AFIT IN SPACE
Career-building Education and Research Starts Here

By Col Timothy Albrecht, Director
Air Force Institute of Technology
Center for Space Research and Assurance

Welcome to the September issue of the AFIT Engineer—an issue that highlights AFIT’s role in preparing our students for the rapidly evolving space domain. As one of eight research centers within the Graduate School of Engineering and Management, the Center for Space Research and Assurance (CSRA) meets the challenge head-on with an interdisciplinary team comprised of faculty, staff, and students focused on the evolution of defense and intelligence missions in space. Here, and in subsequent articles, we introduce you to our award-winning people, facilities, academics, and research activities.

Founded in 2012 to enhance AFIT’s research-based, space-focused graduate education programs and to provide a staff of technical experts across space-related disciplines, CSRA links the AFIT research team with external Dept. of Defense (DoD) and Intelligence Community (IC) sponsors while providing laboratory and other resources to support research objectives. In this way, students apply their thesis and dissertation efforts to tackle real-world challenges in the DoD and IC space communities.

CSRA creates and facilitates collaborations with government organizations such as the Air Force Research Laboratory, National Reconnaissance Office, the National Air and Space Intelligence Center, and the Space and Missile Systems Center. We pursue research challenges for these sponsor organizations across space disciplines such as astrodynamics, guidance, navigation, optimal control, propulsion, systems architectures, as well as structures and materials. We also enter into agreements with commercial entities like SpaceX, Pumpkin Inc., Analytical Graphics Inc., and Tethers Unlimited Inc. to further our students’ space research efforts.

CSRA’s $12M laboratory and equipment suite enables us to pursue cutting edge research across the space portfolio, giving our students hands-on experience in areas like the design, fabrication, and testing of small spacecraft. Recent successes in this area include two AFIT-designed and built spacecraft that were launched into space; SOS in 2019 and SkyPad in 2020. Two more experiments are slated for delivery in 2021 and 2022.

The DoD stood-up the United States Space Force (USSF) in December of 2019 to align resources, mission, and organization with the imperative of defending and projecting our national interests in and through the space domain. Likewise, CSRA continues to adapt to meet the challenges of a space domain that is increasingly contested and congested. Our faculty have designed new courses to address current and future space issues within our Astronautical Engineering and Space Systems degree programs. These new courses include: spacecraft survivability, proximity operations, space control, spacecraft reverse engineering, cislunar orbital design, and space combat modeling and simulation.

The stand-up of the USSF closed out 2019, which saw AFIT celebrate its centennial with none other than Apollo 11 astronaut ‘Buzz’ Aldrin in attendance. Our CSRA team had a banner year too, taking home “AFIT’s Team of the Year 2019” award as well as the “General Muir S. Fairchild Educational Achievement Award” for 2019 for the most significant achievement to Air Force education. Our faculty and staff continue to earn individual recognition at the Air Force level in STEM research and education while our students regularly earn recognition amongst their peers for their thesis and published research. We look forward to carrying our successful momentum from 2019, through the COVID environment in 2020, and into 2021.

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www.afit.edu/EN/afitengineer
‘Virtuality’ Emerges as Mode of Operation During COVID-19 Pandemic

We are delighted to bring you another edition of the AFIT Engineer. This Volume 2, Issue 3 continues the tradition of keeping our constituents informed and abreast of the latest developments in the Graduate School of Engineering and Management at the Air Force Institute of Technology (AFIT). With the physical separation mandated by the COVID-19 pandemic, it is even more imperitive that we reach out to everyone via the printed word. “Virtuality” (yes, my new term of systems engineering, not yet in your e-Dictionary) is emerging as the mode of operation in most things we do. Two cases in point are the recent virtual orientation programs we conducted for new faculty and new Air Force Scholars (students) assigned to AFIT. Without compromising quality or content, we are figuring out new ways of moving AFIT’s education mission forward. A total of 22 new faculty joined AFIT this Fall Quarter. All the programs for getting the faculty properly oriented to the teaching, research, and Air Force consultation were conducted via virtual means. Similarly, we conducted a virtual orientation for 245 new Air Force Scholars. This demonstration of adaptability, flexibility, reliability, and virtuality allows us to practice what we teach in terms of expanding the concept of “ilities” of systems engineering in our mission skills set.

I am particularly proud of the feature story on “AFIT in Space” on the front page of this newsletter issue. The recognized accomplishments of systems engineering in our mission skills set.

Respectfully,

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

AFIT Welcomes New Students

Graduate School Hosts First-ever New Student Virtual Orientation

The Graduate School of Engineering and Management hosted AFIT’s first-ever virtual new student orientation on 24 Aug 2020 which was led by Col John “Andy” McQuade, Dean of Students. The virtual event welcomed approximately 245 new graduate students to the AFIT campus, WPAFB and the Dayton area.

“This orientation was designed to ensure that the best and most accurate information could be transferred to you and that you feel as though your AFIT family is happy you are here, that your AFIT family is focused on you progressing through your mission and that you are going to be a full-fledged student when October gets here and you start that mission,” said McQuade.

The orientation included remarks from AFIT Director and Chancellor, Dr. Todd Stewart, who reminded new students to be proud of being competitively selected for a unique advanced academic education opportunity at AFIT.

Additional remarks came from AFIT leadership including Col Paul Cotelleco, ADET 1 Commander/Director of Staff, Dr. Adedeji Badiru, Dean of the Graduate School of Engineering and Management, and Col James Fee, Associate Dean of the Graduate School of Engineering and Management.

