PRESS RELEASE

Professor John Buck studies passive sonar, whale songs

John Buck, Associate Professor of Electrical and Computer Engineering at the University of Massachusetts Dartmouth is a sound man. Much of his time between teaching courses is spent listening to noises and compiling data that is of use to researchers and the defense department alike.

Prof. Buck and ECE MS graduate Keenan Ball discuss the beamforming video recorder system Keenan built for his thesis. Since graduation, Keenan has been a research engineer at the Woods Hole Oceanographic Institution.

Dr. Buck recently received a three-year grant totaling $211,642 from the Office of Naval Research's Undersea Signal Processing Program. Working with graduate students, he will study passive sonar, that is, listen to underwater noises in coastal areas and try to detect their sources and other data such as range and depth. This type of information is helpful to homeland security in trying to pinpoint the location of ships or submarines, he said.

In the early stages, Dr. Buck said, the work involves researching the performance limits in the passive sonar problem using information and coding theories. "We will treat the sonar problem like a communication system and treat a hypothetical submarine like a crude form of modem," he said. The project initially will rely on theoretical research as well as computer simulations using numerical models for underwater sounds. At the end of the three years, Dr. Buck foresees

collaboration with a laboratory or company on sonar systems used in Navy submarines. This grant is a follow-up to Dr. Buck's work under the ONR Young Investigator Program.

Dr. Buck returned to the UMass Dartmouth campus during the summer of 2004 following a year's sabbatical in Australia. He was one of five Fulbright Senior Scholars selected from 60 applicants to spend time in Australia. The scholarship enabled him to travel to that continent and work with leading acoustic scientist Doug Cato at the Australian Defense Science and Technology Organization, a government research laboratory.

In Queensland, the team conducted experiments recording the sounds of humpback whales as they migrated to feed in the Antarctic. Dr. Buck said his role was to develop methods for analyzing the structure of the whale's songs. These songs have been previously speculated to have repeated patterns with a phrase structure similar to human language.

"The phrases are linked into themes which formed a cycle called a song. It's like how people put words together into phrases, then sentences and paragraphs," Dr. Buck said. "As a result, you can predict what will come next by listening to what came before. No other non-human animal has been proven to have acoustical communications with this structure."

In collaboration with neuroscientists at Brown University, Dr. Buck is also working on a bat sonar project. He explained that a bat uses sounds and echoes to navigate in the dark and researchers are studying the functions of a bat's ears and auditory nerves. Dr. Buck's job is to build a computer model of their theories to demonstrate how a bat is able to use these echoes to fly without incident, maneuvering around, rather than hitting the objects in its path.