

### *Qualifications Summary*

- More than 35 years of experience at MIT, EG&G, and Woods Hole Group, Inc. in applied science and ocean engineering for a wide range of commercial and government clients
- Expertise in the analysis of coastal ocean dynamics, especially circulation and mixing on the continental shelf, as well as tides, waves, and deep ocean features
- Design and management of major oceanographic measurement and analysis programs
- Oceanographic instrumentation design and performance evaluation
- Signal processing and data analysis techniques; data acquisition and processing system design, implementation, and technology evaluation
- Real-time system design, testing, and installation

## **BRUCE A. MAGNELL, Sc.D., M.S., B.S.**

Senior Scientist/Senior Oceanographer  
Oceanography and Measurement Systems

### **Professional Affiliations**

American Geophysical Union  
Institute of Electrical and Electronic Engineers  
American Association for the Advancement of Science  
The Oceanography Society  
Marine Technology Society

### **Fields of Expertise**

Physical oceanography, electrical engineering, coastal ocean dynamics, oceanographic instrumentation design and evaluation, signal processing, data analysis, data acquisition, real-time telemetry, processing system design and implementation, technology evaluation, business management and business development.

### **Higher Education**

Sc.D., Physical Oceanography-Massachusetts Institute of Technology/Woods Hole Oceanographic Institution (1973)  
M.S., Physical Oceanography-Massachusetts Institute of Technology (1968)  
M.S., Electrical Engineering-Massachusetts Institute of Technology (1968)  
B.S., Electrical Engineering-Massachusetts Institute of Technology (1966)

### **Employment History**

1995-Present Woods Hole Group, Inc.  
1994-1995 EG&G Marine Instruments, Inc. EG&G  
1983-1994 Washington Analytical Services Center, Inc.  
1974-1983 EG&G Environmental Consultants, Inc.  
1973-1974 MIT (Division of Sponsored Research)

## Key Projects

### **Performance of the Teledyne RDI 75 kHz Long Ranger ADCP Near an Oil Rig in Deep Water in the Gulf of Mexico, CASE-EJIP, 2005-2006 - Program Manager and Principal Investigator**

Dr. Magnell proposed and carried out a major intercomparison study to evaluate and understand the performance limitations of the widely used T-RDI LR75 ADCP, which was reported to have limited range and poor accuracy when used in deep water where the density of scatterers is low. Two LR75s and a 300 kHz T-RDI Workhorse Sentinel ADCP were deployed by ROV on the seafloor about 65m away from a semi-submersible oil drilling rig, and a 1200 kHz Workhorse, an Aanderaa RCM-11, and five Nortek AquaDopp current meters were deployed on a nearby taut 500m-tall taut sub-surface mooring. All instruments were configured to sample intensively and provide as much raw data as possible. Analysis of the data showed that the LR75's velocity estimates were corrupted by coherent echoes (possibly reverberation) of the ADCP's acoustic side lobe signals from the nearby vertical steel riser of the oil rig. The result was significant low bias in the reported current speeds, not just at close ranges where some interference had been expected, but out to the maximum observable range of the ADCP as well. The findings of this study have far-ranging implications for the use of this type of instrumentation in the oil industry.

### **Design and Testing of a Deep Water, Real-time Data Telemetry Relay Buoy, C&C Technologies for Petrobras (Brazil) - Senior Engineer**

Dr. Magnell designed and supervised the construction and testing of a deep-ocean telemetry relay buoy to obtain real-time ocean current data from a 75kHz Long Ranger ADCP on a sub-surface mooring. Acoustic telemetry modems (Link Quest) are used to transfer data from the sub-surface ADCP to the surface buoy, where the data are collected and buffered. A satellite transmission system (Global Star) is used to send the data from the surface buoy to a shore station. The buoy is deployed offshore Brazil in the Campos Basin.

