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THE GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT AFIT ENGINEER

Air Force Institute of Technology

USSF Chief of Space Operations Celebrates AFIT Grads as Commencement Speaker

88th Air Base Wing Public Affairs

During the Air Force Institute of Technology's Graduate School of Engineering and Management graduation ceremony on March 25, history was made as this year's class included Guardians of the U.S. Space Force. A total of 230 master's and six doctorate degrees were awarded in the science, technology, engineering and math fields. One graduate earned dual master's degrees.

Due to COVID-19 concerns, the commencement ceremony was livestreamed for family and friends. The graduating class included 172 Air Force officers and three noncommissioned officers, 33 Space Force officers, six Army officers, five Marine Corps officers, 11 Defense Department civilians and three defense contractors. Two international students from Australia also graduated.

"Your AFIT degree will give you initial credibility with others but also establish some very high expectations of your ability to use what you learn here to help solve some of the tough challenges facing our Air and Space Forces today and in the future," said Dr. Todd Stewart, AFIT director and chancellor. "I am confident that your AFIT program has prepared you well to make important contributions for our Air and Space Forces."

Following Stewart's remarks, Acting Secretary of the Air Force John P. Roth relayed a message in a recorded video. "Graduates, as you relish in this moment, be proud," he said. "Benjamin Franklin



Counterclockwise: USSF Gen. John W. Raymond, Chief of Space Operations, speaks at AFIT's graduation ceremony March 25, 2021.

Dr. Stewart, AFIT Director and Chancellor, Lt. Gen. Hecker, AU Commander and President, Dr. Ries, AFIT Chief Academic Officer, and Dr. Badiru, AFIT Graduate School of Engineering and Management Dean.

Students participated in the socially-distanced 2021 AFIT graduation while friends and family were invited to watch online.



U.S. Air Force photos

once said, 'If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.' As a career comptroller, I can tell you, he was right.

"Education certainly pays the best interest, but it is up to you to invest. Going forward, I encourage you to take what you have learned combining over thousands of pages, hundreds of studies, and countless papers and focus on three areas: inspire, inquire and take initiative."

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www.afit.edu/EN/afitengineer



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WOMEN IN STEM

SPECIAL FEATURE PAGES 14-22

The Importance of Celebrating Women in STEM

Happy summer to all stakeholders of AFIT. Welcome back to reading this June 2021 issue of the AFIT ENgineer, the quarterly newsletter of AFIT/EN. Among the several inspiring stories in this issue, I want to point, in particular, to the special feature that celebrates **Women in STEM**. This has been a topic of special interest to me for decades, even before the present-day push for DEI (Diversity, Equity, and Inclusion).



Dr. Adedeji Badiru

In my very first textbook, **“Project Management in Manufacturing and High Technology Operations,”** published by John Wiley & Sons in 1988, I devoted a section to highlighting the diversity of thought and contributions emanating from women in the technical workforce. So, it is a delight for me nowadays to see more and more dedication of efforts in recognizing women in STEM. Along this line, I recall an inspirational quote by Professor Marie Ventrice, one of my favorite engineering professors at my alma mater, Tennessee Technological University in the 1970s. In Spring 1995, she was interviewed for the Tennessee Tech University *Visions* magazine. Her statement then still resonates greatly with me today and is fundamentally relevant to present-day initiatives of DEI. For its full impact, I am echoing the quote here.

“Why is it important that we encourage women to pursue nontraditional careers? I emphasize women because I am one. Much of what I say applies to African Americans and other minorities also. If we restrict some areas to white males only, we lose the benefits of all the insight, understanding, inventiveness, creativity, intelligence, quickness, initiative, hard work, and everything else that those who are excluded have to offer. If we restrict people’s options, we constrict their minds and their lives. We throw away and destroy valuable resources. And engineering is a challenging, satisfying, and rewarding profession; so why should only the guys get to participate?”

—Dr. Marie Ventrice, Tennessee Tech University *Visions* magazine, Spring 1995

This is a very powerful statement that sets the benchmark for what today’s DEI pursuits should represent. I invite readers to enjoy it, reflect on it, and practice the principles therein contained.

Respectfully,

Adedeji B. Badiru, Ph.D., PE, PMP, FIIE
Dean, Graduate School of Engineering and Management

EN OUTREACH

The AFIT ENGINEER is an official publication of the Air Force Institute of Technology, Graduate School of Engineering and Management.



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USSF Chief Celebrates AFIT Grads

Continued from cover

Lt. Gen. James Hecker, Air University commander and president, also congratulated the graduates. “You will be known as AFIT graduates now. There is only a small fraction of our Air and Space Force that can say they are AFIT graduates, and that means something,” he said. “Make sure that you always know, people will look at you differently because you are an AFIT graduate. Be the person the commander goes to when they have a hard job to get done, because that is going to be the expectation.”

“And guess what? You will deliver because of the faculty and everything you learned here. You are prepared to meet that challenge.”

Gen. John W. “Jay” Raymond, the first chief of Space Operations, was guest speaker for this year’s ceremonies and praised the graduates for their hard work and accomplishment. Raymond conveyed that the Air Force Institute of Technology has been the means by which the Air Force has enhanced the technological superiority of the nation’s air, space and cyber forces for more than a century. AFIT and its predecessor organizations have delivered world-class education to hundreds of

thousands of defense professionals. “Today, we are operating in an extremely complex security environment, probably the most complex environment since the Cold War,” Raymond said. “There is a lot that can go wrong and there are many challenges that lie ahead. Now, more than ever, we need technically minded joint warfighters who are ready to meet the challenges of our time.”

“While I have no doubt that our joint coalition forces are the envy of the world, our advantage, our superiority is diminishing. Parity undermines global stability. We must rapidly evolve and stay ahead of that growing threat. The Department of Defense is primed for rapid innovation and transformation, and it is you who will inspire and lead that change. There is no moment better than now, and no one better than you to lead that effort.”

Raymond urged the graduates to employ what they had learned at AFIT. “Don’t be afraid to fail, don’t be afraid to fall short,” the general said. “Trust yourself and trust what you learned. You are all ready and all of you are good enough to do great things in defense of our freedom.”



Top to bottom (left to right): Air Force and AFIT leadership arrive on stage for the 2021 commencement ceremony.

AFIT Chaplain Capt Gerardo Rodriguez provided the ceremony’s invocation.

Graduate students participate in a socially-distanced 2021 graduation ceremony.

Air Force Chief of Staff Gen Brown delivers a virtual message to graduates.

AFIT Graduate School Dean of Students Col McQuade congratulates the class of 2021.

AFIT students celebrate graduation achievements.

Three U.S. Army students earned master’s degrees in operations research.



U.S. Air Force photos

GSEM Annual Graduation Award Winners

By Katie Scott
Air Force Institute of Technology

The Air Force Institute of Technology's Graduate School of Engineering and Management presented awards to faculty and graduating students during a ceremony on March 25. The annual awards ceremony served as a celebration of accomplishments for the more than 200 students who received their diplomas in a separate ceremony later that evening.

Graduate School level awards

- **MSgt Arvin Bada** received the Secretary James G. Roche Award presented to the graduating enlisted student who has demonstrated exceptional academic achievement through a combination of grade point average and outstanding research, as well as high qualities of character, initiative, leadership and service.

- **Capt Justin Tullos** received the Lieutenant Edwin E. Aldrin, Sr. Award sponsored by the Wright Memorial Chapter of the Air Force Association and named in honor of Lt. Aldrin; a member of the institute's first graduating class of 1920. This award recognizes the student who has displayed the most exceptional leadership characteristics while in the graduate program.

- **Capt Evan Fortney** received the Louis F. Polk Award sponsored by the National Defense Industrial Association. The winner of this award has exhibited the highest standards of academic and professional accomplishment, and through their research made a significant contribution toward strengthening the nation's industrial defense base.

- **1st Lt Hanna Gjermo-Chomitz**, U.S. Space Force received the Mervin E. Gross Award. The award is presented to the graduating student who has demonstrated exceptional academic achievement and high qualities of character, initiative, and leadership while in a master's graduate program.

The Dean's Award

The Dean's Award recognizes the most exceptional master's thesis by a graduating student within each academic department. Award determination is based on the master's thesis reflecting the most exceptional contribution to scientific, management, or engineering knowledge.

Each individual was competitively selected by their respective academic department. The winners were **2d Lt Jeremiah Lane**, Department

of Mathematics and Statistics, **Capt Brenna Cole**, Department of Electrical and Computer Engineering, **Capt James Stofel**, Department of Engineering Physics, **Capt James Crumpacker**, Department of Operational Sciences, **Capt Troy Searcy**, U.S. Marine Corps, Department of Systems and Engineering Management and **Maj Michael Sherman**, U.S. Space Force, Department of Aeronautics and Astronautics.

The Chancellor's Award

From the collection of Dean's Award recipients, one overall winner is chosen to receive the Chancellor's Award. The Chancellor's Award is presented to the graduating student who produced the most exceptional master's thesis.

