

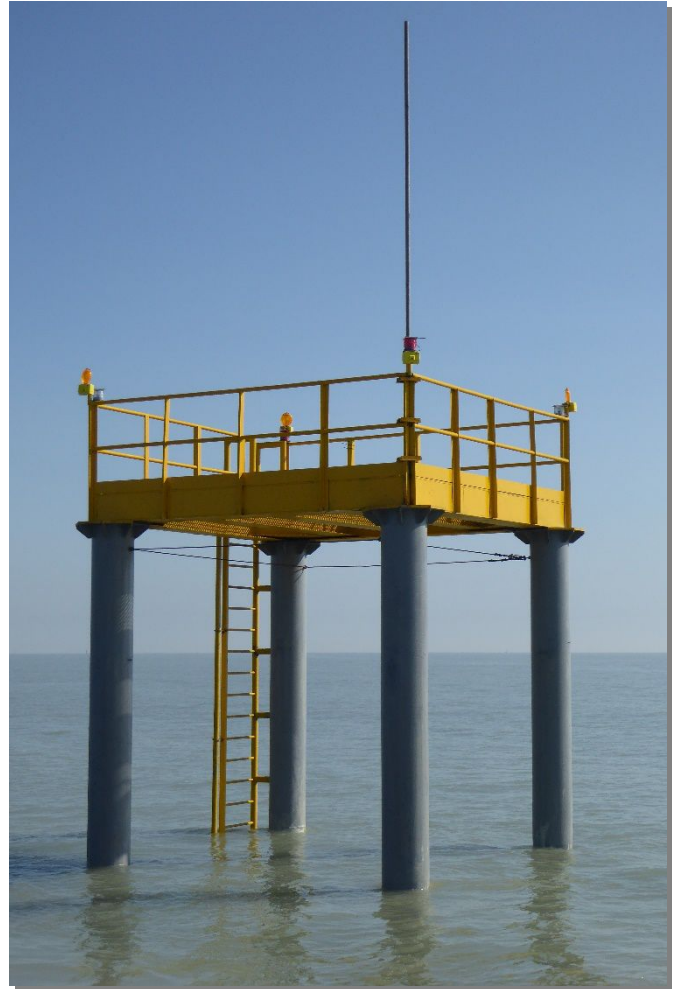


The Application :

Water Level, Wave, Tide, Current, Meteorological and Hydrological Monitoring System for Offshore Platform

1. Buyer requirements:

- A complete monitoring system (Turn-key Solution) with multiple hydrological and meteorological measurements (water level, waves, tides, water current, wind speed & direction, temperature of air & water, atmospheric pressure, turbidity, conductivity).
- A central station installation with PCs and servers, reception for the data, processing, analysis, viewing and storage of data. Additional backup systems also required.
- High data accuracy with state of the art equipment.
- Redundancy in the measurements (additional measurement technologies, even higher number of sensors). Three different technologies required for wave, water level and tide monitoring: airborne ultrasound, radar and acoustic Doppler (from the seabed looking upwards).
- Continuous data communication over long distance (20km).
- A single contractor to offer the whole system, installation, commissioning and training (reasonable since with many subcontractors system integration becomes problematic).
- A system that is easy to manage, oversee and provides easily comprehensible data.
- A system that is robust, requires little repair and maintenance, ideally an annual inspection. Zero tolerance for lost data !
- Delivery, installation, commissioning, test (proof of system operation over an extended period) and training, all in a period of 6 months.
- Annual maintenance and continuous support.
- Static survey and Tide gauge bench-marking also requested.
- Stand-alone offshore system (energy autonomous system) through solar energy.
- Data used for planning & operation procedures for Breakwater construction (similar for Waterway Engineering, New Ports, Networks)



