

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 506

Meteorological and Oceanographic Forecasting

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01	01/2011	Additional requirements for current forecasting
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1. Scope

This General Specification covers the provision of METeorological and OCEANographic (metocean) forecast services for Company's offshore and onshore surface installations and operations. Such services comprise the prediction and dissemination of not only wind and meteorological parameters, but also waves, current, tide and other oceanographic variables, in order to provide advance knowledge of metocean conditions. For convenience, in this document the term 'metocean' is used generically to describe either type of forecast, unless the narrative states otherwise.

Metocean forecasts are required for a number of applications including:

- Routine daily (or several times daily) forecasts to support on-going operations at one or more offshore, coastal or onshore sites
- Ad-hoc forecasts to support weather sensitive operations such as heavy lifts, tows, offshore installation etc.
- Specialist forecasts to support particular Company operations.

This General Specification describes generic requirements for the provision of forecasting services and indicates the minimum standards required by Company. The duration and exact scope of a forecasting services contract will depend on Company's particular objectives, which are described in the Scope of Work and other documents issued as part of the Invitation to Tender (I.T.T).

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

Except where otherwise stated, this specification does not refer to, or cover, the deployment and use of instrumentation by which data for forecast calibration, validation or verification may be obtained. These topics are covered by [GS EP GEO 501](#) and [GS EP GEO 505](#).

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
ICAO/WMO Doc. 9680-AN/949	Manual on the Provision of Meteorological Service for International Helicopter Operations
NOAA National Weather Service Instruction 10-303	Marine and Coastal Services Standards and Guidelines

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Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP GEO 501	Meteorological and Oceanographic Survey
GS EP GEO 505	Monitoring of Metocean Conditions for Offshore Units

3. General Conditions

3.1 General Forecasting Requirements

- Contractor is responsible for the timeliness, currency and accuracy of forecasts issued for the area of responsibility.
- Contractor shall always seek to maximise spatial and temporal consistency between consecutive forecast periods and, where appropriate, adjoining offices.
- If any error is observed in any part of the forecasting process, Contractor shall correct it at no charge to Company.
- Contractor shall always include in his forecasts significant or predominant metocean events impacting, or likely to impact, forecast users. This includes metocean conditions associated with tropical revolving storms.
- Forecast services shall be run and assessed in accordance with the following standards (NWS 10-303):

Aspect	Standard	Measure
Timeliness	Routine products disseminated according to published time schedules Event driven products disseminated as soon as possible	Compare issuance and scheduled times Compare lead time between event occurrence and product issuance
Accuracy	Products consistent with actual weather	Compliance with expected (required) standards
Consistency	Products coordinated between adjoining areas Products consistent with other in-office products	Consistency between neighbouring areas Consistency with appropriate aviation and public products
Format	Products disseminated in the proper format Products contain required information Products grammatically correct	Comparison with approved format Comparison with approved content Compliance with correct spelling and approved acronyms
Usefulness	Products clear and concise	Easily comprehended by users

One key requirement of the forecasting service is that it should be simple and easily understood.

3.2 Forecast Provision

The work defined in this General Specification shall include all works necessary for, or incidental to, the preparation and provision of meteorological or metocean forecasting for the project, except the installation and maintenance of measuring sensors. The work shall include but not necessarily be limited to, the following:

- Collation of recorded and/or modelled meteorological and/or oceanographic data
- Analysis and synthesis of recorded or modelled meteorological and/or oceanographic data
- Forecast verification and validation
- Preparation and dissemination of forecast reports providing sufficient information for project operations
- Back up and archive of all relevant forecast data and documentation, such that in the future it may be supplied to Company if requested
- Note that English is the required language for any forecast, documentation and correspondence
- Contractor shall ensure that all forecast presentations are correctly labelled with the units and directional conventions applied.

4. Forecasting Services - Standard Requirements

4.1 Forecast Production

Contractor shall specify in his tender submission the process and means by which his forecasts will be prepared. This information shall include as a minimum:

- Software - data plotting and analysis, production of forecast parameters
- Hardware - PC's, servers and backup/archiving procedures
- Numerical models - description of models, data acquisition routes and model verification details
- Recorded data - acquisition and integration in forecast production process
- Production flow diagram, from initial reception of model/measured data to final issue of forecast.