The 2021 Chancellor's Award and Russ Prize went to **Capt James Crumpacker** from the Operational Sciences Department earned the Chancellor's Award for his thesis titled "Air Combat Maneuvering via Operations Research and Artificial Intelligence Methods." The research, sponsored by the Air Force Research Laboratory, was motivated by the need to develop intelligent, autonomous behavior of entities within government owned, mission-level combat modeling simulation frameworks. Crumpacker formulated and solved a within visual range air combat maneuvering problem using operations research and artificial intelligence methods.



Award winners selected by students

- **Capt Devin DePalmer** received the Ivan B. Thompson Award.

- **Dr. Scott Nykl**, Associate Professor of Computer Science, Department of Electrical and Computer Engineering received the Leslie M. Norton Teaching Excellence Award.

- **Capt Matthew Nicholson** received the Dr. Anthony D'Angelo Student Leadership Award.

- **Dr. Christopher Chini**, Assistant Professor of Engineering Management, Department of Systems Engineering and Management received the Sigma Iota Epsilon Management Professor of the Year Award.

- **Dr. Scott Nykl**, Associate Professor of Computer Science, Department of Electrical and Computer Engineering received the Electrical and Computer Engineering Faculty Member of the Year Award.

- **1st Lt Zachary LaMere** received the Tau Beta Pi Thesis Award sponsored by the Ohio ETA chapter of TBP National Engineering Honor Society.

- **Dr. Darren Holland**, Research Assistant Professor of Engineering Physics, Department of Engineering Physics received the Tau Beta Pi Thesis Advisor of the Year sponsored by the Ohio ETA chapter of TBP National Engineering Honor Society.

Professional society sponsored awards

- **MAJ Camero Song**, U.S. Army received the Jerome G. Peppers Jr., Outstanding Student Award on behalf of the Dayton Chapter of the International Society of Logistics.

- **Capt Carlos Esguerra** received the Dr. Martin D. Martin and Dr. John Adams Award on behalf of the Dayton Chapter of the Project Management Institute.

- **Capt William Wilson** received the Dr. James T. Moore Graduate Research Prize.

- **Capt Sureshan Suntharalingam**, Royal Australian Air Force received the National Measurement and Signature Intelligence Committee Academic Excellence Award.

- **1st Lt Hanna Gjermo-Chomitz**, U.S. Space Force received the Advanced Technical Intelligence Association Outstanding Student Award.

- **1st Lt Stephen Baxter** received the American Nuclear Society Thesis Award sponsored by the Alpha Chapter of ANS.

- **Capt Layne Barrett** received the American Institute of Aeronautics and Astronautics Graduate Student Award for Research Excellence sponsored by the Dayton-Cincinnati Chapter of AIAA.

- **1st Lt Christopher Amaddio** received the General Bryce Poe II Award sponsored by the Air Force Historical Foundation.

- **Capt Matthew Nicholson** received the Society of American Military Engineers Kittyhawk Chapter SAME Award.

- **Capt Sarah Brown** received the George K. Dimitroff Award sponsored by the Air Force Civil Engineer Center.

- **MSgt Arvin Bada** received the United States Cyber Command Cyberspace Research Excellence Award.

- **Capt Daniel Clarke** received the Institute of Navigation's Research Excellence Award.

- **1st Lt James Goljan** received the Greater Dayton Chapter of the International Cost Estimating and Analysis Association ICEAA Thesis Award.

- **2d Lt Jeremiah Lane** received the International Society for Optics and Photonics SPIE Thesis Award.

- **Maj James Lievsay**, Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering received the Dayton Area Chapter of the Military Officers Association of America MOAA Outstanding Military Professor Award.

- **Capt Justin Anderson** received the Dr. George S. Patnell Military and Security Research Award sponsored by the Military and Security Society of the Institute for Operations Research and the Management Sciences.

International student badge and certificate recipients

- **1 Lt LT Israel Dunk and Capt Sureshan Suntharalingam** from Australia were presented with the Air University Certificate and Badge on behalf of Lieutenant General James Hecker, Air University Commander and President, and the Air University International Officers School.



Above: Grad School students celebrate following the graduation awards ceremony.



U.S. Air Force photos

Left: Capt James Crumpacker received the top honor for the most exceptional master's thesis. Crumpacker (center) is pictured with Dr. Todd Stewart, AFIT director and chancellor and Maj. Gen. Everett Odgers, Ret., Vice President of Finance, AFIT Foundation.

LEARN MORE ONLINE



Complete Awards Ceremony Article:

<https://www.afit.edu/news.cfm?article=03614100>

List of 2021 AFIT Graduates:

<https://www.afit.edu/news.cfm?article=03614000>

“ Each graduation event represents the culmination of years of study, testing, grading, and reaffirmation in a student-faculty partnership demonstration. As students receive their rewards in terms of diplomas and certificates, the faculty also receive awards for their superior performance in preparing students to reach their respective end goals. Because we are in the profession of arms in the military, I often remind myself of the analogy of considering an academic curriculum as a weapon (albeit non-kinetic) of knowledge transfer. For this reason, I extend my congratulations to the students and faculty their accomplishments in the 2021 commencement exercises. ”

— Dr. Adedeji Badiru
Dean, Graduate School of Engineering and Management

GSEM Faculty Receive AFA Sponsored Awards

By Katie Scott
Air Force Institute of Technology

During a virtual ceremony on Feb. 25, three AFIT Graduate School of Engineering and Management faculty members received awards sponsored by the Wright Memorial Chapter 212 of the Air Force Association. The awards recognize faculty who advance aerospace power and technology through innovative efforts in education and research. The AFA has sponsored the awards since 1982.

One part of the AFA mission is to promote aerospace and STEM education and professional development. “Our sponsorship of these awards is a great opportunity to celebrate the amazing achievements of those professionals who contribute so much to our shared values and goals,” said David Babcock, executive vice president of the AFA Wright Memorial Chapter.

“The recognition by the Air Force Association is a high point for us as they help recognize our outstanding individuals in the service of our Air Force and country.”

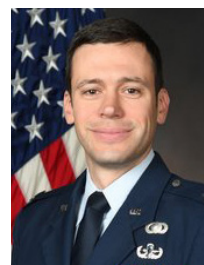
— Dr. Todd Stewart, AFIT director and chancellor

Dr. James Petrosky received the General Bernard A. Schriever Award. This award is given in recognition of a person who advances aerospace power, technology, doctrine, or the Air Force as a profession. The award is named in honor of Gen. Schriever, an AFIT alum from 1941, who organized and formed the Air Force’s ballistic missile and military space program.



Petrosky is a professor of nuclear engineering in AFIT’s Graduate School of Engineering and Management responsible for teaching and research in nuclear weapons effects. In 2019 he spearheaded the development of AFIT’s Nuclear Expertise for Advancing Technologies Center focused on solving key strategic national security problems related to nuclear survivability, surety, and security. Additionally, he stood up a cutting edge nuclear professional continuing education program where he delivered over 6,000 man hours of in-residence instruction to nuclear warfighting leadership.

Maj. James Bevins received the Colonel Charles A. Stone Award. This award is given in recognition of an individual who accomplished specific achievements that furthered the AFIT mission through new and innovative efforts involving demonstrated personal leadership. The award is named in honor of Col. Stone, the dean of AFIT’s School of Systems and Logistics from 1962-1966, who was instrumental in the



school receiving accreditation to award master of science degrees. Bevins is an assistant professor of nuclear engineering in AFIT’s Graduate School of Engineering and Management where his research interests include radiation transport modeling, radiation detection and analysis methods for nuclear security applications. In 2019 he led a robust research group of nine master’s students, four doctoral students, and one research faculty member while directly executing over one million dollars in nuclear focused research. Under his leadership, the group published six journal articles with five more in review, 13 conference papers, and two provisional patents.

Dr. Julie Jackson received the Gage H. Crocker Outstanding Professor Award. This award is presented to the individual who made the most significant contribution to the AFIT mission through excellence in teaching, curriculum development, educational innovation, consulting, or research. The award is named in honor of Col. Crocker who served as the dean of AFIT’s School of Systems and Logistics from 1971-1972 and was a coauthor of papers on turbulence associated with blunt body flow.



Jackson is a professor of electrical engineering in AFIT’s Graduate School of Engineering and Management where she teaches courses on advanced radar system analysis, multidimensional signal and image processing, and random signal and system analysis. In 2019 her unique innovations made her an international leader in radar research as evidenced by her recognition as the Institute of Electrical and Electronics Engineer’s top young radar engineer in the world with the Fred Nathanson Memorial Radar Award for her innovative systems engineering advancements in the exploitation of scattering phenomena for the next generation passive and active imaging radars.



U.S. Air Force photo by MSgt Jason Vavro

Dr. Todd Stewart, Air Force Institute of Technology director and chancellor presented the 2019 Air Force Association Wright Memorial Chapter awards to AFIT faculty members including Maj. James Bevins.

STEM PIONEERS

AFIT Engineer Series of Influential Leaders in STEM



DR. RUSSELL M. GENET

M.S. Logistics Management, 1980
Air Force Institute of Technology

Doctor Russell Merle Genet (born 1940) is an American astronomer, who specializes in photometric observations and probing of very short-period eclipsing binary stars.

Between 1964 and 1968 he worked as a rocket scientist for Space and Missile Systems, San Bernardino, California. Between 1969 and 1975 he worked as a mathematical analyst for Aerospace Guidance System Center, Newark, Ohio. Since then until 1990 he worked as a research supervisor for Air Force Human Resources Laboratory, Dayton, Ohio, and Mesa, Arizona.



