the survey.

The tests will be fully documented and will record every measurement taken, and every adjustment made, and will include the time at which the adjustment was made. Digital recordings will be made throughout the time of the tests and the written and digital logs will be submitted to the client.

3.5 Gravimeter absolute calibration

Prior to the start of the survey, any suitable IGSN71 gravity base stations within reasonable proximity of docking locations will be identified, which may be used during the survey. A suggested reasonable proximity is 500 m. These drift recordings will be available for inspection by client.

If a land gravity base station exists within 500 meters of the still reading site, this will be sufficient land gravity data and no further tie will be required.

If no suitable gravity base station exists within reasonable proximity of gravity still reading locations occupied during the survey, then a new gravity base station will be established at the gravity still reading location.

All dockside checks and calibrations will be conducted at the same dockside location. A diagram (map) will be generated, illustrating the vessel's orientation to the dock, key dockside structures, and location of the survey mark. The date, time, latitude and longitude will also be annotated on the diagram.

A qualified gravity technician will complete a full set of "in-port checks and calibrations" as per industry standard procedure prior to the dockside still readings being undertaken.

The marine gravity meter will have been at operating temperature for at least twelve (24) hours prior to the dockside still readings being undertaken.

3.6 Drift

The drift of the marine gravity meter will be checked every time the vessel returns to the port. Gravity readings will be referred to the IGSN point (or known base station) or to the new gravity base station near the harbor.

Gravity system drift will be less than three (3) mGal per month. Gravity meter drift will be monitored by one of the following methods:

Collecting and comparing gravity still readings at each dock or anchorage occupied and reoccupied

during the work. Gravity still readings will be available for inspection.

3.7 Acquisition tolerance

Subject to operational requirements, whenever possible the vessel will adhere to the following limits regarding course changes:

a run-in of at least 10 minutes, or 1 kilometers on the same heading as the survey line. Course changes will not exceed 5°/min and speed changes will not exceed 1 knot/min.

when on-line, course changes will not exceed 2°/min and speed changes will not exceed 1 knot/min.

All speed changes (engine RPM) and heading changes of one degree or more must be annotated on the gravity log.

4 Offshore Magnetic operation

4.1 Installation of Marine Magnetometer

All necessary winches, tow lines and equipment will be supplied to be able to tow the magnetometer sensor behind the vessel at a distance of at least two point five (2.5) times the vessels length, but in any event not less than 150 meters from the stern of the vessel. The sensor is at tow depth of at least five (5) meters. Additionally, the sensor must be kept away from any other in-water seismic equipment. Subsequently, total noise level for deployment will not exceed two (2) nT (including all extraneous and instrument noise).

An accurate drawing of the sensor tow configuration and positioning relative to both primary GNSS antenna and navigation reference point and in-sea equipment will be included in a final report.

4.2 Calibration and Checks

Magnetometers used will be maintained, checked and calibrated as the manufacturer's recommended schedule prior to survey commencement.

4.3 Magnetic Data Record

Magnetic Data Record System from Geometrics Inc. will log Magnetic data at one second sampling interval, and display received magnetic field data and GPS Position data for monitoring in real time. If operating conditions permit, the magnetic data will be measured and recorded with relevant positions during Line changes. Magnetic recording may be interrupted while off-line to accommodate DATA archive functions, daily checks or calibrations, system reconfiguration, testing and maintenance.

4.4 DATA Acceptance & Tolerances

A method for the measurement of the DATA quality and the system noise will be employed. The following is an acceptable example.

Noise

Envelope

e:

After application of a one-second filter, a noise envelope of +/- 1.0 nT or better from all sources within the magnetometer system, (sensor, preamplifier, compensator and digital recording) will be maintained.

For a dedicated magnetic survey, acquisition of magnetic DATA should not take place during magnetic storms.

For the purpose of this specification a magnetic storm is defined as either 5 nT nonlinear variation in five minutes or 15 nT linear variation in 15 minutes. Excessive variations of magnetic DATA on line will be reported to ONBOARD QC REPRESENTATIVE and commented in the line log.

