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# THE AFIT ENGINEER

Air Force Institute of Technology

## AFIT Centennial Celebration

A Century of Education Excellence: Inspiration to Innovation

By Amy Rollins  
Skywrighter Staff

On November 7, The Air Force Institute of Technology celebrated its centennial with a symposium carrying a theme of inspiration to innovation. Its 750-seat Kenney Auditorium was packed, with a stand-by space populated by remaining guests. Multiple speakers and a panel of astronauts who are AFIT graduates were the morning session's highlights. The symposium's afternoon session was devoted to many other speakers, with the day concluding in an awards and recognition banquet recognizing the achievements of alumni and contributions of faculty and staff.

Maj. Gen. William Cooley, Air Force Research Laboratory commander and '97 AFIT alumni in engineering physics, served as the morning session's keynote speaker. He highlighted how Airmen have had to become technologists since the earliest days of air power – a need that continues today.

"We, collectively, need to emphasize the need for every Airman – military, civilian, contractor – to see themselves as technologists and educate appropriately via discipline and traditional academic approaches as well as short courses to expose the new technologies and opportunities."

Cooley asked the students to embrace their role as technologists, be justifiably proud of AFIT and balance persistence with openness for novel approaches. "I am very proud of my time at AFIT. Time and time again I am impressed by the caliber of the

Guest speaker,  
Ms. Amanda  
Wright-Lane,  
great grandniece  
of Orville and  
Wilbur Wright.



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

students and the folks we produce," he said. "This is a first-rate institution. You all are getting a top-drawer education. You are only limited by your own hesitation to dive in and make a difference. Be very proud of this institution."

The second speaker was Amanda Wright Lane, great grandniece of Wilbur and Orville Wright. "There is not a day of my life that I don't think about flight. It has its own heartbeat here in the Midwest," she told the audience. "I hope that when each of you spend time here at Wright-Patterson Air Force Base, you've felt it, too, because when it comes to flight, this is sacred ground. I say that not only because of the work and accomplishment of my great-grands, but because of yours."

"Like you, (my great-grand uncles) were motivated. Like you, they were innovative. Like you, they were not afraid of hard work, but most importantly, they saw a future in which aerospace would truly benefit the whole of mankind," she said.

The third speaker George Hardy, a retired lieutenant colonel and two-time AFIT graduate in systems engineering/reliability and electrical engineering, spoke about his

early career as a Tuskegee Airman in the Army Air Corps and later achievements as a B-29 bomber pilot during the Korean War. Hardy also served as a C-119 gunship pilot, flying 70 missions during the Vietnam War.

Hardy outlined his career, which began when he was 18. He served as a pilot, maintenance crew officer and electronic systems reliability expert. He worked on automatic voice networks until he flew in his third war before retiring in 1971 and going to work for GTE Corp. "When I think of my career, I do not think of the flying missions. I think of AFIT, what it did for me and how much I loved being here," Hardy said.

*(This article has been edited for length.)*

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## Digital Engineering on a Space Platform

Much is being said nowadays about the emergence of digital engineering in defense operations. Yes, indeed, digital engineering promises to revolutionize operations that had, hitherto, been tackled with analog processes. The US Air Force now has a digital engineering roadmap.



Dr. Adedeji Badiru, Dean

In July 2018, the Department of Defense (DoD) released its Digital Engineering Strategy for the purpose of promoting the use of digital representations of systems and components and using digital artifacts to design and sustain national defense systems. The pursuit of this strategy is now spreading rapidly throughout all the arms (no pun intended) of the Department of Defense. Fortunately, we, here at AFIT, are already aligned with the game. We hosted a well-received digital engineering symposium as long ago as 30-31 October 2017. So, we are well-positioned and prepared to offer workshops, credit courses, certificates, training sessions, and research on the multitude of topics embedded within digital engineering. This we can do through partnerships and collaborations with like-focused organizations and individuals, but from a System of Systems perspective. A systems framework can ensure that all the parts are operating in consonance such that the output of the overall system would be higher than the mere sum of the individual outputs of the disjointed subsystems. In this regard, integration of efforts is the key to success.