Dr. Russell Genet at the Orion Observatory in Santa Margarita, California with the Meade 10” equipped with a CCD camera.

In 1979 he founded the Fairborn Observatory, which he moved from Fairborn, Ohio to Mount Hopkins, Arizona in 1985, and worked there until 1993. He was also its first director, until 1989. Genet and his colleagues developed robotic telescopes there. It became the first totally automatic robotic observatory in the world. It appeared in the documentary of the Public Broadcasting Service The Perfect Stargazer. He also established the magazine *IAPPP Communications*, the first international astronomical photometry journal.

In 1983 he received the Amateur Achievement Award of the Astronomical Society of the Pacific for his photometric studies and in 1986 the Leslie Peltier Award of the Astronomical League. After Genet left this observatory, he founded the Orion Observatory in Santa Margarita, California.

In 1993 Genet was elected the 51st president of the Astronomical Society of the Pacific and served in this position for two years. Throughout his career, he taught at Central Arizona College, California Polytechnic State University’s Osher Institute and Cuesta College.

Genet has authored a dozen books and over 100 scientific papers. In 2007 he published the book *Humanity: The Chimpanzees Who Would Be Ants*.

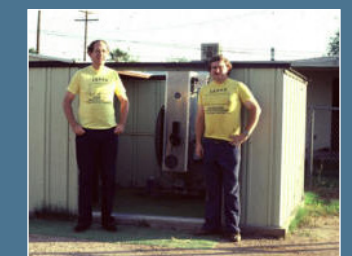
Information and photos on this page from: https://en.wikipedia.org/wiki/Russell_Merle_Genet and <http://www.orionobservatory.org>.

FAIRBORN OBSERVATORY

The Fairborn Observatory—the planet’s first totally automatic, robotic observatory—was founded in 1979 by Dr. Russell Genet. Together with Louis Boyd, Donald Hayes, Kenneth Kissell and others, Genet pioneered the development and use of automatic telescopes and robotic observatories.

In 1985 the Fairborn Observatory moved from its birth place near Fairborn, OH to Mt. Hopkins, AZ, where the dark night skies are a boon to the many observatories located there. As an integral feature of its program to develop robotic telescopes and observatories, the Fairborn Observatory organized a dozen conferences on the use of microcomputers in astronomy, automated photometry, and robotic observatories. Many of these conferences were held at the Lazy K Bar Guest Ranch in the Tucson Mountains of Arizona, and the Lazy K became an annual event that was attended by robotic astronomy developers from around the world.

Genet eventually turned the Fairborn Observatory over to Boyd and he turned to his studies of cosmic evolution by founding the Orion Observatory in Santa Margarita, California.



Dr. Russell Genet and Lou Boyd after the first full night of automatic operation, October 12, 1983.

DATA ANALYTICS

GRADUATE CERTIFICATE



In 2018 the Air Force Chief Data Officer (CDO), Ms. Eileen Vidrine, outlined her vision for the future of Air Force data analytics in which she remarked, “the Air Force is a data-driven organization, which requires technology, process, and people. A graduate education in data analytics is a key component in our workforce development approach to improve the Air Force data enterprise and increase data-driven decisions.” This facilitates the intent of Air Force Chief of Staff Gen. Brown, who said a priority is “fostering a new cadre of Airmen who are experts in software development, artificial intelligence, and joint operations...” Along similar lines, the National Defense Strategy emphasized the growing need for personnel with data analytics capabilities in order to maintain military advantage, while recognizing that few DoD personnel are taught the skills required to manage and analyze data.

In response, in 2019 the Air Force Institute of Technology launched an on-line data analytics certificate program designed to aid the U.S. Air and Space Forces in becoming more data-informed organizations. The five-course sequence focused on enabling Airmen and Guardians to use and understand data analysis applications and tools and included topics such as database design and management, machine learning, statistics, and computer programming. A little over a year later, over 414 students have taken at least one class and 27 have earned a Certificate in Data Analytics as part of the first graduating class in winter 2021.

One of the CDO’s primary goals was to help democratize the use of data analytics throughout the service. Mission effectiveness of all organizations could be enhanced by using data analytics to recognize actionable opportunities in the mountains of data they generate. Thus far, the DA Certificate program has helped meet this goal by reaching students from around the globe including all U.S. Air and Space Force MAJCOMS, Airmen/Guardians supporting EUCOM, INDOPACOM and USTRANSCOM, Headquarters Air Force, over a dozen agencies and Direct Reporting Units. The Data Analytics Certificate Program Director, Dr. Brent Langhals stated, “We are extremely excited by the reach our program is having throughout the Air and Space Forces. We are seeing interest from all corners of the Air Force and beyond, including new partnerships with organizations like Lawrence Livermore National Labs and the National Geospatial Agency.”

Currently, the data analytics certificate program is open to all active duty and civilian Air and Space Force personnel at no cost. Students can expect to gain an understanding of how to combine analysis techniques with their specialized expertise to enhance data analysis leading to better policies, processes, and decisions.

Continued on next page

“This program is unique in that it challenges students to not just learn and understand data analytics tools, but also to apply them to relevant work problems. We are especially proud of the capstone projects our students are completing which not only meet rigorous academic standards for academic publication but also provide real answers to relevant Air Force and DoD issues.”

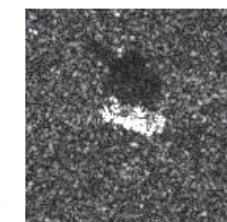
— Dr. Brent Langhals
AFIT Data Analytics Certificate Program Director



In the certificate capstone course, **Machine Learning**, students devote five weeks towards performing a machine-learning analysis on a topic that supports their organization’s mission. This fulfills the Chief Data Officer goals of developing subject matter experts to identify and exploit data analytics opportunities. After completing their certificate, several students have made progress towards publishing their analyses with the support of Data Analytics faculty.

The following are several examples of the level of analysis students are capable of upon graduation:

- **Determine the Risk of Marijuana Use by Personality Trait Data** – Marijuana is the most commonly abused drug for military personnel tested at the Air Force Drug Testing Laboratory. A publicly available dataset with 30 variables and 1885 datapoints related to drug use, personality traits and demographic data were modeled with logistic regression, decision tree and neural network models. Neural networks had the best performance after two iterations of a 9-dimensional hyperparameter search, and the final accuracy (0.86) improved upon prior work by 8%. These results could increase the efficacy of military drug prevention and intervention programs.
- **Per-pixel Cloud Cover Classification of Multispectral Landsat-8 Data** – Random forest and neural network algorithms are applied to identify cloud cover in images using 10 of the wavelength bands available in Landsat-8 imagery. 38,000,000 pixels from 12 image sets were classified as clear, cloud shadow, light cloud, or cloud. The best overall classifier was found to be a random forest with an overall accuracy of 77% across the four classes. Automated cloud mask identification could free an imagery analyst to apply their expertise to advanced analytical techniques, rather than searching for cloud-free image sets.
- **Synthetic Aperture Radar Image Recognition of Armored Vehicles** – Synthetic Aperture Radar (SAR) imagery is not affected by weather and allows for day-and-night observations; however it can be difficult to interpret as shown in the graphic. The publicly-available Moving and Stationary Target Acquisition and Recognition dataset was used, which contained 2,987 total observations of the BMP-2, BTR-70, and T-72 armored vehicles, with 19,182 input variables resulting from 138x139 pixel images. A convolutional neural network was able to achieve a 97% accuracy with lower model complexity than currently exists in the literature. Automated target recognition using SAR imagery has the potential to further improve situational awareness for blue forces.



SAR Imagery of T-72 Tank

The ability to recognize statistical and machine learning opportunities in data is a learned skill, and the examples above show that the Data Analytics certificate develops this ability in students to improve personnel retention, process efficiency and situational awareness. Infusing Data Analytics expertise into subject matter experts across the Air Force and Space Force has a strong potential to increase mission effectiveness at all levels.

WANT MORE INFORMATION?

- 1 More information on AFIT’s Graduate Certificate in Data Analytics is available on the AFIT website at www.AFIT.edu/EN/allprograms.
- 2 Questions can be emailed to AFITensDataAnalytics@afit.edu.
- 3 Prospective students can apply online at www.afit.edu/Admissions/AFITApplicationProcess.

FOLLOWING THE DATA

SUCCESS IN NUMBERS

2019

Year AFIT launched online Data Analytics Certificate Program



414+

Students have taken at least one Data Analytics class



27

Students earned a Certificate in Data Analytics in winter 2021

GLOBAL REACH

The Data Analytics Certificate Program is reaching students from all U.S. Air and Space Force MAJCOMS, Airmen/Guardians supporting EUCOM, INDOPACOM and USTRANSCOM, Headquarters Air Force, and over a dozen other agencies and Direct Reporting Units.

MISSION IMPACT

Infusing Data Analytics expertise into subject matter experts across the Air Force and Space Force has a strong potential to increase mission effectiveness at all levels. After completing the certificate, several students have made progress towards publishing their analyses with the support of Data Analytics faculty.