Briefings were made by Mr. Eric Walsh, Chief of Security, Dr. Amanda Bullock, AFIT Foundation, Capt Devon DePalmer, AFIT Diversity & Inclusion, 2nd Lt Kyle Emery, AFIT Student Association, Ms. Tess Willstatter, AFIT Spouses Association, and Maj Timothy Bennett, AFIT Legal Office. These representatives introduced students to the various organizations that offer support and services to AFIT graduate school students, both on and off campus.
The Air Force Institute of Technology's Graduate School of Engineering and Management has completed the academic year 2019-20 promotion and tenure cycle. Seven faculty members underwent a rigorous evaluation of their teaching, scholarship and service resulting in a promotion in academic rank.

“Our promotion and tenure evaluation process is built on a rigorous evaluation of each candidate in order to identify those of such high quality as to merit academic promotion,” said Dr. Christine Schubert Kabban, Faculty Council President for the Graduate School.

Dr. Brian Lunday
Dr. Brian Lunday earned promotion to Professor of Operations Research within the Operational Sciences department. Lunday first joined the AFIT faculty in 2013 as an Assistant Professor while serving as an active duty Army officer. He was hired as a civilian faculty member in 2013 upon his retirement from active duty in the Air Force.

Dr. John Elshaw
Dr. John Elshaw earned promotion to Associate Professor of Systems Engineering with tenure within the Systems Engineering and Management department. He is a graduate of Purdue University with a Ph.D. in management specializing in organizational behavior and human resource management. He joined the AFIT faculty as a military member in 2008, and became a civilian faculty member in 2013 upon retirement from active duty in the Air Force.

Dr. Scott Nykl
Dr. Scott Nykl earned promotion to Associate Professor of Computer Science with tenure within the Electrical and Computer Engineering Department. He joined the Graduate School faculty in 2015, approximately two years after receiving his Ph.D., summa cum laude, in computer science from Ohio University.

Nykl has advised 11 master’s students, four of which were distinguished graduates, and one earned the prestigious AFIT-level Polk Award recognizing student research that has made a significant contribution toward strengthening the nation’s industrial defense base.

Nykl has authored 11 peer-reviewed journal articles, two book chapters, contributed to 18 peer-reviewed conference papers, 12 peer-reviewed abstract conferences, and awarded two patents with one additional patent pending. Nykl has supported 15 funded research projects totaling over $1.8M, including $31M in sponsor funding. His research interests include real time 3D computer graphics, computer vision, sensor fusion, parallel processing, interactive virtual worlds, and computer networking.

Nykl’s awards and honors include the Air Force Level Winner for STEM Advanced Technology Development (2019) and the Air Education and Training Command’s nominee for the Air Force Outstanding Scientist/Engineer (2018). Nykl was also mentioned in Forbes’ “The Greatest Young Inventors in America” in 2012 for his work on an eWake-Turbulence Aware Attenuator.

By Katie Scott | Air Force Institute of Technology

The Graduate School Faculty Academic Promotions

Graduate School Faculty Academic Promotions

The Air Force Institute of Technology's Graduate School of Engineering and Management has completed the academic year 2019-20 promotion and tenure cycle. Seven faculty members underwent a rigorous evaluation of their teaching, scholarship and service resulting in a promotion in academic rank.

“Our promotion and tenure evaluation process is built on a rigorous evaluation of each candidate in order to identify those of such high quality as to merit academic promotion,” said Dr. Christine Schubert Kabban, Faculty Council President for the Graduate School.

Dr. Julie Jackson
Dr. Julie Jackson earned promotion to Professor of Electrical Engineering within the Electrical and Computer Engineering department. Jackson joined the Graduate School in 2009 following receipt of her Ph.D. from The Ohio State University.

Jackson’s research interests include radar signal processing, synthetic aperture radar imaging, passive radar, and automatic target recognition. She has authored 15 peer-reviewed journal articles; contributed to 45 peer-reviewed conference papers; has one patent pending; supported 26 funded research projects totaling over $2.2M, including over $1.2M in personal funding; and advised 25 Ph.D. and 50 master’s students.

Jackson has received numerous awards and recognitions including the prestigious IEEE Fred Nathanson Memorial Radar Award (2019).

Dr. John McClory
Dr. John McClory earned promotion to Professor of Nuclear Engineering within the Engineering Physics department. He earned a Ph.D. from AFIT in nuclear engineering in 2008 and then joined the AFIT faculty while serving as an active duty Army officer.

McClory has taught most of the AFIT nuclear engineering courses, 37 course offerings to 906 students. He is an excellent instructor and has a very successful record mentoring AFIT graduate students, serving as the committee chair for 36 master’s and 17 Ph.D. students.

McClory has published 32 archival journal articles and 37 in limited distribution publications of the DoD. He and his students present in the restricted annual Hardened Electronics and Radiation Technology Conference and have publications in the associated peer-reviewed journal of Radiation Effects, Research and Engineering at INTRA classified levels.

McClory’s research in radiation effects on electronic devices and materials, radiation detector development, and nuclear weapons effects has been lauded by DoD customers. He has brought in more than $2M of sponsor funding and manages $350,000 per year as the director of the NWPEP program.

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Dr. John Elshaw earned promotion to Associate Professor of Systems Engineering with tenure within the Systems Engineering and Management department. He is a graduate of Purdue University with a Ph.D. in management specializing in organizational behavior and human resource management. He joined the AFIT faculty as a military member in 2008, and became a civilian faculty member in 2013 upon retirement from active duty in the Air Force.

