

Optical Sciences and Engineering Faculty

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Adjunct Faculty:

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The Graduate School of Engineering and Management

The Air Force Institute of Technology (AFIT), located at Wright-Patterson AFB (Dayton, Ohio), is the Air Force's premier institution of graduate and continuing education in science, engineering, and advanced technology. A component of Air University, the institute provides responsive graduate education, research, and consulting programs to keep the Air Force and DoD on the leading edge of technology and management.

The Graduate School of Engineering and Management (EN) provides advanced scientific, technological, and technological management education in an Air Force research and development environment.

Civilian Graduate Education Opportunities at AFIT

AFIT M.S. and Ph.D. degree programs are open to U.S. citizens who meet entrance requirements:

www.afit.edu/en/admissions.

For more information concerning application, admission, and financial opportunities, visit:

www.afit.edu/en/students/prospective.cfm.

Civilians interested in attending AFIT should pursue scholarship opportunities through DAGSI, SMART, NDSEG, NSF, or other funding vehicles.

Research Assistants and Co-ops

ENP offers engineering co-op and research assistant opportunities for both undergraduate and graduate students interested in working on a diverse set of DoD-centric research efforts. These opportunities can occur at any time during the academic year, or summer, or both. Research Assistants are hired via SOCHE (www.soche.org) or as overhire government civilians.

Inquiries relative to co-op and intern opportunities should be directed to Nancy C. Giles, Ph.D., nancy.giles@afit.edu, (937) 255-3636, x4601.

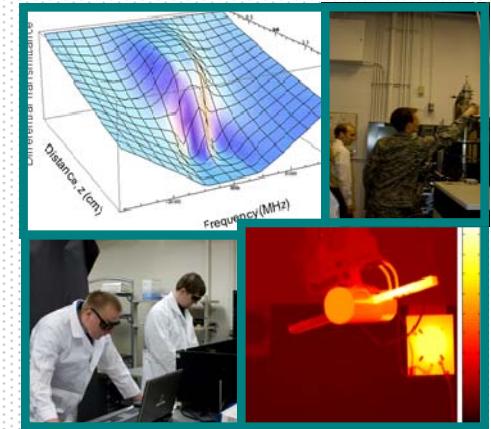


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Air Force Institute of Technology Graduate School of Engineering and Management

Department of Engineering Physics Optical Sciences and Engineering Program Overview



www.afit.edu/en/enp

Michael A. Marciniak, Ph.D.
Associate Professor and Program Chair
Nancy C. Giles, Ph.D.
Professor and Head

Program Overview:

The Optical Sciences and Engineering Program (OSE)

offers studies leading to the M.S. and Ph.D. degrees. The AFIT OSE program has a strong heritage of excellence and a reputation of graduating academically strong and technically astute professionals who make strong contributions to the physics and national defense communities. AFIT is a unique educational asset that provides accredited graduate education to U.S. military officers. The OSE program is also open to U.S. citizen civilian students. These students add breadth, depth, and diversity to both the OSE program and collaborating academic departments: the Departments of Engineering Physics and Computer and Electrical Engineering.



Michael A. Marciniak, Ph.D.
Optical Sciences
and Engineering
Program Chair
AFIT/ENP
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The OSE program is designed to provide a student who has a background in physics, physical science, or engineering with the knowledge of optics and laser technology necessary for work in the field of optical science and engineering. Flexibility in the program is maintained in order to take full advantage of the varied backgrounds and abilities of individual students. OSE faculty members are drawn from outstanding academic institutions and have a broad spectrum of professional experience and research interests. A mixture of military and civilian faculty achieves continuity and currency. Students will find that academics are kept focused, robust, and warfighter relevant. Research programs are product driven and address the warfighter need.

OSE faculty members maintain robust research programs in well equipped and maintained laboratories sponsored by USAF and DoD customers focused on DoD problems. Robust research is a core component of the advanced degree experience. OSE students are encouraged with faculty support to present their work at technical meetings and pursue publication in appropriate, peer reviewed STEM journals.

