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.
‘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 imperative 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 requirements 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 “fitness” 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 our Center for Space Research and Assurance (CSRA) confirmed that we have been in the space-research domain for quite some time and we are moving forward progressively in support of the newly-created United States Space Force (USSF). Basically speaking, we are all in this “space” together and we must work together to support space pursuits.

Respectfully,

Adedeji B. Badiru, Ph.D., PE, PMP, FIEEE
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-up round 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 Cotellesso, AU DET 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 Welsh, Chief of Security, Dr. Amanda Bullock, AFIT Foundation, Capt Devin DePalmer, AFIT Diversity & Inclusion, 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.

EN OUTREACH

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

FROM THE DEAN’S DESK

FROM AF ORGS:

AF ROTC: 24
AF TOTAL: 245

DEGREES:

M.S. 85%
Ph.D. 15%

ARMY: 7

MARES: 3

CIVILIANS: 3

FROM USAFA:

AF ROTC: 28

MARRINES: 3
**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 promotion in a 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 Kaban, Faculty Council President for the Graduate School.

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**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 masters’ and five Ph.D. students.

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

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**Dr. Brian Lunday**

Dr. Brian Lunday earned promotion to Professor of Operations Research within the Operational Sciences department. Lunday first 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.

Lunday has published 38 archival journal articles, 23 of which are in what are considered top- tier, and six in the top journal in his field. He is a sought-out academic advisor having advised four Ph.D. students and 22 master’s students. He received the 2019 Professor Ezra Kotcher Award.

Lunday’s technical research emphasizes theoretical developments in math programming, game theoretic models, and algorithmic design for global optimization, as well as applications to the areas of network design, network optimization, network interdiction, network restoration, facility/ resource location, and resource location/ allocation and assignment.

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**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 masters’ and 17 Ph.D. students.

He has 90 refereed publications, 53 in open source archival journals 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 ITAR or 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 NWEEIP program.

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**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.

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 $1.8M 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 Industrial and Systems Engineering Research Conference.

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**Lt. Col. Andrew Geyer**

Lt. Col. Andrew Geyer

Lt. Col. Andrew Geyer earned promotion to Associate Professor of Statistics with military tenure within the Mathematics and Statistics department.

In 2014, Geyer graduated from AFIT with a Ph.D. in Applied Mathematics. Then joined the faculty. He has served as the researcher advisor for three doctoral and 11 master’s students.

Geyer’s research interests include design of experiments, combinatorial optimization problems in statistics, statistical performance metrics, and statistical classification techniques.

He has published eight refereed journal articles, one book chapter, and 16 conference presentations. He received research grants totaling $214k from the Air Force Technical Applications Center, Air Combat Command, the 45th Weather Squadron, and the U.S. Space Command.

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**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 abstracts, and awarded two patents with one additional patent pending. Nykl has supported 15 funded research projects totaling over $1.9M, including $1M in personal 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.

This article has been edited for length.

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**Lt. Col. Andrew Hoisington**

Lt. Col. Andrew Hoisington earned promotion to Associate Professor of Engineering Management with military tenure within the Systems Engineering and Management department.

He has 19 years of active duty experience in the DoD environment; civil engineering and education. He received a doctorate degree from the University of Texas at Austin in environmental engineering in 2013.

Hoisington has advised seven master’s theses, served on committees for two Ph.D.s and 11 master’s students, and led 13 undergraduate researchers. His dedication to education and students has been recognized in awards including the Society of American Military Engineers National Educator of the Year, USAFA Outstanding Academy Educator, and the AFIT Military Officers Association of America Outstanding Military Instructor.

To date, Hoisington has 21 peer-reviewed journal articles, one book chapter, five conference publications, six distinguished lectures, and 64 non-peer-reviewed articles. Google scholar notes his peer-review work has 347 citations and he has h-index of 10.

