



Exploration & Production

## GENERAL SPECIFICATION

### SURVEYS

#### GS GEO 501

**Metocean survey**

|      |       |                                                 |
|------|-------|-------------------------------------------------|
|      |       |                                                 |
| 02   | 10/04 | General review                                  |
| 01   | 10/03 | General review – Change of Groupe name and logo |
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## 1. Scope

A metocean survey consists of collecting measurements in order to characterize the metocean parameters for a project:

- Wind and other meteorological parameters
- Waves, current, tide and other oceanographic parameters.

The duration of the data acquisition, the number of parameters measured and the equipment used depend on the objective of the survey, which is described in the Particular Technical Specification issued as part of the Invitation to Tender (I.T.T).

The general objective of a metocean survey is to develop a comprehensive metocean database relevant to a specific project. It may consist of:

- Comprehensive survey required for a development project, for instance in a data sparse area. Generally, the measurement of principal wind, wave and current parameters for at least one year is necessary in order to capture a representative range of conditions in the measurements.
- Complementary survey required for the verification of assumptions in the design basis of a project. It can be limited to one or two months, for example a tide or tidal current survey.
- Spot checks for particular projects, for example, measurements of seawater temperature and salinity profiles or measurements of sea water turbidity.

This General Technical Specification describes the general requirements for data acquisition, processing, analysis and reporting. It indicates the minimum standards required by COMPANY. However, COMPANY may specify additional requirements, as detailed in the Particular Technical Specifications.

The work defined in this specification shall be performed in accordance with the CONTRACT.

## 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.

### Standards

| Reference                                               | Title                                                                                                                                   |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">NORSOK Standard 002 Rev 1 Sept 1997</a>     | Collection of metocean data                                                                                                             |
| <a href="#">ISO/DIS 19901-1, DRAFT dated 2004-09-09</a> | Petroleum and natural gas industries — Specific requirements for offshore structures — Part 1: Metocean design and operating conditions |

## Professional Documents

| Reference                                     | Title                                                                                  |
|-----------------------------------------------|----------------------------------------------------------------------------------------|
| WMO no. 8 - 1996                              | Guide to meteorological instruments and methods of observation                         |
| WMO no. 49 Vol.1 - 1988                       | General meteorological standards and recommended practice                              |
| API RP2A-WSD 21 <sup>st</sup> Ed. - Dec. 2000 | Recommended practice for planning, designing and constructing fixed offshore platforms |
| OGP Report 348 Dec 2003                       | HSE guidelines for metocean surveys                                                    |

## Regulations

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

## Codes

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

## Other documents

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

## Total General Specifications

| Reference  | Title                                               |
|------------|-----------------------------------------------------|
| GS GEO 301 | Offshore surface positioning works                  |
| GS GEO 504 | Comprehensive evaluation of metocean conditions     |
| GS GEO 505 | Monitoring of Metocean Conditions on Offshore Units |

## 3. General conditions

The general conditions of metocean surveys are specified hereunder.

English is the required language for any documentation and correspondence.

If a subcontractor is involved, they shall comply with the same requirements as CONTRACTOR.

### 3.1 Survey work

The work defined in this specification shall include all works necessary for, or incidental to, the execution of meteorological and oceanographic surveys for the project.

The work shall include, but not necessarily be limited to the following:

- Meteorological and oceanographic data acquisition
- Analysis of recorded meteorological and oceanographic data
- Preparation of reports providing sufficient information for the project engineering studies
- Supply to COMPANY of recorded meteorological and oceanographic data.

### 3.2 Survey requirements

CONTRACTOR shall ensure that its work shall lead to the best possible quality of survey, by undertaking all work in a professional and careful manner.

CONTRACTOR shall ensure that sufficient data are collected to produce a meaningful analysis, as defined in this General Specification and in the Particular Technical Specification. CONTRACTOR shall take all reasonable precautions to ensure the integrity, accuracy and security of the equipment, measurements and the processed data.

In the event of insufficient data from a specific parameter being collected to produce a meaningful analysis, CONTRACTOR shall repeat that part of the survey once.

If any error is observed either in survey work or in calculations, notes, drawings, etc., CONTRACTOR shall correct it at no charge to COMPANY.

### 3.3 Personnel

CONTRACTOR shall demonstrate in his offer that all personnel selected for the survey are qualified, competent and medically fit to undertake the tasks assigned to them, in accordance with section 5.4 of the [OGP Report 348](#). The number of operators shall be sufficient at all times in order to perform the operation as stated by CONTRACTOR in his offer, in accordance with section 5.4 of the [OGP Report 348](#).

CONTRACTOR shall submit for approval to COMPANY the resumes and the details of all personnel that will be involved in the work, including where appropriate academic and professional training certificates and certification for offshore working.

In particular, CONTRACTOR shall appoint (and identify in his offer) a project manager who shall be its representative at CONTRACTOR office, as well as an on-site representative for the duration of site works. CONTRACTOR shall also identify in his offer the person selected to lead the survey operation (where multiple vessels are proposed, each vessel to have a designated survey leader in addition to an overall survey leader).

CONTRACTOR personnel shall always note that the survey or survey preparation area may cover private land and that the personnel must behave correctly with owners and property even though necessary authorisation to enter property has been obtained.

All data, all results and all information that are provided by CONTRACTOR to COMPANY shall be checked and approved by a recognised metocean expert, whose resume, details and certificates shall be provided in CONTRACTOR's offer.

### 3.4 Working environment

CONTRACTOR shall take into account the local working environment for the definition and the design of the survey, for the logistics, for the maintenance of equipment and for the watching of equipment. Where possible COMPANY will provide details of environmental conditions and

climate in the survey area. COMPANY will also provide where possible region specific information (for example political situation, operating regulations).

CONTRACTOR shall be responsible for obtaining all necessary permits, licenses etc. for all personnel and equipment to operate at the sites.

When possible, COMPANY will give assistance to CONTRACTOR for logistics.

In general, the working environment is one of the following categories, with regard to logistics:

### 3.4.1 Area with existing offshore installations

In such environment, CONTRACTOR will generally find:

- Structures for support of sensors
- Positioning system or the means to easily install such a system
- Marine logistics for installation, maintenance, inspection and watching of equipment.

In such an environment, COMPANY will generally be able to give assistance to CONTRACTOR for marine logistics.

In general, CONTRACTOR will be authorized to take advantage of existing structures to install the sensors, providing:

- Necessary approvals shall be obtained from COMPANY.
- Equipment shall comply with safety requirements according to the operating mode (radio transmission) and power supply.
- Installation shall comply with safety requirements pertaining to the area of installation (safety zones).
- Equipment shall not impair or interfere with existing installation (transmission frequencies, underwater acoustic frequencies, etc.).