Elshaw has published 11 refereed journal articles, 1 book chapter, and 12 peer-reviewed conference papers. He has received numerous research grants, with direct responsibility for over $138K of research funding. He has advised 24 students as thesis chair, and 37 additional students as a committee member across all department programs.

Elshaw’s research interests include acquisition in the DoD environment; learning curve analysis and its application to organizations; leadership; human-technology interaction (virtual teams, electronic monitoring, distance leadership); motivation (self-regulation, intrinsic versus extrinsic control); human performance, and organizational trust and commitment. Together with co-principal investigators, Elshaw received the 2016 Best Track Paper – Safety, Human Factors, and Ergonomics at the International and Systems Engineering Research Conference.

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By Katie Scott | Air Force Institute of Technology

“These successful applicants have demonstrated the value of an AFIT education by strategically integrating teaching, research, and Air Force consultation. I am proud of their accomplishments and I look forward to their future contributions to the advancement of graduate education at AFIT.”

– Dr. Adediji Badru, Dean of the Graduate School of Engineering and Management

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SMART Scholarship Program Earns Degree at AFIT

By Katie Scott
Air Force Institute of Technology

Raised in the small town of Denison, Texas, Lansing S. Horan IV earned a bachelor’s of science degree in nuclear engineering from Texas A&M University. In his undergraduate senior year, he researched graduate schools and funding sources when he came across the Science, Mathematics, and Research for Transformation Scholarship-for-Service Program. He learned about an advanced educational opportunity from the Air Force Institute of Technology through an internet search on nuclear technology, engineering, and mathematics disciplines to receive a full scholarship and guaranteed civilian employment with the Department of Defense upon degree completion. The opportunity to earn a master’s degree and have a job when complete was very attractive to Horan. “It’s nice to have something guaranteed, especially in our current environment,” Horan noted.

Horan learned about an advanced educational opportunity from the Air Force Institute of Technology through an internet search on nuclear engineering programs. “I saw that it was a very unique program offering a focus on nuclear weapon effects as opposed to nuclear power or radiation effects,” Horan added.

“AFIT is an ideal institution for civilians to attend as part of the SMART Scholarship program,” said Col. Andy McClade, dean of students within AFIT’s Graduate School of Engineering and Management. “The immersive academic and research experience allows civilian scholars to work defense-focused problems with uniformed service members, other civilians, and international partners.”

Attending the Air Force’s graduate school seemed like a nice pairing since Horan’s sponsor was the Air Force Technical Applications Center at Patrick Air Force Base, Fla. “With AFIT located on a military base and being a military organization, and then knowing I was going to work for the DoD, it linked together for me,” said Horan.

Horan’s thesis focused on researching asteroid deflection using a nuclear explosive. Done in collaboration with the Planetary Defense group at Lawrence Livermore National Laboratory, it is a topic that Horan believes he was able to choose because of the unique connections that AFIT faculty have with the DoD and other defense-focused agencies like the DoE. “If I had gone into almost any other nuclear engineering program in the country, I don’t think I would have had the opportunity to study a topic like that,” said Horan.

“For me, AFIT was definitely the right choice,” Horan noted. “It was a very valuable experience and AFIT’s uniqueness plays an important role in shaping an individual’s diversity of education and experience.”

More information about the SMART Scholarship-for-Service Program can be found at www.afst.edu/SFSPProgram. More information about AFIT’s STEM degree programs can be found at www.afit.edu/aen/afitprograms.

Marine Commanders’ View on an AFIT Education

By Donna Lindner
Air Force Research Laboratory

Air Force Women in Science and Engineering resource group from the Air Force Research Laboratory (AFRL) recently hosted a virtual presentation titled “Unconscious Bias in Hiring Practices” by Dr. Alice (Betsy) Grimes, member of the Diversity and Inclusion Working Group at the Air Force Institute of Technology (AFIT).

Grimes discussed conscious and unconscious biases, and how to be inclusive in recruiting and retaining students.

“Awareness of unconscious bias and its potential impact is the first step in diminishing the effect and helping to ensure that the individuals are evaluated fairly,” said Grimes.

“Unconscious biases can be problematic as they may cause individuals to make assumptions about personalities, capabilities, and beliefs,” said Grimes.

Another barrier leading to bias are interview questions that may be used to address a particular job and more general in nature, leaving room for the interviewer’s own interpretations and judgments to cloud decisions. A good tactic would be to give a realistic scenario for the job being filled and ask the candidate how they would respond to specific scenarios.

“We hear about promoting respect and preserving dignity in the workplace,” said Simone Koram, AFRL’s Sensors Directorate Learning Officer and AFWARE member. “Equality and race is a sensitive topic on the radar of many minds, yet undeclared due to fear of being misunderstood or judged. Today’s leaders are seeing the opportunity to address the upswing emotions of the workforce on the issue of unfair treatment and respect for equality,” she said.

“My experiences both at AFIT and teaching at the Naval Academy have been very helpful in formulating my command philosophy and desire to develop the leaders among Marines so they can be competent in their field, courageous in their decisions, and they make, and also compassionate in taking care of other Marines,” shared Paxton. The process of researching and writing his master’s thesis helped to hone his critical thinking and decision making skills that are vital to his leadership of the squadron. “Even though it isn’t in the same technical realm, just analyzing all the information at hand and being able to apply it to the situation and make a decision utilizes the same thought processes we employed at AFIT. It has been very helpful because as a commander you need to think beyond the tactical level and understand the repercussions of decisions at the operational and strategic levels,” said Paxton.

