

# Metocean Automatic Monitoring Stations in Malaysian Waters

Marine meteorological and oceanographic (metocean) data is required at all levels (e.g. planning and operations) of the Meteorological Department, the Naval Department, Ports or Harbours and the Oil and Gas Industry. The Meteorological Department of Malaysia has recently embarked on a Coastal and Port Automatic Meteorological and Oceanographic station network to support weather forecasting. This paper details functions and requirements for the development of this system.

Marine meteorological and oceanographic technology has advanced a long way since the early days, from recording measurements on paper chart rolls to using solid-state memory, from simple wave staffs to satellite-transmitting wave directional buoys, and from back-of-the-envelope wind-wave relationships to sophisticated numerical models.

But despite these considerable advances, the “weather” in the atmosphere and oceans is ever varying, with patterns and cycles that are still not properly understood. Despite many years of data collection, there still remain significant uncertainties and due allowance has to be made for these when determining extreme-event environmental criteria for design and development purposes.

Marine metocean is a specialist area, with very limited applied industry-related experience in the marketplace.

## Development and Operation Objective

Essentially, the business objective in marine environment or metocean matters reflects the overall company objective. In specific marine metocean terms, at each stage of design, development and operation, the business objectives are centred on:

- safety
- protecting the environment
- protecting investment
- economical and profitable operations.

## Requirements

In all port and harbours in Malaysia, requirements for marine metocean data arise in connection with:

- design and expansion of port and facilities
- dredging
- operational planning offshore and
- weather forecasting.

Requests for data ranging across the full spectrum of metocean parameters are included in Table 1.

## Operating Conditions

Similarly, for operations it is the current, waves and wind conditions that dominate and are the major cause of downtime and accident in offshore, port and harbour areas. Accurate daily weather forecast is therefore essential for safe operations and to minimise downtime and accident.

## Meeting the Needs

How best can marine metocean expertise meet developmental and operational needs and challenges offshore and in port and harbour? What are the tools that will be used and where can advantage be taken of rapid improvements in technology? Increased computing power now available has led the bias in marine metocean works to move towards numerical modelling. However, field measurements are needed to give real-time data in support of operations, to calibrate and validate the models, and to provide information on forecasting and real-time modelling work. The capabilities of the tools to be used are discussed in the following sections.

## The Metocean System

The Metocean System should comprise a database respiratory system for storing metocean environmental parameters, equipped with a set of statistical and engineering software to perform quality assurance, processing and analysis of data for operational use. The system should also provide the opportunity to undertake further quality control checks on the measured data. However, while validation of data uploaded into the data bank is essential, it is meant as the “last line of defence”. Resources must go in the first place to ensuring that a system is designed and built to match the functional requirements. The needs to be followed up with a well-documented and planned maintenance and calibration programme.

The system, shown in Figure 1, is best developed in a PC environment, making use of Windows as the operating system, having a Graphical User Interface and a Geographical Information System (GIS) map referencing system. The system should be user-friendly and facilitate maximum value extraction from the data.

The main purposes of the system are:

- to provide secure and accessible storage for marine metocean data
- to enable ready use of data for maximum benefit
- to allow fast and efficient extraction of environmental planning criteria and statistics.

#### The Oil and Gas Industry

A new offshore automatic metocean station network has been installed on six platforms in Sarawak/Sabah waters and three platforms in West Malaysia, offshore Trengganu. Each platform measures the following parameters:

- Wind speed
- Wind direction
- Waves
- Air temperature
- Barometric pressure

On eight of the platforms, wave height is measured using a platform-mounted, downward-looking laser. For the ninth platform, waves are measured using a transmitting directional wave rider buoy.

Each system is fitted with a power supply which cannot be interrupted (UPS) which protects it from power surges and reduces the risk of noise corrupting the data. A PC on each platform carries out the processing in real-time and performs extensive Quality Control (QC). Suspect data is flagged and where samples are rejected or weather conditions exceed pre-set thresholds raw digital data is logged for post-analysis onshore. Platform personnel have the benefit of real-time displays of processed values updated every minute. Within this new system, the radio operator on each platform will also have the facility to type in visual weather observations, with time of entry automatically logged.

