



Exploration & Production

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 204

Geophysical debris survey

04	10/2009	Revision § 2, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.7 & 7.2.2.7
03	10/2008	Reference to GS EP GEO 301 & 302. Pipeliner removed.
02	10/2005	Addition of "EP" root to GS identification
01	11/2003	Change of Group name and logo
00	02/2001	First issue
Rev.	Date	Notes

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1. Scope

This Specification describes the work related to an offshore debris clearance survey to be carried out on an offshore field, before the installation on the seabed of drilling/production structures, and/or before a seismic survey to ensure clearance for the streamer(s) and the seismic survey vessel.

It defines the equipment and describes the procedures to be used in order to establish the seabed features and sub-seabed conditions likely to be encountered within the surveyed area.

All requests in this Specification are considered as a minimum and shall be fulfilled. This document shall be used as the basis for data acquisition, interpretation and production of the final report.

The objectives, based on the acquired data, are to evaluate the potential risks affecting the installation of any structure on the seabed including, but not limited to:

- Presence of production/off-loading structures (platforms, pipelines, subsea templates, wharf, loading stations, etc.)
- Presence of natural obstructions (coral reef, rock outcrops, boulders, shoals, etc.)
- Presence of explosive ammunitions (mines, bombs, etc.)
- Presence of man-made obstructions (wrecks, dead weights, debris, fishing nets, etc.).

To achieve these objectives, the following investigations shall be carried out:

- Measure the water depth variations from surface
- Determine the slope of the seabed
- Locate by acoustic scanning any natural or man-made seabed obstruction such as rock outcrops, escarpments, reefs, depressions, debris, mines, bombs, wrecks, industrial structures, pipes or cables, etc.
- Identify visually and locate the main potential obstructions on the seabed.

Detect buried magnetic debris in some specific areas.

A classical debris survey is performed in a first stage. As an OPTION, a survey conducted with an ROV can be performed.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

In addition, applicable codes and Standards which are to be used in conjunction with this specification will be listed in the Particular Specification.

The order of precedence of the applicable documents shall be:

- The Particular Specification
- The present General Specification
- The Codes and Standards in reference.

Where this specification states no overriding requirements, the referenced Codes and Standards shall apply in full. Standards equivalent to those referenced herein shall not be substituted without written approval from the COMPANY.

Standards

Reference	Title
IAGC E&P Forum	Marine Geophysical Operations Safety Manual 7th edition, 1991 Service Vessel Marine Safety Guidelines, Report no. 6.38/213, December 1994 Health, Safety and Environmental Schedules for Marine Geophysical Operations, July 1995 Guidelines on the use of Small Boats in Marine Geophysical Operations, July 1995

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP GEO 201	Offshore geophysical surveys
GS EP POS 001	Offshore surface positioning works
GS EP POS 002	Subsea positioning works

3. Units and abbreviations

3.1 Units

System of measurements: The SI system of units shall be used in all relevant measurements, processing and reporting.

3.2 Abbreviations

COMPANY	Total or its subsidiary or agent acting on its behalf
CONTRACTOR	The COMPANY, or their agents designated in the contract as being the main CONTRACTOR for the installation and the survey of the pipeline
DGPS	Differential Global Positioning System
HPR	Hydroacoustic Positioning System
LBL	Long Base Line System
USBL	Ultra Short Baseline System
ROV	Remote Operated Vehicle
LAT	Lowest Astronomical Tide
DCC	Distance Cross Course
TDS	Temperature Depth Salinity
VHF	Very High Frequency
WGS 84	World Geodetic System 1984
UTM	Universal Transverse Mercator
KP	Kilometre Post

Additional terms and definitions utilized herein are defined elsewhere in the relevant contract documents.

4. Survey location and scope of works

4.1 Survey location

The area to be surveyed is defined in the Particular Specification.

These coordinates shall be confirmed prior to starting the operation. The coordinates of the platforms shall also be supplied prior to starting the operations.

4.2 Scope of works

The survey comprises tasks. These tasks are defined in the Particular Specification.

5. Requirements for the general debris clearance survey

The debris clearance survey shall be performed according to the following requirements:

5.1 Minimum size of areas to survey

The size of the area is defined in the Particular Specification.

5.2 Minimum grid

The grid is defined in the Particular Specification.

5.3 Minimum side scan resolution

A compromise between the sonar range and the vessel speed must be reached in order to locate all debris with a minimum size of 50 cm.

A maximum sonar range of 100 m is requested.

6. Equipment

6.1 Survey/ROV support vessel

6.1.1 Vessel acceptance

The vessel must be designed for survey investigations and ROV operations. In addition, the vessel must be designed for work in the area all year round and be able to stay at sea for a minimum period of four weeks without port calls.