Paxton’s advice for future AFIT students is to go all in. “Go for it – do it – I think it is going to be a great experience. But I also say buckle up because you are going to be doing some hard work. There is always the tendency to do well enough to make the grades and move on, or even compete with each other to get the best grade, but embrace the actual learning so that you can take the knowledge and experiences with you wherever you go in order to better serve others.”

Alumni/Student Semifinalists of AFMC 2020 MAJCOM Spark Tank

By Maria Alia-Novobilski
Air Force Materiel Command

Four AFIT alumni and one current Ph.D. student from the Graduate School of Engineering and Management were selected as AFMC 2020 MAJCOM Spark Tank semifinalists. Spark Tank, a collaboration between AFWERX and Deputy Under Secretary of the Air Force, Management and Resources, is an annual campaign designed to spur and empower innovative ideas from Airmen to further strengthen Air Force culture and capabilities.

The semifinalists present their innovative and game-changing ideas to a panel of leaders during the upcoming AFMC Senior Leader Conference (SLC). The top two ideas will go to represent the major command in the 2021 Air Force Spark Tank competition.

The semifinalists are:

- *Patronizing AI* by Maj. John Brewer (AFIT Ph.D. student), Air Force Civil Engineer Center
- *Pubs 3.0, submitted by Maj. John Brewer (AFIT Ph.D. student), Air Force Civil Engineer Center*.

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(Click to read full story)
The AFIT/AFRL D’Azzo Research Library Recognized with Award

By Katie Scott
Air Force Institute of Technology

The D’Azzo Research Library, a joint effort between the Air Force Institute of Technology’s Academic Library and the Air Force Research Laboratory’s Technical Library, was honored for increasing outside-in access and outreach to AFIT students and faculty, AFRL engineers and scientists, and the global research community.

“I am delighted for the D’Azzo Research Library’s recognition for both its outstanding customer service and collaboration on electronic subscriptions,” said Ms. Annette Marshall, AFRL/RQW division chief and AFRL library director. “Our partnership is important to both organizations as we share similar goals to support the mission of the Air Force and the Warfighter.”

Working with AFRL and base contracting, the organizations collaborated to purchase more than 23 databases and journal collections, saving more than $382,000. On-site, a staff of 13 responded to 5,612 reference requests and taught 36 academic research classes to 533 participants while completing a library space reconfiguration that increased visits by eight percent.

“As a direct and frequent user of the library, I cannot be more proud of our librarians for this externally-bestowed honor. This proves that our librarians are the best,” said Dr. Adejodi Badrun, Dean of AFIT’s Graduate School of Engineering and Management.

“The library is named in honor of Dr. John D’Azzo, an engineer, educator, and technology leader, who served nearly 64 years at Wright-Patterson AFB. With more than one million items, it is the third largest research library in the Air Force. I am extremely proud of the progress the D’Azzo librarians have made towards increasing access to resources and improving the user interface and research experience,” said Mr. Rob Marshall, AFRL/RQW division chief.

In fiscal year 2019, the library launched its institutional repository, AFIT Scholar, a single, central, searchable database and delivered 36,850 theses and dissertation downloads to 2,486 institutions in 166 countries.

“We strive to meet the changing learning, research, and teaching needs of the Graduate School of Engineering and Management to enable the school to attain its strategic directions. As we move forward, we will endeavor to continue our support to faculty, enhance spaces, and most importantly, student success.”

– Dr. Ellis Betek, AFIT library director

“D’Azzo Research Library staff and leadership gathered in honor of National Library Worker’s Day in April 2018. The joint AFIT/AFRL library received the 2019 Federal Library/Information Centers of the Year award in the large library/information center category.”

“AFIT Launches Online Graduate Certificate in Countering Weapons of Mass Destruction”

By Katie Scott
Air Force Institute of Technology

Weapons of mass destruction can be man-made or naturally-occurring in a chemical, biological, radiological, or nuclear form. Regardless of the source or type of agent, several U.S. government agencies are responsible for anticipating, evaluating, and countering WMD threats. Personnel with an understanding of the scientific principles behind WMDs are critical to advising leaders at all levels of government.

“The COVID-19 pandemic has brought back to light the fact that weapons of mass destruction, whether they be biological, chemical or nuclear, can make a huge impact on our way of life,” said Dr. James Petrovy, professor of nuclear engineering and director of the Nuclear Expertise for Advancing Technologies Center at the Air Force Institute of Technology.

The Countering of Weapons of Mass Destruction graduate certificate program is an online part-time program designed to be completed in one year. Students take one course each quarter that will provide a fundamental scientific knowledge base related to the production, use, effects, and mitigation of WMD.

“The graduate certificate programs at AFIT fill a niche with graduate-level, technical and achievable education for working professionals to complete part-time in about a year,” said Dr. Jeremy Stagler, assistant professor of industrial hygiene and environmental science and director of the CWMD graduate certificate program.

What makes the AFIT CWMD certificate program unique is the graduate-level technical focus of the classes with a focus on both warfare and terrorism. “There are several programs offered throughout the country on CWMD, but none are technical. They are political science type programs based on policy and agreements,” said Dr. John McCloy, professor of nuclear engineering and chair of the nuclear engineering program at AFIT.

The ability for AFIT to launch the online certificate program is due to support received from the Department of Homeland Security whose leaders were looking for technical, graduate-level education in the WMD field. “There is a need for this technical education, especially in the folks who are looked to as experts to advise decision makers at all levels of the government,” said Stagler.