### **Near-Bottom Deep Water Current Profiling Systems for Measurements in the Furrows in the Gulf of Mexico, Petrobras America Inc., 2008-2009 - Senior System Engineer**

Dr. Magnell was the chief design engineer for a set of six bottom platforms deployed the field of Furrows at the base of the Sigsby Escarpment in 2500m depths of the Gulf of Mexico. Each platform was equipped with a 1 MHz acoustic Doppler current profiler (Nortek AquaDopp) to obtain high-resolution current profiles inside a furrow, and a 300 kHz T-RDI Workhorse ADCP to obtain bottom current profiles above the top of the furrow. The platforms were deployed inside furrows using an ROV from a workboat for a 1-year measurement program. Each platform was equipped with floatation and dual acoustic releases to permit recovery without needing an ROV. Acoustic telemetry was successfully used to download data at 4-month intervals.

### **Integrated Marine Monitoring System, West Seno Oil Production Platform, Makassar Strait, Indonesia, Unocal Oil Company, 2003 - Program Manager and Senior System Engineer**

Dr. Magnell was the principal designer of a multi-platform, multi-sensor integrated data collection system on Unocal's West Seno Tension Leg Platform, offshore Borneo in the Makassar Strait. The system collected data on tendon tension, riser tension, platform motion, as

## **Key Projects (continued)**

well as environmental variables such as current profiles and wind speed and direction. Separate data collection PCs on the platform itself, on an attached drilling vessel, and on a nearby Floating Production Unit were linked over the client's local area network and shared all data. Data were also telemetered in real time to shore stations. Dr. Magnell supervised the design and testing of a comprehensive software suite that integrated all the data into a set of user-selectable displays.

### **Metocean System for Cassia Platform, Offshore Trinidad, BP Trinidad & Tobago LLC, 2006-Present - Program Manager and Senior System Engineer**

Dr. Magnell designed and supervised the construction and installation of a metocean system on a gas platform off the east coast of Trinidad. In addition to routine meteorological measurements, the system utilizes a pair of Nortek AWAC current profilers with Acoustic Surface Tracking (AST). The design includes an innovative mechanical system using guide wires between the surface and an underwater base clamped to a leg of the platform, with a moveable carriage for the current meters that can be winched up and down for service without use of divers. The system has provided excellent quality data for several years. Data are displayed locally on the platform and transmitted in real time to client and WHG facilities via the Internet. An external website is maintained to allow access to the data for authorized users.

### **Design of a Current Meter Deployment System for the Lankahuasa Offshore Gas Platform in the Southern Gulf of Mexico, Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) for the Mexican National Oil Company PEMEX, 2007 - Senior System Engineer**

Dr. Magnell was the principal design engineer for a mechanical deployment system for Nortek AWAC AST current profilers on an offshore gas platform in Mexican waters of the Gulf of Mexico. The design was based on that of the successful Trinidad system of 2005-2006.

### **Moonpool ADCP Deployment System for Drillship Discoverer Spirit, Unocal Oil Company, 1999-2000 - Senior System Engineer**

Dr. Magnell was the principal design engineer for a moonpool ADCP deployment system for the drillship *Discoverer Spirit*, operated by Unocal in the Gulf of Mexico beginning in 2000. The moonpool ADCP deployment system utilized existing structural elements on the drillship to mount a set of 65-ft tall vertical rails, on which a moveable carriage was mounted. The ADCP was mounted in a frame attached to the carriage, which could be raised to deck level using an air winch. The system has been in use for more than 8 years.

### **Moonpool ADCP Deployment System for Drillship Discoverer Clear Leader, Chevron Oil Company, 2008-2009 - Senior System Engineer**

Dr. Magnell was the principal design engineer for a moonpool ADCP deployment system for the new-build super-drillship *Discoverer Clear Leader*, operated by Chevron in the Gulf of Mexico beginning in 2009. The deployment system was based on the successful WHG design of the ADCP deployment system on the *Discoverer Spirit* in 2000.

## Key Projects (continued)

### **Hudson Canyon Oceanographic Measurement Program, Blue Ocean Energy Offshore LNG Facility, ExxonMobil Corporation, 2008-2009 - Principal Scientist**

Dr. Magnell is the scientific manager of a one-year coastal oceanographic measurement program offshore NJ, in the upper Hudson Canyon area. Two locations are instrumented with bottom-mounted T-RDI ADCPs and sub-surface moored Nortek AWAC AST current/wave sensors. An ASL Wave Profiler is also deployed, together with two chains of temperature and conductivity sensors suspended from surface buoys. In addition to characterizing the ocean current environment, the study has specific objectives of detecting and characterizing infra-gravity waves (those with periods longer than about 50 seconds) and high-frequency internal waves (solitons) and internal tides. Dr. Magnell will assist in the development of new analytical techniques for these special investigations.