6.1.2 Vessel certification

The vessel must be certified and equipped according to its class and number of personnel to stay on board.

6.1.3 Key Personnel qualification

The certificates and qualifications of the officers on board must be accepted by the local authorities and be in accordance with the Total reference documents

6.1.4 Safety

The vessel must have been audited by the Company prior to the commencement of the work.

6.1.5 Specifications

- Vessel minimum length: 40 metres
- Vessel minimum transit speed: 10 knots
- Vessel working speed: 3 knots

6.1.6 Acoustic noise

The noise generated by the vessel must be outside the frequency spectrum recorded by the equipment used for the survey.

An acoustic spectrum of the ship's engines must be provided prior to mobilisation, if no evidence of similar use within the same specifications can be supplied.

6.1.7 Communication

6.1.7.1 Externally

- VHF radio covering all standard marine frequencies and preferably also common frequencies used by fisheries
- Satellite telephone and telex/telefax
- Radio telephone with telex/telefax operational in the area of interest.

6.1.7.2 Internally

A minimum, fixed two-way communication system between the following locations:

- Bridge
- Instrument room
- Navigation room.

And a portable system between:

- Bridge
- Aft deck.

6.2 Shallow draught boat

A shallow draught boat shall be used for all surveys in areas where the water depth is less than 10 metres and basically in all places where no access is given to the main survey support. The basic equipment for the survey of these shallow areas is remote DGPS (boat position followed on the main survey vessel), pole mounted echo sounder and pole mounted side scan sonar. Due to the risk of unforeseen contacts with the coral reef or coral spot rocks, a hard hull is requested (metal or plastic).

VHF radio communication shall be made available with the main support as well as DGPS radio transmittal of remote position. Special frame shall be made for the installation of the survey acquisition equipment (Echo sounder + Side scan sonar). The possibility of towing a magnetometer fish must also be available, if this equipment was decided to be used for specific purposes. Snorkelling diving equipment shall be available on this small boat for local visual checks in shallow water (less than 10 metres).

6.3 Positioning and navigation system

6.3.1 Geodetic parameters

They shall be defined in the Particular Specification.

6.3.2 Differential GPS system

The positioning work shall only commence with all systems fully functioning. All specified navigation and positioning equipment including computer hardware and software shall be installed, calibrated and operational.

The positioning must be performed in accordance with the **GS EP POS 001**.

6.3.3 Shore calibration

The shore calibration must be performed in accordance with the **GS EP POS 001**.

6.3.4 Offshore calibration

The offshore calibration must be performed in accordance with the **GS EP POS 001**.

6.3.5 RTDGPS positioning system requirements

The requirements are detailed in the **GS EP POS 001**.

6.3.6 Peripherals

The positioning system shall be interfaced with peripherals including: calculator, on-line plotter, video monitor (in wheel house and in laboratory), printer, data logger, all necessary programmes.

The navigation system will have the capability of recording and displaying the parameter of each shot position. The Quality Control statistics shall be available at the end of each survey line.

Mainly:

- Histogram of the line deviation which peak value shall not exceed ± 10 metres from the preset track
- Histogram of the fixing interval which deviation shall not exceed 10% of the selected value.

6.3.7 Ultra short base line acoustic positioning

The Ultra Short Base Line positioning must be in accordance with **GS EP POS 002**.

6.3.8 Integrated navigation system

A PC shall be interfaced to acquire the positioning data in real time (including bathymetry, acoustic distances, gyro heading, etc.). The data shall be stored, with some output to plotters, printers and monitors.

The available options in each navigation peripheral must include, but shall not be limited to:

- Real time plotter:
 - Antenna position
 - Position of equipment corrected for lay back or lateral offset
 - Scale.
- Monitor:
 - Vessel's shape
 - Existing structures or obstacles
 - Plot of course to follow
 - Plot of course made good
 - Eastings

- Northings
- Latitude and longitude
- Standard deviation¹
- Water depth
- Official time
- Line identification of line acquired or to be acquired
- Distance to start of line
- Distance to end of line
- Gyroreading
- Course made good
- Distance cross course
- Speed
- Scale.
- Printer:
 - Line identification
 - Fix number
 - Official time
 - Identification and co-ordinates of the reference stations
 - Gyroreadings
 - Eastings
 - Northings
 - Latitude and longitude
 - End of line statistical analysis consisting of:
 - . Standard deviation histograms (values within 3 metres)
 - . DCC histogram (within 10 metres of the theoretical lines)
 - . Fix interval histogram (within 10% of the theoretical interval).

