

FUGRO OCEANOR WAVESCAN BUOY TSUNAMI DETECTION SYSTEM



MALAYSIA

In 2005 Fugro OCEANOR delivered three WAVESCAN buoys with Deep Sea Modules to the Malaysia Meteorological Department (MMD) through Astronautic Technology (M) Sdn Bhd (ATSB). They form an integrated part of the Tsunami Early Warning System installed in Malaysia. The buoys measure selected metocean parameters. All data are transmitted to shore in real-time using the Inmarsat-C system.

Six automatic water level stations are also being delivered and installed along the exposed Malaysian coastline. Real-time data are transmitted to MMD from remote areas and islands. The data transmitted from all stations are integrated into the data flow of the Tsunami Warning Centre established at MMD.

The photograph below shows one of the Malaysian buoys and Deep Sea Modules en route from Fugro OCEANOR's facilities in Trondheim, Norway to the nearby Trondheim fjord for in-water testing. The next photograph shows one of the WAVESCAN buoys during deployment in Malaysia.



INDIA

In early 2006 Fugro OCEANOR was awarded a contract with the National Institute of Ocean Technology (NIOT) in India for the supply and installation of two SEAWATCH Deep Sea Modules (SDSM) for interfacing to surface buoys. The pressure sensors are to be suitable for depths of up to 4000m. NIOT may purchase an additional 8 units if performance is shown to be good.

GREECE

One SDSM is being produced for the Hellenic Centre for Marine Research (HCMR) in Greece as part of the POSEIDON 2 project. It is designed to allow the inclusion of additional sensors.

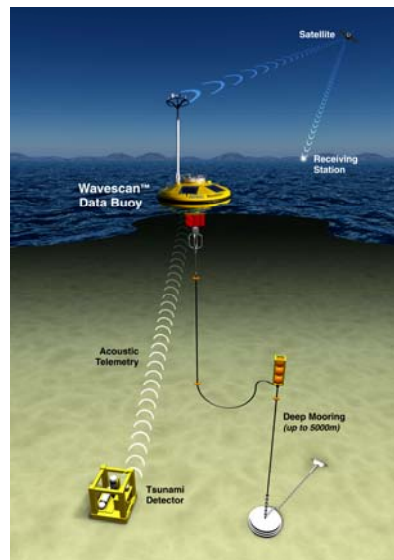
TSUNAMI COMPONENT

The modular design of the OCEANOR SEAWATCH system allows the integration of a SEAWATCH Deep Sea Module (SDSM). This unit consists of a pressure sensor, processor, batteries and an acoustic modem. Water pressure is continuously measured and at regular intervals (eg. once / hour) a measurement is transmitted to the surface enabling verification of the system's operation. The pressure measurements are processed by the seabed processor in real-time, the tidal variations and any variations due to sensor instability are eliminated from the time series. The resulting data are then analysed for tsunami events. In the case of a likely tsunami event, the SDSM switches into fast data transmission mode, sending the pressure time series to the surface buoy, which in turn sends the data to shore using the satellite link. The Deep Sea Module has a very high accuracy and may detect changes in the water pressure corresponding to 1cm or better at depths of up to several thousand meters.

The presentation software, StationGuard, is configured to raise the alert once the buoy has detected the tsunami characteristics. During a tsunami event, the data reception system will indicate an alarm situation. An appropriate method of communication, eg. email, SMS message, fax, etc is chosen to distribute the alarm to key personnel. The data will at this stage be readily available for an expert team to evaluate, together with seismic data and other possible sources of information.

FUGRO OCEANOR SEAWATCH

Fugro OCEANOR SEAWATCH systems are integrated, real-time marine monitoring and information systems, consisting of networks of oceanographic buoys deployed offshore around the world. Data are transmitted by satellite from the buoys to national data centres. The main applications include monitoring and forecasting of atmospheric and ocean circulation, pollution transport, sea state, storm surge and tsunami waves.



Further Information:

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FUGRO OCEANOR WAVESCAN BUOY

TSUNAMI DETECTION SYSTEM



WAVESCAN BUOY

Buoy Overall Dimensions

Weight	924kg
Diameter of hull	2.8m (with fender)
Buoy total height	6.75m (mast to keel)
Buoyancy	3000kg

Power Supply

Solar panels	80W
Lead acid battery bank	240Amph
Lithium backup	385, 770, 1155 or 1540Amph

Navigation

Navigation light and radar reflector in compliance with IALA requirements

On Board Processor

32-bit microprocessor, flash disk data storage
Real-time operating system, low power consumption
A large number of serial and analogue inputs
Flexible data acquisition software

Data Communication Systems

Satellite	Inmarsat-C and ORBCOMM two-way communication ARGOS one-way communication
Telephone	GSM, two-way communication
Radio	UHF/VHF two-way communication
Other options available	
Operating Temperature	-5 to 55°C (min.)
Storage Temperature	-20 to 50°C (min.)

Sensor options:

Directional waves, surface current speed and direction, surface temperature and salinity, temperature and salinity profiles, dissolved oxygen, light attenuation, chlorophyll-a, hydrocarbons, air temperature, air pressure, wind speed and direction.

Enquire for other parameters

Specifications available

SEAWATCH DEEP SEA MODULE (SDSM)

Acoustic modem (other depth ratings may also be supplied)

Baud rate	140 2400 bits / second
Maximum depth	6000 meters
Transmit power consumption	2A average, 5A peak @21V
Receive power consumption	25mA
Low power consumption	0.5mA
Operating frequency	9 to 14 kHz

Pressure sensor

Repeatability(*):	±0.01 % of range
Hysteresis(*):	±0.01 % of range
Maximum overpressure:	1.2 times the range with no change in calibration
Temperature sensitivity:	45 ppm/°C
Sensitivity:	0.001 meter
Maximum depth:	700, 1400, 2100, 4200 or 7000 meters

(*) not important in this application

Temperature Sensor

Accuracy:	±0.1°C
Resolution:	±0.05°C
Range:	-5 to +30 °C

Processor

Program memory size:	64 kB
RAM size	36 kB
Serial ports	2
Counter inputs	4
Analog inputs:	8
Analog to Digital resolution:	16 bit
Processing power:	4 MIPS
Onboard watchdog circuit	

Batteries

Chemistry:	Alkaline
Nominal voltage:	10.5V max, 6.3V min
Capacity:	60 Ah (1 year of operation)