Hoisington’s primary research focus is studying the built environment to improve occupant’s health. Specifically, his work has investigated building factors that correspond with negative mental health outcomes. In addition, he has interest in the microbiome of occupants and the built environment.

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**By The Numbers**

Accumulative achievements by these seven graduate school faculty members:

- 300+ publications
- 165+ students advised
- Nearly $7M in sponsored research funds

“**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. Aidedjej Badru, Dean of the Graduate School of Engineering and Management
SMART Scholarship Program Earns Degree at AFIT

By Katie Scott
Air Force Institute of Technology

United States Marine Corps Lieutenant Colonel James C. Paxton III is currently serving as the Commanding Officer of Marine Corps Air Station Yuma and Headquarters and Headquarter Squadron (designated the “Guardians”) in Yuma, Arizona. He is a naval aviator who flew F/A-18C and KC-130 aircraft, and now flies the UC-12J. He attended the United States Naval Academy and was designated a Strike Fighter Tactics Instructor.

Returning from deployment in 2013, Paxton was selected by the Commandant’s Professional Intermediate-Level Education Board to earn a master’s degree in aeronautical engineering from the Air Force Institute of Technology’s Graduate School of Engineering and Management. “The immersive program,” said Col. Andy McQuade, 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.”

At AFIT’s graduate school, Paxton’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 tied 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 have with the DoD and other defense-focused agencies like the DoE. “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.smartscholarship.org. More information about AFIT’s STEM degree programs can be found at www.afit.edu/EN/allprograms.

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 her experiences and stereotypes. They may result in unconscious and quick projections about personalities, capabilities, and beliefs. Grimes believes that it is imperative to recognize biases and devise strategies to avoid pitfalls.

“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.

Another barrier leading to bias are interview questions that may be ill-suited for 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. “Equity and race is a sensitive topic on the radar of many minds, yet underdiscussed due to fear of being misunderstood or judged. Today’s leaders are being the opportunity to address the upbringing 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 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 utilizing 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 grade 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.”

By Donna Lindner
Air Force Research Laboratory

Dr. Alice Grimes, Sensors Directorate Faculty Development Director, moderates the virtual presentation. Air Force Research Laboratory

Alumni/Student Semifinalists of AFMC 2020 MAJCOM Spark Tank

By Marisa Alia-Novobiski
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 MARCOM Spark Tank semifinalists. Spark Tank, a collaboration between AFWER and Deputy Under Secretary of the Air Force, Management, 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. The top two ideas will go to represent the major command in the 2021 Air Force Spark Tank competition.

Alumni/Student Semifinalists of AFMC 2020 MAJCOM Spark Tank

By Marisa Alia-Novobiski
Air Force Materiel Command

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The AFIT alumni/student semifinalists are:

• Data Driven Facilities with Robotic Process Automation (RPA), submitted by Maj. Patrick Grandjean (M.S. Engineering Management, 2015), Air Force Civil Engineer Center

This article has been edited for length.
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 online access to federal information centers. The award recognizes the many innovative ways that federal libraries fulfill the information demands of the government, business, and scholarly communities.

The D’Azzo Research Library, in honor of the late AFRL RQWL branch chief and AFRL Academy of Distinguished Engineers inductee, Dr. John D’Azzo, an engineer, educator, scientist, and global research community leader, is the third institution to receive this honor in the federal library program. This proves that our great librarians have made towards increasing access to resources and improving the user experience and research experience,” said Mr. Rob Marshall, AFRL/ROW division chief.

The library is named in honor of Dr. John D’Azzo, an engineer, educator, and technology leader, who served nearly 60 years at Wright-Patterson AFB. With more than one million items, it is the third largest research library in the Air Force.

“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 Betleck, AFIT Library director
DATA FROM SPACE

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 relationship with sponsors like AFRV/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 astronautical engineering graduate, 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.