Application for installation of equipment shall be made to COMPANY with supporting documents:

- Safety certificates of equipment
- Installation description
- Installation procedure.

### 3.4.2 Area without marine logistics

In such environment, CONTRACTOR will generally not find any installation close to the survey area.

CONTRACTOR shall arrange the following:

- Marine logistics for installation, for regular maintenance and inspection.

In case the vessel is supplied by CONTRACTOR, the logistics during the mobilisation and the demobilisation phase will be under the CONTRACTOR's responsibility with COMPANY's approval. The logistics will include but not be limited to the following :

- Transportation of the equipment from CONTRACTOR's yard to port of embarkation
- Transportation of the CONTRACTOR personnel to the port of embarkation

- Room and board of the CONTRACTOR personnel in port of embarkation
- Transportation of the equipment from port of embarkation to site
- Transportation of the CONTRACTOR and COMPANY personnel from port of embarkation to site
- Room and board of the personnel on site
- Necessary marine support or others for equipment deployment at sea and for recovery
- Providing of helpers.
- All the technical equipment required for the performance of the WORK.
- Telecommunications (INMARSAT portable station, talky-walky, etc....)
- Positioning system
- Watching of equipment by security personnel, satellite tracking or other appropriate means as discussed between COMPANY and CONTRACTOR.

### 3.4.3 Area without marine nor land logistics

In such environment, CONTRACTOR will generally not find any assistance from COMPANY, neither offshore nor inshore.

CONTRACTOR shall arrange the following:

- Land logistics, as necessary
- Marine logistics for installation, for regular maintenance and inspection (see section 3.4.2)
- Positioning system
- Watching of equipment by security personnel, satellite tracking or other appropriate means as discussed between COMPANY and CONTRACTOR.

## 3.5 Health, Safety and Environnement (HS&E)

Complementary to specific HS&E requirements disseminated in the present General Specification, additional HS&E documentation shall be given to COMPANY post award of CONTRACT. As a minimum, this will likely include:

- Project Safety Plan (Appendix E of the [OGP Report 348](#) refers)
- Emergency Response Plan (Appendix F of the [OGP Report 348](#) refers)
- A Job Hazard/Safety Analysis (JHA/JSA) associated with the different types of operation should accompany these plans.

## 3.6 Equipment

The term 'equipment' includes all instruments and sensors, all acquisition, processing, recording, transmission and display systems and all other materials and complementary equipment necessary to complete the survey.

CONTRACTOR shall supply all equipment. The equipment shall include all spare parts and repair kits that may be necessary to provide normal and continuous operations.



CONTRACTOR shall guarantee that equipment is designed to perform the work in accordance with COMPANY requirements and as specified in the General and Particular Technical Specifications.

Equipment shall be properly maintained, in a clear and orderly condition, and shall be in good operating condition at the start of the survey. It shall be sufficient at any time to perform the whole operation within the time stated in the Particular Technical Specification. In particular, CONTRACTOR shall carry out tests on all equipment, prior to commencing operations, to ensure that everything is in perfect working order. CONTRACTOR shall provide certification of all lifting/lowering gear to be used during the survey, including design breaking strains and safe working loads.

CONTRACTOR shall guarantee that instruments are selected to provide accuracy of measurements within the tolerances specified in the General and Particular Technical Specifications.

CONTRACTOR shall ensure and provide evidence that all sensors are calibrated just prior to deployment, in order to guarantee the accuracy of measurements, and just after the end of the survey in order to check drift in measurements and to correct it if necessary. In addition, CONTRACTOR shall supply prior to commencement of operations MANUFACTURER's calibration certificates.

COMPANY may request CONTRACTOR to perform complementary in-situ calibration for surveys lasting more than six months, and for sensors requesting frequent calibration (dissolved oxygen, humidity, for instance). In such case, CONTRACTOR shall submit for approval to COMPANY, in-situ calibration procedures.

Typical values of requested measurement ranges, accuracy and sampling are given in section 5. CONTRACTOR shall state the range, resolution and accuracy of each instrument included in his offer.

The instruments and their mountings shall be designed, deployed and moored in accordance with the specifications of the instrument MANUFACTURERS.

The moorings, including the mooring lines, the frames, the ballast weights, the floatation buoys and the acoustic release systems, etc. shall be designed in order to limit the environmental loads on the moorings and to limit the environmental disturbance by the moorings. They shall be designed and deployed in accordance with the specifications of the MANUFACTURERS. CONTRACTOR shall describe his mooring design procedures (for example, model or software used in the design process) and provide evidence that the mooring design is appropriate to the proposed location of deployment and for the duration of the survey.

Instruments deployed at sea shall be equipped with sufficient buoyancy and with ARGOS beacons, or other similar devices, in order to allow for instrument surfacing and further drift monitoring in case of mooring failure.

When several instruments have to be located in the same maritime area, their locations shall be defined, and they shall be deployed, so that they will not interfere with each other during deployment, measurement and recovery.

When specified, the data acquisition system shall include a real time data transmission system able to transmit measured data to the requested location. When specified, the data acquisition system shall include a display unit and a printing unit, able to display specified data on a computer screen and to print all necessary data. Reference is made to the General Specification **GS GEO 505**, sections 4.5 and 7.3.

The acquisition, transmission, processing, display and recording systems shall be able to process all measured/recorded data and to store all raw and processed data as specified in the Particular Technical Specification. "Raw" is defined as "instantaneous prior to any processing".

### 3.7 Site conditions

CONTRACTOR shall carry out a study of site conditions in the area of survey, in order to characterize the environmental conditions prior to designing the survey equipment and the site operation procedures. COMPANY will assist where possible as detailed in section 3.4 of this General Specification.

In particular, the bathymetry of the area, the sea bottom conditions and the long term land and marine weather conditions shall be characterized. The equipment shall be designed to withstand the long term meteorological and oceanographic conditions. The procedures shall be adapted to ensure safe and rapid site operations.

CONTRACTOR shall liaise with COMPANY to establish the location and activity of all existing installations in the general area of the proposed survey, including (for example, but not necessarily limited to) drilling operations, vessel movements, sea bed pipelines and cables, ROV operations, diving operations, escape routes, contingency plans, etc. CONTRACTOR shall take into account these issues when designing moorings, equipment installation and recovery procedures.

### 3.8 Weather

CONTRACTOR shall be required to cease operations in adverse weather conditions only when it is considered that such adverse conditions may affect:

- The safety of personnel and of equipment
- Or the quality of the work.

COMPANY and CONTRACTOR representatives shall define such adverse conditions in common agreement with the vessel master (where a vessel is used in the survey operation). The vessel master may order the cessation of operations if, in his opinion, the safety of the vessel or personnel thereon, is at risk.