“We are extremely excited by the reach our program is having throughout the Air and Space Forces. We are seeing interest from all corners of the Air Force and beyond, including new partnerships with organizations like Lawrence Livermore National Labs and the National Geospatial Agency.”

— Dr. Brent Langhals
AFIT Data Analytics Certificate Program Director

2021 AETC iChallenge Award Winners

By Stacy Burns
Air Force Institute of Technology

The Air Force Institute of Technology is proud to recognize its 2021 Air Education and Training Command (AETC) iChallenge Award winners. Dr. Scott L. Nykl, Associate Professor of Computer Science at the Graduate School's Department of Electrical and Computer Engineering, took first place in the Accelerate Change Award category for the 3D virtual training application "Cyber Space Odyssey." 1st Lt Kasey Stout, Academic Program Manager and Executive Officer, and Dr. Alice Grimes, Graduate School of Engineering and Management Director of Faculty Development, were awarded second place in the ADAPT Award category for the "Facilitator Cadre Program."

The 2021 Innovative Challenge (iChallenge) was launched last November by Lt Gen Brad Webb, AETC Commander, with the intent to capture and fund innovative ideas that directly align with the Air Force Chief of Staff Gen Brown's "accelerate change or lose" action orders and AETC Strategic Plan priorities. All of AETC was challenged to take part and those who submitted the most innovative ideas were selected as finalists to present their virtual pitch on April 19 to Lt Gen Webb and the AETC Selection Committee.

On May 6, Webb announced two winners from each of the three AETC iChallenge categories and awarded a combined \$300,000 during the annual Gathering of the Torch event. The winners will work with their wing leadership to use the funds to further advance their innovative ideas.

Read more about the AFIT
iChallenge winning projects

Cyber Space Odyssey

Dr. Scott Nykl
2021 iChallenge Accelerate Change Award
1st Place Winner (\$75,000)

In this challenge category, winners developed innovations in direct support of CSAF Brown's priority to "accelerate change or lose."

Cyber Space Odyssey (CSO) is a novel, 3D virtual training application that gamifies cyber security in a live, team-oriented scenario while incorporating the most ubiquitous cyber tools in today's arsenal. The elements create an effective and motivating training environment to increase cyber training efficacy and tempo. Specifically, it facilitates hands-on network analysis involving the capture and crafting of simple UDP network traffic to manipulate the state of a real-time 3D virtual world.

Trainees leverage state-of-the-art network analysis tools (e.g. Wireshark) and perform network packet crafting (e.g. UDP datagram construction). The acts of successfully capturing network traffic, decoding it, and crafting syntactically and semantically correct packets receive immediate positive reinforcement through visible changes within the 3D virtual world set in earth's orbit. Teams compete against each other and the clock to collect intel and solve the game's mystery. This "capture, analyze, craft, visualize" paradigm provides a powerful and responsive pedagogical mechanism for learning enhancement.

Cyber Space Odyssey can help develop the next generation of cyber-security leaders through effective training tools and has been used at AFIT's Advanced Cyber Education (ACE) summer ROTC training program for the past five years with excellent success.

LEARN MORE ABOUT CSO ONLINE

Read an academic overview of the Cyber Space Odyssey project in the IEEE Transaction on Learning Technologies journal article "Cyberspace Odyssey: A Competitive Team-Oriented Serious Game in Computer Networking." <https://ieeexplore.ieee.org/document/9138771>

Watch a Cyber Space Odyssey instructional video:
<https://www.youtube.com/watch?v=fn9QNoVsnZI>

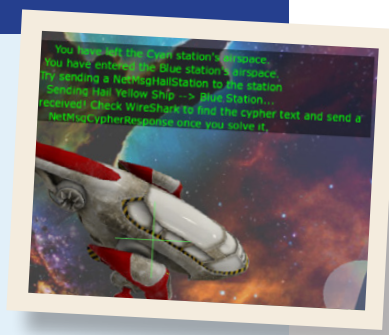


Courtesy photo

Col James Fee, AFIT Deputy Director & Director of Staff, presents the AETC iChallenge Award to Dr. Scott Nykl (first place winner) during a virtual meeting with Lt Gen Hecker, AU Commander and President.

"Our current goal is to bring Cyber Space Odyssey to the larger USAF, USSF, and greater DoD. To do this, we plan to move Cyber Space Odyssey into the cloud, making it accessible to a vast pool of future cyber defenders. We have already created a proof-of-concept implementation within Amazon's AWS Gov Cloud showing the technology is feasible, but we require more software development resources to fully achieve this undertaking. Winning the iChallenge and receiving support funding is a step in the right direction," Nykl explained.

"Competitions like this show how seriously the Air Force seeks innovative solutions to challenging problems. With Cyber Space Odyssey, being able to pitch such a 'moonshot' idea to the highest levels was an excellent opportunity to advance the digital prototype and help our fellow Airmen receive the best cyber training possible. I look forward to our continued engagement with USAF/USSF leaders and delivering the best cyber education the Air Force has to offer," Nykl said.



Facilitator Cadre Program

1st Lt Kasey Stout and Dr. Alice Grimes
2021 iChallenge ADAPT Award
2nd place winner (\$25,000)

The ADAPT Award category recognizes projects that were previously attempted but did not meet the desired results. By adapting and combining lessons learned with potential award funding, the managers

AFIT's Facilitator Cadre Program leverages small group discussions as an effective way for getting Airmen's inputs, cultivating a sense of belonging and being heard. The program was developed in response to a 2020 Secretary of Defense call for the "development of a program of instruction containing techniques and procedures which enable commanders to have relevant, candid, and effective discussions" with their Airmen.

Dr. Alice Grimes has served as a member of the leadership team of AFIT's Facilitator Cadre Program since its inception in the fall of 2020. "The USAF has recognized and acted upon the growing need for awareness and responsiveness to the interpersonal and intrapersonal needs of all Airmen. These efforts include small group discussion and training opportunities that address social change, equity and inclusion and also concerns for mental health, violence prevention, and suicide prevention. These efforts require guidance from trained facilitators to insure the benefits of these opportunities are realized," Grimes explained.

The Facilitator Cadre Program's mission is to recruit and equip facilitators to confidently and effectively lead trainings and small group discussions by creating a psychologically safe environment for interaction in order to foster a culture of diversity, equity, and inclusion where the input of all members of AFIT is valued and recognized.



Courtesy photo

Col James Fee, AFIT Deputy Director & Director of Staff, presents the AETC iChallenge Award to 1st Lt Kasey Stout and Dr. Alice Grimes (second place winners) during a virtual meeting with Lt Gen Hecker, AU Commander and President.

The Facilitator Cadre Program has made great strides under Program Manager 1st Lt Kasey Stout's leadership. Stout guided the program as it recruited and trained a team of volunteer facilitators, organized a leadership committee to guide the program, and developed a set of training goals and materials in less than a year since the program inception. These steps have been taken to ensure that facilitators are well-equipped to conduct small group discussions in the workplace. The Facilitator Cadre achieved a new milestone when it successfully conducted its first small group discussion with all members of the AFIT community on the topic of extremism during the Air Force mandated stand down on April 1.

"We really threw our facilitators in the deep end right off the bat, and they handled it wonderfully. We learned a lot as a program for the future, but this was a significant step in our development as we now have relevant and practical experience under our belt," Stout said.

The Facilitator Cadre Program committee is now focused on creating an online process for training, certification, and management of volunteer facilitators to address the needs of AFIT. Stout and Grimes believe AFIT's program has the potential to be developed into a USAF-wide training center to train and equip military members and civilian employees alike with a foundation of facilitation skills at a minimal cost and in a relatively short period of time.

2020 STEM Award Winners Announced

Congratulations to the GSEM winners in the 2020 Air Force Science, Technology, Engineering, and Mathematics (STEM) Awards program.

AIR FORCE-LEVEL AWARD WINNERS:

Dr. Stephen C. Cain

Dept. of Electrical and Computer Engineering
Air Force John L. McLucas Basic Research Award

Lt Col James Rutledge

Dept. of Aeronautics and Astronautics & AFMC
Air Force Outstanding Science and Engineering Educator

2d Lt Katherine E. Cheney & 2d Lt David D. King
Autonomous Unmanned Aerial Systems Team
AFIT Systems Engineering Award

AFIT ALUMNI AWARD WINNERS:

Capt Austin Troya

(M.S. Systems Engineering, 2018)

Air Force Outstanding Scientist/Engineer Award – Junior Military category

Maj Michael Archer

(M.S. Electrical Engineering, 2013)

Air Force Outstanding Scientist/Engineer Award – Mid-Career Military category

Lt Col Gregory Izdepski

(M.S. Electrical Engineering, 2005)

Air Force Outstanding Scientist/Engineer Award – Senior Military category

Capt Anthony Portante

(M.S. Cyber Operations, 2017)

Air Force Research and Development Award

AETC-LEVEL AWARD WINNERS:

Maj Robert A. Bettinger

Dept. of Aeronautics and Astronautics

AETC Outstanding Scientist/Engineer (Mid-Career Military)

Dr. Julie A. Jackson

Dept. of Electrical and Computer Engineering

AETC Outstanding Scientist/Engineer (Mid-Career Civilian)

The Center for Space Research and Assurance

AETC Outstanding Scientist/Engineering Team of the Year Award

Lt Col Jeffrey R. Komives

Dept. of Aeronautics and Astronautics

AETC Science and Engineering Educator of the Year Award

AFIT Research Recently Cited in IEEE Spectrum

Using Publicly-available Data to Create an Automated Satnav Interference Detection System

Lt John Stader, an Electrical Engineering master's student with a focus on Global Navigation Satellite System (GNSS) interference detection, and Dr. Sanjeev Gunawardena, Research Assistant Professor of Electrical Engineering with the Autonomy & Navigation Technology (ANT) Center, authored a paper describing a system that automatically ingests data from publicly available sources and applies algorithms to detect GNSS interference events. The data is sourced from the International GNSS Service (IGS), a network of over 500 satnav signal monitoring sites spanning all seven continents.

