

**Dr. Brian Lemoff**

Dr. Brian Lemoff is the vice president for Advanced Technologies at the WVHTC Foundation. In addition to heading up the Advanced Technologies Group, Lemoff is the technical lead for the group's optics and photonics research projects. Lemoff joined WVHTC Foundation in 2005 after 11 years at Hewlett-Packard Labs and Agilent Technologies Labs in Palo Alto, Calif. Lemoff received his Ph.D. in physics from Stanford University and his BS and MS in physics from Caltech.



(TOP) Rob Martin (left) and Bob Ice (right), research engineers in the WVHTC Foundation's Advanced Technologies Group, make adjustments to an experimental power converter in the group's pulsed power laboratory.

# WVHTC's ATG has diverse field of expertise

FAIRMONT — Where in North Central West Virginia can one find a group of scientists and engineers engaged in leading-edge research ranging from explosives detection to intelligent power grids, from night vision to theoretical plasma physics, or from optical communications to biometrics-enabled surveillance technology? The answer: Right here in Fairmont, at the WVHTC Foundation's Advanced Technologies Group. The Advanced Technologies Group (ATG), which is the scientific research arm of the WVHTC Foundation, has a staff of 14 researchers, including eight with Ph.D.'s in physics, electrical engineering and computer science. The group's research projects are divided into four focus areas: optics and photonics, data analysis and signal processing, power electronics and electromagnetics, and space weather prediction. Since 2007, the group's researchers have competed for and won new research contracts and grants worth more than \$15 million for projects covering all

four of these research focus areas. The group's government customers include multiple agencies within the U.S. Department of Defense (DOD), U.S. Department of Homeland Security (DHS), and the National Science Foundation (NSF). Excluding university and government labs, the Advanced Technologies Group now has one of the largest teams of Ph.D. research scientists and engineers in West Virginia. While ATG projects span the research spectrum from basic research to advanced development, most efforts within the group can be described as "applied research." These projects lie somewhere in between the fundamental research that is typically done at universities and the product development typically done at for-profit businesses. In fact, ATG has several active collaborations with universities as well as with for-profit businesses. ATG provides its university partners a more practical, application-focused perspective.

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(LEFT) Members of the WVHTC Advanced Technologies Group are pictured assembling a research prototype for an ultra-compact high-power transformer that could be used to help communities following a disaster.

PHOTOS COURTESY OF WVHTC ADVANCED TECHNOLOGIES GROUP

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# ATG

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while it provides its industry partners with a more long-range, research-oriented perspective.

Dr. Michael Goodman, a distinguished scientist in ATG, leads the space weather prediction efforts. Since his arrival in Fairmont in 2002, Goodman, a theoretical plasma physicist, has won three NSF grants to study the sun.

In particular, his research is developing physical models of the solar atmosphere to better understand phenomena such as solar flares, coronal mass ejections, the solar wind, and the emission of ultraviolet radiation, all of which have an enormous impact on the earth.

Another distinguished scientist, Dr. Thomas Owens, leads the ATG efforts in power electronics and electromagnetics. Owens has been with the group since 2004. In a career that spans more than 30 years, he has developed high-power electronic devices for many applications including nuclear fusion, particle accelerators and microwave heaters.

Since coming to West Virginia, Owens has worked on a high-energy electric pulse generator for a spacecraft thruster, a new type of high-power microwave amplifier, and an underwater acoustic pulse generator for a spacecraft diver deterrent. Most recently Owens has been leading ATG efforts to develop a new type of ultra-lightweight power converter that could enable rapid replacement of a damaged power substation transformer and has the potential to enable a new class of mobile power micro-grids for military bases.

ATG's Data Analysis and Signal Processing (DASP) Group is managed by Dr. Mary Ann Harrison, a principal scientist who has also been with the group since 2004.

Current DASP research efforts are developing technologies, for potential use by the military, to identify and track people as they walk