### 3.9 Documents

In his offer, CONTRACTOR shall specify the proposed instruments, the equipment, the method of operation, the procedures, the data processing quality control, analysis and the reporting, as well as the personnel involved in the work. This information shall be provided in the relevant Exhibits to the CONTRACT as follows:

- Particular Technical Specification:
  - Specification of data quality control, processing, analysis and reporting
  - Schedule of work
- Personnel (section 3.3 of this General Specification refers, and [OGP Report 348](#) section 5.4 and Appendix D):
  - List of personnel with resumes, certificates and details;
- List of Equipment and Specifications (section 3.5 of this General Specification refers):

- List of all instruments, with their performance, including proof of accuracy and calibration, including navigation and positioning equipment;
- List of all acquisition, processing, recording and transmission systems, with their performance;
- List of spares, complementary equipment and all other materials ;
- Basic design of instrument moorings or fittings, including a first estimate of mooring line watch circle under extreme environment;
- Description of deployment and retrieval procedures;
- Description of maintenance/inspection procedures.
- Crew and Specification of Vessel: where COMPANY has NOT assisted with the provision of a vessel (**OGP Report 348** section 5.3 and Appendix C refer):
  - Specification of support vessels used for operations and their equipment
  - Specification of navigation and positioning system
  - Specification of onboard gear for instrument deployment/recovery.

Prior to site operations, CONTRACTOR shall provide COMPANY with following documents that shall be approved by COMPANY:

- Instrument calibration certificates
- Design of instrument moorings and fittings, including calculation of mooring line watch circle under extreme environment
- Detailed procedures
- As per section 3.5, Emergency Response Plan and Project Safety Plan.

After any site operations, CONTRACTOR shall provide COMPANY with relevant reports listed in section 7.

### 3.10 Measured data

Data recorded by CONTRACTOR are the property of COMPANY.

CONTRACTOR shall provide COMPANY with all raw and processed data relative to the measurements. The data shall be given in electronic files, in a format compatible with PC based computer programs.

### 3.11 Units

The required system of units is the S.I. (Metric) system.

In case other units are used, the conversion factors shall be given.

All units, directional and other conventions and frames of reference for all measured and derived parameters shall be clearly defined.

Time references shall be given in UTC. For ease of operation local user interfaces could show local time or UTC clearly marked.

## 4. Operations

The operations to be carried out by CONTRACTOR personnel are specified hereunder.

CONTRACTOR shall submit for approval to COMPANY the design, the operating procedures and all necessary requirements for the transport to site, the deployment and the setting up of all survey equipment.

COMPANY shall approve the design and the procedures prior to the mobilisation of equipment and personnel.

Prior to the operations, CONTRACTOR shall prepare with the assistance of COMPANY a Project Safety Plan and an Emergency Response Plan (OGP report 348, Appendices E & F refer).

Prior to any operation, a “toolbox” meeting (safety discussion) shall be organised by CONTRACTOR; it involves everyone associated with the onboard operations and must take place prior to starting any work. The meeting should cover key safety aspects of the work and result survey and appropriate vessel personnel supporting the survey being made aware of their responsibilities during the operations. Sections H1 and H2 of OGP Report 348 provide guidance for some of the key considerations that should be addressed during this meeting.

### 4.1 Equipment transport to site

In some instances COMPANY may give assistance with equipment transport to site (as specified in the Particular Technical Specification).

Mobilisation of CONTRACTOR equipment and personnel shall take place at a harbour location specified by COMPANY.

CONTRACTOR shall arrange the transport of equipment and personnel from CONTRACTOR office to the mobilisation harbour.

CONTRACTOR shall arrange the transport of equipment and personnel from the mobilisation harbour to the operation site, except where otherwise stated in the Particular Technical Specification. If transport to mobilisation harbour involves shipment by sea then the conditions applicable to support vessels (Section 4.2 below) shall apply.

### 4.2 Support vessels

In some instances COMPANY may give assistance with provision of a vessel (as specified in the Particular Technical Specification).

The vessels to be used by CONTRACTOR shall be adequate for the specified work (Appendix C of the OGP Report 348 provides minimum vessel standards expected by COMPANY).

In respect of any vessel that is to be chartered by CONTRACTOR, CONTRACTOR shall submit for approval to COMPANY all necessary information with respect to the chartered vessel, including sketches, photographs, specifications and certificates.

Any vessel employed or chartered by CONTRACTOR for the performance of the work shall at all times remain in full, proper and safe working order. CONTRACTOR shall ensure the cleanliness of the vessel.

CONTRACTOR shall ensure that any vessel used in the work show evidence of all necessary safety and seaworthiness documents and certificates permitting it to be employed in such work.

CONTRACTOR shall ensure that no modification invalidates the said documents and certificates.

CONTRACTOR shall permit COMPANY at its request to examine any and all original said documents and certificates. Copies of all certificates of the proposed vessels shall be sent to COMPANY representative before the beginning of the works.

CONTRACTOR shall ensure that any vessel used in the work shall be free from any legal, contractual or other restriction preventing it from operation in the areas required under the terms of the CONTRACT.

Master, mate and crew shall be specifically trained or experienced with operations at sea. They shall be fluent in English and shall have proper recognized certification for safely operating vessels. Resumes, certificates and details of vessel Master and Mate together with other key personnel shall be sent to COMPANY representative before the beginning of the works.

The vessels shall be equipped with following equipment:

- Handling and lifting equipment such as lifting arm, hydraulic crane, stern frame, suitable for handling of equipment on deck and for deployment at sea
- Navigation equipment, including at least a satellite navigation and positioning system, radar and a gyro compass
- Fully operative radio equipment including HF and VHF radio telephone designed for uninterrupted contact with the shore network and other vessels. The radio shall be equipped with frequencies used in the country of work.

The autonomy of the vessel (accommodation, fuel, lubricants, food, fresh water and all consumables) shall be sufficient to ensure the complete performance of the survey (or agreed element thereof without call into a port, taking into account the maximum authorised loading capacity of the vessel.

The vessel shall have a motorised small inflatable dinghy or equivalent, always ready to be launched within 10 minutes. Two engines appropriate to the inflatable dinghy shall be available and always in perfect working conditions. The dinghy shall be used whenever requested by COMPANY representative. Vessel crew shall be specifically trained to launch the craft within requested time. Personnel manoeuvring the craft shall be fully qualified and trained.

The vessel should be ready at any time for a COMPANY safety inspection.

The vessel shall have an independent room for COMPANY representative where desk work and charting can be performed.

