2023

FY2022 Annual Report of the Graduate School of Engineering and Management, Air Force Institute of Technology

Office of the Dean of the Graduate School of Engineering and Management, Air Force Institute of Technology

Adedeji B. Badiru
Air Force Institute of Technology

FY2022 ANNUAL REPORT

AIR FORCE INSTITUTE OF TECHNOLOGY

GRADUATE SCHOOL OF ENGINEERING & MANAGEMENT

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The annual report is published each year by AFIT's Office of the Dean, Graduate School of Engineering and Management at Wright-Patterson Air Force Base, Ohio. It shares information about the activities of the Graduate School with the U.S. Department of the Air Force (DAF), Department of Defense (DoD), and wider public. All images are DAF, AFIT-owned or used with permission unless otherwise identified. The DoD, other Federal Government, and non-Government agencies supported the research reported herein but have not reviewed nor endorsed the contents of this publication.

A MESSAGE FROM THE DEAN

Welcome to the 2022 Annual Report of the Graduate School of Engineering and Management at the Air Force Institute of Technology.

As in the past, exciting developments are happening in our classrooms, laboratories, and research centers. We used to proclaim how we were laser-focused on diverse technologies. That claim has now been elevated to being hyper-focused on emerging technologies, particularly hypersonics, space, digital engineering, artificial intelligence, and quantum systems. The 2022 annual report covers a selection of such technologies that our Graduate School is actively engaged in.

AFIT is a direct beneficiary of the ongoing resurgence of the focus on research and innovation at the Air Force level. The emergence of the Space Force has created new academic and research opportunities that we are tapping into. We continue to teach what we research and research what we teach. This has increased our return-on-investment value to the Department of the Air Force, sister services, and the Department of Defense.

We cannot ignore the ongoing conflicts around the world, which threaten to disrupt the basic foundation of democracy. Technology is playing a more significant role in helping to defuse, resolve, and/or mitigate the disruptive platforms of international conflict. I continue to challenge and encourage our students, faculty, and researchers to leverage the legacy of the Air Force Institute of Technology to make intellectual and operational contributions wherever and whenever we are called upon.

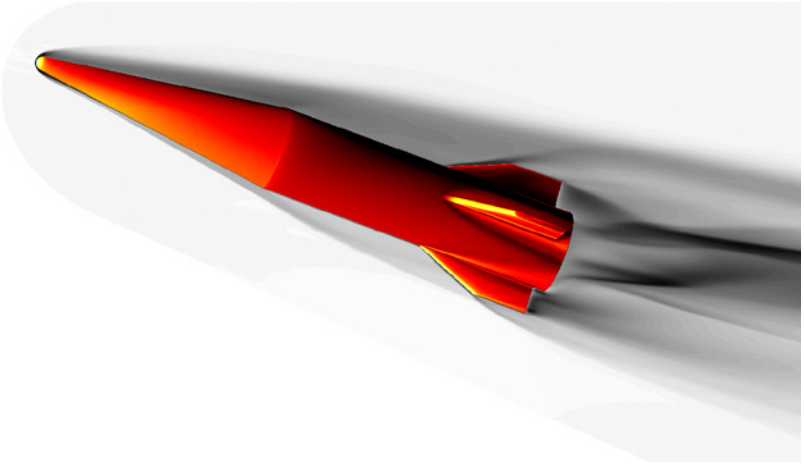
Through this annual report, please join us on our dedicated journey of excellence in meeting the needs of our national defense as well as the needs of society at large. We look forward to your continuing engagement and advocacy for the academic and research programs in the Graduate School of Engineering and Management at the Air Force Institute of Technology.

With the best of AFIT regards to all,

Adedeji B. Badiru, Ph.D., PE

Adedeji B. Badiru
Dean, Graduate School of Engineering and Management

Graduate Certificate Program in Hypersonic Flight



High fidelity simulation of a representative hypersonic vehicle showing surface heating and flowfield shock structures.

Lt Col Robert MacDermott

The Air Force Institute of Technology's Department of Aeronautics and Astronautics is proud to offer a Graduate Certificate Program in Hypersonic Flight. The field of hypersonics has emerged as a technical discipline that is critical to ensure the United States will be able to fight and win future conflicts. The Graduate Certificate in Hypersonic Flight is specifically designed to produce technical professionals who can understand, evaluate, and communicate the unique complexities of the hypersonic flight environment.

The program consists of a rigorous collection of graduate level courses. The courses are offered in-residence at the AFIT main campus located on Wright-Patterson Air Force Base, Ohio. Students must complete three (3) core classes and then select one (1) elective course, for a total of 16 quarter of graduate level studies. The three (3) core courses cover the areas of inviscid hypersonic flows, high temperature gas dynamics, and hypersonic propulsion. The one (1) elective course may further the student's understanding in either computational fluid dynamics, nonequilibrium phenomena, reentry dynamics, or chemical propulsion.

Upon completion of the program, graduates will have a general understanding of the differences between hypersonic flight regimes and the subsonic and super-sonic flight regimes which make the hypersonic environment unique. They will also have a thorough understanding of the aerothermodynamic properties of hypersonic flows and how to approach and appropriate engineering analysis given hypersonic flight conditions. Finally, graduates will be equipped with the skills needed to critically analyze hypersonic vehicle systems and subsystems at the appropriate fidelity.

Registration is currently open for students who wish to apply. Prospective students should hold an ABET-accredited degree in aeronautical, aerospace, astronautical, or mechanical engineering with a cumulative GPA of 3.0 (on a 4.0 point basis) in that degree. Waivers to the degree or GPA requirement may be considered on an individual basis. Questions about the certificate program may be directed to the program chair, Lt Col Robert MacDermott.

More details available online at:
https://e.AFIT.edu/Nb13nn

AFIT Data Science Master of Science Degree

Dr. Mark Gallagher

Deputy Secretary of Defense David Norquist published the "DoD Data Strategy" in September of 2020. One of the four essential capabilities listed is talent: service members and civilians empowered to use data empowering operations. In response, the Department of the Air Force (DAF) created the Chief Data Officer, and the new Space Force is becoming a "digital service" to accelerate innovation. However, the ability to recruit high-end data scientists is extremely challenging with their many opportunities across the private and public sectors.

The Air Force Institute of Technology (AFIT) is responding to educate data scientists within the Air Force and Space Force, along with the rest of the DoD. AFIT created an academic specialty code for data science (OCCE) so units may code their billets to require this education and so data scientists serving in the Air Force may be easily identified. Furthermore, the AFIT Department of Operational Sciences initiated a Master of Science in Data Science program in September of 2021. This 18-month in-residence program's core courses provide the desired mathematical and statistical foundations, along with education in data engineering, as well as knowledge in developing artificial intelligence and machine learning (AI/ML) algorithms. The electives enable the graduate students to explore diverse topics, such as computer vision, data wrangling, text mining, and reinforcement learning. The thesis research hones their skills to address real DoD challenges using and exploiting data for better performance.

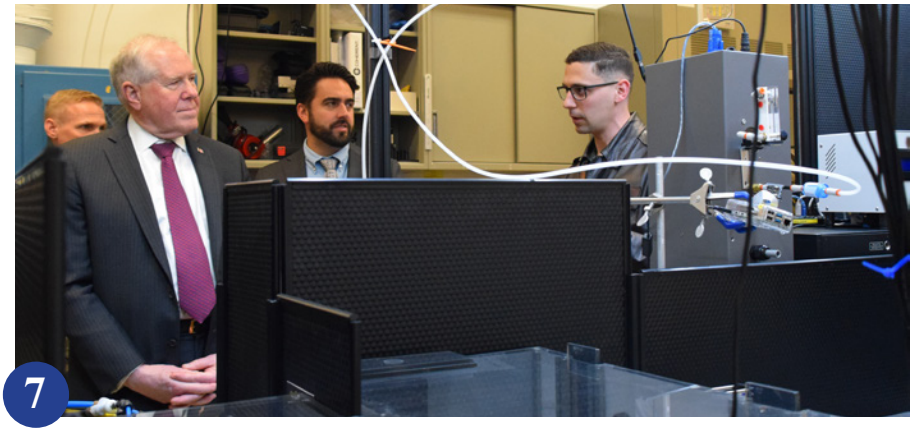
The first cohort in the data science degree started in September of 2021 and graduates in March of 2023. These seven officers span the career fields of operations research analysts, cyber operations, and engineering. Additional Wright-Patterson Air Force Base civilian and military part-time students are pursuing this degree. In today's fast-paced, information-dense warfare, all occupational fields are inundated with data; thus, technical experts from diverse backgrounds benefit from this data-centric education.

Beginning with the thesis research from its first cohort, AFIT is developing numerous lines of relevant research. Current research spans data on medical, contracts, and target images. As a partial list of examples of cutting edge research AFIT Data Science students are: developing insight to tailor virtual reality pilot training to ensure trainees maintain optimal stress levels via psychometric data; creating new computer vision models which output accurate classifications with well calibrated certainty measurements; enhancing algorithms to engage in autonomous air-to-air dogfighting; and many additional topics spanning the gamut from basic research to operational issues.

The Department of Operational Sciences continues to grow this vital data capability, and recently hired new faculty with data engineering expertise. The department also developed a PhD in Data Science, and the professors are eager to start educating their first students. Potential students should contact the department. Units desiring officers with data science degrees should code their billets with the academic code OCCE. Organizations with significant data challenges should discuss potential research with the faculty.

For more information beyond the AFIT website, contact MS in Data Science Program Chair Dr. Mark Gallagher at mark.gallagher@us.af.mil.