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4.2 Forecast Verification

Contractor shall verify his forecasts, wherever possible by comparison with recorded data. Contractor shall at all times ensure the highest levels of accuracy and integrity of his forecasts. In his tender submission, Contractor shall provide full details of:

- Proposed forecast verification procedures
- Evidence of verification on at least two previous forecast service contracts, ideally in the form of comparative time series plots of forecast and measured parameters.

Contractor shall submit for Company inspection monthly forecast verification reports for the duration of the forecast services contract. Where sufficient validation data exist, these reports shall as a minimum contain:

- Summary of metocean conditions in the month being reported
- Monthly time series plots comparing measurements of mean wind speed (Ws) and significant wave height (Hs) with forecasted values at synoptic hours to be agreed between Company and Contractor
- Calculation of the monthly forecast bias and root mean square error based on the measured mean wind speed (Ws) and significant wave height (Hs) used for validation, at synoptic hours to be agreed between Company and Contractor.
- Comparison of cumulated probability distributions for wind speed (Ws), significant wave height (Hs) per month
- Quantile-quantile plots of forecasted versus recorded data for wind speed (Ws), significant wave height (Hs) per month
- For Hs and Ws thresholds to be agreed between Company and Contractor, contingency tables of the form:

		Observed		
		Yes	No	Total
Forecast	Yes	Hit	False alarm	x
	No	Miss	Correct negative	y
	Total	a	b	Totals (a+b) = (x+y)

- A brief summary and interpretation of the key results.

In addition to a monthly verification report, if in-situ measurements are available daily, Forecaster should also provide in his daily forecasts a comparison of the forecast and the measurements of the previous day.

4.3 Data Assimilation

Contractor shall provide details of how measured or supplementary modelled data are assimilated in the forecasting process.

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In some instances, Company will have deployed instruments and weather stations in the forecast area, measuring metocean parameters in real time. In such cases, Company will provide at least the following details (as available) to Contractor:

- Specification of the instruments and weather stations, including location, make, model, parameters measured, sampling intervals etc.
- Details of data storage, access to historic databases, archiving protocols
- Data transmission details, including telemetry system, data format.

If such systems are operational at the tendering stage, Contractor shall provide in his tender submission full details of how such real time data will be assimilated and used to improve the accuracy of the forecasts. Where Company does not have such systems already operational, Contractor may in his tender submission make recommendations for the deployment of appropriate instrumentation that will enhance the quality of his forecasts.

If in-situ measurements are available daily, Contractor should also provide in his daily forecasts a comparison of the forecast and the measurements of the previous day.

4.4 Forecast Transmission

4.4.1 Methods

Depending on the nature of the services contract, Company will require forecasts to be issued by one or more of the following means:

- Secure website
- Email
- Facsimile
- Telephone - land, satellite and GSM.

Company may require the onsite presence of a forecaster to provide face-to-face briefings. This may be onshore in an office environment, delivered as a daily service to several personnel at the same time or, for a limited duration, offshore in support of a specific, weather-sensitive operation.

4.4.2 Internet based transmission

Where Company requests forecast transmission by internet, Contractor shall agree with Company the structure and functionality of his website. These may vary according to the specific purpose or location, but in all cases the following shall apply:

- Company shall specify how access is to be controlled, for example this could be via username and password or by computer IP address recognition.
- Contractor shall ensure the website is easily navigable and understood by non-experts.
- The website shall contain a full glossary of technical terms used.
- Contractor shall ensure that his contact details (telephone numbers, email addresses etc) are display on the opening page of the site and remain accessible from all other parts of the site.

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- Contractor shall assume all responsibility for website maintenance and upgrading, at rates to be agreed with Company.
- The website shall be capable of displaying textual, graphical and pictorial information.
- When proposing a website structure, Contractor shall consider user interaction and shall include the option to select and configure displayed content. Every page of the website shall be saveable and printable via .pdf format.
- Contractor shall ensure that all presentations on the website are correctly labelled with the units and directional conventions applied.
- Contractor shall provide a contingency plan in the event of a server or network failure.

4.5 Emergency and Ad-hoc Services

4.5.1 Forecast Amendments

In the event of rapidly changing or unexpected conditions, Contractor shall issue an amended forecast and a warning notifying Company personnel of the update. Contractor shall implement a procedure to ensure that such warnings are actually received by Company, for example a warning box displayed on the web site that has to be manually removed by the viewer.