### What is Digital Engineering?

To collaborate on digital engineering, we must all have a common understanding of what it entails. For our common understanding, digital engineering is the combined art and science of creating, capturing, designing, evaluating, justifying, and integrating data using digital (i.e.,

electronic) tools and processes. This requires the humans in the loop of the process to also have a digital mindset. A digital tool that is devoid of the digital readiness of humans will be for naught. So, workforce development along the digital spectrum is essential for sustainable success. With its education mission, AFIT

is most suited to leading digital efforts for the US Air Force. Digital engineering will require new and novel methods, systems-based processes, and appropriately-customized tools. If we are serious about digital engineering, we must fundamentally change the way we manage, monitor, and control operations. All AFIT schools are integratively ready to help with this challenge.

### Space-based Application Platform

As a Systems Engineer, I have been wrestling with the thought of how we can leverage the digital revolution to foster international collaboration in the pursuit of World peace. Over the years, much has been done by the US Institute of Peace in Washington, DC about how to leverage the capabilities of STEM players to develop strategies for pursuing World peace. I recall a key extract from a proposal that I submitted to the Institute of Peace in 1993: "The premise of this proposal is that industrial cooperation can serve as a driver for World peace because of the mutual dependency that can result from such cooperation."

With the emergence of digital engineering with potential applications of

additive manufacturing (3D printing) on the International Space Station, I am reviving the thought of what may be possible in that far-up space platform. Coincidentally, advanced research in 3D printing for space applications is one of AFIT's present capabilities. The International Space Station has demonstrated the possibility of collaborating nations working "peacefully" way up there. With the spread of digital engineering, can we learn new space-based disposition towards pursuing sustainable peace down here? Can the floating international space station be a movable platform for world-peace collaboration? Time and research will tell.

Meanwhile, we can explore an envisioned implementation of digital engineering along the systems engineering framework presented in the graphic below.

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

### Digital Engineering Systems Wheel of Implementation



# CENTENNIAL HIGHLIGHTS



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



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

Above: Lt Col George Hardy, Ret, a Tuskegee Airman and veteran of three major conflicts.

Left: AFIT astronaut panel members (from left to right): Retired Colonel Buzz Aldrin, Retired Colonel Guy Bluford, Retired Colonel Mark Brown, Retired Colonel Steven Lindsey, and Retired Colonel Richard "Mike" Mullane.

## EN OUTREACH

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



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

Counterclockwise from left: Keynote speaker Maj Gen William Cooley, Air Force Research Laboratory Commander.

AFIT centennial awards banquet keynote speaker and AFIT alum, Maj Gen Carl Schaefer, Deputy Commander, Air Force Materiel Command.

Special Legacy Recognition presented to Tuskegee Airman Lt Col George Hardy, Ret by AFIT employees Kathleen and Dan Burden, at AFIT's Centennial Celebration.



U.S. Air Force Photo by T. Greenlees



Please visit [www.facebook.com/AFIT100/](https://www.facebook.com/AFIT100/) to view more images of the Air Force Institute of Technology Centennial Celebration.

## AFRL Physicist, AFIT Alum Wins Top Science Award

By Jeanne Dailey  
Air Force Research Laboratory

Air Force Research Laboratory scientist Dr. Robert Johnson has won the most prestigious science and technology award in the U.S. Air Force – the Harold Brown Award. The award is given annually to a scientist or engineer who uses scientific research to solve a problem critical to the needs of the Air Force.

In a ceremony held on Nov. 21 at Kirtland Air Force Base, N.M. and presided over by Dr. Richard Joseph, Chief Scientist of the Air Force, Johnson was presented a trophy and a certificate signed by the Acting Secretary of the Air Force Matthew P. Donovan and the Chief of Staff of the Air Force Gen. David Goldfein. “Dr. Johnson is most deserving of this recognition,” said Joseph. “I was particularly struck by the leadership he brought to his team – great leaders magnify the work of a team and for that reason alone Dr. Johnson deserves this award.”

AFRL Commander Maj. Gen. William Cooley made the announcement to his workforce in an email announcement on Nov. 14. “Dr. Johnson is leading the way for our Air Force with cutting edge research and is an example to scientists and engineers across the lab,” said Cooley. “Dr. Johnson was selected for this prestigious award for outstanding contributions including identifying a breakthrough in physics that enables high-resolution ground to space imaging. His contributions provide optical space situational awareness techniques found nowhere else. This breakthrough has provided the U.S. military with a decisive advantage in space surveillance.”

