

A Case Study

Real World Solutions
from Teledyne Benthos

*Wireless real-time acquisition of
deflection monitoring data during
installation of subsea structures in
oil and gas fields*



TELEDYNE BENTHOS
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Teledyne Benthos Equipment: Acoustic Modems

Customer: Rental Technologies and Services (RTS), AS



www.rts.as

Application: Underwater Wireless Data Transfer

Depth: 0 to 3,000 meters

Range: ROV short range 5-30 meters & SDM to platform up to 3,000 meters

Data Rate: 1,200 bits/sec acoustic data throughput with error correction convolutional coding

Host Sensor: Heading, Pitch, Roll, Depth, Inclination & Deflection

Wireless real-time data would yield a faster installation time, decrease the required on-site ship and ROV time, and reduce the project cost.

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The Challenge

RTS AS needed a reliable and efficient method for wirelessly monitoring and retrieving data, in real time, from subsea structures during seabed installations in oil and gas fields. The system had to provide real time heading, pitch, roll, depth, inclination and deflection information to the operator during installation. The system was based on an instrument frame containing a subsea logger and gyro with inclinometers and a battery pack. A set of high precision depth sensors were also installed in each corner of the structure and were used for deflection calculations. This information was required for precise positioning, leveling and regulation of the suction process during installation. All sensor data needed to be collected, time stamped and logged by the RTS subsea logger, and

simultaneously transferred to the ship via acoustic link. To facilitate recovery of the system after the operations were completed, the Subsea Deflection Monitoring System (SDM) instrument frames also had to be equipped with an ROV recoverable bracket mount. Depending on the project, one or two identical systems would be installed on the structure; one as the primary system and the other as a backup system.

An extensive deployment of navigational mid-frequency (MF) acoustic transponders further complicated the project.

The ability to monitor and retrieve real time data would alleviate the necessity for manual measurements. Wireless real time data would yield a faster installation time, decrease the required on-site ship and ROV time, and reduce the project cost.

The Solution

RTS AS needed a reliable and accurate wireless acoustic modem system. Teledyne Benthos was contacted and after a successful demonstration at the RTS office in Åkrehamn, NORWAY, RTS selected the Teledyne Benthos ATM series acoustic modems for use on their newly designed Subsea Deflection Monitoring System (now known as their SDM System). The Teledyne Benthos acoustic modems selected included:

- ▶ ATM-886 used on SDM instrument frame
- ▶ ATM-886 as ROV modem

- ▶ ATM-891 deck box used together with AT-408 as a topside dunking transducer deployed from the ship (spare unit/contingency)

The SDM instrument frame utilized ATM-886 acoustic modem as a transparent half duplex communication link to the support ship. During operations, the ship would normally deploy two ROV's, one for controlling the suction panels and one for general observation. By installing ATM-886 acoustic modems on the ROV's, RTS was able to obtain reliable short range communication with low transmit power and thereby avoid acoustic noise from the



Figure 1 Barge used to deploy subsea structures



A "silent window" is a period of quiet while the subsea modem listens for communications or instructions from the topside unit.

*Our thanks to
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and Freddy Knutsen of
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topside support ship. Low frequency (LF) 9-14kHz acoustic modems were selected to avoid any possible interference with the MF acoustic transponders used for positioning in the area. For maximum flexibility, RTS placed a subsea modem for receiving data, on each of the two ROVs. As a contingency, they also deployed one ATM-891 acoustic modem with an AT-408 dunking transducer from the topside ship. All three receiving modems were communicating with the surface unit simultaneously, allowing the surface unit to automatically select the modem with the best acoustic path for data telemetry. This method allowed the operators to maintain a continuous data link with the ROVs even when they were moving or were obscured behind steel structures.

The ATM-886 modem on the SDM instrument frame was configured to send data every six seconds to the ROV modems allowing for the smallest possible "silent window". A silent window of some length was needed so the topside modem could send commands down to the modem stationed on the SDM system. If continuous data were sent from subsea to either the ROV's or topside modem, then these topside commands could not be received by the subsea modem. This "silent window" requirement was identified during the demonstration at the RTS facility and was factored into their system setup.