The first course in the series this fall is biological weapons effects and technology. The course is particularly interesting at this time with the COVID-19 pandemic and the worldwide response. “A relatively quiet period in infectious disease was ended by the emergence of COVID-19. Biological weapons generally are simply infectious diseases and the world is affected at all the time,” explained the course instructor, Lt. Col. Casey Cooper, assistant professor of industrial hygiene.

AFIT first awarded the CWMD certificate in 2009 as part of an in-resident master’s degree program. Thirty students earned the certificate before the master’s program was suspended in 2018. This is the first time the certificate has been offered as a stand-alone program and executed fully online. The CWMD graduate certificate program is open to government personnel at no cost.

More information on the CWMD Online Graduate Certificate is available on the AFIT website at www.afit.edu/EnrollmentPrograms and prospective students can apply online at www.afit.edu/Admissions/AFITApplicationProcess.

New Graduate School Program Options Available AY20-21

Masters’ in Residence Programs
Acquisition & Program Management
Scientific & Technical Intelligence

In-Residence Certificate Programs
Low Observables
Radio Frequency
Low Observable Materials Engineering
Space Vehicle Design

Distance Learning Certificate Programs
Countering Weapons of Mass Destruction

Data Analytics
Operations Research
Space Systems
(Residence option also)
CSRA Space Object Self-Tracker Sending Daily Data Messages

By Jaclyn Knapp
Air Force Institute of Technology
Center for Space Research and Assurance

The Air Force Institute of Technology’s Space Object Self-Tracker experiment, launched in June of 2019, is now fully operational, providing daily data messages containing its current position and velocity in space.

The SOS is a self-sufficient, low-cost, low-weight, and low-power system which demonstrates precise orbit tracking capabilities for use in future Space Domain Awareness and Space Traffic Management applications. The SOS experiment is a hosted payload on NASA’s Green Propellant Infusion Mission spacecraft. As a hosted payload, AFIT’s Center for Space Research and Assurance’s SOS team anxiously waited for permission to begin its experimental mission. AFIT’s CSRA designed, manufactured and tested the payload through one of several collaborative efforts with the Air Force Research Laboratory Space Vehicles Directorate at Kirtland AFB, New Mexico.

“Now fully operational, SOS data will be used in both the classroom and for further research. Our collaborative relationships with sponsors like AFRL/RV provide our students with unique opportunities to receive both a hands-on space education, while also making a research contribution to the larger space community,” said Dr. Rich Cobb, CSRA associate director.

Student involvement with SOS technology development has contributed to research topics in orbital dynamics, systems engineering, and solar cell and panel design technology. AFIT’s Center for Space Research and Assurance’s orbital dynamics graduate student, John Claybrook, researched an orbital dynamics problem for his thesis to ensure the mission objective could be achieved.

“The two greatest benefits of my education at AFIT were the ability for a hands-on research investigation leveraging modeling and simulation tools as well as collaborating with other senior subject matter experts,” said Claybrook, section chief and capability manager, space asset resilience, Arnold Engineering Development Complex.

“This experience was also an opportunity to conduct thesis work within a real, meaningful DoD-based problem set, rather than a pure academic investigation where the thesis ultimately ends up sitting on a shelf,” said Claybrook.

According to Dr. William Wiesel, AFIT professor of astronautical engineering and SOS principal investigator for the navigation mission, the data from AFIT’s SOS experiment is now being used to qualify and further develop the next generation of autonomous, onboard satellite navigation and mission planning software. Although the original experiment software showed that kilometer level navigation was possible, computer technology is advancing so quickly that miniature single board computers can now execute advanced orbit determination algorithms, allowing for accuracy of a few tens of meters.

“SOS-derived technology will allow much of the satellite’s ground site “handholding” to be offloaded to the satellite itself, allowing the vehicle to plan and execute a list of high-level objectives,” said Wiesel.

Top photo: Chris Sheffield, laboratory technician for AFIT Center for Space Research and Assurance, conducts testing on AFIT’s Space Object Self-Tracker
Center photo: The Space Object Self-Tracker after completing pre-launch checkout before delivery for final integration. The payload is now fully operational, and provides daily data messages containing its current position and velocity in space.
A doctoral specialty may be pursued in any of the areas of concentration within the Department. Specialty coursework generally consists of one or more graduate sequences, augmented by the more advanced courses, which are offered for doctoral students. Students interested in a doctoral program should discuss those interests with a member of the Department who is actively engaged in research in an area of interest to the student.

Additionally, the Space Systems (GSS) certificate is available as either an in-residence or distance learning program.

For additional information about graduate or post-doctoral degrees in Astronautical Engineering or Space Systems, please visit the CSRA web page at https://www.afit.edu/CSRA/ and click on the "Degree Programs" tab.
AFIT’s Center for Space Research and Assurance formed in November 2012 to meet the space needs of the Department of Defense (DoD), Department of the Air Force (USAF and USSF), and Intelligence Community (IC) by both enhancing AFIT’s research-based, space-focused graduate education programs through external sponsorship and by providing a staff of technical experts in many disciplines to support a wide variety of areas of research across multiple academic departments.