Curriculum Focus:

- **Adaptive Optics:** Adaptive optics (AO) compensates for the dynamic blurring that atmospheric turbulence has on light. This blurring is random and evolves quickly, causing severe problems for imaging, laser comm., and laser weapon systems, thus making it a very challenging problem for USAF optical systems. The AFIT curriculum focuses on coursework and computer simulation, where the theoretical basis for models of optical propagation through turbulence and of the control of AO systems are developed, and on experimental work, where high-speed wave-front sensors are used to measure turbulence, both simulated in the laboratory or real in the field, to develop the models further. **POC: Dr. Salvatore Cusumano; salvatore.cusumano@afit.edu**
- **Optical & IR Signatures:** The USAF is interested in measuring, understanding, and controlling the optical, particularly infrared (IR), signatures of its vehicles. The AFIT curriculum focuses on both coursework, where the theoretical basis for the emission and reflection of optical radiation is developed, and experimental work, where the spectral, polarimetric, and directional characteristics of emission/reflection of novel surfaces and materials are measured and novel measurement techniques and standards are investigated. Together, these lead to improved emission and reflection models for these surfaces/materials and, therefore, improved USAF signature analysis. **POC: Dr. Michael Marciniak; michael.marciniak@afit.edu**
- **Remote Sensing:** AFIT classroom and experimental work is focused on developing phenomenological models to enable physical understanding, reducing data dimensionality and extracting key features of remote transient combustion events in the battlespace, such as high-explosive detonation fireballs, muzzle flashes from small- and large-caliber weapons, rocket and aircraft exhaust plumes, and smokestack effluents. Available state-of-the-art instrumentation includes hyperspectral imagers, spectrometers, radiometers, and high-speed cameras in both the visible and infrared. **POC: Dr. Kevin Gross; kevin.gross@afit.edu**
- **Lasers:** Focusing on USAF and DoD high-energy laser weapons, the AFIT lasers curriculum includes classroom, computer-simulation, and experimental work in fundamental spectroscopy, chemical kinetics, and gas-phase laser demonstrations, with an emphasis on the Chemical Oxygen-Iodine Laser (COIL), Diode-Pumped Alkali Laser (DPAL), photo-dissociation lasers, and lasers for infrared countermeasures. **POC: Dr. Glen Perram; glen.perram@afit.edu**
- **Laser Radar:** AFIT classroom, computer-simulation, and experimental work in Laser Detection and Ranging (LADAR) focuses on USAF LADAR performance characterization and enhancement, and LADAR-based automatic target recognition (ATR). Recent specific topics include improvements in spatial and range resolution in 3-D LADAR systems and the deconvolution of laser-speckle-degraded imagery to improve spatial resolution in coherent imagery. **POC: Dr. Steven C. Cain, AFIT/ENG; steven.cain@afit.edu**

AFIT/ENP Centers of Specialized Research



The Center for Directed Energy (CDE) focuses and leverages ENP's leadership in directed education, research, and innovation since the envisioning of high-energy lasers as weapons systems. CDE is established as a cross-

disciplinary center focused on education, consulting, advising, and conducting sponsored research supporting the development and evolution of directed energy enabling technologies. The focus of CDE is threefold:

- **Research:** CDE research is focused on solving DoD research problems related to directed energy related technologies and DoD applications of directed energy in the battlespace.
- **Education:** Pre-service and in-service short courses are offered to support the DoD directed energy cadre. Co-ops and internships within CDE introduce directed energy STEM to a new cadre of scientists and engineers.
- **Innovation:** CDE strives to contribute to the DoD directed energy community through robust research solutions and delivery of products addressing critical needs. **CDE Director: Salvatore J. Cusumano, Ph.D.; salvatore.cusumano@afit.edu**

The Center for MASINT Studies and Research (CMSR)

is focused on the research and educational needs of the U.S. intelligence community. Research areas cover the six disciplines of MASINT plus advanced biometrics for human ID. Educational programs range from seminars to courses.



Research focuses on applications for the national and tactical intelligence users. CMSR has an active, interdisciplinary research portfolio of projects addressing intelligence community requirements. Current research projects include efforts related to laser intelligence, counter-denial and deception, bomb detonation characterization, advanced biometrics, ISR space methodologies, and the ARTEMIS hyperspectral sensor.

To best accomplish this work, the CMSR has established teaming arrangements both within AFIT and with external organizations; federal organizations, such as NASIC, NRO, DIA, JIEDDO, NPS, NSA, and AFRL; and academic institutions, such as NPS, WSU, VA Tech, NMSU, University of Missouri, and Utah State University. **POC: Ronald F. Tuttle, Ph.D., CMSR Director; ronald.tuttle@afit.edu**