RESEARCH HIGHLIGHTS



1) Dr. Carl Hartsfield in the Space Propulsion Analysis and Simulation System Vacuum Chamber with a commercially sourced 600W permanent magnet Hall Effect Thruster. 2) Dr. Robert Leishman speaks to Dr. Wendy Walsh, Air Education and Training Command Chief Learning Officer in the Autonomy and Navigation Technology Center. 3) U.S. Army Capt Jeremy Hunter, Maj Christopher Sutphin and Dan Felker in the Environmental Analytical Lab. 4) Dr. Steven Fiorino, Professor of Atmospheric Physics and Director of the Center for Directed Energy, discusses miniaturized optical turbulence sensors integrated on AFIT's small unmanned aircraft system (sUAS). 5-6) 2d Lt Jack Haynes in the Geo-Satellite Nano-Propulsion Technology Lab (GNaT Lab) evaluating a commercially sourced cold-gas thruster unit for Cube Sats. 7. Capt Benjamin Rinaldi discusses his efforts to characterize the effects small nano-sized aerosols can have on lasers and their effectiveness in future military operations with Secretary of the Air Force Frank Kendall.

Bilateral Enterprise Analysis Model (BEAM)

Dr. Mark Gallagher

The defense analytic community needs a campaign simulation to rapidly examine potential military strategies and force structures. Military strategy prioritizes the missions and their targets, by combat phases. Current campaign models embed the military strategy into the tactical data so testing alternative strategies is, in essence, impossible. Hence, while analytic centers can recommend the optimal force mix given to a military strategy, they cannot evaluate alternative strategies in a timely manner.

In response, the Secretariat of the Air Force (SAF) Studies and Analyses (SA) began exploring alternative modeling approaches to address this challenge of searching and evaluating potential military strategies along with rapidly evaluating force structures. They developed a lower-resolution approach that employs statistical distribution of combat assets in large geographic regions. This modeling concept focused on missions, which are collections of assets, rather than individual units or systems. Their initiative grew into the BEAM project. In 2020, SAF/SA appointed Dr. Mark Gallagher, AFIT Professor of Practice, as the BEAM Product and Integration Manager.

With funding from Air Force Research Lab (AFRL), particularly Strategic Development, Planning, and Experimentation (SDPE) office, along with Space Force Space Operations Command (SPOC), Linquest has continued the BEAM development and deployment. BEAM employs a new modeling approach that addresses uncertainty through simulation threads and without the computational burden of replications. Dr. Gallagher has used BEAM in three AFIT classes to propose new approaches to determine a military force structure and develop an approach to find cost-imposing strategies. Additionally, his PhD student is developing a game theory approach to improve the allocation of forces for both opponents.

The Linquest BEAM development team continues to enhance the model. The current version is a tool that evaluates ground, maritime, air, and space systems and units in joint fight against an adaptive adversary. The model makes it easy to build scenarios, evaluate force structures and infrastructures, and test alternative military strategies.

The Air Force approved the release of BEAM to government organizations, defense contractors, academia, and foreign partners. In September, Linquest produce a BEAM package of software, database, user manual, and training videos. So far, Air Force, Space Force, Army, Marine Corps, one foreign government, three major defense contractors, and several universities have requested and received BEAM. Over 30 organizations are evaluating BEAM. The North Atlantic Treaty Organization (NATO) Modeling and Simulation (M&S) Panel is investigating BEAM as part of their NATO Next Generation M&S initiative.

Contact mark.gallagher@us.af.mil or beam@linquest.com for more information.

Air Force Cadet Non-Rated Line Officer Career Field Assignment Problem

Lt Col Jesse G. Wales

The mission of the Air Force Personnel Center (AFPC) is to "develop and deliver innovative, customer-focused Total Force support solutions to commanders, Airmen and families." Part of this mission is matching non-rated line (NRL) officer career fields to cadets from the United States Air Force (USAF) Academy and Reserve Officer Training Corp (ROTC). Every year nearly 2,000 cadets are matched to about 40 career fields. The outcome of this matching affects i) career field health, such as having the right number of high-quality and qualified Airman within the career field in the short and long term, and ii) the performance of the officer, such as satisfaction with their career field, promotions, and their likelihood of staying in the career field and the Air Force.

Currently, AFPC uses a deterministic optimization model, the NRL classification model, to inform cadet career field decisions. This integer programming model seeks to balance the needs of the AF, career field requirements, and cadet interests and includes priorities such as: fulfilling career field targets, meeting education requirements, balancing cadet merit and source of commissioning across large career fields, and considering cadet preferences. In recent years, the NRL classification model has failed to achieve a feasible matching solution that satisfies all the constraints, and/or results in a solution that requires many changes to meet a growing number of priorities.

An operations research master's student at AFIT developed an improved methodology to match USAF Academy and ROTC cadets to NRL officer career fields. This methodology presents a new approach to the cadet matching problem. Rather than provide a one-size-fits-all formulation of the assignment problem, a Value-Focused Thinking (VFT) framework is applied, in conjunction with an optimization model using the framework, to measure overall solution quality for an alternative assignment of cadets to career fields, given numerous weight and value parameters. The power of optimization under a VFT framework is in the ability to capture what decision-makers want, as well as how much they want it. This approach allows each career field manager and AFPC to identify the value structure of the competing requirements and determine trade-offs between cadet and career field priorities. This research shows that the new VFT model outperforms the original model on solution quality by almost 7% on average when measured using many different VFT weight and value parameters on real class year instances. Additionally, the AFIT-developed methodologies use Python with open-source packages/solvers to determine solutions. The student that led this research is now assigned to AFPC, his VFT model was chosen over the previous integer programming approach to make the cadet career field assignments for a recent year group. AFPC and the career field managers prefer this approach and it has become the new standard other methods will be evaluated against.

Conformal Prediction Approach to Quantify Student Pilot Error via Multimodal Physiological Signals

By 1Lt Gregory Barry USAF (PhD Candidate, Department of Operational Sciences)

The United States Air Force has struggled to quickly and properly train new pilots to maintain the needed number of airmen for all necessary operations. The force has suffered delays to begin training, as well as prolonged training curriculums with extended pauses, causing a grave deficit in pilots needed versus pilots available. Using physiological and positional data recorded from simulated flights, we hypothesize that within this multimodal recording, there are key features which allow for accurate, autonomous scoring of pilot error. Through correctly predicting error in training flights within an allowable range, we can eliminate mundane duties of instructor pilots and focus them instead on personalized and individual training for individual student pilots.

Our research focuses on different feature selection techniques and applications of machine learning methods, along with uncertainty quantification, to produce models which utilize the key physiological features to properly predict error. Figure 1 illustrates the methodological process we implement throughout our research to transform vast recordings of pilot data to implementable models which quantitatively define a student pilot's performance.

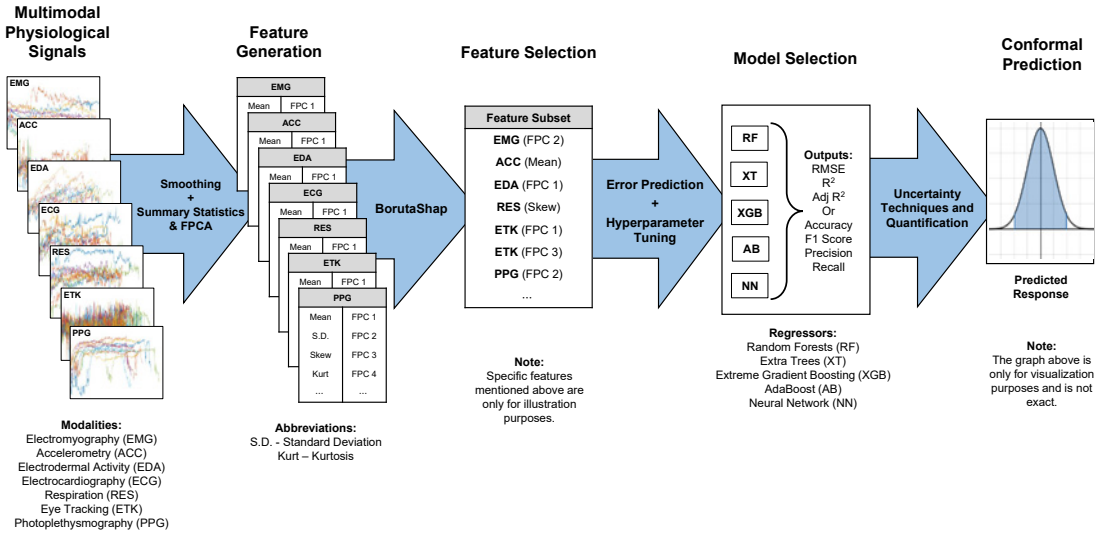


Figure 1. Research Pipeline Architecture

We aim to identify and minimize the necessary signals in-order to suggest physiological sensors to be integrated into the pilot-training curriculum to enable automatic scoring and potential prediction of future error. Explainability and application of results found is paramount in finding a method to apply this across all pilot-training units, expediting the demand to update pilot training for 21st century needs.

Uncertainty quantification utilizes the allowance of error to fluctuate, and enables a range of results with increased accuracy that will engage instructor pilots to grasp key statistics of a student's performance. Such technological improvements, paired with pilot training policies that minimize that instructors a student flies with, will create a more efficient and intentional pilot-training experience that will propel the United States Air Force into the future, easily meeting mission demands and strengthening our pilot force.