6.4 Equipment for seabed and debris investigation

6.4.1 Bathymetric equipment

6.4.1.1 Echo-sounders

Two echo sounders (+ spares) shall be supplied: one fix system on the main survey support and one portable system on the shallow draught boat.

¹ If applicable

6.4.1.1.1 Specifications

- Dual frequency transducer (typically 30 and 200 kHz)
- Narrow beam
- Stabilised power supply
- Display of the propagation velocity in water
- Digitisation of readings
- Heave compensator (not necessary on the shallow draught boat).

6.4.1.1.2 Procedure for calibration

Determining the transducer depth

The depth of the transducer must be measured prior to departure from port, on return after completion of the work, and after bunkering or loading of any heavy piece of equipment likely to change the draft of the vessel.

Determining the average sound velocity in the water column at location

The calibration is performed using a metal grating lowered into the water below the transducer. Unambiguous readings must be taken every 10 metres all the way to the bottom. The same procedure should be used when retrieving the metal grating.

The calibration shall be performed before and after the bathymetric work on each survey location or as often as necessary when conditions change (climate, breakdown, etc.).

During calibration, position fixes must be taken at regular intervals. The date and time of calibration should be indicated.

If environmental conditions prevent the use of a metal grating, the average sound velocity in the water column shall be determined using a TDS or velocimeter probe.

The calibrations are essential. If they are not performed all bathymetric recordings will be rejected.

Note: The cables for the two items (metal grating and TDS) must be graduated and long enough to reach the sea bottom.

6.4.1.2 Tidal corrections

Raw soundings must be corrected for tidal variations and hydrological balance (to be obtained from local sources) and expressed into the local vertical reference datum. If necessary, a tide gauge mooring will be deployed for this survey.

6.4.2 Side scan sonar equipment

6.4.2.1 Fish and recorder

- Slant range correction bi-frequency Sonar of 100-500 kHz
- Dual channel isometric paper/digital recorders and processing/charting software. The charting software shall include real time geo-referenced mosaicing
- Scales from 25 to 150 m.

6.4.2.2 Winch-cable

An electric/hydraulic winch with slip rings shall be provided to adjust the length of cable out during the runs.

A minimum length of cable (typically 500 metres) shall be supplied according to the specified water depth.

A "length of cable out" measuring device shall be supplied with direct read-out in the instrument room.

The height of the tow fish above the seabed (typically 10% of the selected range) and the speed of the vessel must be adjusted to ensure optimum performance of the system.

6.4.2.3 Back-up equipment

Due to the large amount of lines to be recorded, two back-up sonar systems shall be supplied.

6.4.2.4 Fish tracking

The fish must be positioned with the acoustic USBL system.

6.4.3 Magnetometer equipment

A high sensitivity magnetometer shall be used for the location of ferrous debris. During the acquisition of lines, the system shall be towed. The system shall be versatile enough to be used on the ROV. For this specific survey, which will be run in the vicinity of jackets platforms, the system shall be capable of approaching the platforms until a distance of 10 metres.

The minimum requirements are:

- Light weight system to be used either on the ROV or as a towed system
- High sensitivity: 0.01 Gamma
- Acceptable position of the tow fish: ± 5 m
- Control of the fish depth with pressure gauge.

6.4.4 Remote Operated submersible Vehicle (ROV) - OPTIONAL

Basically the ROV shall be used for the sole observation and identification of the echoes found on the seabed. Nevertheless, some bathymetric and magnetometric survey may be carried out and therefore some survey equipment shall be requested.

The proposed **Obs-ROV**, its survey and acoustic positioning equipment must be adequate for the water depth and environmental conditions expected in the area.

The ROV must have sufficient power to progress in currents up to 1.0 knot from any direction and to overcome drag forces on the umbilical paid out.

The ROV must have sufficient payload to carry its basic equipment outfit and the survey equipment defined below:

- High frequency obstacle avoidance sonar
- Closed circuit colour television system
- Compass
- Bathymetric survey suite comprising an echo sounder and depth sensors

- Acoustic transponder/responder (USBL system compatible with survey vessel acoustic system)
- Magnetometer frame.

The umbilical capacity and multiplexer system must be sufficient to supply all the required power to control the ROV and its equipment and to transmit all the sensor signals, when used simultaneously, with no mutual interference.

6.4.4.1 Closed-circuit television system

The ROV shall be equipped with one colour video camera mounted on pan and tilt unit.

The camera shall be controlled from the surface control unit, and recorded on original video tapes with voice commenting and appropriate annotation (Coordinates, depth, etc.) superimposed on the display. Good lighting is required to ensure high quality video data.

