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## GROUP SUMMARY UW

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The Undersea Warfare Academic Group (USWAG) consists of ten faculty members plus the Curricular Officer. The faculty members teach in the USW curriculum and are responsible for its academic content. Members conduct USW-related research and serve as thesis advisors for USW students.

Associate Professor Steve Baker (Physics)  
Professor Robert Bourke (Oceanography)  
Assistant Professor Donald Brutzman (Undersea Warfare)  
Professor Ching-Sang Chiu (Oceanography)  
Professor James Eagle (Operations Research), Chair  
Associate Professor Ralph Hippenstiel (Electrical and Computer Engineering)  
Professor Tom Muir, Chair of Mine Warfare (IPA assignee from the University of Texas at Austin)  
Professor James Sanders (Physics)  
Associate Professor Clyde Scandrett (Mathematics)  
Assistant Professor Kevin Smith (Physics)  
CDR Mike McMaster, USW Curriculum Officer

An overview of research sponsored or co-sponsored by the USWAG is below.

**Middle Atlantic Bight (Shelfbreak Primer) Field Study:** Professor Ching-Sang Chiu continued to collaborate with Woods Hole Oceanographic Institution in the ONR-sponsored Middle Atlantic Bight Field Study. The overall goal is to understand the propagation of sound from the continental slope to the continental shelf, including the effects of shelf-break frontal features and seasonal stratification. In particular, one major goal is to obtain a high resolution description of the spatial and temporal evolution of the shelf-break front and to clarify the mechanisms by which eddies are formed.

**Data Analysis for the Shallow Water Acoustics in a Random Medium (SWARM) Experiment:** Professor Ching-Sang Chiu continued evaluation of data collected by two upward-looking Acoustic Doppler Current Profilers deployed as part of the multi-institutional SWARM study. The objective of this research is to characterize the internal waves and their impact on the spatial and temporal variability and coherence of acoustic transmissions in a shelf environment.

**Monitoring Whales Using the Pt. Sur Acoustic Array – A Feasibility Study:** Professors Ching-Sang Chiu and Curtis Collins collaborated to: (1) investigate the feasibility of locating and tracking distant California blue whales using a former SOSUS array and matched signal algorithms; (2) explore the possibility of providing supplementary information on counts and transit paths of California blue whales; and (3) enhance the understanding of low-frequency sound propagation physics in a littoral environment.

**International Conference in Shallow-Water Acoustics:** Professor Ching-Sang Chiu continued work toward the long-term goal of formulating and conducting a collaborative international experiment in the seas of China. Such an experiment will focus on studying the physics and variability of sound propagation and scattering that are unique to the coastal waters of the Asian Pacific region. The FY97 objective was to promote scientific exchange and establish a dialog between Asian and U.S. scientists who are active in shallow-water acoustics research.

**Development of the Pt. Sur Ocean Acoustic Observatory:** Professor Chiu continued his work to preserve the functionality of the Pt. Sur SOSUS horizontal hydrophone array and toward the conversion of the facility into a dual-use Ocean Acoustic Observatory for undersea research. In 1997, the development of the Pt. Sur Ocean Acoustic Observatory (OAO) was continued using reimbursable funding provided by SAIC, Cornell University, and the Office of Naval Research. The 1997 OAO research projects include nuclear test ban treaty monitoring, coastal ocean circulation studies, and marine mammal studies. The latest accomplishment is the development of a full-array classified data archival capability. This enhanced capability will enable the conduct of both classified and unclassified research that requires spatial beamforming using the horizontal array.

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**Rapidly Reconfigurable Virtual Environment Network Protocols:** Assistant Professor Don Brutzman and Professor Mike Zyda are creating a formally specifiable behavior protocol that permits scalable inter-entity interactions to be defined, modified, and tested while large-scale exercises are in progress.

**Tactical Visualization of the Environment: Manta Minefield Search:** Assistant Professor Don Brutzman has been working with the Naval Undersea Warfare Center, Newport, Rhode Island, on the Manta submarine-launched underwater vehicle program. The purpose of Professor Brutzman's project is to demonstrate how tactical visualization of real-world environments can provide significant insights into robot system development and tactical deployment.

**Autonomous Underwater Vehicle (AUV) Development:** Assistant Professor Don Brutzman and Professor Anthony Healey and thesis students are attempting to solve open problems in underwater vehicle control to allow the docking of an AUV with a tube in the presence of time-varying turbulent flow fields.

**Mine Countermeasures Program:** Professor Tom Muir occupied the Chair of Mine Warfare and provided overall coordination of mine warfare-related activities at NPS. This included planning the weekly Menneken Lecture Series on Mine Warfare and coordinating preparations for and executing a major mine warfare symposium to be held at NPS in April 1998.

**Surf Zone Seismo Acoustics:** Professor Tom Muir and Associate Professor Steve Baker have continued working on the concept of using of an active, seismic sonar for the detection of mines buried in the surf zone. Electromechanical transducers having two, controllable degrees of freedom were developed to selectively excite seismic interface waves that travel along the air or water boundary with the sediments. These interface waves were caused to reflect off buried mines, and the received echoes were detected in such a way as to determine the range and bearing of the buried targets from the sonar.