The Solution to Wireless Underwater Communication
A reliable, affordable underwater acoustic communication link

Benthos new Telesonar Acoustic Telemetry Modems bring wireless underwater communication to a new level. The Telesonar Modems, developed in cooperation with University and Navy research scientists, offer significant improvement in performance and reliability over the previously available technology. New and enhanced DSP modulation/demodulation, combined with a comprehensive upgrade in both hardware and software design, have resulted in significant enhancements, including increased data reliability, higher data rates, reduced system size and weight, and lower cost.

**Performance Features**

- Bidirectional data transmission at through-put rates of up to 2400 bits/second.
- Reduced power consumption allows for extended operation.
- Versatile modular configuration offers a choice of three frequency bands (LF 9-14 kHz, MF 15-20 kHz, or HF 25-30 kHz). Each system can be custom designed for the user's unique application.
- Each modem (topside and subsea) can be configured with either a directional, omnidirectional or line array transducer.
- Selectable multifrequency modulation schemes (data coding) provide for decreased error rate in difficult environments at through-put rates up to 1200 baud.
- Standard 900 Kbyte buffer memory/data logger allows data to be transferred to, and stored within, the modem.
- Modems can be configured for long range horizontal transmission in shallow water, or vertical transmission in depth to 6000 meters.
- Diagnostic reporting capabilities including ambient noise, SNR, error rate, range, battery voltage, and other valuable parameters.
- Easy to use Hayes modem "AT" command software allows for remote modem and host instrumentation configuration and transparent communication.

Cover photo: NOAA PMEL tsunami warning system uses Benthos Telesonar Modems to transmit pressure data to a surface buoy from 4000 meters.
Model Summary

ATM-871/870 Topside Telesonar Modems

ATM-875/ATM-877 Subsea Acoustic Telemetry Modems

AT-408/AT-409/AT421 Acoustic Transducers

▲ The ATM-871 Deck Unit, the AT-408 Omnidirectional Transducer, and the ATM-875 Subsea Modem with integral omnidirectional transducer.
**Improved Data Reliability**

Underwater sound transmission can be extremely difficult. This is why Benthos has gone to such great lengths to design a highly robust communication system that significantly improves data transmission. After extensive research and development, Benthos has chosen to employ many high performance modulation schemes which effectively reduce the physical barriers to underwater communication.

- **1 of 4 MFSK**: An advanced modulation scheme which allows for high speed data transmission (up to 2400 baud). 1 of 4 MFSK is bandwidth efficient, fast and relatively simple to encode.

- **Hadamard MFSK**: An advanced modulation scheme used to minimize the effects of frequency dependent fading. This scheme also allows the system to operate at a lower signal to noise ratio (SNR) by working reliably at lower transmit power levels.

In addition to 1 of 4 MFSK and Hadamard MFSK, the Telesonar Acoustic Modems incorporate three other methods for increased data reliability. These include data redundancy, convolutional coding and a multipath guard period. (Data through-put rate is reduced when utilizing these methods for improved reliability.) All three methods are user selectable and can be applied when using either modulation scheme.

- **Data Redundancy**: A technique in which the same data bits are transmitted two or more times (user selectable) in the same data frame. Data reliability is increased through repetition and frequency diversity.

- **Convolutional coding**: An error correction technique in which a Viterbi algorithm is implemented to detect and correct received bit errors.

- **Multipath Guard Period**: An effective technique for use in high multipath environments. This feature allows the user to incorporate a selectable delay period between data frames. This brief delay allows time for the multipath to die down in the communication channel before sending out the next data frame.

**System Versatility**

Because no two applications are identical, Benthos Telesonar Acoustic Modems have been designed to provide optimum system versatility. The modular system design allows the user to custom design a communication system appropriate for their unique requirement. System design options include:

- **Customer Selectable Frequency Range**: The Telesonar System can be configured to operate within one of three standard frequency ranges: 9-14 kHz (LF), 15-20 kHz (MF), and 25-30 kHz (HF).

- **Customer Selectable Transducer Arrays**: Each of Datasonics Telesonar Acoustic Modems (topside and subsea) can be configured to include a directional, omnidirectional, or line array transducer.

- **Remote/Integral Transducer Configuration**: Each of the Telesonar Subsea Modems can be configured to include either an integral or remote transducer, depending upon the customer’s space and orientation requirements. (Topside Modems require a remote configuration.)
Sample Modem Applications

Military
- UUV communication
- Autonomous ocean sampling network communication (AOSN)
- Tactical underwater local area network communications

Oceanographic
Real time command, control, and acquisition of data from underwater instrumentation
- Current meters
- Tide gauges
- CTD instruments
- Special purpose instrumentation

Offshore Oil/Gas Industry
- Command, control, and acquisition of data from remote underwater instrumentation
- Long range, low frequency communication with remote wellhead location
- Wireless communications between platform and sea floor instrumentation

▲ Command, control and data acquisition from under-ice AUV or manned submersible

▲ Data acquisition from and remote control of underwater instrumentation.

▲ Control and data acquisition between a platform and remote pipeline instrument.