Johnson is a principal investigator at AFRL’s Starfire Optical Range (SOR) located on Kirtland AFB where he leads



U.S. Air Force Photo by Macee Hunt

**Left to Right: Air Force Research Laboratory 2018 Harold Brown Award winner Dr. Robert Johnson and Dr. Richard Joseph Chief Scientist of the Air Force stand in front of AFRL’s Starfire Optical Range telescopes.**

research on electro-optics for space situational awareness. “It is an honor to recognize Rob and his team for their tremendous accomplishments in the field of adaptive optics and sodium guidestar development,” said Dr. Kelly Hammett, AFRL’s Directed Energy Director. “The results of their research is being transitioned across the nation and the world.”

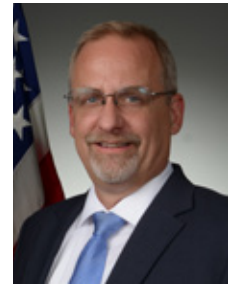
Johnson is well qualified for his job. He holds a Bachelor of Science in Physics from Texas A&M University in College Station, Texas; a Master of Science in Applied Physics from the Air Force Institute of Technology at Dayton, Ohio; and Doctor of Philosophy in Optical Sciences from the University of Arizona in Tucson, Arizona. “Electro-optics, and in particular adaptive optics, is important to national defense because it is a technology that uniquely solves some of our most important challenges in space situational awareness,” said Johnson.

*(This article has been edited for length.)*

## AFIT Alum Named New Director of AFRL’s Aerospace Systems Directorate

By Holly Jordan  
AFRL Aerospace Systems Directorate

A new leader has taken the helm at the Air Force Research Laboratory Aerospace Systems Directorate, as Dr. Michael Gregg officially assumed the role of director on Sept. 3, 2019.



Dr. Michael Gregg

Although new to the directorate, Gregg is no stranger to AFRL. As a young Air Force officer, he spent the early years of his career working as a scientist at what was then the Rome Air Development Center at Hanscom AFB (now Rome Research Site in New York, home of the Information Directorate) and the Directed Energy Directorate at Kirtland AFB. He also spent time at Wright-Patterson AFB as a graduate student at the Air Force Institute of Technology. Gregg earned an M.S. in Engineering Physics in 1992 and a PhD in Applied Physics in 1996.

After an accomplished career that included leadership roles within the Missile Defense Agency, C-17 System Program Office, Space and Missile Systems Center, and the C-5 and C-17 sustainment community, Gregg retired from the Air Force and accepted a position at Dayton Aerospace, Inc., where he spent the next six years working on Air Force programs.

For Gregg, it was a desire to get back into the laboratory environment that drew him to his new role in the Aerospace Systems Directorate. He said it is exciting to get back to the place where innovative ideas first begin to take shape.

*(This article has been edited for length.)*

## AFIT Emeritus Professor's Memoir Reflections

By Jan Muczuk  
Emeritus Professor of Management  
Cleveland State University and  
Air Force Institute of Technology



Dr. Jan Muczuk

**Life in Poland.** I was born in Sahryn, Poland on February 12, 1939. At the time of my birth, Sahryn was a village in Southeast Poland about 12.4 miles west of the Bug River, which is now the border between Poland and Ukraine. My father was born in Camden, New Jersey, but was taken back to Poland by his parents as a young boy, and where he married my mother, a Polish national. This was a tragic time not only for Poland, but for my family in particular. On September 1, 1939 Germany invaded Poland, and sixteen days later the Soviet Union did likewise. Furthermore, in 1943-1944 this part of Poland was contested by Ukraine and Poland. The Ukrainians claimed the territory and killed many Poles in the ethnic cleansing that ensued. Two of the victims were my paternal grandparents. My uncle was executed by the Germans in full view of his wife and children. My father was shot in the thigh by German troops while escaping forced labor in Poland, but managed to survive his wound.