The platform prior to the installation

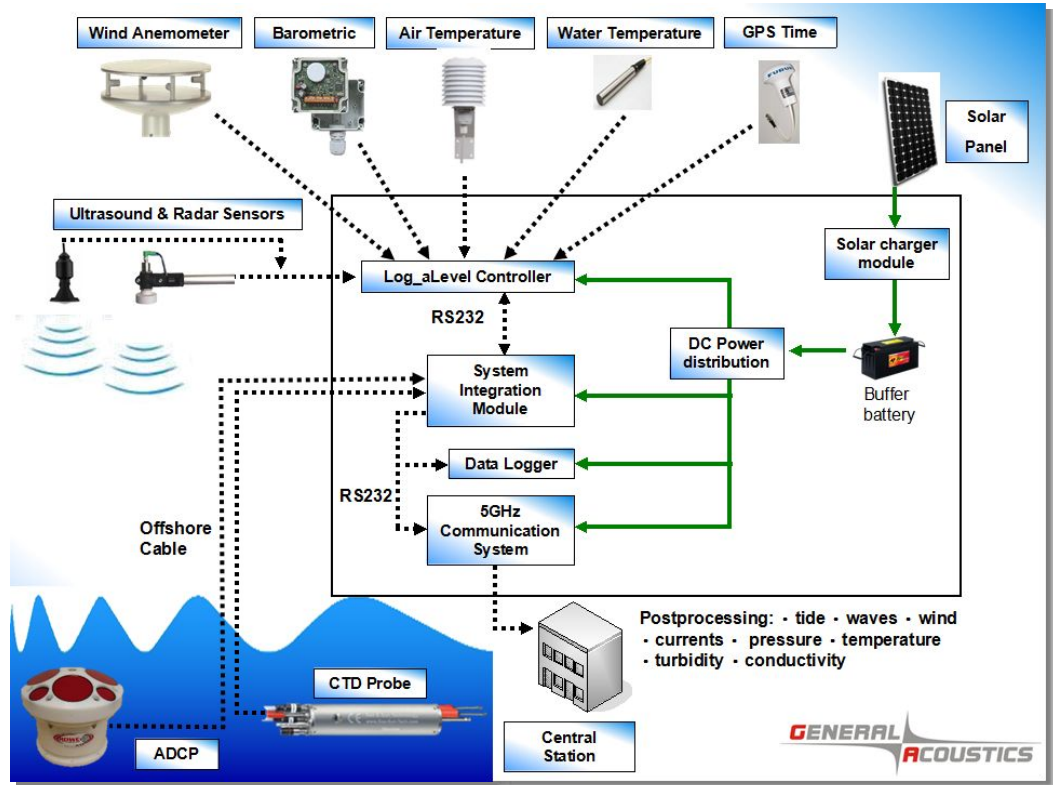
2. Seller deliverables:

- Complex system with various measurement technologies and data formats requires intensive system integration as well as hardware and software system customization.
- Supplying state-of-the-art equipment on a moderate budget.
- A high bandwidth, license-free data communication is necessary to transmit without errors over the large distance. License-free systems chosen to alleviate time-consuming bureaucracy.

Complete Solution for Coastal, Near Shore and Offshore Monitoring System






- Providing a system that is extremely robust, is not affected by any kind of interference from Buyer's personnel (often untrained personnel perform wrong connections, re-configure software setups; trained personnel also make mistakes). Any such human errors should not affect the critical system operations.
- The seller's experienced personnel have to be able to work under difficult, harsh and dangerous conditions. Personnel's thorough understanding of the system, experience with offshore installations and safety training are crucial.
- Solar energy system must be robust and provide adequate power based on environmental calculations.
- Shipping, custom issues can present huge efforts, costs and delays. Offshore construction in remote regions presents a logistics problem.
- Robustness and reliability of such systems are of paramount importance as these can be hard to access offshore locations. Each part of the system needs to be reliable under maritime usage to ensure hassle-free uninterrupted operation for a number of years.