Where possible specifications of the vessel and its equipment shall be attached to the AGREEMENT. Otherwise, CONTRACTOR shall guarantee to charter a vessel only if it meets the minimum requirements laid down in Appendix C of the [OGP Report 348](#).

Prior to leaving mobilisation harbour, a summary of vessel operator's procedures in the event of a vessel emergency arising shall be presented by CONTRACTOR to the crew.

### 4.3 Navigation and positioning

CONTRACTOR shall provide all necessary equipment required for navigation and positioning, in accordance with this General Specification and [GS GEO 301](#).

COMPANY will have no liability for loss of time due to navigation or positioning.

The navigation and positioning equipment shall include but not necessarily be limited to:

- All necessary marine and bathymetric charts of the work area
- Standard navigation system
- Positioning system able to provide an horizontal positioning accuracy of 50 m or better in deep water and 5 m or better near shore
- Precision hydrographic echo-sounder, such as bi-frequency transducers (33/210 kHz), preferably hull-mounted. Soundings shall be coupled with CTD measurements or with direct sound velocity measurements, in order to guarantee accuracy better than 0.2 % of water depth. Tide variations shall be corrected and the water depth shall be reduced to the local chart datum. CONTRACTOR may propose alternative solutions for positioning but shall submit for approval to COMPANY the operating procedures and the equipment to be used for the soundings. They shall be presented in the offer and shall be attached to the CONTRACT.

Prior to survey commencement:

- CONTRACTOR shall ensure that the navigation and positioning equipment is operating in accordance with MANUFACTURER's recommendations.
- All specified equipment, including computer programs, shall be installed, calibrated and operational.
- All necessary spare parts, operation and maintenance manuals, pre-plots, navigation charts, etc. shall be aboard the vessel.
- All charts shall be annotated with co-ordinates system employed (geodetic datum, spheroid, grid system, origin of projection, false easting, false northing, scale factor).
- All relevant information on the equipment shall be logged and made available to the COMPANY.

All positioning references shall be made in accordance with the geodetic system and the chart datum specified in the particular technical specification.

Specifications of the navigation and positioning equipment shall be attached to the AGREEMENT.

#### 4.4 Deployment of instruments

CONTRACTOR shall submit for approval to COMPANY all necessary information on the equipment of the support vessel chartered for instrument deployment and retrieval, including main sketches, photographs and certificates.

When complementary equipment has to be built and installed on board the marine support, CONTRACTOR shall submit for approval to COMPANY all necessary information on the equipment, including specifications and calculation notes.

CONTRACTOR shall prepare deployment procedures and design the necessary equipment with due regard to:

- The type of instrument
- The site
- The duration of measurements.

At the design stage, CONTRACTOR shall submit for approval to COMPANY the deployment procedures and the equipment design. CONTRACTOR shall take into account:

- National and International Regulations, as well as Local Regulations
- Equipment weight and buoyancy
- Corrosion and remedial use of suitable material and sacrificial anodes
- Safety: all components (moorings for buoys, installation brackets for fixed structures, etc.) shall be designed to withstand the maximum loads, including applicable safety factors, during operation and installation or retrieval
- Easy installation and retrieval: design shall be conducted in order to minimize handling loads and to simplify working procedures
- Recommendations of the MANUFACTURER of instruments
- Existing installations and operations in the survey area.

Just before deployment, CONTRACTOR shall make a Notice to Mariners. Soon after deployment, CONTRACTOR shall inform COMPANY of the final position of the deployed instrumentation, in the relevant geodetic reference system, also to permit a Notice to Mariners.

During deployment operations, CONTRACTOR shall fill the instrument deployment sheet, for any sensor and equipment, as specified below in section 4.7.

#### 4.5 Maintenance/Inspection

Service visits shall be programmed either for routine maintenance operations, when survey duration exceeds one month, or for specific inspections at COMPANY request or as specified in the Particular Technical Specification.

During service visits, CONTRACTOR shall carry out following operations:

- All equipment shall be retrieved or dismantled from supports.
- Data recorded to date shall be saved on appropriate media such as computer memory and a copy sent to COMPANY.
- Data shall be quality checked with suitable data processing tools (to be described by CONTRACTOR).
- Data logging system shall be checked.
- Sensors shall be cleaned and inspected.
- New calibration shall be performed if necessary.
- New batteries shall be fitted.
- Anodes, shackles or other connecting or fastening equipment shall be checked and changed if necessary.

If any sensors, data logging or other equipment are not perfectly operational, they shall be replaced by new ones.

Just before the operation, CONTRACTOR shall make a Notice to Mariners. Soon after redeployment, CONTRACTOR shall inform COMPANY of the new position of the redeployed instrumentation, in the relevant geodetic reference system, also to permit a Notice to Mariners.

During maintenance/inspection retrieval operations, CONTRACTOR shall fill in the instrument deployment sheet, for any sensor and equipment, as specified below in section 4.7.

#### 4.6 Retrieval of instruments

CONTRACTOR shall submit for approval to COMPANY all necessary information for instrument retrieval, as specified for instrument deployment (cf. section 4.4) and regarding retrieval procedures, marine support equipment, complementary equipment and particularly navigation and positioning equipment necessary to allow for an accurate positioning of the instruments.

CONTRACTOR shall agree with COMPANY, in respect of each mooring, whether ballast weights may be left on the sea bed, or whether they must be recovered. CONTRACTOR shall where possible use non-toxic material in ballast weights. CONTRACTOR shall not take unnecessary risks to recover ballast weights from the seabed in deep water areas, but in any case shall refer to the Particular Technical Specification for COMPANY requirements.

Prior to retrieval operations, CONTRACTOR shall make a Notice to Mariners.

During retrieval operations, CONTRACTOR shall fill in the instrument deployment sheet, for any sensor and equipment, as specified below in section 4.7.

#### 4.7 Instrument deployment sheet

CONTRACTOR shall prepare an instrument deployment sheet, for each instrument and for each item of equipment. CONTRACTOR shall fill in the instrument deployment sheet for any site operation.

The instrument deployment sheet shall include the following (which may be adapted to suit various instruments as appropriate):

##### DEPLOYMENT

- Instrument (or equipment) – Manufacturer, Type, Model, Serial number.
- Target location of deployment – Degrees, minutes and seconds, also water depth
- Target period of deployment – scheduled deployment and recovery dates.
- Mooring configuration (including sketch if appropriate) showing which particular instrument in the array the deployment sheet refers to.
- Provide all details of instrument configuration (bin sizes, sampling frequency, etc.)
- Confirmation that new batteries fitted
- Confirmation that instrument rated to proposed depth of deployment
- Confirmation that any pressure gauge affixed to instrument is rated to proposed depth of deployment and/or if to be used for tidal measurement, has a resolution appropriate to the task.
- Time the instrument was switched on.
- Time that the instrument first recorded data
- Time stamp and value recorded to memory – first record
- Time that the instrument recorded the second value to memory
- Time stamp and value recorded to memory – second record



- Time interval between measurements – record and confirm correct configuration.
- Battery life confirmation (calculate number of records scheduled and cross reference to battery life)
- Memory check (calculate number of records scheduled and cross reference to memory capacity)
- Confirm instrument closed following manufacturers recommended procedure and all seals properly lubricated and in place. Record time of closure.
- Time instrument entered water
- Time instrument commenced descent
- Actual location following deployment
- Remarks on deployment procedure
- Status of instrument at deployment
- Name of Oceanographer in charge
- Name of Vessel used
- Name of Vessel Representative.