**ALICE 3U CubeSat Experiment (2012)**

The ALICE (AFIT LEO-iMESA CubeSat) satellite was a 3U CubeSat supplied by the National Reconnaissance Office (NRO), Colony CubeSat program to test technologies in orbit. The satellite carried the iMESA (Integrated Miniaturized Electrostatic Analyzer) and the CNT (Carbon Nano-Tube) experiments. Georgia Tech manufactured the carbon nanotube array and AFIT built the payload and assembled and tested the satellite. The objective was to test the performance of the carbon nanotube array by using custom-built integrated miniaturized electrostatic analyzer (IMESA) sensors, based on designs provided by the U.S. Air Force Academy.

**RIGEX Space Shuttle Experiment (2008)**

Rigidizable Inflatable Get-Away-Special Experiment (RIGEX), an experiment designed and built by AFIT students to study the behavior of structures built using rigidizable/inflatable technology, was flown on NASA Space Shuttle Endeavour Mission STS-123 and successfully tested in a near zero gravity environment. The first ever designed/built/tested space flight experiment for AFIT, RIGEX was the collective thesis effort of multiple AFIT students (AF and Navy) across the Aeronautical, Astronautical, Electrical, and Systems Engineering programs.

**GRISROM 6U CubeSat Program Initiation (2016)**

AFIT is developing a space-qualified 6U CubeSat bus, called Grissom, to support hands-on student education and research. Students will use the Grissom 6U busses both in classroom and thesis work to design, build, and test CubeSat missions. This effort will leverage significant bus component and core flight software development performed at AFIT over the past few years and will include in-house hardware and software development, bus integration, and environmental testing.

For its first mission, the DoD’s Space Experiment Review Board (SERB) approved the Grissom 1-CubeSat to launch aboard the Space Test Program’s STP-528 mission in early 2022 and carry two experimental payloads. The Grissom 1-CubeSat represents AFIT’s first autonomous space flight experiment to be fully developed, integrated, and tested by AFIT faculty, staff, and students. Lessons learned from the Grissom project will enhance the development of the planned 12U (Cooper) and 27U (Eisele) CubeSat buses. The CubeSats are named after AFIT alumni who became astronauts: Lt Col Virgil “Gus” Grissom (B.S. Engineering Sciences, 1956), Col (ret.) Leroy Gordon Cooper (B.S. Aeronautical Engineering, 1956), and Col (ret.) Donn Eisele (M.S. Astronautics, 1960).

**AFIT’s SkyPad Payload Launch (2020)**

USSF-7 mission successfully launched AFIT’s SkyPad, a payload aboard the United States Air Force Academy’s FalconSat-8 spacecraft bus, which is an experiment hosted on the X-37B Orbital Test Vehicle. SkyPad’s mission is to demonstrate star tracking and high performance on-board processing using commercial cameras and graphics processing units. The GPUs will be reprogrammable on-orbit to enable experimentation in star tracking, image processing, data compression, and orbit determination using software code developed at AFIT. The payload employs an experimental suite of components for demonstration in the space environment. This collaboration also provides a platform for graduate research and hands-on education in mission analysis and design, payload hardware and software development, integration and testing and on-orbit experimentation. The CSRA SkyPad team, composed of more than 60 students, military, and civilians, delivered a space-ready mission in less than six months ahead of schedule.

**AFIT’s Space Object Self-Tracker (SOS) Experiment Launched (2019)**

AFIT’s Space Object Self-Tracker (SOS) experiment launched in June 2019, on the Department of Defense’s first SpaceX Falcon Heavy rocket. The SOS is a self-sufficient, low-cost, low-weight, and low-power system which demonstrates precise orbit tracking capabilities for use in future Space Domain Awareness and Space Traffic Management applications. The SOS experiment is a hosted payload on NASA’s Green Propellant Inflation Mission spacecraft.

AFIT’s CSRA designed, manufactured, and tested the payload through one of several collaborative efforts with the Air Force Research Laboratory Space Vehicles Directorate at Kirtland AFB, New Mexico. Data from AFIT’s SOS experiment is being used to qualify and further develop the next generation of autonomous, onboard satellite navigation and mission planning software. As of July 2020, the tracker was fully operational, providing daily data messages containing its current position and velocity in space.

**FOCUS ON SPACE RESEARCH**

AFIT ALUMNUS IN SPACE

“...The two greatest benefits of my education at AFIT were the ability for a hands-on research investigation leveraging modeling and simulation tools as well as collaborating with other senior subject matter experts,” explains John Claybrook, AFIT graduate. “This experience was also an opportunity to conduct thesis work within a real, meaningful DoD-based problem-set, rather than a pure academic investigation where the thesis ultimately ends up sitting on a shelf.”

Mr. John Claybrook, Section Chief and Capability Manager, Space Asset Resilience Arnold Engineering Development Complex Master of Science, Astronautical Engineering, 2013
AFIT ALUMNI IN SPACE

During the past century, AFIT and its predecessor organizations have educated hundreds of thousands of military professionals. AFIT graduates have made significant contributions in Air Force organizations such as Space and Missile Systems Center (SMC), United States Air Force Academy (USAAF), Air Force Research Laboratory (AFRL) and the newly-created United States Space Force (USSF). In regards to space, 30 astronauts have received their graduate degrees at AFIT.