A shore-based PC interrogates the offshore stations by telephone and downloads the processed data. Through an electronic mail notice board and the website, data is made available to interested parties. Data (including visual observations) is sent twice daily by fax to the Malaysian Meteorological Service in Kuala Lumpur. Once each week, the onshore PC automatically takes the processed data, reformats it and sends it for uploading into a climatological databank.

To complete the metocean data collection package, tide measurements are collected at a number of coastal and offshore locations and this data is used in connection with a platform-subsidence monitoring programme.

Current data is also collected at two offshore sites, now using bottom-mounted, upward-looking, self-recording Acoustic Doppler Current Profilers. A wave directional buoy is also deployed at a remote, deep-water site, transmitting processed values via the ARGOS satellite.

#### Meteorological Department of Malaysia

An Automatic Metocean Station is needed to enhance the operation of weather forecasting services. Real-time marine information reaching the forecaster will instantly increase the accuracy of the forecast. Real-time marine information provides input for the forecast of tides, current and wave situation when needed during critical operation time and for further planning.

The system makes use of the latest technology in sensors, hardware and software, with emphasis on reliability and data quality control. It measures wind speed and direction, current speed and direction, wave height, direction and period, tides or water level, air temperature and pressure and water temperature. Figure 3 shows the Coastal Station Diagram.

The ocean sensor is fitted in an underwater frame system and wired up to selected beacons at the entrance to the port or harbour. The meteorological sensor is sited on top of the port or harbour building. A PC located at the Meteorological Department office in Kuala Lumpur receives all data from the ocean station and from the coastal station over a GSM and Satellite Modem. The data is processed and values displayed every hour (60 minutes); during bad weather, however, data will be processed and displayed every ten minutes.

#### Benefits

The preceding section has described the metocean technology required by port and harbour to meet operational and developmental needs. The tangible benefits in three key areas are highlighted in further detail below.

#### Automatic Real-time Marine Metocean Data

As metocean information concerning actual conditions becomes available it is, in line with most IT computer technology, now taken for granted and accepted as the norm. Examples of immediate benefits include the following.

- Modern, reliable displayed condition of wind, wave, current and tide make for safer vessel operations, removing guesswork from estimation of conditions.
- Greater awareness at the control tower, improves the operational decision-making process.
- Data is available as primary input for any spill emergency and becomes an integral part of the oil spill contingency plan.
- Data is available as primary input for tide, current and wave prediction, making operation planning more efficient.

#### Metocean System

Metocean System is a tool for metocean data processing and analysis.

- The system will provide more accurate statistical analysis, thus saving on repairs (structure) and remedial action.
- The system will provide a long-term database system for future development and expansion of port and harbours.

#### Weather Forecast

Advances in computer technology and satellite imagery in recent years have brought significant improvements to the capability of numerical weather forecast models and to the general level of weather forecast accuracy. However, full advantage can only be taken of these improvements if more attention is paid to obtaining real-time data as input for weather forecasting.

Squalls represent a significant hazard for offshore and coastal Malaysia and these are not easy to forecast with local precision. One solution would be to install a chain of Doppler Weather Radar along the coast. The key to success, however, would lie with the radar operator giving the appropriate warning directly to relevant users, effectively and without delays. However, the hardware and 24-hour operating cost of this would be expensive and could only be justified as a joint venture with other interested parties.

### Conclusions

This paper has set out to demonstrate how advantage is being taken of the development and latest technological advances in marine metocean technology as applied to oil and gas industry operations. The Meteorological Department of Malaysia has taken the initiative in advancing capabilities in the marine metocean system. Their main aim in doing so is to have more accurate forecasting to provide safe operation and cost saving. It is therefore essential for other marine industry-related agencies in Malaysia to implement metocean capabilities in the near future.

### Acknowledgement

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### Editor's Note

Rozlan Bin Mohd Ramli, the author of this article, died on 16th September 2003, at the age of 44 years. He submitted this feature just before his death. His relatives have expressed the wish that it nevertheless be published in the hope that it will benefit all. We have left the biography as submitted and print the article with deep respect, as one fitting the theme of this issue.