

Woods Hole Group Services

Woods Hole Group provides cradle to grave services for our ADCP systems. We use 3-D mechanical rendering software to design our systems. We maintain an archive of drawings of all recent systems and can easily provide customized modifications to accommodate rig-specific constraints. Customized operations manuals are provided for each system.

Our systems are built by a Houston fabrication company, so that progress can conveniently be monitored by both WHG and the client. Our fabricator provides custom services and works in accordance with oil industry standards for welding, inspection, and coating of steel structures. They also provide certification of materials, and arrange certified testing as required to meet client specifications.

Once the system is complete and a Factory Acceptance Test (FAT) has been performed and approved by the client, the systems are shipped to the client's marine facility in the Gulf of Mexico region, or elsewhere in the world as required.

WHG maintains a staff of offshore-qualified technical and engineering personnel, who work with rig and client personnel to direct the installation of the system on board using ship-provided lifting, welding and electrical support.

After installations are completed and systems become operational, WHG personnel regularly visit each rig, performing standard and preventive maintenance, ensuring the systems continue to operate smoothly, and providing operational training to rig crews.

WHG investigates any problems such as stoppage of data flow to NDBC, inaccurate data, etc. Problems can often be 'fixed' remotely or through interaction with rig personnel.

WHG typically provides monthly archives of quality-checked data to the client, and data reports if desired.



Rig-Based Metocean Systems



Woods Hole Group Contact Information:

Houston Office Team:

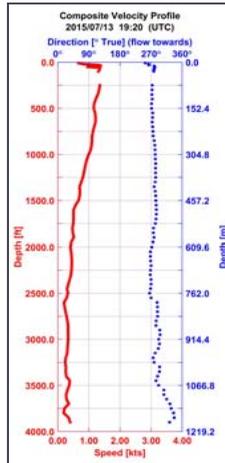
David Szabo, Manager
Rafael Ramos, Senior Oceanographer
Eric Aronchick, Field Technician

281-565-1240

Falmouth Office Team:

Bruce A. Magnell, Senior Oceanographer
A. Todd Morrison III, Senior Ocean Engineer
Minhchau Hung Vu, Chief Engineer
Leonid Ivanov, Oceanographer
Peter Collins, Oceanographic Field Technician
Trevor Ball, Mechanical Engineer
Ruiping Ma, Software Engineer

508-540-8080



Profiles of current speed and direction.

History

Woods Hole Group is an international organization focused on: Applied Ecology; Coastal Sciences, Engineering & Planning; and Oceanography & Measurement Systems.

Specialty technologies include: high resolution numerical modeling of coastal systems; climate change vulnerability assessments and sustainable design; real-time oceanographic measurement systems; and ecological risk assessments. The company has supported a diverse government, private and industrial client base since 1986.

Corporate Headquarters:

Woods Hole Group
81 Technology Park Drive
East Falmouth, MA 02536
P: (508) 540-8080
F: (508) 540-1001

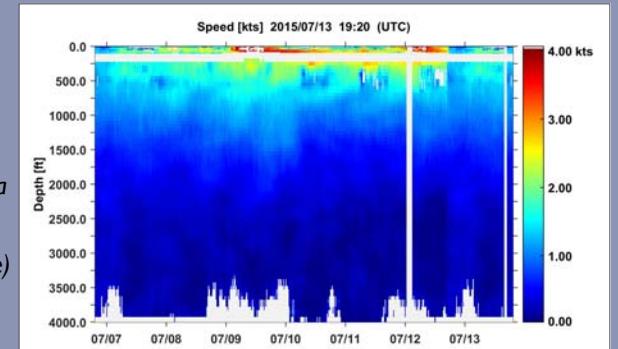
Field Offices:

Woods Hole Group - Houston
Office Manager: David Szabo
12705 South Kirkwood, Suite 100
Stafford, TX 77477
P: (281) 565-1240

Woods Hole Group - Mid Atlantic
Office Manager: Clinton Hare
100 Carlsons Way, Suite 9
Dover, DE 19901-2365
P: (302) 734-1434