B.S. Engineering Sciences, 1956

- Selected as one of NASA’s Original Seven Mercury Astronauts
- Became the first Air Force astronaut in space on the second Project Mercury mission
- First man to fly in space twice (Gemini III)
- Selected to command the first Apollo manned mission
- Died at NASA Kennedy Space Center in the 1967 Apollo spacecraft fire during a launchpad test
- Inducted into the U.S. Astronaut Hall of Fame (1990)
- AFIT’s CSRA manages the Grissom CubeSat Project, a 6U common bus development effort, named to honor the AFIT alumnus and astronaut

Massachusetts Institute of Technology, Ph.D. Astronautics, 1962

- Aldrin obtained a graduate education through AFIT’s Civilian Institutions education program
- Became a member of the Gemini 12 mission in 1966 and established a new record for extravehicular activity (EVA), spending 5-1/2 hours outside the spacecraft
- Named lunar module pilot for Apollo 11 (the first manned lunar landing mission) which resulted in Aldrin becoming the second human being to set foot on the Moon in July 1969
- Inducted into the U.S. Astronaut Hall of Fame (1993)
- Participated in AFIT’s Centennial (2019) astronaut panel

DID YOU KNOW?

Lt Edwin Aldrin, Sr. was a student of the first graduating class of the Air Service Engineering School (AFIT) in June 1920. In his class photo, Aldrin, Sr. is the first student seated on the bottom row.

*DENOTES AFIT DISTINGUISHED ALUMNI AWARD WINNER

GUION “GUY” BLUFORD, JR.
(COL., USAF, RET.)*
NASA Astronaut 1978-1993

- Ph.D. Aerospace Engineering, 1978
- M.S. Aerospace Engineering, 1974
- Distinguished graduate
  - The first African American in space
  - Logged more than 688 hours in space on four separate flights
  - Inducted into the U.S. Astronaut Hall of Fame (2010)
  - Participated in AFIT’s Centennial astronaut panel (2019)
  - Received the Ohio Distinguished Service medal for his lifetime achievements in service to the state and nation (2020)

COL. SHANE CLARK
30th Space Wing vice commander, Vandenberg AFB (Ret. Summer 2020)

M.S. Space Systems, 2004

- Launch Decision Authority (LDA) for two launches: Delta II and Falcon 9, two flight tests; Minuteman III and a Missile Defense Interceptor, and participated in numerous other launches and tests
- Final launch: Mission director for the May 2020 launch of the USSF’s USSF-7, and the X-37B Orbital Test Vehicle for the Department of the Air Force’s Rapid Capabilities Office
- AFIT’s Center for Space Research and Assurance’s SkyPad payload was also aboard the U.S. Air Force Academy’s FalconSat-8 spacecraft bus, which is an experiment hosted on the X-37B Orbital Test Vehicle

AFIT ALUMNI IN SPACE

MARK BROWN (COL., USAF, RET.)
M.S. Astronautical Engineering, 1980
Dayton, Ohio native

- Supported STS flights 2, 3, 4, 6, 8 and 41-C in the Flight Activity Officer/Staff Support Room of the Mission Control Center
- Served as astronaut member on the Space Station Freedom Program
- Participated in AFIT’s Centennial astronaut panel (2019)

BRIG. GEN. DOUGLAS SCHEISS
Commander, 45th Space Wing, Patrick Space Force Base & Cape Canaveral Space Force Station

M.S. Space Systems, 2004

- Achieved “Drive to 48” in 2019: Aug 2019: Launched four times within four weeks, launched two times within 34 hours (which hadn’t been done in 30 years)
Dec 2019: Supported two launches in one week
- Commander of the first base to change their name to reflect the USSF (2020)
Follow-on Space Assignments for AFIT Graduates

Follow-on assignments for space-related March 2020 AFIT graduate students include the following: NRO, AFRL/RV, SMC, 35ES, 533TRS, UPT, and F-22 SPO.

Maj Timothy Anderson earned a Ph.D. in applied mathematics and his follow-on assignment is the detachment commander for the 18th Space Control Squadron Detachment 1. The current mission is Space Domain Awareness (SDA) with the ultimate goal of converting the detachment into a space experimentation squadron within the SDA domain.

Lt Taylor Whitney earned an M.S. in Applied Physics and her thesis research focused on solar physics working toward the goal of forecasting solar flares. Her follow-on assignment is at the Space Weather Operations Center, where her work will support the Space Force.

Capt Brandon Huftstetler, 35S, earned an M.S. in Operations Research and he is assigned to the 533 Training Squadron at Vandenberg AFB, CA to be a space instructor at the schoolhouse. His thesis was titled Heuristic Approaches for Near-Optimal Placement of GPS-Based Multi-Static Radar Receivers in American Coastal Waters. He has applied to the NASA Astronaut program with an endorsement from Gen Raymond.

By Jaclyn Knapp
Air Force Institute of Technology
Center for Space Research and Assurance

Due to COVID-19 restrictions, AFIT CSRDA was forced to switch all-in-person classes to distance learning; something that has never been implemented before in the history of the Center. In March 2020, the Center also welcomed its first international intern, 2d Lt. Paul Gindre from the French Air Force Academy; another history-making milestone for the Center, the internship enhanced its diversity by bridging international cultures and relations to the Center, the internship enhanced the intern’s research collaboration in space, as well as other faculty and staff of the Air Force Institute of Technology’s Center for Space Research and Assurance. With the recent establishment of the United States Space Force as the nation’s newest military service, it is particularly fitting that this award recognizes and highlights AFIT’s unique capabilities to support the advance education needs of that new service,” said Dr. Todd Stewart, AFIT director and chancellor.

The General Muir S. Fairchild Educational Achievement Award was established in 1964 to recognize the most significant contribution to Air Force education. Its purpose is to stimulate and reward creative and outstanding achievement in military education and to increase interest in furthering professional educational development with the Air Force.