Artificial Debris Collision Risk Following a Catastrophic Spacecraft Mishap in Lunar Orbit

Mr. Nathan Boone USAF/NASIC (PhD Candidate, Department of Aeronautics & Astronautics)

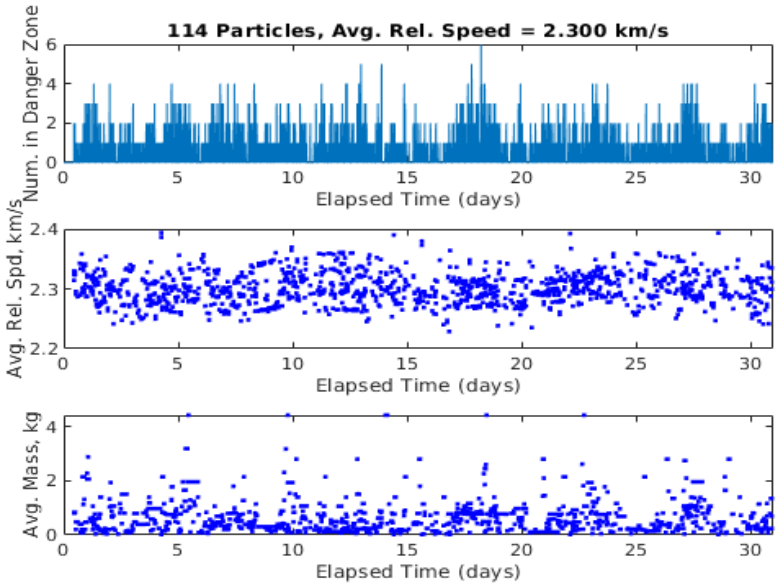
Over the past several years, interest in lunar exploration has begun to increase, with a variety of new space missions operating in the lunar orbital region. These new space operations include international missions to the Moon such as China's 2018 Chang'e-4 far side lunar lander, Israel's 2019 Beresheet mission, India's 2019 Chandrayaan-2 mission, and China's 2020 Chang'e-5 lunar sample return mission. Furthermore, NASA plans to return humans to the Moon through the Artemis program within the next decade. The Artemis program aims to provide manned landings on the Moon, lunar colonization, and a manned space station near the Moon called the Lunar Gateway. Increased international access to and potential exploitation of the lunar environment will necessitate an expansion of U.S. Space Domain awareness and space control efforts in the cislunar and lunar environments to ensure continued U.S. freedom of action beyond the confines of geosynchronous orbit. The multi-body gravitational field of the general Earth-Moon system, coupled with the highly non-spherical and irregular lunar gravitational potential create a non-traditional operating environment for U.S. space vehicles that will require the development of computational intensive and complex dynamical models to accurately conduct mission planning and execution. Increased interest in manned exploration of the Moon is expected to lead to even greater numbers of spacecraft operating in the lunar region in the coming years.

As more spacecraft operate in the lunar region, the lunar space environment may become more crowded. As lunar orbit becomes more crowded, then proper debris management techniques may be required to avoid a potential scenario much like "Kessler Syndrome," where a cascading series of collisions in lunar orbit renders certain lunar orbits unusable. Spacecraft congestion, international competition for cislunar/lunar access, and any debris events that may arise from expanded cislunar/lunar operations will undoubtedly threaten the resiliency of proposed U.S. national and commercial space architectures and systems intended for this environment. Artificial debris events of this nature in Earth orbits have been heavily studied, but very few studies have examined the risks from artificial debris in orbits beyond Earth or around other celestial bodies. Debris in lunar orbit could be consequential due to small size of the Moon, which provides more opportunities for intersections with debris, and the lack of atmospheric drag around the Moon, which could cause particles to remain in orbit for extended periods of time.

The collision risks to spacecraft from notional, artificial debris is determined through computer simulation of debris motion following a catastrophic spacecraft mishap. The catastrophic mishap is modeled through a statistical model previously developed by Boone that generates the masses and velocities of debris particles released in a simulated catastrophic battery explosion. Debris particle trajectories are then simulated in a lunar-centric reference frame incorporating the gravitational forces of the Moon, Earth, and Sun, with the non-spherical lunar gravitational field captured by the dynamical model to enhance simulation realism. Finally, the survivability of a notional lunar spacecraft moving through the debris field is computed by applying a variation of the Poisson survivability model. In this model, the debris density within a spherical "danger zone" is used to calculate the probability of intersection with a smaller spherical "hazard zone" that bounds a notional spacecraft threatened by debris. The result of this survivability analysis is the probability of hazard, or the probability that a debris particle capable of destroying the spacecraft will enter the hazard zone sphere. The survivability of the notional spacecraft is evaluated for several scenarios, each involving different initial conditions for both the notional spacecraft and the spacecraft suffering the mishap.

Initial results show that a mishap in lunar orbit results in significantly greater risk probability than mishaps in other regions of cislunar space. Using similar methodology, previous work by Boone and Bettinger found probabilities of hazard to spacecraft in the vicinity of an explosion of a 1,457 kg spacecraft near the Lagrange points to be approximately 4 × 10−8% over a 50-day period. The probabilities of hazard obtained in the present study are far higher, on average approximately 1.4 × 10−3%, despite featuring a smaller mishap and a shorter simulation. This higher percentage is due to the gravity well of the Moon that confines the debris to a small region following the explosion. This leads to a greater risk to other spacecraft operating in the vicinity of the mishap.

For all simulations, the overall average velocity of the debris particles in the danger zone relative to the notional spacecraft was very close to 2.31 km/s, which was the difference in velocity between the notional spacecraft's orbit and the initial pre-explosion polar lunar orbit. This is expected because the explosion adds random velocity vectors to the original velocity vector, so the average velocity across all particles remains close to the original velocity vector. We assess that impacts at this velocity will penetrate the spacecraft's Whipple shield for all but very small particles. The following figure outlines the number of particles in the notional spacecraft's danger zone, as well as the relative speed and mass of these particles for a single simulation run.



While the computed average probability of hazard is low for colliding with debris in lunar orbit, this probability would likely create some concern in a real-world scenario, and it may raise the risk from debris collision in lunar orbit to levels comparable to the risk in Earth orbits. Additionally, the risk did not diminish noticeably after one month for the initial conditions selected, likely indicating potential long-term debris hazards to lunar spacecraft from the mishap. The results of this study demonstrate the need to consider debris mitigation strategies in lunar orbit, especially as more spacecraft begin to operate in this orbital environment.

Future studies of lunar debris could better characterize the risks from a catastrophic mishap by simulating a mishap that generates more debris particles, simulating the particles for longer periods of time, varying the initial lunar orbit of the spacecraft that suffers the mishap, and studying the risk to notional spacecraft in other types of lunar orbits. Longer simulation time periods would enable an understanding of the longevity of lunar debris, which would be important to understand the likelihood of accumulation of debris in lunar orbit over time, and potentially affect systems engineering decisions regarding the inclusion of survivability enhancement measures (e.g., impact shielding) in vehicles operating in this environment. It becomes more important to fully evaluate the risks that could be posed by artificial lunar debris as USSF cislunar missions and civil crewed lunar operations begin over the next decade.

Evaluation of Collision Hazards in Low Earth Orbit to Aid Space Policy Development

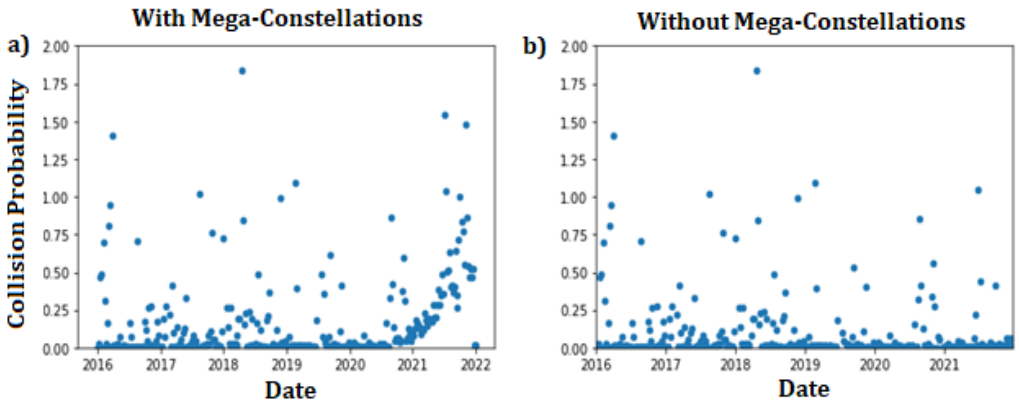
Lt Col Daniel Moomey USSF (PhD Candidate, Department of Aeronautics & Astronautics)

Over one million orbital conjunction data messages (CDMs) are generated each day by the 18th Space Defense Squadron (18 SDS). They alert satellite owner/operators (O/O) all around the world of upcoming conjunctions. The 18 SDS' efforts to identify these hazards and enable monitoring and mitigation by the O/O, of the risks of collisions fits squarely in the Department of the Air Force's space operations safety mission by reducing the calculated probability of collision (Pc) through measures such as orbital maneuver and/or changes in vehicle orientation to minimize the cross-sectional area in the direction of the potential collision. While this mission has proven necessary to maintain today's space order of battle, it is also somewhat of a myopic approach as humanity transitions towards a proliferated low Earth orbital environment.