The surface control room shall include:

- The control console
- The navigation control monitor
- The colour TV monitors
- The data and video recording systems.

6.4.4.2 Video print facilities

Printing from the video tape shall be available upon request.

6.4.4.3 Compass

The ROV shall be equipped with a flux gate compass and its calibration shall be checked at regular intervals against the vessel's gyrocompass.

6.4.4.4 Bathymetric survey suite

In order to provide highly accurate depth measurements, the ROV shall be equipped with a high precision altimeter together with a high precision pressure sensor (0.1% of the water depth).

Both sensors must be calibrated and the results compared with those of a vessel's hull mounted high precision echo sounder. Depth information shall be logged for further integration in the processing and drafting sequence.

The velocity through the water column shall be calculated using appropriate equipment.

Atmospheric pressure shall be taken into account.

6.4.4.5 Magnetometer system

When debris are buried, their position shall be obtained from a magnetometer system.

This equipment shall be mounted on the front of the ROV, within sight of the front camera.

Target representations and numeric indications shall be displayed on the surface console and recorded on video tapes.

All digital data shall be logged on disk for further processing.

6.5 Real time processing and charting

Besides to the usual real time digital video/recorder displays of the side scan sonar systems, a special attention shall be paid to real time charting and processing of the data, in order that all significant echoes and targets are listed and located during the acquisition of the sonar records.

Due to the amount of side scan sonar data expected to be recorded, and the necessary online processing, at least two kinds of specialised computer facilities are requested:

- Real time geo-referenced display on screen of the sonar records and possibility of online storage with the mouse of the targets parameters: time, X, Y positions, comments. Simultaneous online charting of the targets on a large A0 format plotter is also requested
- Off line charting facilities for the production of onboard documents, and particularly a high performance mosaicing system is requested.

7. Quality control and reporting

7.1 Quality control

7.1.1 Equipment quality control

All equipment must be installed and operated in accordance with the MANUFACTURER's specifications.

All items of equipment must be tested and calibrated in accordance with the operator's quality procedure and the MANUFACTURER's procedures, as often as recommended by MANUFACTURERS in order to ensure that the equipment is providing consistent, reliable data during the course of the survey.

Equipment provided must be of recent make and under no circumstances older than five years.

7.1.2 Data quality control

In order to check the data quality during the tuning phases, when applicable, the operator must run one or more test lines on areas where survey work has been done in the past. Records will then be compared and the quality of current records must be at least equivalent.

7.1.3 Spare parts

All key equipment must be duplicated and all necessary spare parts supplied to avoid down time during the survey. A detailed list of the back-up equipment and of all spare parts must be documented in the tender documents by the operator and checked by the onboard representative during mobilisation.

The detailed technical manual of each item of equipment must be available on board.

7.2 Reporting

7.2.1 Preliminary report

A preliminary report shall be delivered to the onboard representative before survey demobilisation. This report shall be accompanied by a copy on floppy disks of the raw co-ordinates of the events (ASCII format).

The preliminary report must include the following:

- Water depth over the survey area
- Min. and max. water depth in the survey area
- Min., max. and average slope
- Possible obstructions, with:
 - Date
 - Time
 - Description of events
 - Dimensions
 - Co-ordinates
 - Corresponding video tape number.
- Potential problems which might be encountered during installation
- Preliminary recommendations before installation.

7.2.2 Final reports

One report for each task shall be issued.

Prior to dispatching, the draft final version of the survey report shall be submitted for checking and approval not more than twenty one (21) calendar days after arrival of the field data at the operator's premises.

7.2.2.1 Title

The final report shall be entitled:

Subsidiary name
Project name
Debris clearance survey
Survey COMPANY'S name
Start/end dates of offshore works
Survey report

7.2.2.2 Certification

The first page of each report shall be the certification and shall specify:

- Name of Party Chief in charge of the field works
- Name of person responsible for checking Navigation/Bathymetry
- Name of person responsible for Sonar and magnetometer Interpretation
- Name and signature of QA/QC issuing Authority
- Date of issue.

7.2.2.3 Content

The report shall contain the following sections:

Section 1

"Abstract" giving a brief description of the operations:

- Date of survey
- Location surveyed with key co-ordinates and situation plan
- Type of vessel and equipment used, positioning, acquisition procedures and operation parameters
- The number of line kilometres recorded
- Summary of the main survey results (water depths, sonar features or obstructions, expected nature of soils at the seabed)
- Evaluation of potential risks regarding the installation of the structure on the seabed
- Conclusion and recommendations summarising the main results with respect to the planned activities.

