gn "Virtual" Auditory Space

gist of several superimposed conversations can be understood because the human auditory system can focus on sounds coming from specific directions. With headphones, such selective listening can be difficult or impossible.

Researchers in AFRL's Human Effectiveness Directorate, in collaboration with Dr. Barbara Shinn-Cunningham of Boston University, have made important strides in solving this problem for headphone users. The goal is to create headphone-based auditory displays in which each sound source has a well-defined position in three-dimensional space. The first step is to isolate the various electronic signals reaching a headphone so that each communication occupies one channel in a multi-channel system.

The next step is to modify the acoustic waveform at the ear so that, to the listener, each communication appears to originate from a separate, nearby location, rather than from the headphones. To create this 3-D auditory illusion, Dr. Shinn-Cunningham and AFRL's Dr. Douglas Brungart have collaborated on a detailed study of how people decipher the direction and distance of ordinary sounds in various 3-D environments. Using data from their extensive laboratory studies, along with mathematical models of directional hearing, these scientists have developed ways to transform the acoustic waveform to "convince" the human brain that a sound or voice emanates from almost any desired spot in a room or cockpit.

Dr. Barbara Shinn-Cunningham

Potential applications abound. For example, a pilot could hear the AWACS controller speak from one consistent position in the cockpit, while the navigator always speaks from another. Signals from the ground could appear to come below. Signals from another aircraft could correlate with the craft's actual position. An "auditory pointer" could guide visual attention to an important instrument in the cockpit. The same technology could be adapted to improve directional awareness for hearing-aid users. In each case, the goal is to harness direction-selective listening to increase human information-processing capacity.

"There would be no hope for these technological innovations without a very concerted effort to find out how directional hearing actually works," observes Dr. Willard Larkin, who is the Program Manager for the project. "Basic research is the indispensable key."

Rokhlin – In The News...

A prestigious publication in the scientific community recently recognized the efforts of an AFOSR-sponsored researcher by including his work in its "Top" lists.

Dr. Vladimir Rokhlin

The Fast Multipole, or FM, method of Dr. Vladimir Rokhlin of Yale's Dept. of Computer Science was included in Computing in Science and Engineering magazine's Top 10 Algorithms of the Century. His FM method (1987) is cited for its revolutionary impact on the gravitational or electrostatic N-body problem.

Recently, under AFOSR and DARPA sponsorship, Dr. Rokhlin has successfully extended his FM method to revolutionize the numerical prediction of the scattering of electromagnetic waves (radar) from large, electromagnetically complex objects. The Air Force has long wished to document the radar signatures of a variety of existing objects (theirs and ours) as well as predict the radar signatures of a variety of contemplated objects and to do both of these jobs under a variety of possible conditions/configurations. But until the FM extension, the existing numerical codes for these large, electromagnetically complex objects took months to complete a single run. Run times of less than 12 hours are now being reported for current research codes, and transition to industrial strength codes is not far off.

PECASE (cover story)

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square inch. Other possible applications of her research include quantum computing and biomolecule detection," said Dr. Harold Weinstock, program manager in AFOSR's Physics and Electronics directorate.

These presidential awards, established by President Clinton in 1996, embody the high priority the Administration places on producing outstanding scientists and engineers and nurturing their continued development. Eight federal departments join together annually to nominate the most meritorious young scientists and engineers who will advance science and technology that will be of the greatest benefit to the participating government agencies.

This award is the highest honor bestowed by the U.S. government on young professionals who are at the outset of their independent research careers.