## RECOVERY

- Time acoustic release activated.
- Time and location mooring spotted on surface
- Time instrument recovered to deck
- Time instrument opened
- Time stamp and value recorded to memory – last record but one
- Time stamp and value recorded to memory – last record
- Time instrument switched off.
- Remarks on retrieval procedure
- Status of instrument at retrieval
- Check of data logging
- Status of data recorded
- Name of Oceanographer in charge
- Name of Vessel used
- Name of Vessel Representative.

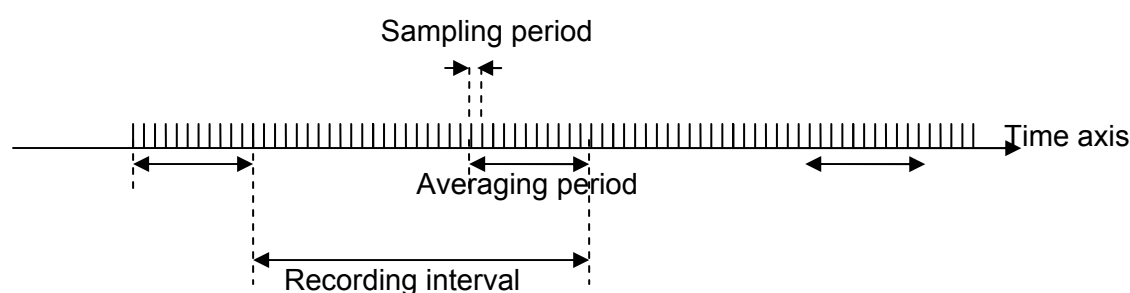
## 5. Data acquisition

The data acquisition covers the measurements by the sensors, the data recording, as well as the data transmission, when it is specified.

The data acquisition shall be performed in accordance with the General and Particular Technical Specifications. This General Specification lists the usual data measurement, data recording and data transmission systems, with the required performance, whilst the Particular Technical Specification gives details of any project-specific variations.

The sampling and recording intervals shall be chosen in order to get simultaneous measurements of all parameters.

The following definitions are used. Recorded parameters shall be derived from the time period preceding the allocated time stamp. Where the averaging period is less than the time interval between samples, the last averaged value shall be recorded unless otherwise specified.



Definitions extracted from [WMO-N°8](#):

**Accuracy of measurement:** The closeness of the agreement between the result of a measurement and a true value of the measurand.

**Resolution:** A quantitative expression of the ability of an indicative device to distinguish meaningfully between closely adjacent value of the quantity indicated.

Special consideration shall be paid to the definition of direction:

The direction (wind, wave, current ...) must be based on a **vector average**. An arithmetic average of direction data that included values either side of North would be in error (e.g.  $(359 + 001)/2 = 180$ ).

**Oceanographic convention** is that winds and waves approach from the given direction, whilst currents flow towards the given direction.

## 5.1 Quality of measured data

CONTRACTOR shall guarantee the quality of the collected data throughout the required duration of measurements.

CONTRACTOR shall propose the necessary means to check the data quality during the survey.

The data return shall be calculated as the percentage ratio of actual recorded and quality-controlled data, in compliance with the Particular Technical Specification, to the total number of possible records during the period considered. COMPANY shall not accept more than 10 % of any of the recorded parameters failing to meet the required standard (i.e. data return < 90%).

## 5.2 Wind

### 5.2.1 Measured parameters

In accordance with the Particular Technical Specification, the following wind parameters may be required:

- Wind speed
- Wind direction.

Unless specified otherwise in the Particular Technical Specification, the requested wind data from measurements are:

- Wind speed and direction for 1 hr (mean wind speed), 10 min, 1 min, 15 s, 3 s (gust)
- Time series of 10-min wind speed and wind direction for selected wind conditions, generally for wind speed over a threshold that is given in the particular technical specification
- Wind spectra for selected wind conditions, generally for wind speed over a threshold that is given in the particular technical specification.

Sensor performances, sampling rates and duration shall be as specified below:

| Wind               | Range         | Resolution | Accuracy | Sampling frequency | Averaging period | Recording interval |
|--------------------|---------------|------------|----------|--------------------|------------------|--------------------|
| Wind speed         | 0 to 75 m/s   | 0.1 m/s    | 2 %      | 0.5 s              | 10 min*          | 1 hour*            |
| Wind direction     | 0 to 360°     | 1°         | 5°       | d°                 | d°               | d°                 |
| Spectral frequency | 0.001 to 1 Hz | 0.01       | 2 %      | d°                 | d°               | d°                 |

\*Continuous wind data may be required, depending on the application (e.g. needed for derivation of spectra and/or squall analysis).

Depending on the location, measurements may be performed by sensors mounted either on large oceanographic buoys, on floating supports or on fixed platforms. For an installation on offshore units, the instrumentation shall comply with **GS GEO 505**.

Specification of sensors shall comply with World Meteorological Organisation Standards.

### 5.2.2 Deployment

Installation of sensors shall comply with World Meteorological Organisation Standards.

Wind shall be measured at location chosen to minimize the influence of any nearby structure or obstacle, preferably at 10 m above mean sea level. In case this height is not feasible, readings shall be corrected to this height with appropriate formula, taking in to account the type of measurement (1 hr average, gust, etc.) and the characteristics of the site (land, coastal waters, offshore, tropical cyclones, extratropical storms). Details of the height conversion formulae used shall be provided within the data record and the relevant reports.