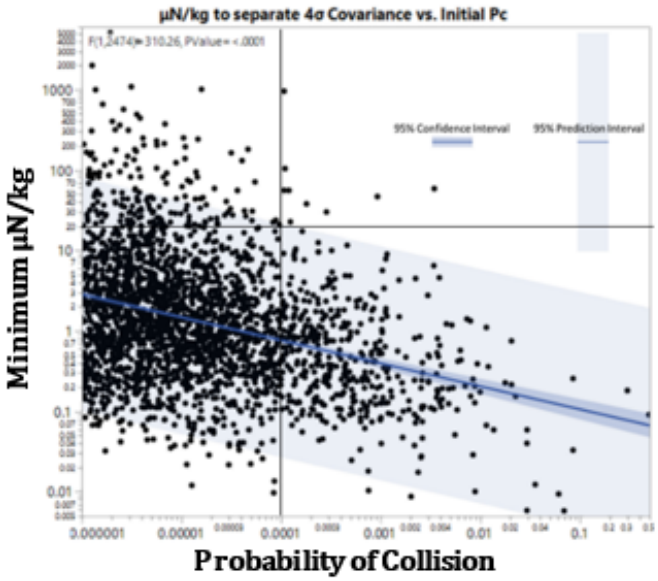
From the perspective of the O/O, the Pc=Risk. Now, traditionally risk is the product of the probability of an unfavorable outcome and the consequence of that outcome. From the O/O's perspective, any collision with a cataloged object can be expected to be catastrophic to its mission. However, that only considers the first order consequences to the space order of battle. The larger and longer-term consequence should also consider how such a collision affects the sustainability of the operational environment, and in doing so research suggests that not all collisions are catastrophic.

Tools such as NASA's Standard Satellite Breakup Model, the ESA's MASTER model, and the Aerospace Corporation's IMPACT model provide the information necessary to characterize the consequence of a collision to the environment in terms of the number, size, and velocity distribution of debris products from a collision. These models have been used to perform analytical assessments of how the sustainability of the low Earth orbital environment may change over time. However, this has not been demonstrated or validated using empirical data on a mass scale. Doing so will help answer questions such as "how bad is the problem of orbital debris generation from collisions?" and "How quickly is it getting worse?". The question of "How do we solve the orbital debris problem?" is frequently asked, but before that question can be answered, we must first learn how bad the problem is and how quickly its changing. Unfortunately, the 18 SDS is not currently equipped or charged with that mission set.

AFIT's CSRA is working to build analysis capabilities which aim to address these questions through access to the historical CDM repository through Space-Track.org dating back to 2016. The repository is now some 300+ Million events large. CSRA is partnering with HQ Air Force Safety Center to integrate these analytical tools with the back-end environment at space-track.org, fusing the existing empirical data with established models. Doing so enables statistical analyses and inference of orbital environmental trending metrics. Such metrics can then be regularly reported and be leveraged to inform policy decision makers on the state of the environment and how it is changing, from the perspective of historical empirically observed events for the first time. Preliminary uncalibrated results are shown Subplot (a) on the next page, depicting integrated weekly collision probabilities over time. The remarkable upward trend beginning in 2020 should not necessarily be cause for alarm, as these results do not currently account for maneuver mitigations. Though, when the Starlink and OneWeb constellations are removed from the plot, it changes drastically, as is shown in Subplot (b). This implies that a high post mission disposal reliability (PMD) will be critically important to the future sustainability of the environment, and as the 2019 update to the U.S. Orbital Debris Mitigation Standard Practices indicates, 90% PMD will not be sufficient, and that we should consider making it an engineering priority to strive for 99% or better PMD.



Preliminary results have yielded recommendations to the FCC on their Notice of Proposed Rule Making effort in 2019, which recommended a set of minimum maneuverability requirements. Analysis of historical CDM information was able to yield a recommendation for a prescriptive requirement of a minimum acceleration threshold for such a requirement, which had not been previously analyzed prior to the publication of the draft rule. The figure below shows the recommended minimum threshold of maneuverability to be 20 μN/kg of spacecraft mass for satellites ≤500kg, and 100 μN/kg for satellites > 500kg after analyzing a random sample of 230,000 low Earth conjunction events from 2019.



Future work aims to complete development of an integrated capability to analyze CDM data within the space-track.org environment, perform the first "All vs All" orbital conjunction trending analysis including all CDMs below 1,000 km which occurred between 2016-2022, and lastly, provide an R&D repository for external users to access, with permission from USSPACECOM, and lastly to provide a set of repeatable orbital sustainability metrics which can be regularly sampled for policy decision making purposes at agency/department, national, and international levels. Success for these efforts provides a better understanding of the future nature of the environmental hazards of the domain. History is replete with examples that "knowing the lay of the land" is critical to success on the battlefield. Consider, space is not immune from that maxim. As such, ensuring a favorable Space Order of Battle for the future requires understanding the dynamics of the future state of orbital environment sustainability. Those tools can and should be built today, and improved over time as the dynamics have already begun to change.

AFIT & GRADUATE SCHOOL LEADERSHIP NEWS

AFIT Welcomes Isbill as Commander and Director of Staff

Col Sarah Isbill assumed command of Air University Detachment 1 at the Air Force Institute of Technology in June 2022. As the senior military leader, she is responsible for the good order and discipline for approximately 1,800 active duty faculty, staff, and students. In addition to her commander duties, Isbill serves as the director of staff at AFIT where she leads the strategic vision and tactical decisions of the Institute.

Isbill entered the Air Force in 2001 after graduating from the United States Air Force Academy with a bachelor's degree in chemistry. Her career has included security forces assignments at several locations, as well as a teaching assignment at USAFA. While assigned to Wright-Patterson Air Force Base as an action officer at Headquarters Air Force Materiel Command, she earned a master's degree in chemistry from Wright State University in 2011. She has also served on deployments to Iraq, Pakistan, Afghanistan, and Kuwait.

AFIT is the Department of the Air Force's leader for advanced, multi-disciplinary academic education and technical professional continuing education. A component of Air University and Air Education and Training Command, AFIT employs more than 750 military and civilian faculty and staff members and manages a $224.2M annual budget. AFIT provides professional continuing education for nearly 36,000 students and graduate education to more than 1,000 students annually. In addition, AFIT's Civilian Institutions Program Office manages approximately 2,500 students enrolled in a variety of health profession programs and another 1,000 line, legal and chaplain officers enrolled in various programs at leading civilian universities and research centers.

Awards:

- Bronze Star Medal
- Meritorious Service Medal with silver oak leaf cluster
- Air Force Commendation Medal with three oak leaf clusters

AFIT Welcomes Peterson as Associate Dean for Academic Affairs

Dr. Gilbert Peterson was selected as the new Associate Dean for Academic Affairs in September 2022. In this role he is responsible for academic policy formulation, assessment and accreditation, academic program oversight, and strategic planning within the Graduate School.

He leads a team tasked with faculty personnel program administration, program reviews and development, institutional research, distance learning services, and the D'Azzo Research Library. Additionally, he also manages AFIT's model and fabrication machine shop which develops and constructs various experimental apparatus to support experimental research programs conducted by faculty and students.

A member of the AFIT faculty since 2002, Peterson is also a professor of computer science within the Department of Electrical and Computer Engineering where he teaches and conducts research in digital forensics, statistical machine learning, and autonomous robots.

AFIT Welcomes Center for Space Research and Assurance Director

The Air Force Institute of Technology welcomes Colonel Nathan Terry as the Center for Space Research and Assurance (CSRA) Director and Senior Military Professor.

Terry has a deep experience leading transition in a host of DoD programs including basic research into fiber and semiconductor lasers, active and passive electro-optic sensing, plasma physics, additive manufacturing, radio frequency sensing, computational electromagnetics, high energy lasers, and emerging precision navigation and timing technologies. His assignments include chief of wing analysis, graduate student, research physicist, deputy branch chief, branch chief, assistant professor, assistant to the chief scientist, high energy laser program manager, and military assistant to the Director of Defense Research and Engineering for Research and Technology in OSD. Terry has conducted and published research on a variety of topics including lasers, non-linear optics, educational psychology, and nuclear deterrence.

Reeder Named Head of the Department of Aeronautics and Astronautics

Dr. Mark Reeder is Head of the Department of Aeronautics and Astronautics. Reeder also serves as a Professor of Aerospace Engineering within the Graduate School.

Reeder has been an AFIT faculty member since 2002 when he joined the Department of Aeronautics and Astronautics as an assistant professor. His research interests include all aspects of experimental fluid mechanics with an emphasis on applications involving wind tunnel testing, mixing enhancement for combustion, and micro air vehicles. Additionally, his expertise in the area of hypersonics has been highly regarded by both AFIT and its students.

He is a graduate of The Ohio State University, where he earned a Ph.D. in Mechanical Engineering in 1994 and a M.S. in Mechanical Engineering in 1991. Reeder also has a B.S. in Mechanical Engineering from West Virginia University in 1989.

Prior to taking a position with AFIT, Reeder served as an NRC Research Associate at NASA Glenn and subsequently as the manager of R&D for a manufacturer of industrial mixing equipment.

He has co-authored articles published in a variety of journals including the *Journal of Fluid Mechanics, Experiments in Fluids, The AIAA Journal of Aircraft, The AIAA Journal of Propulsion and Power, The AIAA Journal of Spacecraft and Rockets, Physics of Fluids, NASA Tech Briefs, and Chemical Engineering Progress.*

He has four patents to his credit, is a licensed Professional Engineer in the State of Ohio, and is a member of AIAA and ASME.