5 Processing Sequence

5.1 Gravity Data

Expected processing steps are:

- 1) Load gravity and navigation into 1 sec database
- 2) Meter gravity recomputation yielding zero-phase unfiltered primary gravity signal
- 3) Cross-correlation of accelerometer-based monitor channels with recomputed gravity
- 4) Appropriate filtering of raw 1 second gravity data (typically with a 120 second filter)
- 5) Calibration of gravity from counter units to mGals and apply drift correction
- 6) Correction to datum using absolute gravity base tie supplied, tie location to be fully documented.
- 7) Removal of Eötvös effects using time-varying decorrelation technique
- 8) Compute theoretical latitude corrections
- 9) Free-air anomaly computation
- 10) Resample data to 10 second sample interval and merge with final navigation from P1/90 tape
- 11) Levelling of line data using zero order intersection mistie statistical procedure and zero error normalization.
- 12) 3D Bouguer correction using predetermined compensation density or statistically derived optimum correction density (suggested as 2.20 g/cm³).
- 13) Data Gridding

Gridding of

data:

In addition to these standard corrections, all clearly erroneous spikes will be edited, areas lacking digital data will be infilled with data digitized from the analogue records, if available, and the gravity data will be filtered to remove noise whilst retaining as much signal as judged available.

Final levelled resolution/accuracy to meet or be less than 400m and 0.4 mGal as determined by along line filtering and zero order cross-over RMS miss-tie statistics (or other agreed method).

5.2 Bathymetry Data

Load bathymetry data with final navigation from P1/11 data and apply the following steps:

- 1) Vessel draft correction, if necessary
- 2) Spike editing
- 3) Levelling of line data using zero order intersection mistie statistical procedure or zero error normalisation
- 4) Data gridding

5.3 3 Magnetic Data

Expected processing steps are:

- 1) Data loading in database, including base-magnetometer data
- 2) Merge magnetic data with final navigation from P1/11 data
- 3) Spike editing and quality control
- 4) Base-magnetometer decorrelation using observatory data
- 5) Computation of relevant IGRF field and reduction of corrected total magnetic field to magnetic anomaly field
- 6) Levelling of line data using zero order intersection mistie statistical procedure or zero error normalization.
- 7) Data Gridding:

In addition to these standard corrections, all clearly erroneous spikes will be edited, areas lacking digital data will be infilled with data digitized from the analogue records, if available, and the magnetic data will be filtered to remove noise whilst retaining as much signal as judged available.

Final levelled resolution/accuracy to meet or be less than 100m and 0.2 nanoTesla as determined by along line filtering and zero order cross-over RMS miss-tie statistics (or other agreed method).

APPENDIX V

PROCESSING/REPROCESSING/INTERPRETATION SEQUENCE AND DELIVERABLES

I. Proposed 3D Processing Sequence:

- **NOTIONAL PROCESSING FLOW**

The processing flow might change according to actual data quality and test results.

A. **Time Preprocessing:**

1. Trace edit, Nav-Merge QC and resample to 4ms
2. Low frequency noise removal
3. Deblending
4. Common shot/channel noise attenuation
5. De-bubble
6. Direct arrival attenuation
7. Shot and channel amplitude compensation
8. Receiver Motion Corrections
9. Tidal Static Correction
10. 3D de-ghosting
11. Zero-phasing and survey matching
12. De-multiple (MWD and 3D SRME)
13. Residual noise attenuation
14. 3D binning
15. 4D Anti-Alias Anti-Leakage Fourier Transform, Regularization & Interpolation
16. High Resolution Radon De-multiple
17. Inverse Q Compensation – single value (Phase Only)
18. Survey matching and merging
19. Acquisition Footprint Removal
20. Residual denoise in common offset

B. **Velocity Model Building:**

21. Water flood through RTMM and water bottom picking
22. Build initial model from available
23. Tomography for shallow velocity update
24. Time-Lag FWI to 8Hz
25. Tomography for target level
26. Well mistie tomography for anisotropy update
27. Time-Lag FWI to 8Hz
28. Tomography for velocity update below top Albian

C. **Fast Track PSDM:**

TTI Kirchhoff PSDM migration using FT input and step 23 velocity model

D. Final Migration and Post-migration Processing:

29. Final TTI Kirchhoff PSDM Migration
 - Migration type – Kirchhoff TTI
 - Bin size – 12.5x15m
 - Half aperture – up to 6km
 - Migration depth – up to 10km
 - Depth step – 5m
30. RMO Velocity analysis
31. Trim statics
32. High Resolution Parabolic Radon De-Multiple
33. Ray tracing-based Depth Q
34. Stack (Full, Near, Mid Far AND Ultra-far Angles)
35. Post Stack Processing