### **Wave, Current, and Ice Thickness Measurement Program in Beaufort Sea Offshore Prudhoe Bay, Alaska, BP Alaska, 2008-2009 - Senior System Engineer and Principal Scientist**

Dr. Magnell is the Principal Investigator and Senior System Engineer for a current, wave, and ice thickness measurement program in the Beaufort Sea, offshore Prudhoe Bay, Alaska. Three bottom-mounted measurement systems consisting of Nortek AWAC AST current/wave sensors and ASL IP5 Ice Profilers were designed, tested and deployed by Dr. Magnell in August 2008. Dr. Magnell worked closely with Nortek AS of Norway to specify and configure an innovative sampling and data recording capability for the AWACs, using Nortek's Internal Processor (NIP) equipped with 4 GB of flash memory. The AWACs are operated in a special diagnostic mode which provides high-resolution acoustic echo amplitude profiles, interleaved with standard wave sampling bursts. The diagnostic mode data are expected to provide data on ice keel depth, and this data will be compared with that from the ASL Ice Profiler. Also, Dr. Magnell originated and supervised the integration of a new type of electromagnetic data telemetry modem with the Nortek AWAC/NIP system, to provide through-the-ice telemetry capabilities during the winter.

### **Meteorological Data Collection and Telemetry System for Cape Wind Offshore Wind Farm, Cape Wind, 2005 - Senior System Engineer**

Dr. Magnell supervised the design and testing of a metocean system installed on a 200-ft offshore research tower in Nantucket Sound, MA. The meteorological part of the system measures wind speed and direction at 3 levels, each equipped with two different types of sensor, as well as vertical temperature gradient and other parameters. Currents and waves were measured for one year using a bottom mounted ADCP. The system is solar powered. Data are rapidly sampled and telemetered on 10-minute intervals to WHG's main office in Falmouth, MA. From there the data are transmitted in real time over the Internet to Cape Wind's public website.

### **Precision Measurement of Water Depth for the Neptune Oil Production Platform in the Gulf of Mexico, BHP Billiton Co., 2007 - Principal Investigator**

Dr. Magnell worked with WHG's Dr. Leonid Ivanov to analyze several months of pressure data collected using a bottom-mounted Paroscientific quartz sensor (SBE-26) in deep water (about

## **Key Projects (continued)**

1500m) in the Gulf of Mexico in connection with the design of a Tension Leg Platform. Long-term average water depth was determined to an accuracy of +/- 40 cm based on CTD profiles to determine water density. Long-period variability of sea surface height was assessed using satellite altimetry data.

### **Survey Sensor Package for Clam Dredge, NOAA National Marine Fisheries Service, 2005-2006 - Senior System Engineer**

Dr. Magnell designed and supervised construction and testing of an instrumentation package for NMFS clam surveys. The Survey Sensor Package (SSP) collects and stores rapidly sampled data on tilt (acceleration), temperature, salinity, ambient pressure, and differential pressure in the dredge's hydraulic rake nozzles. The SSP is designed to mount near the front of a bottom-towed clam dredge, which is an environment characterized by extreme vibration and occasional heavy impacts, so ruggedness was a primary design feature. The SSP collects and buffers 1-second sampled data while underwater, and then telemeters the data automatically by radio modem to a shipboard PC when the dredge is brought on deck. The SSP has been used successfully by NMFS for several 3-year clam surveys, and has also been applied to scallop dredges.

### **Northern California Coastal Circulation Study, U.S. Department of the Interior, Minerals Management Service, Pacific Region OCS Office, Los Angeles, CA - Program Manager**

Program Manager for the NCCCS, a 5-year physical oceanography measurement and analysis program to describe the circulation on the continental shelf and slope between San Francisco and Oregon. The multi-million dollar program, one of the largest coastal oceanography projects ever carried out by the Department of the Interior, involved direct and indirect current measurements using Lagrangian drifters, moored instruments, and CTD/XBT surveys, as well as the collection of meteorology, sea-level, and satellite sea-surface temperature data. Real-time telemetry of near-surface moored current data was successfully achieved from all 16 of the main program moorings using ARGOS telemetry. Data retrieved from Service ARGOS were processed and compiled, together with real-time wind and sea-level data, into real-time data reports distributed to the principal investigators and other users.