Their paper, titled "Leveraging Worldwide, Publicly-Available Data to Create an Automated Satnav Interference Detection System," was cited in a March 2021 IEEE Spectrum article that discusses tracking GPS interferences around the world. The article follows an incident where a private pilot experienced anomalous GPS readings on final approach to an airport in California. The pilot happened to be a professor at Stanford University and was aware of research on GNSS anomalies being performed by the Stanford GPS lab.

Professor Todd Walter from the Stanford GPS lab had received many similar reports of GPS anomalies in the past. One anomaly's source was manually identified after many reports by pilots to the FAA. Professor Walter's team explored a more efficient method for identifying anomalies using ADS-B transponders on planes. While the Stanford team was able to identify 25 interference events, it was challenging for the team to exclude false alarms, and the team could not localize the events.

Professor Todd Humphreys and his team from the Radionavigation Lab at the University of Texas at Austin are exploring the detection of GNSS anomalies using low earth orbit satellites. This methodology shows promise. However, it will be at least a few years until a worldwide capability exists using this method.

As discussed in the article, the AFIT research possesses a unique advantage since the IGS stations are located across the globe and are already available. After the publication of the article, AFIT researchers went on to detect approximately 50 interference events across a subset of 15 IGS sites that occurred over a span of a single day. Incidences of satnav interference has been on the rise for the past several years, particularly with the availability of 'personal privacy' and other such devices available on the Internet. These illegal devices have been known to disrupt essential satnav-based services over a wide area, and therefore presents a threat to military operations. AFIT's system allows continuous worldwide monitoring of satnav interference without having to deploy expensive infrastructure. Analyzing data from the system can provide situational awareness and actionable intelligence for the Air Force. Development continues to field this capability as an operational system that will benefit the warfighter.

LEARN MORE ONLINE

AFIT's complete peer-reviewed paper is located here: <https://www.ion.org/publications/abstract.cfm?articleID=17826>

The full IEEE Spectrum article is at: <https://spectrum.ieee.org/tech-talk/aerospace/aviation/the-networks-that-aim-to-track-gps-interference-around-the-world>

AFIT Earns Reaccreditation for Another Ten Years

By Katie Scott
Air Force Institute of Technology

The Higher Learning Commission reaffirmed the accreditation for the Air Force Institute of Technology for the maximum 10 year period in March 2021. As an independent organization, HLC accredits degree-granting post-secondary educational institutions in the North Central region.



"We have no additional reporting requirements beyond the baseline Open Pathway process – a major accomplishment," said Dr. Heidi Ries, AFIT chief academic officer. "Getting to this point was a significant

undertaking, including our quality initiative, completion of our assurance argument, and most importantly ongoing excellence by all faculty, staff and students in the execution of our mission."

"After years of preparation and months of execution actions, we are delighted about AFIT's HLC accreditation reaffirmation and we are celebrating it as a campus team achievement," said Dr. Adedeji Badiru, dean of AFIT's Graduate School of Engineering and Management.

AFIT followed HLC's Open Pathway option for reaccreditation which focuses on quality assurance and institutional improvement. An institution demonstrates that it meets the criteria for accreditation by preparing an assurance argument and completing a quality initiative project.

There are five criterion for accreditation: 1) mission; 2) integrity: ethical and responsible conduct; 3) teaching and learning: quality, resources, and support; 4) teaching and learning: evaluation and improvement; and 5) resources, planning, and institutional effectiveness.

AFIT's QIP focused on modernizing instructional capabilities across the institute addressing five thrust areas: 1) classroom and teaching laboratory design, functionality, and utilization; 2) e-learning technologies for resident and distance delivery; 3) faculty and staff development programs and support infrastructure; 4) infrastructure to support advanced instructional technology capabilities; and 5) organizational structures, policies, processes, procedures, and strategic vision to support effective teaching.

GSEM to Offer Non-thesis MS Degree Program to USAFA Grads Awaiting Pilot Training

By Stacy Burns
Air Force Institute of Technology

AFIT's history of providing innovative academic programs to the U.S. Air and Space Forces continues with its announcement of a non-thesis master's degree program option for officers in the USAF pilot training pipeline.

The Graduate School of Engineering and Management will be offering the option of an in-residence master's program that does not require completion of a thesis to acquire a degree. This 12-month program will provide officers a quicker path to earning a STEM-related master's degree. The creation of this program is in direct alignment with Air Force Chief of Staff Gen. Brown's "accelerate, change or lose" proclamation. HAF/A3, HAF/A1, SAF/MR, and AFIT agreed upon the non-traditional MS degree option that will initially serve U.S. Air Force Academy (USAFA) grads who are experiencing significant delays in undergraduate pilot training pipeline report dates.

"AFIT has provided a solution to the Air Force-level delay in pilot training throughput. AFIT is offering what we know best, graduate-level education, to answer that need and provide an opportunity to newly commissioned officers to obtain a MS degree benefiting the Air Force and the officer," Col. John M. McQuade, AFIT Graduate School of Engineering and Management Dean of Students, said.

Seventy-two USAFA graduates have been accepted to the new 12-month program and are set to arrive at AFIT on July 28 for

in-processing. The students will start their academic progression in the fall quarter. Without AFIT's degree program option, this group of officers would have been assigned to a training base where they would remain on "casual status" until their undergrad pilot training start date.

"AFIT enrolls officers every year from USAFA that have been accepted into GSP (Graduate Studies Program) who are also in the aviation pipeline with a UPT seat. This group will be in addition to those



U.S. Air Force photo
U.S. Air Force Academy cadets during the 2020 Graduation Ceremony at the Air Force Academy in Colorado Springs, Colo.

officers. These officers are not expected to go on and become scientists and engineers in the Air Force. However, this experience will teach them problem framing, analysis, solving, and a deeper appreciation of their chosen academic discipline. All of these skills are required, whether flying a plane or not, to embody the 'accelerate change or lose' challenge handed to us from Gen. Brown," McQuade explained.

AFIT's Graduate School hopes to expand the program to include USAF ROTC in follow-on yearly offerings. The current non-thesis MS degree program options include advanced degrees in Aeronautical Engineering, Cyber Systems, Operations Research, Space Systems and Systems Engineering.

USAFA Leaders Visit AFIT

By Katie Scott
Air Force Institute of Technology

Key academic leadership from the U.S. Air Force Academy met with Air Force Institute of Technology leaders, faculty, and students during a visit to campus on March 29.

The purpose of the visit was to reinforce relationships and discuss priorities, initiatives, and opportunities for collaboration between the two institutions. Brig. Gen. Linell Letendre, USAFA dean of faculty, along with several department heads from USAFA's engineering division met with AFIT counterparts to better understand and prepare cadets for AFIT's graduate program as well as discuss current and future collaboration efforts.

The group also toured laboratories and learned about student research projects. During the tour, AFIT faculty and staff introduced Letendre to AFIT's capabilities to perform satellite environmental testing, as well as additive manufacturing for a variety of aerospace applications. AFIT's space-related graduate programs and world-class design, test, and fabrication capabilities will likely serve a key role in the education of future U.S. Space Force Guardians following their undergraduate programs at institutions such as USAFA.

Annually, approximately 30 USAFA alumni attend AFIT's Graduate School of Engineering and Management as their first assignment following graduation.



U.S. Air Force photo
USAFA dean of faculty, Brig. Gen. Linell Letendre, learns about student research during a tour of AFIT research laboratories.

Q+A WOMEN IN STEM

View complete bios at www.afit.edu/BIOS/

These accomplished and multi-talented women contribute to AFIT's continued academic and research success while taking the time to mentor students who follow in their footsteps.

In honor of **INTERNATIONAL WOMEN IN ENGINEERING DAY ON JUNE 23**, The AFIT Engineer held a Q&A with a few of the highly-respected women in leadership, academics, and research across the Graduate School of Engineering & Management. We also checked in with some of our female alumni to see how their AFIT degrees have contributed to their career goals.



Dr. Heidi Ries

TITLES: AFIT Chief Academic Officer; Professor of Physics, Department of Engineering Physics

RESEARCH AREAS OF INTEREST: Radiation effects, nonlinear optical materials, electron paramagnetic resonance spectroscopy, and laser processing of materials.

YEARS AT AFIT: 21

Who or what were some of the most important influences that guided you to STEM?

My father was always reading popular science books at the dinner table, although his career was in K-12 music instruction. He encouraged my scientific interests, and never brushed off my questions. We often consulted the Encyclopaedia Britannica or other books together to find answers.