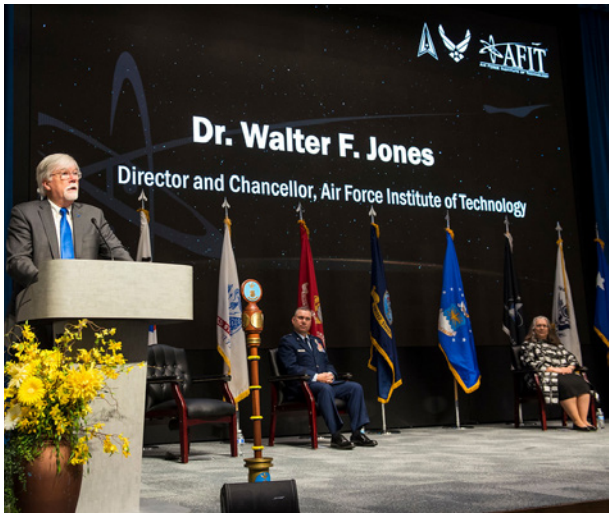
AFIT GRADUATION 2022

U.S. Air Force photos by R.J. Oriez

Left: Secretary of the Air Force Frank Kendall joins Air Force Institute of Technology leadership and distinguished graduates prior to the school's graduation ceremony March 24, 2022 in the National Museum of the U.S. Air Force. Kendall was the ceremony's guest speaker.

Below: Scenes from the 2022 AFIT Commencement Ceremony.

Find the complete list of all graduates online: https://e.AFIT.edu/00h1HT



2022 Distinguished Graduates

The AFIT chancellor is authorized to designate no more than 10 percent of each graduating class as Distinguished Graduates. The criteria for identifying DG achievement encompasses academic scores, the "whole person" concept based on professional qualities, and the recommendation of the department heads to ensure the students are deserving of the honor associated with DG. The DGs for the class of 2022 were:

Capt Patrick Assef (M.S. Systems Engineering)
Capt Tyler Brown (M.S. Electrical Engineering)
Capt Charles Carr (M.S. Astronautical Engineering)
Capt Zachary Cleveland (M.S. Atmospheric Science)
Capt Alexander Contarino (M.S. Applied Mathematics)
2nd Lt Tristan Creek (M.S. Cyber Operations)
Capt Tyler Dolezal (M.S. Applied Physics)
Capt Jacob Hatzinger (M.S. Systems Engineering)
Capt Mark Kurtz, USSF (M.S. Space Systems)
Capt Jedidiah Langlois (M.S. Engineering Management)
2nd Lt Irene Liew (M.S. Operations Research)
2nd Lt Austin Logan (M.S. Operations Research)
Cap. Kaiana Miller (M.S. Cost Analysis)
Capt Zachary Moer (M.S. Engineering Management)
2nd Lt Andrew Mogan (M.S. Operations Research)
2nd Lt David Mottice (M.S. Operations Research)
Capt Daniel Parkhill (M.S. Logistics & Supply Chain Management)
Capt Niko Petrocelli (M.S. Computer Engineering)
1st Lt Guillermo Salcedo (M.S. Electrical Engineering)
2nd Lt Owen Sedej (M.S. Environmental Engineering & Science)
Capt Samuel Vonniederhausern (M.S. Electrical Engineering)
Capt Brady Weaver (M.S. Acquisition & Program Management)

See all 2022 graduation award winners online: https://e.AFIT.edu/jkVc1Z

Dean's Award Winners

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 his or her respective academic department.

Mathematics and Statistics Department
Capt Alexander Contarino (M.S. Applied Mathematics)

Electrical and Computer Engineering Department
Capt Andrew Dittrich, USSF (M.S. Electrical Engineering)

Engineering Physics Department
Capt Tyler Dolezal (M.S. Applied Physics)

Operational Sciences Department
2nd Lt Andrew Mogan (M.S. Operations Research)

Systems Engineering and Management Department
2nd Lt Owen Sedej (M.S. Environmental Engineering and Science)

Aeronautics and Astronautics Department
Capt Charles Carr (M.S. Astronautical Engineering)

U.S. Air Force photos by Jaima Fogg

AFIT 2022 Dean's Award winners

Dr. Walter Jones and Capt. Andrew Dittrich, USSF

Chancellor's Award Winner

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 2022 Chancellor's Award and Russ Prize, sponsored by the AFIT Foundation, went to Capt Andrew Dittrich, USSF (M.S. Electrical Engineering).

GRADUATE SCHOOL ANNUAL AWARDS

GSEM Recipients of the 2021 AFIT Chancellor's Excellence Awards

INNOVATION AWARDS

JUNIOR FACULTY AWARD
Dr. Hengky Chandrahalim
Assistant Professor of Electrical Engineering

JUNIOR FACULTY AWARD
AFIT Center for Directed Energy (CDE)

The Innovation Award celebrates the Airman that have exemplified the Air Force goal of innovation while at AFIT. The award recognizes "outside-the-box" thinking that promotes innovation, creativity, and forward-thinking students and educators.

LEADERSHIP AWARD

Ms. Robin Manly
Graduate School Executive Support Specialist
The Leadership Award recognizes the Airman that has distinguished themselves above their peers as being exceptional leaders across an organization. The award seeks to reach beyond the traditional military leadership structure and recognizes an Airman that led beyond their assigned team.

WINGMAN AWARD

Maj Peter Saunders
Assistant Professor of Atmospheric Science
The Wingman Award recognizes the Airman that has exemplified what it means to be an exceptional wingman while at AFIT. The award recognizes teamwork, service before self, and exceptionalism that supported a wingman in their quest for success. This award encompasses volunteerism, mentorship, and other support systems to exemplify never leaving an Airman behind.

2021 GSEM Annual Award Winners

The value of an academic institution is a function of the accomplishments of its people (faculty, staff, students, and administrators) in both internal and external engagements pertaining to teaching, research, and professional service. The people of AFIT's Graduate School of Engineering and Management (GSEM) continue to excel along all the dimensions of scholarship and preeminence.

ADVISING AND MENTORING AWARD

Lt Col Justin Delorit
Department of Systems Engineering & Management

With only 2 ½ years of advising experience, Lt Col Delorit advised 15 MS students and will advise two students in absentia. A natural leader, Delorit sets high standards and expectations that results in strong student growth and development as he challenges students to achieve beyond what they thought was possible. Delorit was recognized for his excellent advising and mentoring through several student-nominated awards, including the AFIT SIE Management Professor of the Year (2020) and he was a Graduate School finalist for the Leslie B. Norton Award (2021).

RESEARCH AWARD

Dr. Willie Harper
Department of Systems Engineering & Management

Dr. Harper is an internationally recognized leader who has invented a new theoretical approach for successfully modeling biodegradation, developed new biosensors for real-time monitoring of water quality and collaborated with researchers in Japan to discover an abiotic chemical reaction that emits a powerful greenhouse gas from wastewater treatment basins. Harper has worked on water and sanitation issues in developing countries and has contributed new knowledge to the body of literature while he impacted full scale water quality operations. He served as the primary research advisor to three PhD graduates, 29 MS graduates, 19 undergraduate research assistants and six postdoctoral research assistants. Additionally, Harper executed more than $2.5M of federally-sponsored research and produced 79 publications, including 52 peer-reviewed journal articles. Harper has been honored with several distinctive awards, including the NSF Faculty Early CAREER Award (2006-2011) and the Fulbright Scholar Award (2013-2014).

EARLY CAREER ACHIEVEMENT AWARD

Lt Col Samuel Butler
Department of Engineering Physics

Lt Col Butler has taught 20 regular courses and nine short-term refresher courses since 2015, in addition to co-teaching the laser weapons short course. This includes eight unique graduate-level courses and exceeds the department academic promotion hallmark of excellence. Additionally, Butler advised six Master's and one PhD student. Butler's research output includes seven fully peer-reviewed publications, plus a publication in review, and a conference paper accepted based on a full paper review. Additionally, he has 14 conference papers accepted on the basis of an abstract, and three conference presentations, including an invited presentation.

OUTSTANDING STAFF AWARD

Mr. John Reisner
Office of E-learning Support

U.S. Air Force courtesy photo

Mr. Reisner's leadership and accomplishments have advanced the Graduate School's capability to deliver distance learning (DL) courses and enabled blended techniques for resident offerings. Reisner has designed and constructed turnkey studios and a DL classroom for faculty and students to create digital content, including self-made training videos. Reisner and his team have received numerous accolades for their level of customer service, responsiveness to student and faculty needs, and expertise in supporting faculty and students. Reisner provided "emergency" support to the Graduate School at the beginning of the pandemic when many instructors had to pivot quickly to teach virtually for the first time.

TEACHING AWARD

Dr. Christopher Chini
Department of Systems Engineering & Management

Dr. Chini demonstrated excellence across all three facets of faculty performance: teaching, research and service. His performance earned him the designation as a top performer in his department. Chini's passion for teaching is evident and he consistently receives high teaching reviews (from both students and peers). His record of outstanding teaching was recognized via his student-nominated Instructor of the Year award from the Sigma Beta Chapter of Sigma Iota Epsilon at AFIT for 2021. Since 2019, Chini taught six unique courses for a total of 12 different sessions, not including four different independent studies. Additionally, he helmed the GEM fall refresher/short quarter for two years. Chini models high-quality teaching techniques and continues to be engaging and informative, as he adapted to the COVID-forced Teams-based teaching style with ease. Chini demonstrated a willingness to reformat and alter courses as needed based on feedback from students and his own self-reflection. He recently had two articles from his EMGT 723: Advanced Topics in Asset Management course projects published in a relevant career field journal, The Military Engineer. Chini's work is a fantastic example of how AFIT faculty mentor our students to solve real-world problems.

Dean Receives Professional Society's Highest Honor

Ms. Katie Scott

Dr. Adedeji Badiru, dean of the Graduate School of Engineering and Management at the Air Force Institute of Technology is the recipient of the 2022 Industrial Engineering and Operations Management Society International Frederick Winslow Taylor Award. The award will be presented at the society's international conference in March.

"Efficient and effective operations management is at the heart of every organization. I am delighted to receive this award in recognition of what my colleagues and I have done in operations management for several decades. Onward with teamwork and collective successes," said Badiru.