AFIT was the first U.S. school to offer an astronautical engineering degree.
**AFIT’S ASTRONAUTICAL ENGINEERING & SPACE SYSTEMS DEGREE PROGRAMS**

AFIT’s Astronautical Engineering (GA) and Space Systems (GSS) fully-accredited master’s degree programs provide students with the opportunity to broaden their knowledge in the field of Astronautical Engineering and Space Systems, respectively, and apply that knowledge to an in-depth investigation of a specific research topic.

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 most 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/](https://www.afit.edu/CSRA/) and click on the “Degre Programs” tab.

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**SPACE ACADEMIC PROGRAMS**

**CSRA LAUNCHES NEW SPACE COURSES**

**Space Control Sequence**

CSRA debuted two new graduate-level courses in 2019 as part of a wider specialty course sequence pertaining to “Space Control.” The first course, ASYS 631A (Space Mission Analysis and Systems Design), begins with a short mission description and ends with the development of a space vehicle requirements document. In the second course, ASYS 631B (Satellite Systems Engineering), students develop a design solution that satisfies the space vehicle requirements. In the next course, ASYS 632 (Satellite Design and Test), students actually build a representative space vehicle and conduct requirements verification and environmental qualification testing. The fourth and final course, ASYS 633A (Spacecraft Systems Analysis & Design), is new to the AFIT curriculum and will debut in October 2021. This course will serve as the capstone to the program, and will introduce students to forensic and reverse engineering.

After completing this sequence, students will have been exposed to all aspects of the space vehicle development life cycle from mission and system definition, through preliminary and detail design, to assembly, integration and testing. This unique certificate combines analytical design with laboratory tests of actual spacecraft systems to provide students with a unique, hands-on experience. Please check with the Department or the AFIT Registrar for program eligibility.

NEW IN-RESIDENCE GRADUATE CERTIFICATE BEGINS IN 2021

**Space Vehicle Design Certificate**

Starting in January 2021, students will be able to enter into the new Space Vehicle Design program which leverages, in part, AFIT’s existing space vehicle design sequence, originally a three-course sequence designed to give students in-depth knowledge of all aspects of spacecraft design and test.

The first course of the program, ASYS 531 (Space Mission Analysis and Systems Design), begins with a short mission description and ends with the development of a space vehicle requirements document. In the second course, ASYS 531B (Satellite Systems Engineering), students develop a design solution that satisfies the space vehicle requirements. In the next course, ASYS 632 (Satellite Design and Test), students actually build a representative space vehicle and conduct requirements verification and environmental qualification testing. The fourth and final course, ASYS 633A (Spacecraft Systems Analysis & Design), is new to the AFIT curriculum and will debut in October 2021. This course will serve as the capstone to the program, and will introduce students to forensic and reverse engineering.

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HOW TO APPLY TO AFIT

For more information on eligibility requirements and how to apply to AFIT, visit the admissions page at [https://www.afit.edu/ADMISSIONS/](https://www.afit.edu/ADMISSIONS/)
AfT's Center for Space Research and Assurance was founded in November 2012 to meet the space needs of the Department of Defense (DoD), Department of the Air Force (USAF and USSF), and National Reconnaissance Office (NRO) by both enhancing AfT'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.

**RIGEX Space Shuttle Experiment (2008)**
Rigidible Inflatable Get-Away Special Experiment (RIGEX), an experiment designed and built by AfT 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 AfT, RIGEX was the collective thesis effort of multiple AfT students (AF and Navy) across the Aeronautical, Astronautical, Electrical, and Systems Engineering programs.

**ALICE 3U CubeSat Experiment (2012)**
The ALICE (AfT LEO-INSAT-CVT Experiment) satellite was a 3U CubeSat supplied by the National Reconciliation Office (NRO), Colony CubeSat program to test technologies in orbit. The satellite carried the iMESA (Integrated Miniaturized Electrostatic Analyzer) and the CNV (Carbon Nano-Tube) experiments. George Tech manufactured the carbon nanotube array and AfT 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.