System Diagram

3. Results:

The system was delivered including all necessary electronics for the platform and the central station, measurement instruments, mounting accessories, PCs and servers, solar panels, etc... The system components were the following:

<p>Ultrasound LOG_aLevel sensors - 10 meters measurement range</p>  <ul style="list-style-type: none"> • Wave • Water Level • Tide 	<p>LOG_aLevel Radar Sensor - 10 meters measurement range</p>  <ul style="list-style-type: none"> • Wave • Water Level • Tide 	<p>ADCP - 75m offshore cable for communications and power - Anchor and base</p>  <ul style="list-style-type: none"> • Water current profiles • Directional Wave analysis from the ADCP data • 30 meters measurement range
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<p>CTD Multi-parameter Probe</p> <ul style="list-style-type: none"> - 75m offshore cable for communications and power - Deployed on the ADCP frame  <ul style="list-style-type: none"> • Conductivity • Turbidity • Temperature 	<p>Ultrasonic 2D-compact Offshore Wind Sensor</p>  <ul style="list-style-type: none"> • Wind speed • Wind direction • Virtual air temperature 	<p>Barometric sensor</p>  <ul style="list-style-type: none"> • Atmospheric air pressure
<p>Air temperature sensors</p>  <ul style="list-style-type: none"> • Air Temperature 	<p>Hi bandwidth data transmission</p>  <ul style="list-style-type: none"> • Data Communication from Offshore platform to central station 	<p>Solar Power System</p> <ul style="list-style-type: none"> - 2 x 100Wp Solar Panels - MPT charge regulation - 2 x 110 Ah AGM Batteries  <ul style="list-style-type: none"> • Adequate power and power regulation for the offshore platform
<p>Data logger</p>  <ul style="list-style-type: none"> • Data backup for 12 months of recordings (not susceptible to any radio communication problems) 	<p>Central Server</p> <ul style="list-style-type: none"> - Server PCs and Software - External UPS power supply - External NAS for data backup  <ul style="list-style-type: none"> • Server PCs as well as all necessary software for viewing, processing and storing the data • Data verification for completely and correctly received data 	<p>Electronics Housing</p>  <ul style="list-style-type: none"> • Housing for the electronic components on the platform that provides adequate protection

As expected, the LOG_aLevel ultrasound sensor fully resolves all waves and provides the most accurate water level measurement of all systems. Radar gives a “smoothed-out” resemblance of the ultrasound data. The accuracy of the level measurement is 1 cm with no drift and no need for calibration or any additional adjustment. The ADCP system was accurately positioned with a tilt and pitch of less than 2 degrees. The communication and power thought the cable has proven very robust and high quality data is recorded. The CTD multi-parameter probe is a robust, state-of-the-art instrument with high accuracy sensors that requires little maintenance and is very reliable. To simplify



deployment the CTD probe was mounted in a suitable position on the ADCP frame. A separate cable was used for data transmission in real time and power supply. All other sensors are performing within their hi-standard specifications.

A high bandwidth (1Mbit) 5GHz license free data communication was chosen. The VHF communication is able to transmit data over a line of sight of 20km. The 1Mbit bandwidth allows the continuous transfer of all raw data from



The platform after installation

all measurement systems including a LOG_aLevel at 5Hz sample rate and an ADCP delivering large amounts of data. On shore the data is received, stored, analysed and graphically shown on computer displays.

Since continuous feed is required from the ADCP, a submerged cable connects the ADCP to the platform electronics and serves for data communication and electricity.

System integration and vigorous testing resulted in unproblematic installation at the site.

The installation was successfully performed in 10 man-days under very difficult conditions.

The system became immediately operational and was tested for a period of 1 month. Subsequently the client received analysis of the results and a full report of the system. Training and final handover took place at about 2 months after the 1st day of installation.

The end-user interface allows a good overview of all system components and data are presented

in an easily understandable form. The system further allows easy report generation for quick and accurate information dissemination.

The system is optimized for very low maintenance thanks to the remote-sensing technology, sensors with no moving parts, special corrosion protection and extended temperature range of all electronic components. These parts require minimal maintenance, thus significantly reducing operation costs, eliminating problems (in this case: no data). The redundancy in sensors and data communication systems further enhances the system's reliability. All sensors are calibration-free, making the system easy to install and maintain but also ensuring that maximum accuracy is always guaranteed.

A similar solution can be used for coastal applications, with LOG_aLevel and meteorological sensors deployed on-shore and ADCP & CTD deployed at 100m from the coast.