## 5.3 Meteorological parameters

### 5.3.1 Measured parameters

In accordance with the particular specification, the following meteorological parameters may be required:

- Barometric pressure
- Air temperature
- Humidity
- Rainfall
- Solar radiation.
- Visibility

Sensor performances, sampling rates and duration shall be as specified below:

| Meteorological parameters | Range                      | Resolution         | Accuracy | Sampling frequency | Averaging period | Recording interval |
|---------------------------|----------------------------|--------------------|----------|--------------------|------------------|--------------------|
| Barometric pressure       | 800 to 1100 hPa            | 0.1 hPa            | 1 hPa    | 20 s               | 10 min           | 1 hour             |
| Air temperature           | -40 to +60°C               | 0.1°C              | 0.2°C    | 20 s               | 10 min           | 1 hour             |
| Relative humidity         | 0 to 100 %                 | 1 %                | 2 %      | 40 s               | 10 min           | 1 hour             |
| Precipitation             | 0 to 200 mm/hr             | 0.2 mm             | 2 %      | N/A                | N/A              | 1 hour             |
| Solar radiation           | 0 to 2000 W/m <sup>2</sup> | 1 W/m <sup>2</sup> | 5 %      | 60 s               | 10 min           | 1 hour             |
| Visibility                | 0 to 50000m                | 250m               | 5%       | Spot               | N/A              | 1 hour             |

Depending on the location, measurements may be performed by sensors mounted either on large oceanographic buoys (except for rain fall), on floating supports or on fixed platforms. For an installation on offshore units, the instrumentation shall comply with **GS GEO 505**.

Specification of sensors shall comply with World Meteorological Organisation Standards.

### 5.3.2 Deployment

Installation of meteorological sensors shall comply with World Meteorological Organisation Standards.

All sensors shall be protected against wind dynamic effects, precipitations, solar radiations, by suitable protection.

Rainfall funnel shall be installed in an open area.

## 5.4 Waves

### 5.4.1 Measured parameters

In accordance with the particular specification, the following wave parameters may be required:

- Sea-states parameters including significant height, peak wave period, peak wave length, peak wave direction and 2-dimensional spectrum
- Individual wave parameters from time series of sea surface elevation.

#### 5.4.1.1 Time series of water elevation

Several devices are designed to measure time series of water elevation, but only instruments able to measure wave direction are accepted, such as directional wave buoys, pressure sensors with orbital velocity measurements, etc.

Unless specified otherwise in the Particular Technical Specification, the required wave data from time series measurements are:

- Significant wave height ( $H_{m0}$ ), peak period ( $T_p$ ) mean period ( $T_{02}$ ), peak wave direction, mean wave direction, from frequency domain analysis.
- Other directional wave spectral parameters such as spectral width and directional spreading
- Maximum wave height, associated wave period, maximum crest height, from time domain analysis
- Time series of wave elevation for selected wave conditions, generally for significant wave height over a threshold that is given in the Particular Technical Specification
- Directional wave spectra, generally for significant wave height over a threshold that is given in the Particular Technical Specification.

Sensor performances, sampling rates and duration shall be as specified below:

| Waves              | Range          | Resolution | Accuracy | Sampling frequency | Averaging period | Recording interval |
|--------------------|----------------|------------|----------|--------------------|------------------|--------------------|
| Wave elevation     | -20 to +20 m   | 0.05 m     | 2 %      | 0.5 s              | 34 min           | 1 hour             |
| Wave period        | 2 to 30 s      | 0.1 s      | 2 %      | d°                 | d°               | d°                 |
| Wave direction     | 0 to 360°      | 1°         | 2°       | d°                 | d°               | d°                 |
| Spectral frequency | 0.02 to 0.5 Hz | 0.01       | 2 %      | d°                 | d°               | d°                 |

#### 5.4.1.2 Wave spectra

Devices designed to measure wave spectra, such as wave radars, do not allow for time domain parameters.

Unless specified otherwise, the requested wave data from wave spectra measurements are:

- Significant wave height ( $H_{m0}$ ), peak period ( $T_p$ ) mean period ( $T_{02}$ ), peak wave direction, mean wave direction, optionally for swell and local wind sea partitions in addition to the total energy.
- Directional wave spectra for a minimum of 24 directional sectors (15° width) and 32 frequency bands.

Sensor performances, sampling rates and duration shall be as specified below:

| Wave spectra            | Range          | Resolution | Accuracy | Sampling frequency | Averaging period | Recording interval |
|-------------------------|----------------|------------|----------|--------------------|------------------|--------------------|
| Significant wave height | 0 to +20 m     | 0.01 m     | 2 %      | 0.5 s              | 20 min           | 1 hour             |
| Wave period             | 2 to 30 s      | 0.1 s      | 2 %      | d°                 | d°               | d°                 |
| Wave direction          | 0 to 360°      | 1°         | 2°       | d°                 | d°               | d°                 |
| Spectral frequency      | 0.02 to 0.5 Hz | 0.01       | 2 %      | d°                 | d°               | d°                 |

## 5.4.2 Deployment

CONTRACTOR shall design the wave measurement system with respect to following items:

- Easy deployment and retrieval of wave device with standard vessels available at the site
- Interference of mooring restoring forces on wave measurement, in the case of moored buoy
- Interference of the structure on the measurement, in particular in case of wave radar measurements
- Marking of the mooring location and tracking in the event of unexpected early release.

## 5.5 Tide/Water level

### 5.5.1 Measured parameters

In accordance with the particular specification, the following water level parameters may be required:

- Water level variation.

Sensor performances, sampling rates and duration shall be as specified below:

| Tide        | Range        | Resolution | Accuracy | Sampling frequency | Averaging period | Recording interval |
|-------------|--------------|------------|----------|--------------------|------------------|--------------------|
| Water level | -10 to +10 m | 0.01 m     | 1 %      | 1 s                | 30/60 s          | 10 min             |

The tidal variation shall be derived from pressure measurements at a fixed point by a tide gauge. The absolute pressure measurements shall be corrected from the actual effect of density of the sea water column and from the atmospheric pressure. A temperature compensation shall be considered.

### 5.5.2 Deployment

CONTRACTOR shall propose suitable methods fulfilling the following requirements:

- Easy deployment and retrieval of tide gauges with standard vessels available at the site
- Marking of the mooring location
- Minimize wave effects on tide gauge.

The tide gauge shall be installed wherever possible on a flat bottom and the mooring arrangement shall not be modified during the survey. If the tide gauge is removed for maintenance during the survey, it shall be re-deployed at the same location.

The tide gauge shall be carefully levelled, with respect to existing benchmark wherever possible.

Consideration shall be given to the deployment of a replacement tide gauge 12 hours prior to the recovery of the gauge which it is replacing, thereby providing sufficient overlap to endure continuity of record even if the depth of the replacement gauge is not the same.

## 5.6 Current

### 5.6.1 Measured parameters

In accordance with the Particular Technical Specification, the following current parameters may be required:

- Current speed and direction at a specified depth, or
- Current profile (speed and direction) through the water column.

#### 5.6.1.1 Current speed and direction at a specified depth

Several instruments are designed to measure current speed and direction at fixed points. Unless specified otherwise, only instruments without any mechanical device are accepted, such as electromagnetic current meters.