### **Study to Model Cyclone-Generated Currents and Storm Surges on the Continental Shelf Off NW Australia for Woodside Petroleum, Perth, AUSTRALIA, Woodside Petroleum Development Pty. Ltd. - Project Scientist**

Conducted an environmental and engineering study to provide information essential for the design and routing of an 82-mile submarine pipeline from an offshore platform area to a shore facility in the vicinity of Dampier on the northwest shelf of Western Australia. Designed the field program, staged from a remote desert town, which involved long-term comprehensive measurement and analysis of wave, current, and tidal characteristics, as well as dye studies and drogoue tracking to analyze and predict the movement of surface waters in and around a proposed LNG plant. Oversaw the collection of data describing the variations of water temperatures and salinities and extensive meteorological data on the northwest shelf. Supervised a subsequent study, which utilized computer numerical models to predict current and wave conditions in response to cyclones (hurricanes) along the proposed pipeline route. The models were calibrated and verified using data collected during the field program and from historical meteorological records.

## **Key Projects (continued)**

### **Physical-Process-Oriented Study of Extremal Currents in Deep Waters Offshore in the Gulf of Mexico for Conoco, Northern Gulf of Mexico, Continental Oil Company - Project Manager**

Developed a new analysis methodology to provide estimates for a deep-water oil production site on the continental slope of the northern Gulf of Mexico based on identification, characterization, and forecasting of separate physical processes (tides, eddies, wind-driven currents, etc.). Identified and provided long data records, which were necessary to characterize oceanic motions with long time scales. Designed the new study to include the analysis of mooring instrument data, and the study of historical data to find the frequency of occurrence statistics describing the current amplitude of each major process. These were combined with the site-specific results derived from the moored instrument data to produce estimates of extreme currents by depth and for various return periods.

### **New England Outer Continental Shelf Physical Oceanography Program, U.S. Dept. of Interior/Bureau of Land Management, Minerals Management Service (MMS), Reston, VA - Principal Investigator**

Principal Investigator for Moored Current Measurements on the NEOCSPOP program, a physical oceanography studies for the Bureau of Land Management (now MMS). Responsible for the execution of the Moored Conventional Current Meter/Tide Gauge Program. Participated in the analysis and interpretation of all the data, including almost 18 instrument-years of current and bottom pressure data.

### **Deep Water Rig Instrumentation System, Makassar Strait, Indonesia, Unocal Corp. - Project Manager**

Managed engineers and scientists in the design, construction, testing and installation of real-time environmental monitoring systems on Sedco 601 and Sedco 602 anchored drill rigs, operating in the Makassar Strait region, Indonesia. Designed and provided the software for a Windows 95 PC-based data acquisition system on the rig, showing the data in a multiplicity of formats and providing daily archival data files.

### **Real-Time Acoustic Doppler Current Profiler (ADCP) System for Single Point Mooring Facility, Offshore of Barber's Point, Oahu, HI, Tesoro Hawaii (BHP) - Project Manager and Chief Engineer**

Managed and engineered the design, procurement, integration, testing, and installation of a Real Time Current and Wind Monitoring System for Tesoro Petroleum Hawaii. The system is deployed on Tesoro's Single Point Mooring (SPM) buoy, offshore of Barber's Point, Oahu. The system consists of three main subassemblies: 1) the Woods Hole Group Real-Time Data Acquisition and Telemetry System, located on the SPM buoy, which also includes the current and wind sensors; 2) the Base Station PC display and archiving system, located in Tesoro's offices in Honolulu; and 3) the Mooring Masters PC display unit in a waterproof portable case, which is used by the Mooring Master for real-time access to the current and wind information while on the tanker or the tugboats. Both PC-based display units use real-time software developed by WHG.