What do you consider your biggest achievement in STEM?

Successfully leading the Center for Materials Research (CMR) at Norfolk State University was my biggest achievement in STEM. I built the electron paramagnetic resonance laboratory

component, and was PI of the Center for Photonic Materials Research project funded by National Science Foundation's Center for Research Excellence in Science and Technology (CREST) program. The CMR team produced numerous journal publications – but more importantly advanced the STEM careers of hundreds of underrepresented minority students.

What's one piece of advice you would give to others interested in a similar career?

Reflect carefully on your own principles, interests, priorities and lifetime goals. If you have a clear sense of self, you can then act upon, modify or reject the advice you receive from others as you pursue your own version of a successful STEM career.



Dr. Nancy Giles

TITLES: GSEM Associate Executive Dean for Strategies; Professor of Physics, Department of Engineering Physics

RESEARCH AREAS OF INTEREST: Experimental solid state and materials physics; identifying and characterizing device-limiting point defects in materials of interest to Air Force weapon and countermeasure systems.

YEARS AT AFIT: 12

What first sparked your interest in the STEM field?

I was challenged by physics and math in high school; these academic fields were worthwhile to study since they were not just regurgitating what was in a textbook. The challenge meant they were worthwhile intellectual endeavors.

Who or what were some of the most important influences that guided you to STEM?

Throughout undergraduate and graduate school in physics, I was fortunate to have excellent research advisors. I was given an opportunity to spend my summer between junior and senior years at Bell Telephone Laboratories Murray Hill, NJ location – where I met and interacted with top physicists. Those summer research programs continue to be instrumental in helping young people build their resumes for graduate school. Later, in graduate school, my advisor was extremely supportive and taught me how to balance the research business with academic career business. Although I was often the only female in my classes, the research support I received from my colleagues and advisor helped a lot.

Describe a favorite moment in your career.

Some of my most favorite moments were when my female PhD students surpassed me in being the experts in their studies. Unfortunately, that meant they were ready to go off on their own! It was very rewarding to be a faculty member and helping young people attain their goals. Looking back, I see my stubbornness as a useful shield to the professional discrimination. Females pursuing physics and engineering careers at the current time hopefully have an easier job in getting their achievements recognized. Pick your advisor carefully.



Dr. Gaiven Varshney

TITLES: Research Assistant Professor of Nuclear Engineering; Co-Chair, Countering Weapons of Mass Destruction Graduate Certificate Program; Member, Nuclear Expertise for Advancing Technologies Center

DEPARTMENT: Department of Engineering Physics

RESEARCH AREAS OF INTEREST: Characterization of nanomaterials, actinide oxide based semiconductors, radioactive detection, nuclear forensics, wastewater treatments, and environmental remediation.

YEARS AT AFIT: 5

What was your education and career path?

Since my high school days, I have always been fascinated by STEM which led to my PhD in Applied Chemistry in India. In the U.S., I worked as a Research Scientist at the Environmental Protection Agency and eventually found an ideal place at AFIT to continue my professional career and pursue scientific research alongside world-class experts.

What is your favorite part of your job?

Interacting and collaborating with world-class experts in science and engineering and the excitement of learning new technologies. My current organization allows me to continually grow myself technically and professionally as well as mentor the next generation of students and future scientists.

What unique qualities do you think girls and women bring to STEM?

As quoted by Salvador Dali, "Intelligence without ambition is a bird without wings." Along with passion, leadership, and innovation, women bring *ambition* to STEM and inspire the next generation of women scientists, engineers, and doctors. These qualities are essential to succeed in all STEM-associated careers, eventually leading to betterment of the society.

Lt Col Amy Cox, Ph.D., USAF

TITLE: Assistant Professor & Program Chair, Systems Engineering

DEPARTMENT: Department of Systems Engineering and Management

RESEARCH AREAS OF INTEREST: Architecture, innovation, complex systems.

YEARS AT AFIT: 4.5



What first sparked your interest in the STEM field?

My brother's Lego blocks, and later my own. I love trial and error, building and creating. I would take my own toys apart to optimize or hack them. There's nothing like learning (it only took one time) that toy motors will smoke and melt if you rewire them and plug them into the wall.

Who or what were some of the most important influences that guided you to STEM?

My sister Laurie; she forged the mental model that college was just what you did. Also, a mix of rebellion and passion for engineering. My Mom told me I was wasting my time going to college; I'd just fail out and get married, why bother? What self-respecting teenager is going to let their parents be right?

What was your education and career path?

I chose engineering because I love it and the military because I wanted to serve and give back. I have had a winding path, from operations, to engineering, to program management/staff and now academia. I am where I'm at by choice, it's a place where I am constantly learning new things and helping students grow and achieve.

Lt Col Cox returning to base following a final flight (fini flight) with the CV-22.



“ I am extremely grateful to the support that I had from a mentor in AF ROTC, Maj Rick Bowyer. Thanks to his encouragement, I applied to AFIT as a cadet. He saw the supplemental call for applicants, hounded me about applying, and even hand delivered my application to AFIT because he lived near WPAFB. ”



Left inset: Lt Col Cox with dissertation advisor Dr. Zoe Szajnfarber. Cox received a Ph.D. in Systems Engineering through AFIT's Civilian Institution Program.

Lt Col Cox preparing for a flight in an Alpha Jet while serving as an exchange officer at EPNER (France's Test Pilot School) where she completed studies in rotary wing flight test.



Dr. Santasri Bose-Pillai

TITLE: Research Assistant Professor of Engineering Physics

DEPARTMENT: Department of Engineering Physics

RESEARCH AREAS OF INTEREST: Atmospheric characterization, imaging and laser beam propagation through turbulence, coherence and statistical optics.

YEARS AT AFIT: 10

Who or what were some of the most important influences that guided you to STEM?

My mother was the one who primarily guided me to STEM. She was a high school mathematics teacher with a MS in Applied Mathematics. A well-respected educator in the community, her life's goal was to spread her love and interest towards mathematics among her students. That kind of rubbed off on me. I was also fortunate to have some really good science teachers at school.

What was your education and career path?

After high school, I cleared a very competitive entrance exam to get admitted to the electrical engineering program at Jadavpur University, one of the prestigious universities in India. A senior year project on holography got me very interested in optics. After working for two years in the software industry, I came to the U.S. on a student visa to start my graduate studies in electrical engineering with a focus in optics at New Mexico State University. Over the next five years, I worked a research assistant at Dr. David Voelz's lab on AFOSR funded projects and received my MS and Ph.D. After graduation, I taught optics for three years at Rose-Hulman Institute of Technology as a Visiting Assistant Professor. Once I became a U.S. permanent resident, I came to AFIT as a postdoctoral researcher in 2011. I was very happy to be part of the Center for Directed Energy at AFIT and I loved the research and the work environment at AFIT. I have worked on several interesting projects here, published a lot and got a chance to mentor many bright, young minds. I became a member of the faculty in 2017.

What is your favorite part of your job?

What I love about my job is I get to solve interesting problems every day that will directly benefit the Air Force. I also love the fact that I get to share my passion for research with the students and help them grow as independent researchers.



Dr. Julie Jackson

TITLE: Professor of Electrical Engineering

DEPARTMENT: Department of Computer & Electrical Engineering

RESEARCH AREAS OF INTEREST: Radar imaging and signal processing, RF signal exploitation.

YEARS AT AFIT: 11.5

Who or what were some of the most important influences that guided you to STEM?

I come from a family of engineers so STEM was a natural path. I liked electrical engineering best during my freshman engineering class at Wright State. My professors encouraged me to pursue being a professor, though after grad school I considered industry jobs in research and development before starting my career at AFIT.

What do you consider your biggest achievement in STEM?

In 2019, I received the IEEE Fred Nathanson Memorial Radar Award in recognition of my research and my service contributions to the IEEE Aerospace and Electronic Systems Society.

What is your favorite part of your job?

I enjoy all aspects of research: reading literature to learn, simulating and trying ideas (old and new), and technical writing to solidify my understanding and share my findings with others.

STEM CAREERS

AFIT ALUMNI POINT TO STEM DEGREE AS CAREER BOOSTER

Lt Col Olivia “Pi” Elliott, Ph.D., USAF

Current Title: Munitions Directorate Test Lead in AFRL/RW and Deputy Program Manager Tactical Boost Glide

AFIT Degree: Ph.D., Aeronautical Engineering, 2019

What was your education and career path?

I attended the United States Air Force Academy with the goal of becoming a military pilot. In 2000, I graduated from USAFA with a bachelor’s degree in Astronautical Engineering. I went on to obtain my Master’s in Satellite Control Theory and spent eight years flying before entering the U.S. Air Force Test Pilot School where I transitioned into acquisitions as a test pilot. In 2016, I was selected to attend AFIT where I obtained a Ph.D. in Hypersonics Aerodynamics. Currently, I serve as the test lead for the Air Force Research Laboratory’s Munitions Directorate at Eglin Air Force Base in Florida.

How has your AFIT STEM degree helped your career?

Having a STEM degree allowed me to broaden my acquisitions career working in science and technology development and allowed me to bring my operational, test and technical background to support AFRL. It also gave me the opportunity to act as a Deputy Program Manager for a hypersonic demonstration program.