Oceanography & Measurement Systems Highlights:

- 20-years of experience in designing, constructing, deploying, operating, maintaining and providing data quality assurance for ADCP systems on rigs and platforms worldwide.
- Provided ADCP systems for drilling rigs and platforms in the Gulf of Mexico, Indonesia, West Africa, Trinidad and Brasil.
- Provided several different types of systems including track-mounted systems and single- and double-wire gantry deployment systems.
- Typically provided systems that incorporate a downward-looking Teledyne RDI 38kHz Ocean Observer ADCP (about 1000m range) and an upward-looking or horizontal short-range ADCP such as the TRDI 300kHz Workhorse.



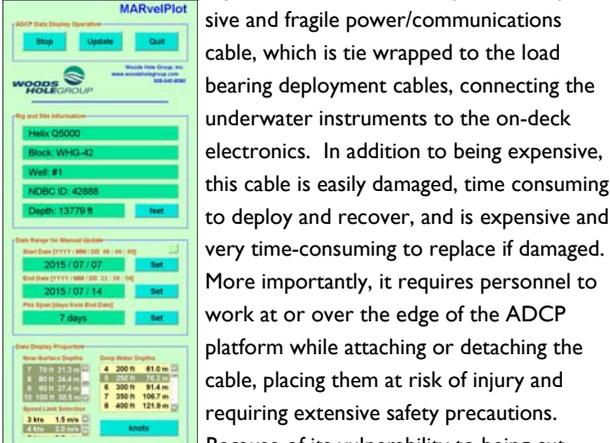
Time-series of current speed profiles.

Rig-Based MetOcean Systems

UWEA Advantages

Our systems designed since 2009 have fully exploited the advantages of the new version of the TRDI Ocean Observer 38kHz ADCP (OO38) with Underwater Electronics Assembly (UWEA).

In earlier designs, such as those used after the introduction of the OO38 but before the UWEA, the electronics unit is located on deck near the deployment A-frame. This requires an expensive and fragile power/communications cable, which is tie wrapped to the load bearing deployment cables, connecting the underwater instruments to the on-deck electronics. In addition to being expensive, this cable is easily damaged, time consuming to deploy and recover, and is expensive and very time-consuming to replace if damaged. More importantly, it requires personnel to work at or over the edge of the ADCP platform while attaching or detaching the cable, placing them at risk of injury and requiring extensive safety precautions. Because of its vulnerability to being cut during recovery, this type of cable also poses a risk of harm to the equipment, and is generally regarded by rig personnel as a nuisance.



Software control panel.

WHG's new design mounts the UWEA on the underwater instrument frame (sled) containing the two ADCPs. By using two integrated electro-mechanical cables, dual winches with slip-rings and an articulated A-frame, risk of damage to equipment is reduced and, more importantly, the safety and productivity of rig personnel are greatly enhanced.

Advantages of WHG's design include:

- Power and communications to and from the ADCPs are integrated into the load-bearing cables, so there is no need to tie-wrap a separate power/comms/data cable to the load bearing cable. Our competitors continue to use a tie-wrapped power/comms cable whether or not a UWEA is deployed.
- There is no need for personnel to work at height, near the edge, or over the water

- Deployment and recovery time is reduced from an hour or more to a few minutes
- Only 2 persons (an operator and a safety observer) are required to perform deployment and recovery operations
- Risk of injury to personnel is reduced
- Risk of damage to cable and equipment is reduced
- Overall operational reliability is increased and operating costs are reduced

LARS Design

The Launch and Recovery System (LARS) is a single turn-key package containing winches, instrument sled, and U-frame.

- 2-cable system holds the ADCP frame parallel to the hull
- Integrated cradle for instrument sled, convenient for storage, maintenance, and rig transits
- Articulated, long reach U-frame deploys ADCPs away from hull or pontoons
- System does not require tag lines or personnel near or under lifted objects during launch or recovery, increasing convenience and personnel safety



LARS control stand and gantry.