The IEOM Frederick Winslow Taylor Award is the highest award presented by the society to recognize members who have distinguished themselves in the IEOM field through scholarly publications, leadership accomplishments, technical achievements including patents, scientific methods invented to improve and elevate mankind's welfare, and long and distinguished service to the profession and community.

In a letter to Badiru, Dr. Hamid Parsaei, chair, Global Council and Dr. Ahad Ali, executive director, IEOM Society International, wrote that Badiru's "… scholarship, lifelong dedication to profession, leadership, and unparalleled service to the IEOM Society … are exemplary and indeed exceptional."

Badiru's career as an industrial engineer extends over 37 years. He joined the Graduate School of Engineering and Management in 2006 as the head of the Systems Engineering and Management department. He was promoted to the school's dean in 2013 where he is responsible for planning, directing, and controlling operations related to granting doctoral and master's degrees, professional continuing cyber education, and research and development programs.

A prolific author and mentor, Badiru has written or co-authored more than 35 books, 30 book chapters, 130 journal and magazine articles, and more than 200 conference presentations. His areas of interest include mathematical modeling, project modeling and analysis, economic analysis, systems engineering models, and efficiency/productivity analysis and improvement. He is the developer of the trademarked "DEJI Systems Model" for systems Design, Evaluation, Justification, and Integration.

Badiru earned a bachelor's degree in industrial engineering, master's degrees in mathematics and industrial engineering from Tennessee Technological University, and a doctoral degree in industrial engineering from the University of Central Florida. He is a registered professional engineer and a certified Project Management Professional. He is a Fellow of the Institute of Industrial and Systems Engineering and a Fellow of the Nigerian Academy of Engineering. He is a member of several professional associations and scholastic honor societies, including the Institute for Operations Research and Management Sciences and the American Society for Engineering Education.

Dean for Research Honored with SECDEF Medal for Exceptional Civilian Service

Ms. Katie Scott

Dr. Darryl Ahner, dean for research within the Air Force Institute of Technology's Graduate School of Engineering and Management, received the Office of the Secretary of Defense Medal for Exceptional Civilian Service for his leadership, commitment, and professional expertise as the director of AFIT's Scientific Test and Analysis Techniques Center of Excellence. The Office of the Secretary of Defense Medal for Exceptional Civilian Service is the OSD's highest-level career medaled award.

The STAT COE consists of an interdisciplinary group of test and evaluation professionals dedicated to improving the planning, execution, and assessment of test and evaluation methodologies. Ahner served as the director of the STAT COE from its inception in 2012 until his promotion to dean for research in 2021.He was presented with the award virtually by Christopher Collins, SES, director of Developmental Test, Evaluation, and Assessments within the Office of the Under Secretary of Defense for Research and Engineering.

Ahner was recognized for creating and leading a center of 45 highly educated experts dedicated to modernizing the Department of Defense's culture of test and evaluation. His efforts culminated in managing a $17 million yearly budget and enabling defense and homeland security test and evaluation interests across nine lines of effort supporting the objectives of the 2018 National Defense Strategy. He created and consistently applied a unique-systems engineering and test hybrid process that improved rigor and effectiveness for 65 major defense acquisition programs, generating more than $204 million in cost savings.

U.S. Air Force photo by Katie Scott

Dr. Darryl Ahner, left, is presented the SECDEF Medal for Exceptional Civilian Service by AFIT Director and Chancellor, Dr. Walter Jones.

"While this is an individual award, I share it with the great professionals within the STAT COE and the office of Developmental Test, Evaluation, and Assessments," said Ahner. "It is a testament to surrounding yourself with great professionals and staying out of their way."

A registered professional engineer and professor of operations research, Ahner has written over 70 technical articles, made over 100 technical presentations, and has led several technical working groups. He is an active member of the Military Operations Research Society, Institute for Operations Research and the Management Sciences, International Test and Evaluation Association, and the American Society for Engineering Education.

AFIT Faculty Receive AFA Sponsored Awards

Dr. Walter Jones, Air Force Institute of Technology director and chancellor presented the 2021 Air and Space Forces Association Wright Memorial Chapter awards to five AFIT faculty members on May 19, 2022. The awards sponsored by the Wright Memorial Chapter 212 of the Air and Space Forces Association recognize faculty who advance aerospace power and technology through innovative efforts in education and research. The AFA has sponsored the awards since 1982.

Dr. Steven Fiorino 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.

Fiorino is a professor of atmospheric physics and director of the Center for Directed Energy within AFIT's Graduate School of Engineering and Management. He expertly led a team of over 10 scientists, engineers, and research interns, whose effort contributed to the overall goal of advancing directed energy science and technologies. Fiorino was heavily involved in the Directed Energy Professional Society over the last 10 years, while he chaired numerous technical sessions for the society's annual and systems symposia and served as the technical editor of the Journal for Directed Energy.

Fiorino is widely recognized throughout the DoD, academia, industry and internationally, and was recently designated as a subject matter expert for NATO SCI-264 and SCI-316 Atmospheric Effects on Laser Propagation, the Effects of High Energy Lasers Project Arrangement Atmospheric Effects on Laser Propagation, and AFRL's Directed Energy Directorate Scientific Advisory Board.

Capt Sven Ellefson received the Colonel Charles A. Stone Award

This award is given in recognition of an individual who has made outstanding contributions to furthering 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.

Ellefson is an instructor in AFIT's Civil Engineer School teaching courses on project management, readiness, and emergency management. In his first year at AFIT, Ellefson superbly directed four courses, taught 85 lessons, and achieved over 1,500 student contact hours resulting in educating 900 total force engineers across 118 installations. He blazed a new path for the Civil Engineer School by developing new educational content for the enlisted force, an expanding demographic in the School's mission.

Ellefson leveraged his deployed and overseas construction management experiences to redesign the 10-hour introduction to project management course. These updates enabled the course to meet the newly mandated upgrade training requirements for over 25,000 enlisted engineers and provided all civil engineer professionals working on construction projects a foundational understanding of project management. His efforts contributed to a 25% increase in enlisted force students at the Civil Engineer School.

Capt Danielle Tabb received the Professor Ezra Kotcher Award

This award is given in recognition of an individual who made significant contributions to curriculum or instructional development within AFIT. The award is named in honor of Col. Kotcher, the first director of AFIT and an aeronautical engineer who worked on inflight fueling and directed the development of the X-1 and X-2 jet planes.

Tabb is a project management instructor in AFIT's Civil Engineer School. She displayed unprecedented creativity to achieve student learning objectives to overcome distance learning challenges and increase student participation during pandemic operations. Using gamification tools, she authored an instructor guide for the hands-on and immersive Project Safety "Escape Room" lesson in the Air Force Civil Engineer Initial Skills course, effectively increasing student exam and homework scores from 43% to 85%.

Because of her innovative mindset, Tabb was selected to present "Synchronous and Asynchronous Project Management Gamification" at the 2022 Air Force Learning Professionals' Consortium. In addition, Tabb developed a "choose your own path" scenario for the Introduction to Project Management course that enhanced comprehension and application levels of learning for 697 students. She increased student accessibility by 80% through embedding this scenario in the learning management system.

Dr. Christine Schubert Kabban 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, research, and service in order to maintain the excellence of AFIT's degree-granting academic programs. 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.

Schubert Kabban is a professor of statistics in AFIT's Graduate School of Engineering and Management where she teaches courses on applied statistical data analysis, applied general linear models, theory of probability, and nonparametric statistics. She exhibited outstanding leadership in classroom teaching and course development, earning her an amazing 4.78 out of five possible on the online student evaluation system. A prolific author, she published critical articles that addressed important applications that advance the Air Force, such as of protection strategies aimed at extending the lifespan of critical infrastructure elements. Schubert Kabban chaired the Graduate Applied Mathematics Curriculum Committee and served as academic advisor to all mathematics students, providing new students with wise counsel and mentorship, as she aided them in setting up their education plans.

Capt Samuel Joslin received the Professional Continuing Educator Award

This award is presented to the individual who made the most significant contribution to AFIT as evidenced through excellence in teaching in order to maintain the excellence of AFIT's professional continuing education academic programs.

Joslin is a mechanical systems instructor in AFIT's Civil Engineer School. In his first year, he single-handedly executed the two-instructor mechanical engineering portfolio for eight months. He directed five course offerings and taught an additional seven courses for a total of 112 hours of live instruction to 408 students. Joslin significantly revamped the Introduction to Mechanical Systems course curriculum after the original became corrupted and was no longer accessible. He created six new lessons and re-formatted an additional 13 lessons. His quick thinking and long hours saved the course for 72 students. As the director of the officer field education portion of the Civil Engineer Officer Initials Skills course, Joslin led 15 officer cadre and 25 enlisted trainers through a seven-day contingency field training capstone that cycled 63 new civil engineer officers through 54 hours of full spectrum capabilities.

Dedicated Faculty Members Celebrate Retirements

Dr. Anthony Palazotto, Distinguished Professor of Aerospace Engineering within the Air Force Institute of Technology's Graduate School of Engineering and Management, retired after 47 years.

Dr. Paul Wolf recently retired from AFIT in September 2022 after 28 years in the Graduate School of Engineering Management. Wolf served as the Associate Dean for Academic Affairs and Professor of Physics. Wolf earned graduate degrees from AFIT – M.S., Engineering Physics in 1979 and Ph.D., Physics in 1985.

Dr. Andrew Terzuoli Jr., Associate Professor of Electrical Engineering, retired in September 2022 from full-time teaching in the Graduate School of Engineering Management where he had been a tenured civilian faculty member since 1982. Terzuoli has been named a Professor Emeritus at AFIT.