4.5.2 24 Hour Telephone Service

Contractor shall for the duration of the contract operate a continuous 24-hour / 7-days-a-week telephone advisory service, from which Company can obtain advice on forecast interpretation and request additional services.

4.5.3 Ad-hoc Requests and Support

Contractor shall provide when requested additional forecasts for special or weather sensitive operations. Contractor shall implement a request service for these ad hoc forecasts and respond to them within 3 hours.

Company may also request Contractor to undertake ad-hoc studies of a metocean forecasting nature and provide general metocean forecasting advice. Such studies may include detailed analysis of a significant metocean event.

Company may at any time request Contractor to attend meetings to discuss aspects of the forecast services contract, such as performance, special ad hoc projects and studies or service changes/improvements.

4.6 Personnel

Contractor shall demonstrate in his offer that all personnel selected for the contract are qualified and competent to undertake the tasks assigned to them. In particular:

- The number of operators shall be sufficient at all times to execute the contract as stated by Contractor in his offer.
- Contractor shall submit for approval to Company the résumés and the details of all personnel that will be involved in the work, including where appropriate academic and professional training certificates.

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- Contractor shall appoint (and identify in his offer) an appropriately experienced project manager who shall be its representative at Contractor office. Where required by the Scope of Work, Contractor shall also identify in his offer the person selected to lead on site operations.
- All forecasts and related information that are provided by Contractor to Company shall be checked and approved by a recognised forecasting expert, whose résumé, details and certificates shall be provided in Contractor's offer.
- Contractor shall indicate which forecasters are suitably qualified or experienced to work onsite, potentially offshore.
- Contractor shall include in his tender submission an organization chart showing the hierarchy of the project team and the positions of key staff in the overall Contractor organisation.
- All Subcontractors shall be bound by the same requirements as Contractor.

5. Forecast Services - Specific Requirements

5.1 Routine Daily Forecasts

At the start of the contract Company shall agree with Contractor the forecast content and format. However, the following is a guide to the scope of a routine forecast, which may be required one or more times per day:

- Header information:
 - Location
 - Time of forecast
 - Unique forecast identifier
 - Period of forecast validity
 - Telephone/email contact details of forecaster.
- Forecast Summary
 - General synoptic situation and outlook to T+240 hours
 - Warnings of gales and other severe conditions
 - Warnings of operability threshold exceedence
 - Lightning/fog risk.
- Tabular and graphical presentations of
 - Wind direction
 - Wind speed and gust at 10 m
 - Wind speed and gust at 50 m
 - Significant wave height (Hs)
 - Maximum wave height (3 hourly)

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- Mean wave period (Tz)
- Swell direction
- Swell height
- Swell period
- Weather
- Air temperature
- Air pressure
- Rainfall
- Visibility
- Cloud cover and cloud base height
- Sea temperature.
- Forecasting synoptic hours
 - Hourly for T0 to T+12
 - 3-Hourly for T+12 to T+48
 - 6-Hourly for T+48 to T+120
 - 12-Hourly for T+120 to T+168.
- Map-based presentations

The limits of all map based presentations shall be agreed between Company and Contractor.

 - Synoptic maps of the forecast region, showing air pressure contours at mean sea level, areas of high and low pressure and other notable features
 - Maps of wind speed and direction, significant wave height and direction, swell height by direction
 - Maps of lightning risk, fog probability, visibility and precipitation
 - Other parameters as relevant to the particular operation or region.

Contractor should avoid the use of qualitative terms such as 'soon', 'later', 'more quickly', but if such terms are used they should be fully in accordance with standard meteorological convention and a web page with corresponding definitions shall be provided.

Contractor shall submit examples of his forecast products, such examples being relevant to Company's specific requirements described in the Scope of Work and elsewhere in the I.T.T.

5.2 Additional Daily Forecasts

In addition to the routine daily forecasts specified above, Contractor shall also supply when requested additional forecasts to support weather sensitive operations, such as heavy lifts, tows, drilling operations or subsea installations. Contractor shall be prepared to supply this

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service within, nominally, 3 hours of receiving Company's first request. The forecasts may be required for a single location or, in the case of a tow, several adjoining areas.

Company shall request a revised format for these additional daily forecasts, where that specified above for the routine daily forecasts does not meet the requirement.

5.3 Current Forecasting Service

5.3.1 Scope and Deliverables

To complement the forecasts described above and below Company may require a current forecasting service, comprising the provision of predicted current speed and direction at one or more specified locations or the provision of maps giving current speed and direction over an area.