Since most ADCP systems are located high above the water, WHG designed a Launch-and-Recovery System (LARS) gantry. The LARS gantry is supplied by WHG as a single, fully assembled package, ready to be welded in position, commonly on a cantilevered platform to maximize the distance between the hull and the deployment cables. The two A-winches and A-frame are hydraulically driven from an operator control stand [positioned inboard of the gantry.]

The A-frame and winches lower the instrument sled, holding the ADCPs and UWEA below the keel and thrusters. This increases measurement quality, and can be accomplished by a single operator and a spotter/safety observer in minutes with minimal risk of personnel injury and equipment damage.

- Maximizes distance between deployment wires and ship's hull
- Deployed and recovered with an operator and observer

- Hydraulic power provides smooth operation of winches and A-frame
- Deployment of instruments below thrusters increases data quality
- Complete deployment and recovery operations in minutes
- Specially designed winches hold the entire length of cable in one wrap, protecting the cable without the complications of a level-wind

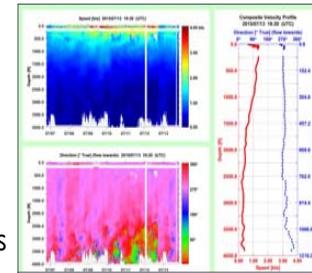
Software

The electronic components of the system, principally the sensors, data connections, and measurement displays, are automatically controlled by WHG's newly developed Oceanographic Measurement System (OMS) software suite and do not normally require intervention by an operator. The software runs on an on-board PC. The system will independently detect when the ADCPs are in the water and will begin collecting current speed and direction profiles that span the water column from the near-surface to a maximum depth of 1200m. OMS will display the resulting profiles in real-time to support rig operations and also archive all data locally and in mandated on-shore archives, including the National Data Buoy Center (NDBC).

The OMS software suite is written in modern, fully supported, software development environments, including Campbell Scientific, Inc. LoggerNet, C#, and Matlab.

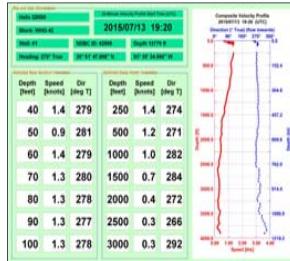
Functions provided by OMS include:

- Automatic control of ADCP operation, including instrument configuration control, sampling synchronization to a real-time clock (absolute time-based) to obtain current profiles on uniform intervals
- Automatic use of pressure data on 20-sec intervals from the WH300 ADCP to control the on-off operation of the OO38 ADCP, which could be damaged if inadvertently operated out of the water



Displays of current speed and direction.

- Position and heading data from rig navigation system is utilized automatically to determine the orientation of the ADCP instrument sled, and to provide meta-data identifying rig position in telemetered data
- 20-second ensemble average are collected from the WH300 ADCP in instrument coordinates and rotated into earth coordinate currents using rig heading data, then averaged to 20-minute ensembles. This minimizes current direction errors if the rig rotates during a 20-minute interval. 60-second ensembles from the OO38 ADCP are similarly rotated and averaged.
- Real-time onboard data processing including automated QC and depth mapping to account for tilt and present information needed by rig personnel on uniform fixed depth levels
- Automatic generation of files and images for onboard archiving of the full history of system use - allowing rig personnel to review past data history and easily export data displays to support rig reporting requirements
- Data displays are available on the rig's CCTV system to support rig operations in real-time
- Data are telemetered in real-time to WHG where we provide daily monitoring services to ensure data quality.
- For Gulf of Mexico systems, real-time data are also sent directly to NDBC in accordance with the requirements of NTL 2009-G02
- Archived data can be exported to a text file or spreadsheet to facilitate direct client access
- Automatic detection and resolution for software faults



CCTV speed and direction display.

Advantages of WHG's modular software architecture include:

- A wide range of data visualization and data processing capabilities
- Easy customization of displays and information presentations to suit client specifications