Section 2 - Results

This part, dealing with the description of seabed features and the seabed obstructions (bathymetry, morphology, debris, nature of soils, etc.), shall include but not be limited to:

- Situation plan with limits of the survey area and existing structures
- Bathymetric data and average, maximum and minimum slopes
- Tidal information and reference level calculation
- Echosounder calibration
- Side scan sonar interpretation
- Magnetometer interpretation
- Prints of the records showing typical seabed features
- Assessment of seabed conditions clearly pointing out hazardous events for the structures and giving a full description of the major obstructions.

Section 3 - "Technical report"

The following shall be included:

- The programme carried out and the number of line kilometres
- The percentage times of operation, transit, stand-by and breakdown
- The settings and the recording parameters used (equipment layout/offsets, source/receiver submersion, energies, filters, ranges, etc.)
- The accuracy on the soundings (statistical analysis of observed discrepancies at line crossing, absolute error calculation)
- The results of the calibration
- Typical examples of QC histograms

- The results of the positioning system accuracy check and monitoring
- A printout of the predicted tidal data.

Section 4 - "Appendices"

This section shall review the work definition and technical specification and provide an extensive description of the resources used to perform the whole survey. It will comprise:

- Appendix 1: Reduction of all charts to A3 standard size
- Appendix 2: Summarised tidal data and correlation to the Chart Datum
- Appendix 3: Description of online and off line processing/charting tools
- Appendix 4: Personnel involved
- Appendix 5: Daily survey diary
- Appendix 6: Detailed description of the survey vessel and survey offsets
- Appendix 7: Detailed description of the survey equipment including echo sounder, side scan sonar, magnetometer
- Appendix 8: Surface positioning system description
- Appendix 9: Acoustic positioning system description
- Appendix 10: ROV and ROV sensors such as altimeter and pressure sensor, gyrocompass, magnetometer
- Appendix 11: ROV video equipment
- Appendix 12: Video recording and display system
- Appendix 13: Video tape index
- Appendix 14: Printout of profiles and field records as listed in 7.2.3.

Section 5 - "Maps"

Because of the reduction of all charts to A3 standard size, special attention must be paid to the printing quality.

All maps should show the geographical and grid co-ordinates in the local datum, as well as the survey grid (in filigree) and a North arrow. All sheets must show overlapping zone (at least 10 cm) with match lines.

An assembly map must be presented on a situation plan, and all symbols used must be explained in a legend.

7.2.2.4 Certification

The personnel in charge, date of issue and revision number must be indicated on each map.

7.2.2.5 Map scales

The scale of all maps shall be defined in the Particular Specification.

7.2.2.6 Maps

- General situation map showing the intended structure location, the existing platforms, cables, pipelines and, in general, all place names used in the report. This map must also appear in the text
- Track charts, showing the tracks, intended and existing structure location, etc.:
 - Vessel reference track chart
 - Sonar fish track chart.
- Sounding chart (soundings reduced to local datum level)
- Contour map (contour interval: 0.5 m) with topographic features/obstructions obtained from side scan sonar. If a large number of features are discovered, a separate morphological map is drawn
- For each map, the corresponding mosaic of the side scan sonar records shall be supplied
- Track chart, showing the ROV reference track, intended and existing structure location, etc.
- Chart of all events related in section 6 hereafter.

Section 6 - "List of events"

This section shall present clearly all the events found in each subdivision of the survey area. The following information shall be given in the form of tables:

- Chart reference
- Number of event
- X position
- Y position
- Description
- Dimensions.

7.2.2.7 GIS requirements

As a separate deliverable, the data acquired shall be provided in a format fully compatible with requirements of the Total GIS (Geographical Information System, or survey database).

7.2.3 Document delivery

7.2.3.1 Final report

When the final version of the survey report has been approved and amended accordingly, the final copies (number defined in the Particular Specification) and one electronic version (Adobe Acrobat PDF files) shall be output and sent to COMPANY as defined in the Particular Specification.

In addition, all charts shall be stored on CD-ROM / DVD in both DGN and DWG formats, to be sent to the COMPANY.

7.2.3.2 Field data

All original records must be sent within one month of final report delivery and must comply with the following requirements:

- Each tape, file and roll shall be assigned a reference number and recorded on the same listing. The detailed listing of original records, including the common reference numbers, shall be included in Appendix 14 (see section 4, para. 8.2.2) indicating for each file roll:
 - The type of equipment
 - The file or number
 - Profile numbers with, for each, the first and last fix numbers
 - The date of the recording
 - The location name.
- Data must not be destroyed without written approval.