Unless specified otherwise, the requested current data are:

- Averaged current speed
- Associated current direction.

Sensor performances, sampling rates and duration shall be as specified below:

| Current           | Range      | Resolution | Accuracy | Sampling frequency | Averaging period | Recording interval |
|-------------------|------------|------------|----------|--------------------|------------------|--------------------|
| Current speed     | 0 to 5 m/s | 0.01 m/s   | 2 %      | 1s                 | 1min             | 10 min             |
| Current direction | 0 to 360°  | 1°         | 5°       | d°                 | d°               | d°                 |

The number of instruments and their levels shall comply with the Particular Technical Specification.

#### 5.6.1.2 Current profile

Current profiles (speed and direction) are generally measured by acoustic devices using the Doppler effect, here referred as Current Profilers (CP). However, CP sensors cannot measure currents near the sensor or close to the surface, for a CP looking upward, or close to the bottom, for a CP looking downward. In addition, the range of measurement depends on water quality. Therefore CONTRACTOR shall clearly state the CP performance in its offer.

Unless specified otherwise, the requested current data are:

- Averaged current speed
- Associated current direction.

Sensor performances, sampling rates and duration shall be as specified below:

| Current profiles  | Range      | Resolution | Accuracy | Sampling frequency | Averaging period | Recording interval |
|-------------------|------------|------------|----------|--------------------|------------------|--------------------|
| Current speed     | 0 to 5 m/s | (#)        | 2 %      | No. Pings          | (**)             | 10 min             |
| Current direction | 0 to 360°  | 1°         | 5°       | d°                 | d°               | d°                 |
| Measurement level | (*)        |            |          | N/A                | N/A              | N/A                |

(#) Resolution (cell/bin size) depends upon the application and shall comply with the Particular Technical Specification

(\*) The range of measurement depends upon the application.

(\*\*) The sampling frequency and interval shall be based on a number of acoustic pings to be confirmed by CONTRACTOR, dependent on environmental conditions.

The number of instruments and their depth shall comply with the Particular Technical Specification.

## 5.6.2 Deployment

CONTRACTOR shall propose suitable methods fulfilling the following requirements:

- Easy deployment and retrieval of mooring lines with standard offshore vessels available at the site
- Marking of the mooring location
- Minimize wave effects on surface or subsurface buoys and on current meters.
- In the case of a mooring, tracking in the event of unexpected early release

CONTRACTOR may propose acoustic releases, if acceptable by local regulations, which may prescribe to remove all objects from sea floor.

Rigid frames may also be used for measurements close to the bottom or for the installation of Acoustic Doppler Current Profilers.

## 5.7 Oceanographic parameters

### 5.7.1 Measured parameters

In accordance with the Particular Technical Specification, the following oceanographic parameters may be required:

- Water temperature
- Pressure
- Conductivity/Salinity
- Dissolved oxygen
- PH
- Turbidity
- Sound velocity

- Sea ice – a combination of manual observations, instrument recording and remote sensing shall be utilised, as detailed in the Particular Technical Specification.

If long term measurements are required, a self recording unit shall be used, for instance a current meter equipped with additional sensors.

Sensor performances, sampling rates and duration shall be as specified below:

| Oceanographic parameters | Range                     | Resolution   | Accuracy | Sampling frequency | Averaging period | Recording interval |
|--------------------------|---------------------------|--------------|----------|--------------------|------------------|--------------------|
| Temperature              | -2 to 40°C                | 0.1°C        | 0.1°C    | 0.5 s              | 1min             | 10 min             |
| Pressure                 | (*)                       | 1 hPa        | 0.5 %    | d°                 | d°               | d°                 |
| Conductivity             | 0 to 70 mmho/cm           | 0.01 mmho/cm | 0.5 %    | d°                 | d°               | d°                 |
| Salinity                 | 0 to 40 psu               | 0.01 psu     | 0.01 psu | d°                 | d°               | d°                 |
| Dissolved oxygen         | 0 to 20 ppm               | 0.1 ppm      | 0.1 ppm  | d°                 | d°               | d°                 |
| pH                       | 0 to 14 pH                | 0.01 pH      | 0.1 pH   | d°                 | d°               | d°                 |
| Turbidity                | 0 to 100 % transmissivity | 1 %          | 2 %      | d°                 | d°               | d°                 |
| Sound velocity           | 1400 to 1600 m/s          | 0.1 m/s      | 0.2 m/s  | d°                 | d°               | d°                 |

(\*) Range to be selected in relation with water depth at location.

For spot measurements, a vertical profile shall be taken using a specialized probe connected to a surface unit by a cable.

In all cases, the depth of measurement shall be measured with a pressure sensor.

### 5.7.2 Deployment

In case of continuous oceanographic survey, instruments shall be fitted on current meters or other instruments whenever possible.

In case of spot measurements, the deployment of the probe shall be performed from a vessel equipped with a suitable launching system (hydraulic crane, stern A frame, etc.). CONTRACTOR shall provide a suitable winch equipped with slip rings.

### 5.8 Data recording unit

A suitable recording means shall be provided for in situ recording of measurements, for further processing or as a back-up for a data transmission system. The recording support may be, for instance, solid state memory.

The minimum data logging autonomy shall be the period between two site visits, with a safety margin to be submitted by CONTRACTOR to COMPANY.

The CONTRACTOR shall provide a suitable reading instrument able to check on site the recorded parameters and the operational status of the recording system.

## 5.9 Data transmission units

For sensors mounted on buoys or on unmanned structures, a data transmission to shore or to a manned structure shall be provided.

Type of transmission may be:

- Short range: UHF, VHF radio waves, telephone lines, submarine acoustic modem, etc.
- Long range: ARGOS Satellite transmission or similar.

The transmission shall be in agreement with international communication standards and local regulation.

CONTRACTOR shall obtain the applicable licences from local authorities and shall confirm the transmission frequencies with COMPANY prior to the start of the operation.

Data transmitted may be the raw measured data and/or the site processed data.

At the receiving station, the data shall be displayed and logged on a suitable means complying with present specification.

More comprehensive information on communication, data transmission to shore, interfaces with other systems is available in [GS GEO 505](#).

## 6. Data processing

The data processing consists of all processing necessary to provide COMPANY with necessary information (statistics and others) on any measured parameter. It covers a standard processing for all parameters and specific processing for each one.

### 6.1 Quality Control

All measurements shall be quality controlled prior to the processing described in this section of the General Specification. CONTRACTOR shall describe the means by which he will ensure that all collected data are processed in such a way that the quality of the data may be verified. The analyses should be sufficiently extensive to allow all significant errors to be discovered, and shall include data return summaries for the pre- and post-quality control data sets with feedback on causes for discarded data.