What advantages are there for women in the AF who earn advanced STEM degrees?

Having an advanced STEM degree as a woman in the Air Force opens a great many opportunities to work not only in technical roles but also to assume leadership positions. An advanced degree helps you stand out amongst your peers and provides you with critical thinking skills to better serve the United States.

Lt Col Olivia Elliott climbs up into an A-10 at Edwards AFB, California in 2013.



Maj Elizabeth Scherrer, USAF

Current Title: Electromagnetic Pulse (EMP) Program Lead, AFGSC/A3C

AFIT Degrees: Ph.D., Applied Physics, 2019; M.S. Nuclear Engineering, 2013

Who or what were some of the most important influences that guided you to STEM?

Truth be told, I was watching “Pinky and the Brain” as a child. I declared at that time I wanted to be a government scientist and take over the world, just like Pinky and the Brain. So two cartoon characters motivated me into STEM.

How has your AFIT STEM degree helped your career?

I am on a MAJCOM staff for an operational unit, and I work with aircrew and missileers closely. Having a Ph.D. in Physics brings instant legitimacy to the table. Additionally, scientists from other organizations speak differently to me once they learn about my education.

What advantages are there for women in the AF who earn advanced STEM degrees?

Having a STEM degree in itself sets an individual apart from the rest of the USAF, but it’s even more true for women in USAF since there are fewer of us to begin with.

LTC Christina Dugan, U.S. Army

Current Title: Nuclear Disablement Team Chief, Nuclear Disablement Team – 3, 20th Chemical Biological Radiological Nuclear Explosive (CBRNE) Command, Aberdeen Proving Ground, MD

AFIT Degrees: Ph.D., Nuclear Engineering; 2018, M.S. Nuclear Engineering, 2011



Who or what were some of the most important influences that guided you to STEM?

The most important influences guiding me into STEM were my science educators. Starting with my crazy high school chemistry teacher, Mr. Yost, to my graduate faculty and mentors from the University of Nebraska and AFIT. These folks are my role models; tirelessly mentoring students while pursuing research focused on the nation’s scientific challenges.



LTC Dugan trains on glovebox sampling techniques.

What was your education and career path?

I graduated West Point in 2000 with a Chemistry Life Science Degree and a Nuclear Engineering track. While deployed to Afghanistan in 2007-2008 as a logistics company commander, I was selected to serve as an Army FA52 which allowed me to pursue my Master’s and Ph.D. in Nuclear Physics at AFIT.

How has your AFIT STEM degree helped your career?

An AFIT STEM degree has greatly strengthened my ability to solve complex problems. The problem may be research related or characterizing a component of the nuclear fuel cycle. In addition, my AFIT degree specialized in nuclear weapons and their effects, which correlates directly with my career as an Army’s Nuclear CWMD officer.

Dr. Amanda Bullock

Current Title: Process and Data Integration Team Lead, AFRL/EZD

AFIT Degree: Ph.D., Electrical Engineering, 2013



Who or what were some of the most important influences that guided you to STEM?

My parents, they had me participating in a variety of STEM camps, extra-curricular activities, and advanced math classes. They grew up in rural Appalachia so they made sure I had every opportunity not afforded to them. When I was older, it was my high school calculus teacher and many of my professors.

How has your AFIT STEM degree helped your career?

I would not be an engineer at AFRL without my degree from AFIT.

I arrived at AFIT as a statistician and they molded me into an Air Force engineer. AFIT taught me how to: learn, lead, fail, ask for help, and finally succeed. It was not easy, but it was invaluable.

What advantages are there for women in the AF who earn advanced STEM degrees?

The Air Force is a service that values education; more doors open when you have an advanced degree, especially STEM. Different perspectives and viewpoints are crucial in order to accelerate change in the Air Force. Women bring diverse thought and diverse thought sparks innovative approaches to solving problems.



FEMALE FIRSTS

AT THE AIR FORCE INSTITUTE OF TECHNOLOGY

NOTABLE ALUMNI

FEMALE GRADS MAKE THEIR MARK ON THE U.S. AIR FORCE

1968

FIRST FEMALE GRADUATE
Class 68A (master's in logistics) graduates 104 students. Included is the first female graduate on Aug. 21, 1968.

FIRST FEMALE TO ENTER CIVIL ENGINEERING FIELD

Col (Ret.) Susanne Waylett (M.S. Engineering Management 1984) was the first female to enter the civil engineer career field.

1971

FIRST FEMALE GRADUATE TO EARN PH.D.
Ann Wells is the first female to earn a Ph.D. from AFIT in Dec. 1987.

1987

FIRST FEMALE COMMANDANT

Brig Gen Paula Thornhill assumes command of AFIT from Brig Gen Matthews as AFIT's first female commandant on Oct. 3, 2006.

2006

2020

FIRST FEMALE CAO

Dr. Heidi Ries is selected as AFIT's first Chief Academic Officer (CAO) in Feb. 2021. She is charged with overseeing and ensuring the highest standards of academic quality in both graduate and professional continuing education instruction and research.

2021



U.S. Air Force photo



DID YOU KNOW?

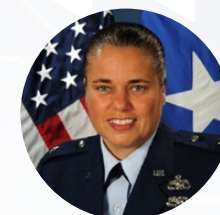
Lt Susanne M. Waylett (M.S. Engineering Management 1984), then Ocobock, was personally welcomed to the Air Force by the Air Force Vice Chief of Staff Gen. John C. Meyer in 1971 (shown above). In April of that year, she became the first female to enter the civil engineer career field. She went on to become the first female civil engineer squadron commander in 1987 and the first female CE to reach the rank of colonel in 1993. Waylett, who retired in 2000 as the commander of the 10th Civil Engineer Group, U.S. Air Force Academy, Colorado Springs, paved the way for other women in the career field.



Brigadier General Rosanne Bailey, USAF, Retired
M.S. Engineering Management, 1984
Served as commander, Cheyenne Mountain Operations Center, Cheyenne Mountain AFS, CO



Colonel Eileen A. Bjorkman, USAF, Retired, SES
M.S. Aeronautical Engineering, 1986
B.S. Aeronautical Engineering, 1982
Executive Director, Air Force Test Center, Air Force Materiel Command, Edwards AFB, CA



Brigadier General Linda S. Hurry, USAF
M.S. Transportation Management, 1995
Director of Logistics, Deputy Chief of Staff for Logistics, Engineering and Force Protection, Headquarters U.S. Air Force, Arlington, VA



Major General Susan K. Mashiko, USAF, Retired
M.S. Electrical Engineering, 1986
Served as Deputy Director, National Reconnaissance Office, and Commander, Air Force Space Command Element, National Reconnaissance Office, Chantilly, VA



Ms. Claudia V. Kropas-Hughes, Ph.D.
Ph.D. Electrical Engineering, 1999
Policy advisor for technology transition activities, Air Force Materiel Command, Wright-Patterson AFB, OH.



Colonel Leigh E. Method, USAF, Retired, Senior Level Executive
M.S. Transportation Management, 1998, Distinguished Graduate
Deputy Director of Logistics, Engineering and Force Protection, Headquarters, Air Mobility Command, Scott Air Force Base, IL
Selected for assignment to Deputy Assistant Secretary of Defense for Logistics, Office of the Under Secretary of Defense for Acquisition and Sustainment, Pentagon, Washington, DC

“My time at AFIT was invaluable to me. I worked with some of the best minds in the country. My career has been shaped by my time there. Air Force issues can be unique and intricate, and solving those problems requires innovative thinking, as well as a dedication to the U.S. Air Force – both of which I learned at AFIT!”
—Dr. Kropas-Hughes

AFIT GSEM vs ASEE Engineering Academic Statistics by Gender



AFIT GSEM vs ASEE Engineering Faculty by Gender

Engineering Tenured & Tenure-Track Faculty Totals

GSEM

Graduate School of Engineering & Management

3.5%
Female
96.5%
Male



ASEE

American Society for Engineering Education

18.5%
Female
81.9%
Male

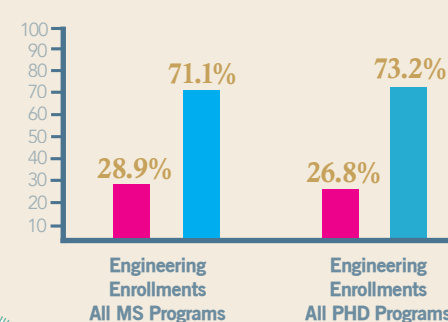
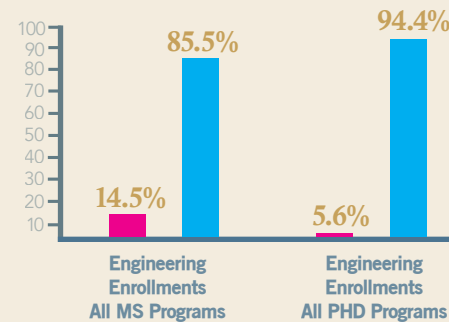


SOURCES: Same as Engineering Academic Statistics by Gender information.

