



SWALE OCEANOGRAPHIC

Advantages of MAVS and Differential Travel Time Measurement

- **Very high single measurement accuracy**
 - MAVS has an accuracy of 0.5 cm/s and a resolution of 0.05 cm/s. The measurement noise floor is less than 0.12 cm/s; 0.07 cm/s is typical. Each acoustic path is linear over the standard full scale range of ± 180 cm/s (± 3.6 kts). Greater full scale linear range is an option.
 - The MAVS differential travel time technique is so unique it is patented.
 - Point measurement Doppler sensors must average many measurements to reduce the high noise inherent in each single measurement.
 - Other Doppler type measurements inherently have less accuracy in each measurement and generally average over large volumes spatially with each ping.
 - Other forward acoustic transmission sensors measure phase differences, a less accurate approach than differential travel time.
- **No dependence on scatterers in the water column**
 - Doppler instruments will only function if enough, but not too many, scatterers are present. They will not work in very clear water, very murky water, in the presence of lots of bubbles, etc.
 - MAVS doesn't use scatterers. It works fine in clear water, murky water, even in the high bubble densities found in the crest of a breaking wave.
- **Point Measurement**
 - The small, well defined sample volume strongly localizes the measurement in space. This is unlike typical Doppler instruments which must assume common flow characteristics over several meters to several hundred meters of the ocean. Additionally proximity to a boundary does not alter the response as it does with an electromagnetic current meter.
- **Turbulence Measurement**
 - Combine the high single measurement accuracy, spatial localization, and the fact the MAVS can operate at up to 30 Hz, and you have a sensor that can measure turbulence well into the inertial sub-range and often down to the dissipation scale.
- **Designed for Field Use, Accurate Enough for the Laboratory**
 - MAVS is designed for low average power drain to allow long battery powered deployments: <20 mA sampling at 2 Hz, <500 μ A in low power sleep.
 - MAVS stores data on non-volatile, high capacity compact flash cards, formatted for compatibility with MS-DOS/Windows PCs. MAVS systems can autonomously record a gigabyte or more of measurements.
 - Shallow water MAVS is rated to 2000 meters. Deep water MAVS is rated to 6000 meters.
 - In 2001 a MAVS sensor was carried along and buried by a massive submarine landslide in Monterrey Canyon. Despite damage, the instrument continued to function and returned a data set that enabled MBARI researchers to document the event and publish their results.
 - An array of nine MAVS sensors is used by researchers at Texas A&M University to make high resolution, synchronous, multipoint measurements of turbulence in a large wave and current facility

- True 3D Measurement
 - The four acoustic paths of the MAVS sensor head provide a true measurement, with redundancy, of the 3-Dimensional velocity vector.
 - The velocity measurement can be specified in the instrument or Earth frame, the latter using the MAVS solid state, temperature compensated, attitude module with 3-axis compass and 2-axis tilt sensors.

- Low Flow Disturbance, Flat Cosine Response
 - The faired rings supporting the MAVS transducer array were designed and tested in a detailed series of tow tank and flume tests. The shape of the rings and the positioning of the transducers prevents significant wake disturbance of the acoustic paths, thus reducing the flow disturbance of the sensor head to a negligible level.
 - The geometry also produces a flat cosine response in the ring (horizontal) plane and a smooth and well defined cosine response perpendicular to the ring plane. This is unique among single point, 3D current meters.

- Two Easy to Use Operator Interfaces
 - MAVS provides the user with a choice of user interfaces. MAVSoft is a simple to use, point and click, graphical interface allowing full control of the system for testing and deployments.
 - MAVS also includes a simple, text based, menu interface giving the operator complete access to all aspects of system control and operation. MAVSoft includes a terminal emulator for access to the menu based interface.
 - The manuals provide a complete description of system operation and calibration procedures and include many examples.
 - The manuals also discuss sampling strategies for typical oceanographic situations.

- Full Featured, Integrated Sampling System
 - The user interface permits full and flexible control of the sampling schedule.
 - On-board utilities assist the operator with deployment planning by automatically calculating battery and memory endurance for the programmed sampling schedule and selected suite of auxiliary measurements.
 - In addition to a high accuracy, 3D velocity measurement with essentially standard compass, tilt, and temperature sensing, MAVS systems can be configured with fully integrated, conductivity, pressure, optical backscatter, florescence, triple thermistor, and numerous other auxiliary sensors.
 - In all cases the data stream is fully integrated with a common time base.
 - In addition to the standard RS-232 serial output, MAVS can be configured to provide
 - RS-422/RS-485 serial output to support real-time system control and data transfer in long-wire applications
 - Analog velocity outputs to support data collection by integrated, multi-sensor, analog sampling systems

- Post-Processing Options
 - MWAVES Directional Wave and Tide software makes the calculation of directional wave spectra from MAVS time-series measurements fast and easy.
 - The MWAVES manual discusses the design of good wave sampling strategies (both sampling schedules and proper sensor deployment), describes how to use the software, and provides many examples.

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