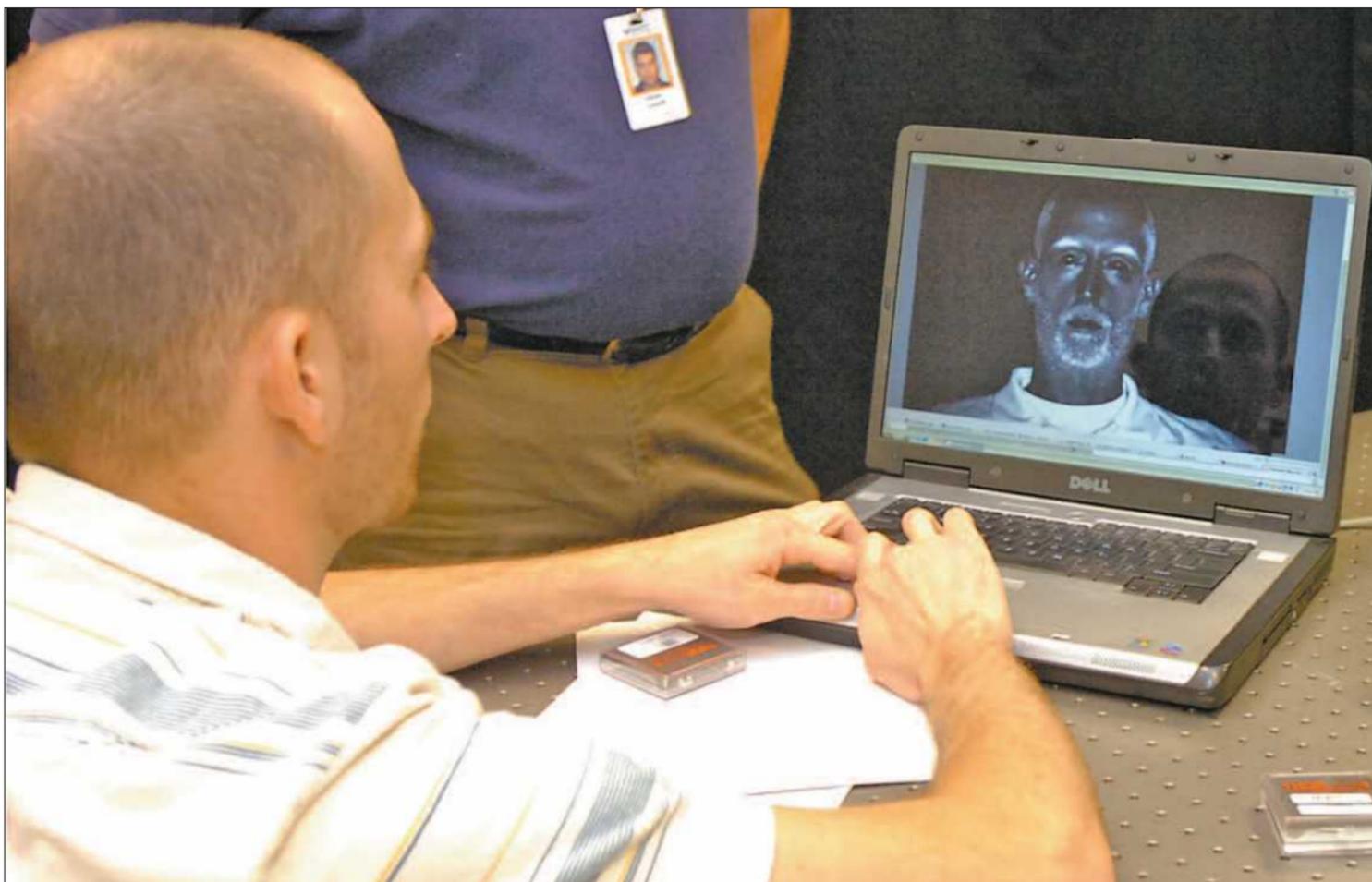


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through an area of interest. The Tactical Analysis of Video Imagery (TAVI) system, developed by the group under funding from the Office of Naval Research (ONR), uses an array of video cameras to track moving people, zoom in on their faces, and identify them using computer face recognition algorithms.

In a closely related project, the group is collaborating with researchers from the University of California at Riverside to develop technologies that can track individuals over a large, city-sized area, even when the people being tracked are only within range of the sensors for a small fraction of the time.

Some of the technologies being developed by ATG for this project include new algo-

rithms to identify people by recognizing their ears and by the way they walk. The Advanced Technologies Group has a diverse set of projects within its fourth focus area: optics and photonics. All of these projects involve lasers, but with three very different applications: data communications, remote sensing of explosives, and long-range nighttime surveillance.

For this latter application, the Tactical Imager for Night/Day Extended-Range Surveillance (TINDERS) project, also funded by ONR, will for the first time enable a warfighter to detect and identify a person from several hundred yards away, even in total darkness.

This exciting new technology, invented and developed by

ATG, uses an invisible short-wave infrared (SWIR) laser beam to illuminate the face of a far away person. While the laser beam is completely invisible (and completely safe) to the human eye, the beam brightly lights up the face as viewed by the telescopic TINDERS SWIR camera. Computer face recognition algorithms then match the face image against a large database of known individuals, ultimately achieving a positive identification.

ATG is also applying lasers, in this case deep-ultraviolet lasers, to the problem of standoff detection of explosives. For several years, under both DOD and DHS funding, the group has investigated the use of deep-ultraviolet resonance Raman spectroscopy (DUVRRS) to detect trace levels

of explosive residue from a distance. In this technique, a deep-UV laser beam scatters off of the surface being probed. The scattered light is detected, and its wavelength spectrum is analyzed for the presence of an explosive signature.

ATG researchers hope that someday this technique will help save lives through early detection of explosive devices.

The group is also working on a project to develop high-speed optical communications components for aircraft local area networks (LANs).

In collaboration with Ultra Communications, which specializes in highly compact and robust photonic components for harsh environment applications, ATG is developing a multi-wavelength tunable

transmitter module. This tiny module will use eight lasers, each with a different, adjustable wavelength, to generate eight 2.5-Gbit/s data streams multiplexed into a single fiber (total of 20 billion bits per second). The module will be optimized to meet the rigorous size, weight and temperature constraints required for use in military aircraft.

ATG is based in the I-79 Technology Park's Research Center, which was recently renamed the Robert H. Mollohan Research Center. In addition to its offices, ATG's research facilities include a photonics lab, laser lab, wide-area surveillance lab, pulse power lab, electromagnetics lab, electronics lab, chemistry lab and machine shop.

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