The General Muir S. Fairchild Educational Achievement Award was presented by AFIT Chancellor, Dr. Stewart.

Col Tim Albrecht, Director of the Center for Space Research and Assurance, was presented with the General Muir S. Fairchild Award at the “AFIT All Call” on 22 August 2020 by AFIT Chancellor, Dr. Stewart.

AFIT Distinguished Alumnus
Gen Muir S. Fairchild

1929: Air Corps Engineering School (AFT)
1946-1948: Commander of Air University
1948: Vice Chief of Staff of the Air Force (rank of a four-star General)
1950: Died in active duty as Vice Chief of Staff

Daedalians

General Muir S. Fairchild Educational Award
Award Presented by General Khooie to:
The Center for Space Research and Assurance

Daedalian Commander and Chairman, Lt Gen Nicholas B. Kohus II, USAF (Ret), presented the prestigious award virtually. The winner of the General Muir S. Fairchild Award is determined from an individual or organization that contributed the most to AFIT, Air University (AU) or Air Force education. Since 1954, each winner is engraved on a trophy that is on display at AU, Maxwell Air Force Base, Alabama.
NASA selects six AFIT/CI alumni to be part of Astronaut Group 3: Donn Eisele, David Scott, Buzz Aldrin, William Anders, Charles Bassett and Roger Chaffee.

Gus Grissom is the second American and first AFIT alum to go into space as part of Project Mercury.

Apollo spacecraft catches fire at Cape Kennedy killing AFIT alum Gus Grissom, Edward White, and Roger Chaffee.

AFIT alum Guy Bluford becomes first African-American in space as Mission Specialist of Space Shuttle Challenger.

Space Shuttle Discovery launches on a mission to International Space Station with AFIT alums onboard – Steven Lindsey (Commander) and Mike Fossum (Mission Specialist).

AFIT alum Guy Bluford becomes first African-American in space as Mission Specialist of Space Shuttle

AFIT alum Mike Mullane serves as Mission Specialist of Space Shuttle Discovery.

AFIT alum Guy Bluford becomes first African-American in space as Mission Specialist of Space Shuttle

AFIT alum Mike Mullane serves as Mission Specialist of Space Shuttle Discovery.

AFIT donates the space flight experiment RIGEX to the National Museum of the U.S. Air Force.

AFIT Centennial celebrations include an AFIT alumni panel of former astronauts Buzz Aldrin, Guy Bluford, Mark Brown, Steven Lindsey, and Mike Mullane.

Gus Grissom is the second American and first AFIT alum to go into space as part of Project Mercury.

Gordon Cooper orbits Earth for eight days proving man could survive in space long enough for a trip to the moon.

Buzz Aldrin serves as Apollo 11 lunar module pilot and becomes second man to walk on the moon.

Don Eisele is command pilot of Apollo VII – the first manned mission in the lunar landing program. Mission transmits the first live TV broadcast aboard a crewed U.S. spacecraft.

Steven Lindsey serves as Commander of the final mission of Space Shuttle Discovery.

Rigidizable Inflatable Get-Away-Special Experiment (RIGEX), AFIT's first designed/built/tested space flight experiment, is tested on Space Shuttle Endeavour.

SOS experiment is launched on DoD's first SpaceX Falcon Heavy rocket.

AFIT's SkyPad payload is successfully launched.

A two-year Astronautics program is initiated at AFIT.

School of Engineering is granted accreditation to award master's degrees.

Ph.D. programs are initiated at AFIT.

Graduate Space Operations program is initiated in response to NORAD request.

AFIT establishes the Center for Space Research and Assurance.

Capability for satellite modeling, simulation, and analysis using high performance computers (i.e., “super computers”) is established.

ALICE 3U CubeSat experiment.

Space Object Self-Tracker (SOS) program is initiated.

Space Vehicle Design Sequence added to curriculum.

Space Vehicle Design Certificate program to begin.

Steve Lindsey is command pilot of Apollo VII – the first manned mission in the lunar landing program. Mission transmits the first live TV broadcast aboard a crewed U.S. spacecraft.

NASA chooses AFIT alums Virgil "Gus" Grissom and Gordon Cooper to be part of the Mercury Seven.
UPCOMING EVENTS

OCTOBER 2020
AFIT Graduate School Summer Graduation Degree Conferral (No Ceremony)
AFIT Campus, WPAFB, OH  I  01 Oct 2020

AFIT Graduate School Fall Quarter Classes Begin
AFIT Campus, WPAFB, OH  I  01 Oct 2020

WPAFB TechExpo
Virtual Event, WPAFB, OH  I  20 Oct 2020

HLC Reaccreditation Team Visit
AFIT Campus, WPAFB, OH  I  19-20 Oct 2020

NOVEMBER 2020
AFIT’s 101st Birthday
AFIT Campus, WPAFB, OH  I  10 Nov 2020

DECEMBER 2020
AFIT Graduate School Fall Quarter Classes End
AFIT Campus, WPAFB, OH  I  17 Dec 2020

AFIT Graduate School Fall Graduation Degree Conferral (No Ceremony)
AFIT Campus, WPAFB, OH  I  24 Dec 2020

STAY CONNECTED

Coming in the December 2020 AFIT Engineer:
Artificial Intelligence Education & Research

AFIT FACULTY SEARCH

To search for AFIT Graduate School faculty members and view their online bios, please visit us at www.afit.edu/BIOS

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Coming in the December 2020 AFIT Engineer:
Artificial Intelligence Education & Research