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Air Force's 'Technology Horizons' makes science fiction a reality

An Airman demonstrates augmentation of human performance through brainwave technology. (Courtesy photo)

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7/15/2010 - **WASHINGTON (AFNS)** -- With innovations seemingly plucked from the latest futuristic Hollywood movie script, Technology Horizons outlines the Air Force's major science and technology objectives through the next decade, officials said here July 14.

Highly adaptable, autonomous systems that can make intelligent decisions about their battle space capabilities and human-machine brainwave coupling interfaces are but two significant technologies contained in the document, said Dr. Werner J.A. Dahm, the Air Force chief scientist.

"These are hands down, slam dunk, among the biggest findings in Technology Horizons; this is one of those 'a-ha' moments for the Air Force," Dr. Dahm said. "If you come back 20 years from now, you'll see an Air Force that looks substantially different than what you see today, and it will look that different, in part, because of Technology Horizons."

Air Force Research Laboratory engineers will use the document to help plan technologies of the future, and have already begun implementing some of the key findings in Technology Horizons.

"We will be making greater use of autonomous systems, reasoning and processes in almost everything the Air Force does," Dr. Dahm said. "This is not only in terms of increasing and enhancing remote-piloted aircraft, but in developing new ways of letting systems learn about their situations to decide how they can adapt to best meet the operator's intent."

He described how future autonomous aircraft would be able to sense battle damage and make intelligent decisions about their remaining capabilities.

"Such adaptable autonomous systems will be able to automatically re-plan their mission to maximize their effectiveness," Dr. Dahm explained. "In decision-making systems and processes, these systems can give us a tremendous operational edge over potential adversaries who are limited to human decision and control."

He explained that in today's combined air operations centers, for example, there are several hundred people involved in assembling daily air tasking orders. Adaptable autonomous decision-making systems can handle many of these steps, reducing the number of people who must be deployed.

Such advanced levels of autonomy, Dr. Dahm added, complement another key focus of Technology Horizons: human performance augmentation.

"Natural human capacities are becoming increasingly mismatched to the data volumes, processing capabilities and decision speeds that technologies either offer or demand," Dr. Dahm said.

He said autonomous systems and advanced human-machine interfaces are among ways the service can meet this rapidly growing challenge.

"To identify threats in full-motion video, we can outfit a helmet with literally hundreds of brainwave sensors and begin to localize and identify reactions you have, even below the level at which you could put them into words," Dr. Dahm said.

Dr. Dahm explained the brain is presented with cues as the video images plays.

"Some of those cues will be strong enough for you to say, 'stop, I saw something there,' but many other cues

may be so low that they evoke only an intuitive response without rising to the level of conscious reaction," he said.

Brainwave sensors can potentially detect these, in effect providing Airmen with enhanced intuitive capabilities reminiscent of Spiderman.

These human performance technologies can create a dynamic in which the machine and the analyst are almost inseparable.

"We are beginning to be able to couple humans and machines in ways that were unthinkable 10 years ago," Dr. Dahm said.

He admits that the concept of an Airman literally becoming part of the computing environment is "bizarre, but technologically credible."

As missions become increasingly faster and more complex, Air Force researchers will need to consider and implement these advancing technologies where they make sense, he said.

Dr. Dahm cited another example in which the same skull caps can measure brainwaves and determine if, by nature, Airmen are trainable to be effective in certain roles or careers.

"Many of these technologies are focused on gaining capability increases even with a smaller force size, Dr. Dahm said. "We will have a much stronger focus on advancing and applying technologies that can make our Airmen even more effective than they are today."

As the Air Force's "in-house" research arm, AFRL researchers will be at the forefront of translating the Technology Horizons' vision into reality.

Some of the research will be contracted out to companies ranging from big aerospace to small innovative firms, Dr. Dahm said.

Air Force officials also will partner with the other services, the Defense Advanced Research Projects Agency, NASA, other agencies and even international partners aligned with U.S. Air Force interests, he added.

In this revolutionary age of social media and online gaming, Dr. Dahm contends the Airmen of today are primed for these very technologies designed to maintain the service's superiority in 2020, 2030 and beyond.

"If this had come out of the blue 50 years ago, even if the technology were ready, the workforce -- the Airmen -- would not have been ready," Dr. Dahm said. "Today, both the technology and our Airmen are ready. Technology Horizons is going to enable changes that literally reshape the Air Force."