## **Key Projects (continued)**

### **Deep Water Rig Instrumentation System, Andaman Sea, West of Thailand, Unocal Corp. - Project Manager**

Managed the design, procurement, integration, testing, and installation of a current profiling system on the anchored drillship Sedco 601 in the Andaman Sea. Integrated the system in less than three weeks from award of contract, and was installed by OMS engineers on the drill rig at sea. Developed real-time data acquisition software for the PC that collected the data on the rig showing the current profile information in several ways including vertical profiles, time-series, color-filled contours, and vectors. Successfully collected significant data concerning large-amplitude internal waves in the Andaman Sea. The Sedco 601 was transferred from the Andaman Sea to the Makassar Straits in early 1998. This project was extended to maintain the real-time current system on the rig during the initial operations in this area. Performed post-process Q/A and reported on data collection.

### **Lake Current Monitoring System, Ontario, Canada, Ontario Hydro - Project Manager and Chief Engineer**

Designed, built, tested, and installed a pair of identical Real-Time Lake Current Monitoring Systems for the Canadian nuclear utility company Ontario-Hydro. Designed all aspects of the lake current monitoring system including the bottom platform for the upward-looking acoustic RD Instruments Workhorse Acoustic Doppler Profiler, the environmentally protected Remote System Manager installation, the base station computer system, and display software. Ensured the transmission of data to shore over a 6000-ft. double-armored electromechanical cable. Oversaw the collection, buffering, and transmission of the data to the utility company's home office over a land telephone line using the Remote System Manager.

### **Tide Measurement System, Naval Oceanographic Office - Project Manager and Chief Engineer**

Managed and engineered the design and construction of 5 portable tide measurement systems (TMS) for real-time water level measurements for use by the Navy in coastal surveys worldwide. Designed the system to determine tide height to an accuracy of +/- 1 cm by using high-accuracy measurements of water and atmospheric pressure, as well as water temperature. Each TMS system consists of 3 deployable tide gauge units, which comprise the sensors and the telemetry transmitter; these units can be mounted in the field in remote locations and function autonomously. A shipboard base station unit receives the telemetered data and provides real-time displays.

### **Estimation of Extremal Currents Offshore Trinidad, Houston, TX, Amoco Inc. - Project Manager**

Managed and served as principal oceanographer for an oceanographic analysis and interpretation study that would determine the probable extremal currents in deep water. Reviewed historical and recent data collected by Amoco to estimate the frequency of occurrence of various extreme currents due to "rings" (eddies spun off by the retroflexion of the Brazil Current).

### **Deep Water Rig Instrumentation System, Gulf of Mexico, Texaco Inc. - Project Manager**

Managed the instrumentation and installation of the system on several anchored rigs and dynamically positioned drill ships for Texaco in the Gulf of Mexico. For the installation on

### **Key Projects (continued)**

Transocean's anchored deep-water drill rig Oceanstar, oversaw a team of ocean engineers in the design and construction of a fixed mounting system for the Acoustic Doppler Current Profiler (ADCP) and the other facilities on board the vessel necessary to operate the system. Manages the ongoing maintenance and periodic visits to the rig to inspect and maintain the system, download the collected data, and prepare oceanographic data reports for Texaco.

#### **Deep Water Rig Instrumentation System, Gulf of Mexico, Amoco Inc. - Project Manager**

Managed ocean engineers and scientists in the design, building, testing, and installation of a current and wind monitoring system on the dynamically positioned drill ship Transocean Discoverer 534 working in the Gulf of Mexico. Oversees the periodic service and repair for the system, the downloading of data collected, and the preparation of data reports for Amoco.

#### **Cooling Water Discharge Plume Study, Pilgrim Nuclear Power Station, Boston Edison Co. - Project Manager**

Managed a field study to assess the impact of elevated temperatures due to the nuclear generating station's thermal discharge on benthic organisms. Oversaw the installation of 64 self-recording temperature recorders on the sea floor in a dense array around the discharge, out to a range of several kilometers, to determine the factors governing the area of benthic impact. Designed the bottom platforms for the sensors, performed simultaneous calibrations of all sensors, supervised field operations for deployment and recovery, and analyzed the data and wrote the final report.

**Publications and Presentations**                      **approximately 40**