### 6.2 Processing

For the data processing, CONTRACTOR shall follow the instructions provided in [GS GEO 504](#).

## 7. Analysis and Reporting

CONTRACTOR shall provide COMPANY with the following reports:

- Operation reports on completion of any site operation
- Interim reports after data collection, processing and analysis
- Final reports after completion of surveys and final analyses.

The reports shall be prepared in accordance with following specifications and with the Particular Technical Specifications.

All reports shall comply with following specifications:

|                                |                                                                                                                                                                                                                           |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Language</b>                | English                                                                                                                                                                                                                   |
| <b>Format</b>                  | A4                                                                                                                                                                                                                        |
| <b>Electronic format</b>       | Reports shall be delivered as non-encrypted portable document format (e.g. Adobe Acrobat .pdf) and as original source as appropriate (e.g. Word, Excel, Autocad, etc.).                                                   |
| <b>Binding</b>                 | 4 Ring binder or special binding                                                                                                                                                                                          |
| <b>Sketches &amp; drawings</b> | Maximum A3 size                                                                                                                                                                                                           |
| <b>Large drawings</b>          | Shall conform to standardized sizes: A0, A1, A2 and shall be folded and placed in special folder bound in the main report.<br><br>A reproducible copy shall be supplied.<br><br>A reduction to A3 size shall be supplied. |
| <b>Executive summary</b>       | Main results shall be gathered in a preliminary chapter to be put in the introduction of the report.                                                                                                                      |
| <b>Index</b>                   | Contents of the report with page numbers shall be put at first page.                                                                                                                                                      |
| <b>Frontispiece</b>            | A sketch of area with location shown shall be put as frontispiece. It shall include details of reference datum and other appropriate survey information.                                                                  |
| <b>Bibliography</b>            | Bibliography relevant to all names, titles, methods used or cited in the report shall be indicated at the end.                                                                                                            |
| <b>Glossary</b>                | All technical terms shall be explained in a glossary.                                                                                                                                                                     |
| <b>Annexes</b>                 | Annexes to the report shall include all computation notes, listings, data sketches, weather maps, etc. not directly necessary for the comprehension of the main report. They shall be bound separately.                   |
| <b>Computer Programs</b>       | A description of the methods and tools used in Computer Programs shall be given.                                                                                                                                          |
| <b>Reference Number</b>        | Date of Report, work order Ref. Number and CONTRACTOR name shall be mentioned on each page.                                                                                                                               |

## 7.1 Operation report

Site operation reports shall be prepared on completion of any site operation. Site operation reports shall include all necessary information on the operations performed during any site operation such as the deployment of the equipment, the service visits or the retrieval of equipment.

One copy of site operation report shall be electronically submitted for approval to COMPANY one week after the end of the operation. If the operation report is commented by COMPANY, CONTRACTOR shall revised it and submit the revision within one week after receipt of comments. After approval, CONTRACTOR shall provide COMPANY with two copies of site operation report, with an electronic version.

Site operation reports shall include but not necessarily be limited to the following information:

- Project name and location

- Summary of the operations with main points
- Dates
- Description of all instruments and all equipment used
- Description of the procedures
- A description of the logistical means (supply vessels, positioning, transportation, etc.)
- Comments on the operations and all necessary information
- Report of accidents/incidents, near misses and unsafe working practice (OGP Report 348 Appendix I refers)
- Daily report with log of daily events
- Copy of all calibration sheets
- Copy of all instrument deployment sheets.

## 7.2 Interim reports

Interim reports shall be provided on completion of data collection and processing after any service visit.

Interim Reports shall include but not necessarily be limited to the following information:

- Project name and location
- Period covered by the report
- Description of instruments and measurements
- Position of instruments
- Presentation of the recorded data
- Percentage of data return, for each parameter
- Presentation of the processing and analyses, for each parameter
- Results of requested processing, as specified in section 6 and GS GEO 504
- Comments on quality of data
- All necessary information on measurements.

Interim reports shall be submitted for approval to COMPANY within four weeks after data collection. If the interim report is commented by COMPANY, CONTRACTOR shall revise it and submit the revision within two weeks after receipt of comments.

After approval, CONTRACTOR shall provide COMPANY with two copies of interim report and with an electronic version.

## 7.3 Final analysis and report

The final report shall be prepared on completion of surveys. If the surveys exceed one year, yearly reports shall be prepared, on the same basis.

The final report shall be prepared in accordance with the table of contents presented in Appendix 1.



The final report shall include all results presented in interim reports, and compiled over the year(s).

The draft final report shall be submitted to COMPANY within four weeks after data collection. If the report is commented by COMPANY, CONTRACTOR shall revised it and submit the revision within two weeks after receipt of comments.

After approval, CONTRACTOR shall provide COMPANY with five copies of final report and with an electronic version.

## 7.4 Archiving

All data collected shall be archived on suitable optical media such as CD ROM or DVD. As a minimum, two copies of the data shall be sent to the metocean representative of the COMPANY.

A copy shall be provided to COMPANY with each related interim or final report.

Data should be stored in self-describing files. The file type shall be ASCII. The files shall be readable with PC based computers. A detailed file content description shall be given.

A second dataset may be supplied in a compressed format, in association with appropriate decompression software.

All data shall be recorded with a common time base and synchronization of all the sensors shall be ensured.

Each data shall be followed by Error Flags indicating the quality of the measurement. Missing data shall be replaced by an Out-of-Range number (for instance: -999).

As a minimum, the files shall include:

- File header: Project – Location – Year - Month – Parameter(s) - No of records - Sensors (type & serial number) - Comments
- Records: Year - Month - Day - Hour - Minute – Measured (or processed) Parameter(s) – Flag.

## Appendix 1 Contents of Final Report

### 1. Executive summary

General objectives of the survey

Main findings. Limitations of the surveys.

### 2. Introduction

Aim of the survey

Contractual requirements

Reference documents

Description of the area - Location map - Detailed map

Description of logistical means

Units and conventions

Chart datum - Co-ordinates reference - Time reference

### 3. Description of equipment

- Characteristics of equipment used:
  - For each sensor:
    - Range
    - Accuracy
    - Sampling rate, means of recording.
    - Calibration
    - Corrections.
- Description of installation, mountings and moorings:
  - For each sensor:
    - Method of deployment and retrieval
    - Location, altitude of sensor, water depth
- Data Return:
  - Table showing periods of recorded and accepted data - percentage data returns
  - Description of difficulties experienced during the survey - modifications made - effects on measurements.

The following chapters regarding data processing shall follow contents of final report, Chapters 4 to 8 and Appendices, as described in Appendix 1 of **GS GEO 504**.