Dr. Bradley Liebst had dedicated 33 years of his career to AFIT's Graduate School of Engineering and Management – both as a faculty member and as part of the Graduate School leadership. Liebst retired as Head of the Aeronautics and Astronautics Department – a position which he held for 24 years. In addition, he enjoyed time in the classroom as a Professor of Aerospace Engineering.

AFIT NOTABLE ALUMNI

Lieutenant General John D. Lamontagne, USAF
M.S. Systems Engineering, 2004
Deputy Commander, U.S. Air Forces in Europe-Air Forces Africa, Ramstein AB, Germany

Career Highlights:
- July 2021–June 2022, Chief of Staff, U.S. European Command, Stuttgart, Germany
- January 2019–June 2021, Deputy Director, J-5, Joint Staff, the Pentagon, Arlington, VA
- July 2018–January 2019, Commander, 618th Air Operations Center, Scott AFB, IL

Lieutenant General Carl E. Schaefer, USAF
M.S. Systems Engineering, 2004
Deputy Commander, Headquarters Air Force Materiel Command, Wright-Patterson AFB, OH
Selected for assignment to Commander, Air Force Test Center, Air Force Materiel Command, Edwards AFB, CA

Career Highlights:
- March 2015–July 2018, Commander, 412th Test Wing, Edwards AFB, CA
- February 2014–March 2015, Special Assistant to the SECAF/CSAF for F-35 Integration, the Pentagon, Washington, D.C.
- July 2012–February 2014, Wing Commander, data masked

Lieutenant General Donna D. Shipton, USAF
Master of Space Systems, 2005
Military Deputy, Office of the Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics, the Pentagon, Arlington, VA

Career Highlights:
- August 2021–August 2022, Deputy Director and Space Force Element Commander, NRO, Chantilly, VA
- July 2020–July 2021, Director, Strategic Plans, Programs, Requirements and Analyses, Air Force Materiel Command, Wright-Patterson AFB, OH
- June 2019–June 2020, Vice Commander, Space and Missile Systems Center, U.S. Space Force, Los Angeles AFB, CA with duty as Air Force Deputy PEO for Space and PEO for Space Enterprise

Major 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

Career Highlights:
- June 2017–July 2019, Commander, Defense Logistics Agency Aviation, Richmond, VA
- August 2016–June 2017, Director, Expeditionary Support, Air Force Installation and Mission Support Center, JB San Antonio-Lackland, TX
- July 2014–August 2016, Commander, 635th Supply Chain Operations Wing, Scott AFB, IL

Major General Thomas E. Kunkel, USAF
M.S. Strategic Leadership, 2006
Commander, North Atlantic Treaty Organization Airborne Early Warning and Control Force, Geilenkirchen AB, Germany

Career Highlights:
- April 2019–July 2021, Deputy Director for Operations, Operations Team Five, National Joint Operations and Intelligence Center, Joint Staff, the Pentagon, Arlington, VA
- July 2017–April 2019, Chief, Air Force Legislative Liaison to U.S. House of Representatives, Office of the Secretary of the Air Force, Arlington, VA
- July 2015–July 2017, Commander, 23rd Wing, Moody AFB, GA

Major General Rodney D. Lewis, USAF
M.S. Strategic Leadership, 2006
Deputy Director for Force Protection, J8, Joint Chiefs of Staff, the Pentagon, Arlington, VA

Career Highlights:
- August 2020–June 2021, Director, Strategy, Posture, and Assessments, Deputy Chief of Staff, Strategy, Integration, and Requirements, Headquarters Air Force, the Pentagon, Arlington, VA
- July 2019–August 2020, Deputy Director for Operations, Operations Team One, National Joint Operations and Intelligence Center, the Pentagon, Arlington, VA
- April 2017–June 2019, Director, SecAF/CSAF Executive Action Group, the Pentagon, Arlington, VA

Major General Evan L. Pettus, USAF
Master of Logistics Sciences, 2008, Distinguished Graduate and Mervin E. Gross Award Winner
Commander, 12th Air Force, Air Combat Command, and Commander, Air Forces Southern, U.S. Southern Command, Davis-Monthan AFB, AZ

Career Highlights:
- July 2021–June 2022, Vice Commander, U.S. Air Force Warfare Center, Nellis AFB, NV
- July 2018–June 2020, Commandant, Air Command and Staff College, Maxwell AFB, AL
- July 2016–July 2018, Commander, 48th Fighter Wing, RAF Lakenheath, England

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

Career Highlights:
- February 2017–July 2018, Deputy Director of Programs, Deputy Chief of Staff for Strategic Plans, Programs and Requirements, Headquarters U.S. Air Force, the Pentagon, Arlington, VA
- January 2015–February 2017, Deputy Director of Operations, Directorate of Air, Space and Cyberspace Operations, Headquarters Air Force Materiel Command, Wright-Patterson AFB, OH
- September 2013–January 2015, Private sector, Everett, WA

Mr. J. Mark Coleman
M.S. Aeronautical Engineering, 1997
Director, Airman Systems Directorate, 711th Human Performance Wing, Air Force Research Laboratory, Wright-Patterson AFB, OH

Career Highlights:
- 2016–2021, Chief, Functional Materials Division, Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright- Patterson AFB, OH
- 2012–2016, Chief, Human Systems Implementation Division, Air Force Research Lab, Wright-Patterson AFB, OH
- 2009–2012, Plans/Programs Engineer, Headquarters, Air Force Materiel Command, Wright-Patterson AFB, OH

Mr. Stephen Gray, SES
M.S. Logistics Management, 2004
Director, 448th Supply Chain Management Wing, Air Force Sustainment Center, Tinker AFB, OK

Career Highlights:
- August 2020–June 2021, Acting Senior Technical Director, 448th Supply Chain Management Wing, Air Force Sustainment Center, Tinker AFB, OK
- July 2019–June 2021, Director, 948th Supply Chain Management Group, 448th Supply Chain Management Wing, Air Force Sustainment Center, Tinker AFB, OK
- May 2018–July 2019, Deputy Director, 948th Supply Chain Management Group, 448th Supply Chain Management Wing, Air Force Sustainment Center, Tinker AFB, OK

Dr. Michael R. Gregg, SES
PhD Applied Physics, 1996
Director, Aerospace Systems Directorate, Air Force Research Laboratory, Wright-Patterson AFB, OH

Career Highlights:
- February 2013–August 2019, Senior Associate, Dayton Aerospace Inc.,
- Beavercreek, OH
- June 2009–January 2013, Commander, 730th Aircraft Sustainment
- Group and System Program Manager, C-5 Galaxy Division, Robins AFB, GA
- July 2008–June 2009, Student, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.

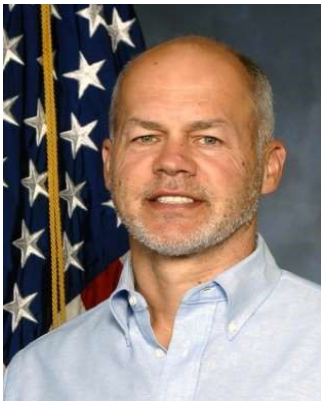
Colonel Leigh E. Method, USAF, Retired, SES
M.S. Transportation Management, 1998, Distinguished Graduate
Deputy Assistant Secretary of Defense for Logistics, Office of the Under Secretary of Defense for Acquisition and Sustainment, Pentagon, Washington, D.C.

Career Highlights:
- November 2018–March 2022, Deputy Director of Logistics, Engineering and Force Protection, Headquarters Air Mobility Command, Scott AFB, IL
- June 2015–October 2018, Senior Adviser, F-35 Integration Office, Headquarters U.S. Air Force, Washington, D.C.
- June 2013–June 2015, Commander, 76th Commodities Maintenance Group, Oklahoma City-Air Logistics Complex, Tinker AFB, OK

Colonel Edwin H. Oshiba, USAF, Ret, SES
M.S. Engineering & Environmental Management, 1997
Acting Assistant Secretary of the Air Force for Energy, Installations, and Environment, the Pentagon, Arlington, VA

Career Highlights:

- November 2018–January 2022, Director of Resource Integration, Deputy Chief of Staff of Logistics, Engineering and Force Protection, HAF, Arlington, VA
- February 2018–November 2018, Director, Air Force Civil Engineer Center, Air Force Installation and Mission Support Center, Air Force Materiel Command, Joint Base San Antonio-Lackland, TX
- February 2015–January 2018, Deputy Director of Civil Engineers, Directorate of Civil Engineers, Deputy Chief of Staff for Logistics, Engineering and Force Protection, Headquarters U.S. Air Force, Washington, D.C.