Depending on the operational requirement, Company may require forecasts of surface currents only, or currents at levels through the water column. Company will agree with Contractor the depths for which current forecasts are required.

The forecast currents shall comprise tidal and, where possible, non-tidal components. The former are easily predicted, but in the latter case Contractor shall consider subcontracting the services of a recognised organisation with the appropriate resources. The deliverables for the current forecast service will include (but not be limited to):

- Current speed and direction at the locations/depths specified by Company.
- Maps showing current speed vectors at a horizontal resolution and at depths to be agreed by Company. The maps shall be appropriately annotated with a latitude/longitude graticule and a current speed scale.
- In areas where specific, episodic oceanographic phenomena are expected to affect the current fields but are not included in the forecast computations (e.g. storm surge, internal waves, topographic Rossby waves, inertial currents etc), Contractor shall issue a text warning on his forecast as to their likely occurrence and their effects on the ambient current regime. Contractor shall make every effort to include the effects of river flow in the current forecasts.

5.3.2 Current Forecast Transmission

When the current forecast service is requested, it shall be considered an integral part of the metocean forecast provision described in this General Specification: accordingly the current forecasts shall be issued via the same transmission methods at the times and synoptic hours specified in Section 5.1, unless otherwise prescribed by Company.

5.3.3 Current Forecast Verification

As described in Section 4.3 Contractor shall utilise all available and appropriate measured data to improve the quality of his current forecasts. The monthly forecast verification report described in Section 4.2 shall be extended to include current speed and direction. Where Company does not already have current meters deployed in the forecast area, Contractor shall in his tender submission make recommendations for deployment of appropriate instrumentation.

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5.4 Specialised Forecast Products

Company may request the following forecast products as part of a regular service or on an as-required basis.

5.4.1 Severe Weather Forecasts

In regions affected by severe weather such as tropical storms or squalls, Contractor shall provide special forecasts:

- In the case of tropical storms, Contractor shall issue a warning should the weather forecast deteriorate: more frequent bulletins shall be sent to Company if a tropical cyclone is forecast. The tropical storm forecast shall include a simple-to-read table and graph that represent the current forecast track and 90% exceedence values of winds and waves (using known characteristics of track forecast errors to develop an envelope of solutions that represent the 90% probabilistic track error).
- In the case of squalls Contractor shall provide an assessment of the likelihood of squall activity in the forecast period. If squalls are forecast, Contractor shall devise a simple-to-read table and graph that represent the current forecast track and alternative tracks with agreed levels of error probability.

5.4.2 Probability Forecasts

Contractor shall provide on request forecasts of, usually, wind speed and significant wave height based on the probability of exceedence of selected thresholds. The thresholds and forecast period shall be agreed between Company and Contractor.

Contractor shall demonstrate consistency in output from models used to produce the routine forecasts and those used for the probability-based products.

Wherever possible, Contractor shall use ensemble forecasting techniques to produce probability based forecasts and associated confidence intervals.

5.4.3 Aviation Forecasts

Company may require aviation forecasts to support helicopter and other air operations. Contractor shall ensure that such forecasts meet the criteria specified in [ICAO Doc. 9690-AN/949](#).

Aviation forecasts may include:

- METAR Meteorological Aerodrome Report, which may be promulgated automatically
- TAF Terminal Aerodrome Forecast
- LAF Localised Area Forecast.

5.4.4 Pollution Control Forecasts

Exceptionally, Company may request a forecast service to assist in the event of a marine pollution incident. The service shall comprise pollutant tracking, either through simple relationships between wind speed and surface current or by using bespoke software that accounts for pollutant dispersion and weathering. Contractor should note that this service will

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require a very rapid response (measureable in minutes) to an initial request for assistance, which will probably come via the 24 hour telephone advisory service.

5.4.5 Forecasts for Onshore Operations

Exceptionally, Company may require forecasts to support onshore operations. In addition to the appropriate elements of the routine daily forecasts, Contractor may be requested to provide:

- Icing and other adverse road conditions
- Maximum and minimum air temperatures.

5.4.6 Swell and Vessel Heave Forecasts

Company will provide seas state thresholds and vessel particulars, as required.

5.4.7 Ice Forecasts (ON HOLD)

- Sea Ice
- Iceberg activity
- Vessel Icing.