Typically, short acoustic communication ranges of 5 to 30 meters were utilized from the SDM instrument frame to the ROV enabling the operators to use low modem transmit power levels, thereby limiting the use of battery power and enabling longer subsea deployment time for the SDM system.

To make the overall system easy to use, RTS implemented simple push button commands for all of the necessary modem functions in their SDM software control package (see figure 4). This development allowed for easy selection of transmit power, modem status updates, and selection between SDM instrument frames when more than two systems were deployed simultaneously. These changes could be accomplished while the system was online and without the use of any special software.

Acoustic modems provide users a reliable method to wirelessly retrieve data and perform command and control functions underwater. The systems provide a viable cost effective alternative to expensive cables and can be used for many subsea operations. RTS AS continues to use the Teledyne Benthos acoustic modems coupled with their Subsea Deflection Monitoring System (SDM). Most recently the systems have been used with success on projects involving the installation of templates and suction anchors for the Gjoa and Skarv Oil Fields in the North Sea.

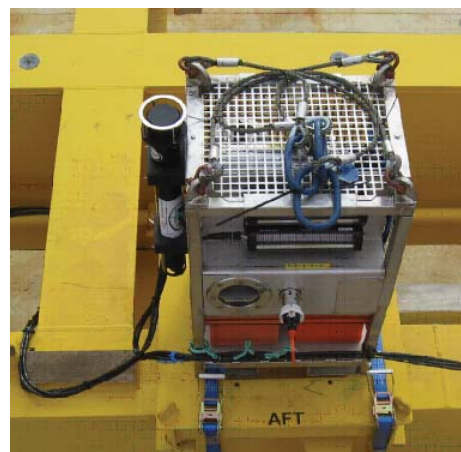


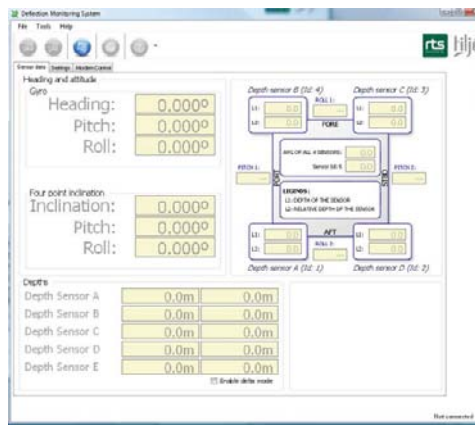
Figure 2

SDM Frame Install: Picture of the SDM system installed on a recoverable base plate on structure. After use, straps are cut and SDM system is lifted recovered. Teledyne Benthos ATM-885 acoustic modem is located on left side of SDM frame.

The ATM-885 was used as part of the demonstration system.

Figure 3

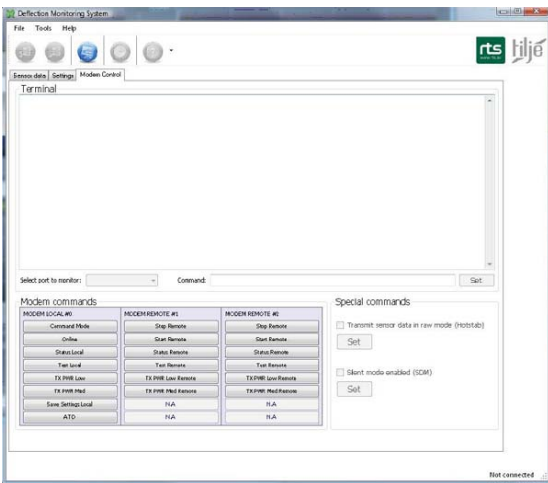
Main Display Window: Displays Gyro Heading, Pitch, Roll and Inclination based on depth sensors, actual depth on each sensor and comparison of depths in each corner, calculated pitch and roll for each long side based on depths. Easy point-and-click modem commands are embedded in the graphical user interface (GUI) at the bottom of the screen.



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Figure 4

Modem Control Window: Displays the integrated modem command buttons and terminal window in the RTS surface unit software, used for changing modem settings and communicating with system sensors.



Teledyne Benthos, Inc.
49 Edgerton Drive
North Falmouth, MA 02556-2826 USA
T: +1 508.563.1000 F: +1 508.563.6444
email: benthos@teledyne.com