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TERC Sensor

Engineers Develop Non-Acoustical Sensor to Improve Battlefield Communication

June 1, 2005 — A new device will soon help troops communicate on a noisy battlefield. The Tuned Electromagnetic Resonance Collar -- or TERC sensor -- detects changes in the electrical field around the neck produced by moving vocal chords. A computer recreates the speech and sends it into the recipients' earpieces.

WORCHESTER, Mass. -- If you're a soldier in a noisy tank or chopper, clear communication can mean the difference between life and death. That's why the Defense Department asked engineers to come up with a new version of the non-acoustical sensor. This device could change communication on the battlefield and even in the workplace.

The Tuned Electromagnetic Resonance Collar -- or TERC sensor -- detects changes in the electrical field around the neck produced by moving vocal chords. This information -- in the form of an electrical signal -- is reflected from the sensor, picked up by a separate device, and reassembled into human speech.

Rick Brown, an electrical and computer engineer at Worchester Polytechnic Institute in Mass., is co-inventor of this unique device. "The military was looking for novel techniques to reduce the amount of background noise in high-noise environments like driving a tank or flying a helicopter," he tells DBIS.

It would be difficult to hear any speech over background noise like a Black Hawk helicopter or Abrahams tank. But using the TERC sensor together with a microphone, researchers can remove background din through special processing.

The prototype has limitations: The sensor cannot pick up certain sounds, like the "K" in ink, and it takes 30 pounds of equipment to make it work.

Brown says, "There's a lot of work that needs to be done to make the sensor more user friendly, also smaller, and cheaper."

With more refinement, researchers think the sensor could have applications beyond the military, like improving communication in noisy work environments and even detecting vocal chord problems.

BACKGROUND: The mini-microphones in cell phones and other communications equipment may soon be replaced with non-acoustic sensors that detect speech without actual sound, so that speech can be heard above loud background noise.

HOW IT WORKS: The tuned electromagnetic resonator collar (TERC) uses sensing techniques developed for magnetic resonance imaging, or MRI. The collar acts like a large capacitor -- an electronic device that can be charged to hold electricity. As a person speaks, the vocal cords vibrate, and the collar translates the movement into an electrical signal. The signal is processed by computer microchips and then synthesized into human speech.

ADVANTAGES: Non-acoustical sensors like TERC pick up only the sound of the person wearing the device. Conventional microphones pick up not just the speaker's voice, but also every other sound within its range, so there is a lot more background noise.

USES: Divers working underwater, crews in noisy vehicles, or soldiers on covert missions will use the sensors first. The technology is perfect for factory or constructor workers who must wear helmets for safety. But one day such sensors may allow people to use cell phones in places such as trains, theaters or libraries without disturbing those around them.

ABOUT SOUND: Sound occurs when a vibrating object, such as a ringing bell, sends a pressure wave through the atmosphere. This moves the air particles around it, which in turn move the air particles around them, spreading the vibration through the air in a wave that ripples outward. Dropping a pebble into a calm pool of water will have a similar effect. Just like light waves, sound waves have their own spectrum of frequencies, known as pitch. A higher wave frequency means that the air pressure is vibrating faster per second and the ear hears this as a higher pitch. With lower frequencies, there are fewer vibrations per second, and the pitch is lower. Unlike light, sound can't travel in a vacuum. Objects can only produce sound when they vibrate in matter.

The Institute of Electrical and Electronics Engineers, Inc., contributed to the information contained in the TV portion of this report.