AfT was designed, tested, and integrated at AfT by a multi- department team of professors, students, and technicians. AfT launched as a secondary payload on an Atlas-5-501 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 Infusion Mission spacecraft.

**AfT's Space Object Self-Tracker (SOS) Experiment Launched (2019)**
AfT's Space Object Self-Tracker (SOS) experiment launched in June 2019 on the Department of Defense's first Space 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 GPSL will be reprogrammable on-orbit to enable experimentation in star tracking, image processing, data compression, and orbit determination using software code developed at AfT. 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 CSA SkyPad team, composed of more than 60 students, military, and civilians, delivered a space-ready mission in less than six months ahead of schedule.

**AfT’s SkyPad Payload Launched (2020)**
USAF-7 mission successfully launched AfT’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 GPSL will be reprogrammable on-orbit to enable experimentation in star tracking, image processing, data compression, and orbit determination using software code developed at AfT. 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 CSA 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 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 (USAFA), 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.

**EDWIN “BUZZ” ALDRIN (COL., USAF, RET.)*
NASA Astronaut 1963-1971

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

**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

**MARK BROWN (COL., USAF, RET.)
NASA Astronaut 1984-1993
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)
The COVID-19 restrictions have brought many changes and challenges for the students, faculty, and staff of the Air Force Institute of Technology’s Center for Space Research and Assurance. One immediate challenge was switching all in-person classes to distance learning, something that has never been implemented before in the history of the Center. Through the use of Microsoft Teams, professors are able to teach live with video capabilities and other technological modifications and applications. Faculty office hours, research meetings, student presentations, and study groups have also continued through the use of virtual technology.

In addition, faculty can also record live lectures so students can view again later for clarification.

“The education we are receiving now is of the same caliber of education we were receiving before the distance learning began,” said Lt. Nathaniel Enders, astronautical engineering student. “This is a testament to both the faculty’s and student’s ability to adapt. All of my instructors this quarter have been very responsive to questions I have in and out of class. They care about students learning just as much as the students do,” said Enders.

To encourage class interaction, professors will present questions to be answered within a time limit. This approach also assists with keeping students actively engaged in class since distance learning requires more effort to stay focused. “CSRA staff and AFIT resources have done a great job making the shift to distance learning. Instructors have communicated expectations early and often, leaving no ambiguity as to when and how course work is to be accomplished,” said Lt. Col. Cindy Agee, astronautical engineering student. “AFIT has enough resources and dedicated staff to ensure success of the student, but it also falls on the individual to take challenges head-on. Staying motivated and driving yourself to learn through individual efforts to take challenges head on. Staying motivated and driving yourself to learn through individual efforts to take challenges head-on. Success of the student, but it also falls on the students.”

Due to COVID-19 restrictions, AFIT CSRA 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 from the French Air Force Academy, another history-making milestone for the Center. Lt. Gindre’s research was focused on validating software-based radiative heat transfer models in order to improve modeling confidence and accuracy of Cubesat component thermal designs. Another focus of his research was to minimize the number of commercial-off-the-shelf modular attitude control units for a 6U Cubesat while maximizing the control torque for a given mission.

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. Students, faculty, and research.

“2019 was a great year for AFIT and the Center. I’m proud of our team and the work we accomplished last year when the DoD and USAF spotlight shined on the space domain,” said Col. Tim Albrecht, CSRA director. “We’re honored to have an astronaut, commander and president of Air University recognized with this award and look forward to carrying this momentum through 2020 in support of our students and research programs,” said Albrecht.

CSRA is one of eight interdisciplinary research centers of AFIT’s Graduate School of Engineering and Management.
Gus Grissom is the second American and first AFIT alum to go into space as part of Project Mercury.

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.

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

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.

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.

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 Challenger.

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UPCOMING EVENTS

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

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

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

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

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

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

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

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