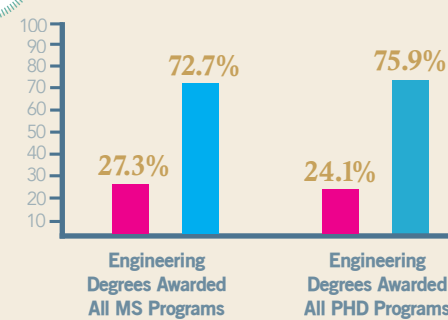
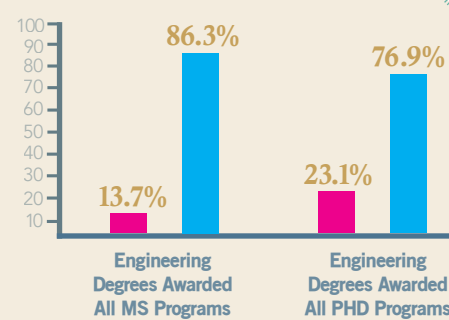
GSEM – Graduate School of Engineering & Management

ASEE – American Society for Engineering Education

ENROLLMENTS BY GENDER



Female
Male



DEGREES BY GENDER

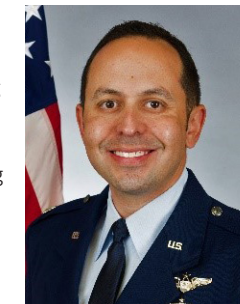
SOURCES: GSEM Numbers: AFIT Institutional Research - Apr 2021; ASEE Engineering by the Numbers: <https://ira.asee.org/wp-content/uploads/2021/02/Engineering-by-the-Numbers-FINAL-2021.pdf>; Learn how ASEE collects data: Visit <https://ira.asee.org/surveys-and-data-collection/>

Alumni Profile: Lt. Col. Proano

By Katie Scott
Air Force Institute of Technology

Lt. Col. Zac “CHAOS” Proano earned a master’s degree in applied mathematics from the Air Force Institute of Technology’s Graduate School of Engineering and Management in 2006. “I valued my time at AFIT and enjoyed being able to focus as a full-time student on active-duty immediately after commissioning. It was eye-opening to experience what graduate-level work is like. It was challenging, but also a huge confidence booster,” recalled Proano. “I give full credit to Dr. [Aihua] Wood, my thesis advisor, and Dr. [Alan] Lair who really helped me with my studies. They took more time with me than I would have received at a civilian university. They really helped get me across the finish line, and I wouldn’t be where I am today without their guidance early in my career.”

His graduate thesis titled “Existence of Large Solutions to Non-Monotone Semilinear Elliptic Equations” focused on semi-elliptic partial differential equation theory and was published in the *Australian Journal of Mathematical Analysis and Applications* in 2007. The effort to research and write a thesis has proven beneficial for Proano who said “it provided me with a larger aperture academically and cognitively to succeed in a variety of missions throughout my career.”



Lt. Col. Zac “CHAOS” Proano,
M.S. Applied Mathematics,
(2006).

during the thesis phase, when I thought I wasn’t going to finish, but that is where you have to lean on relationships forged, and remember your professors want you to succeed, seek their counsel early and often. Find moments to enjoy small victories each quarter, and keep perspective on the great things yet to be achieved.”

Following graduation, Proano was a Flight Test Engineer and Operational Analyst for Air Force Special Operations Command and later selected to attend Undergraduate Flight Training as a Combat Systems Officer (CSO). He was the number one overall graduate of his class, distinguished graduate, academic award winner, and recognized by the Daughters of the American Revolution as the number one overall CSO Student of the year in 2010.

Proano’s current assignment is the Analysis Branch Chief in Headquarters Air Force Strategic Planning Integration Division (AF/A8XP), where he is in charge of developing the Air Force’s 30-year resource allocation plan. “Blessed and humbled to have the opportunity to serve in A8; you get to see every aspect of where the Air Force is going in the future, at a very high level,” said Proano. It’s a very challenging and rewarding assignment, especially balancing fiscal constraints and accelerating desired capabilities, but Proano and his team remain focused on bringing future high-end fight capability to the here and now much faster. “It’s rewarding to come full circle in my career and apply some analysis rigor, using knowledge the AFIT team helped me develop,” said Proano.

Proano is also a B-52H Instructor/Evaluator WSO and most recently served as the Chief Flight Examiner for all of Air Force Global Strike Command and Deputy Division Chief for AFGSC/A3T. Additionally, he served three years in a data masked assignment as an F-16D Test WSO responsible for a \$5 billion dollar portfolio of 100 classified programs. A rated Senior CSO with 1,492 flight hours, he led initial flight testing of the MC-130W and TH-1H helicopter, flew over 70 national priority test missions supporting F-35, F-22, B-2, advanced prototype aircraft, and has flown 15 aircraft during his career.

“My education at AFIT provided an amazing foundation for my entire career,” said Proano. A foundation he would like to expand by continuing his pursuit of being an astronaut, which was a driving force for Proano joining the Air Force. In 2016 and then again in 2020, he was selected by the Air Force as an astronaut candidate to NASA.

Alum Leads International Space Collaboration

By Jeanne Dailey
Air Force Research Laboratory

Air Force Research Laboratory exchange officer to the United Kingdom and AFIT alum, Capt. Jacob Singleton (M.S. Astronautical Engineering, 2016), plays an important role in promoting international cooperation in military research, development and acquisition among the United Kingdom (UK), United States and other North Atlantic Treaty Organization countries.

Through the Department of Defense Engineer and Scientist Exchange program, Singleton has been working with the Space Program at the Defence Science and Technology Laboratory (Dstl) for the UK Ministry of Defence since 2019. He is the space innovation lead, where he heads up Dstl activities focused on working with new startup space ventures.

“I focus on new efforts to exploit emerging commercial space technologies from the private sector to match those with defense needs,” Singleton said. “In many ways this extends my work at AFRL’s Space Vehicles Directorate where I led the development of the space accelerator programs to fast track commercial space technologies to close capability gaps for the warfighter.”

“My role at Dstl has been important in the UK because it has allowed our US-UK collaboration to focus on innovation programs that align our efforts into becoming more relevant customers, in the international marketplace. It is our first step in focusing collaboration on a new priority – the adoption of emerging R&D from the global private sector.”

Article reprinted and edited for length.

SNAPSHOT

TOTAL 2020
USAF NUMBERS =

329,839 Active Duty
64,025 Officers
265,814 Enlisted

USAF WOMEN

69,722 = 21.1%



WOMEN IN THE USAF



» What percent of USAF officers are women?

22.4%

» What percent of USAF enlisted corps are women?

20.8%

QUICK STATS

838 female pilots
375 female navigators
252 female air battle managers

USAF Female Firsts

Women first entered pilot training in 1976, navigator training in 1977 and fighter pilot training in 1993.

Col. Sebrina Pabon is the first female to serve as commandant of the USAF Test Pilot School at Edwards Air Force Base, Calif. in 2020.



CALENDAR EVENTS

JUNE 2021

AFIT Graduate School Summer Quarter Classes Begin

AFIT Campus, WPAFB, OH | 28 Jun 2021

AUGUST 2021

AFIT Graduate School Fall Quarter Registration Begins

AFIT Campus, WPAFB, OH | 02 Aug 2021

AFIT Graduate School Graduation Applications Due

AFIT Registrar's Office | 13 Aug 2021

SEPTEMBER 2021

AFIT Graduate School Summer Quarter Classes End

AFIT Campus, WPAFB, OH | 02 Sep 2021

AFIT Graduate School Summer Graduation (No Ceremony)

AFIT Campus, WPAFB, OH | 16 Sep 2021



AFIT FACULTY SEARCH



To search for AFIT Graduate School faculty members and view their research areas of interest, please visit

www.afit.edu/BIOS

AFIT Receives the Air Force Organizational Excellence Award

The Secretary of the Air Force and commander of AETC awarded the Air Force Institute of Technology with the Air Force Organizational Excellence (AFOEA) Award for exceptionally meritorious service for the time period of 1 July 2019 through 30 June 2020.



AFIT distinguished itself during this period as it adapted to the coronavirus pandemic and safely provided education to over 30,000 total force and foreign military allies representing the acquisition, logistics, civil engineering, medical, cyber, and other career fields. The Graduate School of Engineering and Management awarded accredited science, technology, and mathematics advanced degrees to over 300 graduates, while it continued to expand its portfolio of high-demand programs. The Institute's research centers developed products and expertise across the Department of Defense, conducting over 23 million dollars in defense-focused sponsored research in areas to include on orbit space situational awareness, sensor development, cyber, and many others.

The Civil Engineering School enrolled 9,600 students, the School of Strategic Force Studies enrolled 2,300, and the School of Systems and Logistics graduated 16,500 students, all while converting some initial skills training to distance learning. Finally, the Civilian Institutions program managed 1,900 medical students and 600 Airmen pursuing advanced degree programs, generating over 1,000 medical and legal professionals. The distinctive accomplishments of the members of the Air Force Institute of Technology reflect great credit upon themselves and the United States Air Force.

The Secretary of the Air Force authorized the AFOEA in August 1969 to recognize the achievements and accomplishments of USAF organizations or activities. It is awarded to Air Force internal organizations that are entities within larger organizations. They are unique, unnumbered organizations or activities that perform functions normally performed by numbered wings, groups, squadrons etc.

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