Dr. Steven K. Rogers, Senior Scientist
M.S. Electrical Engineering (Electro Optics), 1981
Senior Scientist for Automatic Target Recognition and Sensor Fusion, Air Force Research Laboratory, Wright-Patterson AFB, OH

Career Highlights:

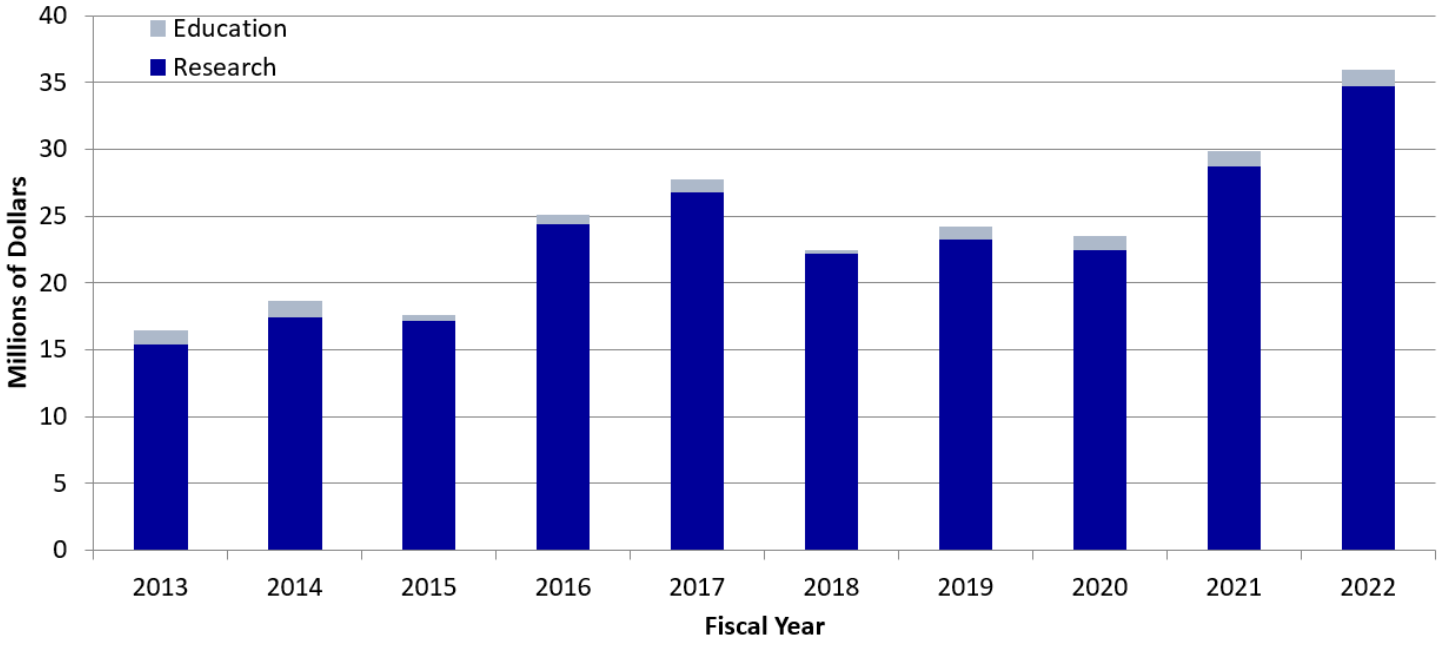
- 2005–2006, Founder and Chief Scientist, Quale LLC, Beavercreek, OH
- 1997–2005, President, CEO and Chief Scientist, Qualia Computing Inc. and CADx Systems, Beavercreek, OH
- 1996–1997, Director, Cognitive Systems, Battelle Memorial Institute, Columbus, OH
- 1984–1996, professor, Air Force Institute of Technology, Wright-Patterson AFB, OH

AFIT ALUMNI CAN EASILY UPDATE CONTACT INFO ONLINE

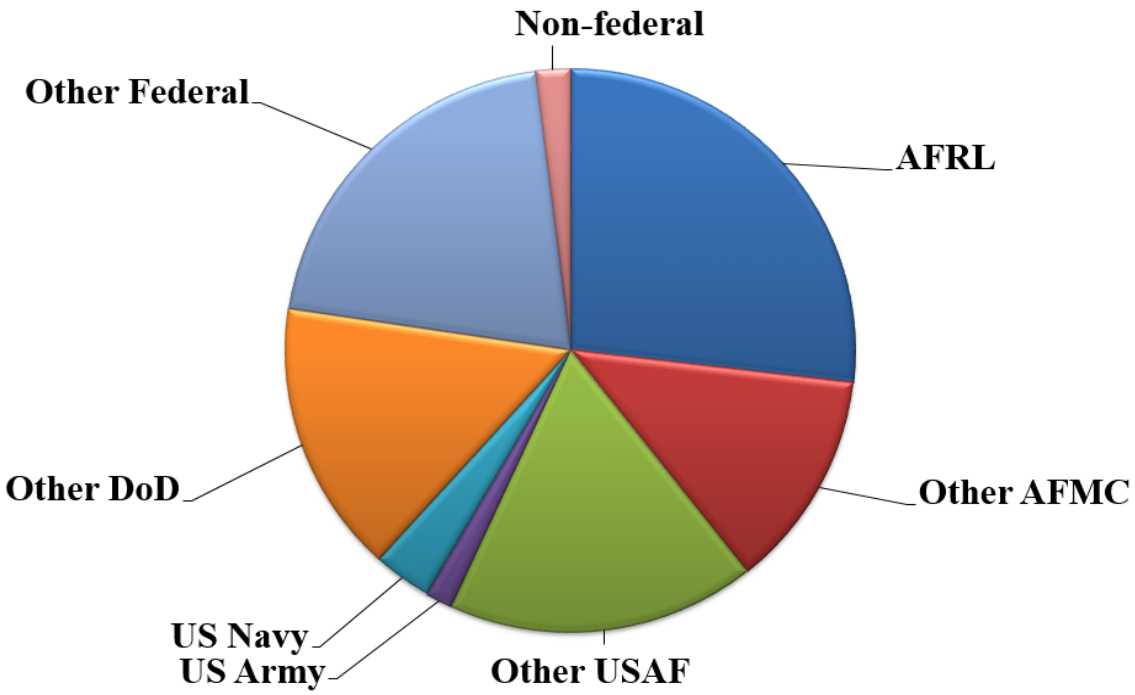
Just visit the AFIT website at the link below, click on the **"Update Your Contact Info"** tab on the right side and fill out the online form.

www.afit.edu/alumni

New Award History Fiscal Year 2013–Fiscal Year 2022



Sponsors of Fiscal Year 2022 Projects



ENROLLMENT INFORMATION

Enrolling at AFIT for Graduate Studies

The Graduate School of Engineering and Management offers multiple graduate and doctoral degree opportunities that focus on high-quality graduate education and research. We serve the Department of the Air Force as its graduate institution of choice for engineering, applied sciences, and selected areas of management. The appeal for our distinct educational opportunities is widespread and attracts high-quality students from other U.S. armed services, government agencies both inside and outside the DoD, and international military students.

Of particular note, under the National Defense Authorization Act for Fiscal Year 2011, the Graduate School may enroll defense industry employees seeking a defense-related master's or doctoral degree. Tuition is waived for all Department of the Air Force military and Air Force civilians, who are not sponsored by the Air Force to enroll at AFIT on a space-available basis.

Our automated application system provides immediate application information to the Office of Admissions, and there is no application fee. The Office of Admissions usually renders an admission decision within 30 days.

Prospective students will join a robust and energetic student body focused on learning and research. Enrollment averages over 700 full and part-time students with a student-to-faculty ratio of 4.5:1. Students usually finish their master's programs within two years and the doctoral programs within three years.

In the academic year 2021-2022, 386 master's and doctoral degrees were awarded to 277 USAF officers, 2 Air Guard, 32 USSF officers, 8 USAF enlisted, 13 sister service members, 48 civilians, and 6 international military officers.

The AFIT campus consists of 9 buildings and features 82 active research laboratories along with the D'Azzo Research Library.

For more information, visit the AFIT Office of Admissions web page: www.afit.edu/admissions.

DID YOU KNOW?

AFIT is regionally accredited by The Higher Learning Commission, and core engineering programs are accredited by Accreditation Board for Engineering and Technology (ABET).

AFIT Internship Opportunities

Internship opportunities are available for undergraduate and graduate science, technology, engineering, and mathematics (STEM) students through the Southwestern Ohio Council for Higher Education (SOCHE). Students have the opportunity to work at AFIT through the Summer Internship Program, the Student Research Program, or both. Students benefit both academically and financially by working in state-of-the-art laboratories with top professionals in their field. Additionally, they can use this experience for senior projects, cooperative education, and graduate research. AFIT receives the benefit of top students, who bring new energy and ideas to the research projects.

For information regarding AFIT internship opportunities visit: www.socheintern.org.

AFIT Research

AFIT's research programs complement our graduate education programs, allowing students to develop enhanced understanding of their disciplines' fundamental principles as well as appreciation of the most pressing unanswered questions. Consistent with the AFIT mission, our basic and applied research projects primarily focus on problems related to current or anticipated Department of the Air Force and Department of Defense needs. **Learn more: https://www.afit.edu/CZ/**

Sponsoring Thesis Topics

AFIT encourages input from your agency that aligns our research and student education to relevant areas to ensure the technological superiority and management expertise of the Department of the U.S. Air Force and the DoD. Each topic submitted has a strong positive impact on AFIT's ability to focus on research relevant to real-world requirements. **For more information, please email the Office of Research and Sponsored Programs: research@afit.edu.**

AFIT Directory

For specific information regarding Graduate School faculty research areas, please see the Faculty Directory and Expertise Search page at: **www.afit.edu/bios**

AFIT Research Centers and Centers of Excellence

Autonomy and Navigation Technology Center	**www.afit.edu/ANT**
Center for Cyberspace Research	**www.afit.edu/CCR**
Center for Directed Energy	**www.afit.edu/CDE**
Center for Space Research and Assurance	**www.afit.edu/CSRA**
Center for Technical Intelligence Studies & Research	**www.afit.edu/CTISR**
Nuclear Expertise for Advancing Technologies Center	**www.afit.edu/NEAT**
Homeland Security Community of Best Practices	**www.afit.edu/HSCOBP**
Scientific Test and Analysis Techniques Center of Excellence	**www.afit.edu/STAT**
Cyberspace Technical Center of Excellence	**www.afit.edu/CYBER**

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