**Coming to America.** My father contacted the U.S. Embassy and arranged for his return, as well as for mine and my sister's. My mother would need immediate family in the U.S. to qualify for a visa, and we would provide that family upon arrival in the U.S. We arrived in the Port of New York on October 1947. My mother joined us some fourteen months later, arriving by plane. My father took me to the local Catholic parish elementary school (St. Joseph's) run by the Felician sisters (a Polish order). I began my academic career in the U.S. in second grade, a year older than the other second graders. I finished the parish high school in 1958.

**The U.S. Air Force.** I enlisted in the U.S. Air Force on July 3, 1958, a couple of weeks after graduating from high school. After

basic training, I was sent to Mather A.F.B. near Sacramento, California. There I began taking college classes at Sacramento City College (now Sacramento State University). When an opening occurred at the Ellenikon Air Base near Athens, Greece, I volunteered because it was considered one of

the best assignments the Air Force had to offer. Fortunately, the University of Maryland, in collaboration with the U.S. Military, offered college courses overseas, and I took full advantage.

After getting separated from active duty June 27, 1962, I enrolled at the University of Maryland, College Park, Maryland. I completed my B.S. (with high honors) in 1964. Also, I received my honorable discharge on July 2, 1964 after completing two years of inactive reserve. I started my MBA at the University of Maryland on a graduate assistantship, but got married and went to work for a company that had a generous tuition reimbursement program, which permitted me to complete my MBA in 1967.

Several of my professors recommended that I enroll in the doctoral program at Maryland. The Vietnam conflict was heating up at this time. Therefore, the Federal Government re-instituted the GI Bill of Rights and made it retroactive to the end of the Korean conflict; thereby entitling me retroactively to the education benefits. The Dean of the College also offered me an instructorship. This financial combination made it possible to complete my doctorate in Organizational Behavior in 1972.

**Academic Career.** I accepted a position at Cleveland State University in the Fall of 1973

as an Assistant Professor and retired in 1995 as a Senior Vice President with a number of administrative positions in between. During my early years at Cleveland State University, I was selected to be a Field Research Associate for the National Academy of Sciences evaluating federally funded manpower programs in Northeast Ohio under the Comprehensive Employment and Training Act (CETA). The findings were published by the U.S. Senate. While at Cleveland State University, I established an exchange program between Cleveland State University and the Jagiellonian University in Krakow, Poland (also known as University of Krakow).

On September 5, 1995, I accepted a position as Dean of the Graduate School of Logistics and Acquisition Management and Professor of Management at the Air Force Institute of Technology. In 1999 I took a leave of absence from the Institute to serve as Dean of the College of Commerce and Economics, Sultan Qaboos University, Sultanate of Oman. I returned to the Air Force Institute of Technology as Chair of Executive Education and Professor of Management in 2002. I became an Emeritus Professor of Management in the Department of Systems and Engineering Management in 2004, which is also the year I retired.

**Post retirement.** Throughout my academic career and into my retirement I remained an active scholar, and I am pleased that my research is widely cited. In addition to enjoying our grandchildren, Dianne and I love to travel and continue to do so. My affection for travel can be traced to a life-altering experience when touring the Parthenon in Athens, Greece while stationed there. I passed an elderly American sitting on a stone and popping pills. His wife was urging him to get up and see the rest of the Parthenon. He pleaded with her to just let him sit there. "After all," he opined, "if you have seen one old building, you have seen them all." I vowed then and there that I would not wait until I became old to see the world, and I surely made good on my vow.



## 2019 Distinguished Professor Award



Col James Fee (left) and Dr. Adedeji Badiru (right) congratulate Dr. Meir Pachter (center) for being named Distinguished Professor.

**Dr. Meir Pachter**  
Professor of Aerospace Engineering

The Distinguished Professor recognition is reserved for faculty who have displayed exceptional, lifelong performance and achievement as demonstrated by nationally and internationally recognized research, outstanding teaching performance, and outstanding service to the Institute. Dr. Pachter is an internationally recognized expert in the Air Force mission-critical area of intelligent autonomous control and navigation of aerospace systems with a current focus on unmanned aerial vehicles and air-to-air operations.

## Dean's Distinguished Teaching Professors Named

Dr. Adedeji Badiru named two professors from each of the Graduate School's six academic departments as the Dean's Distinguished Teaching Professors for the academic year 2019-2020.

**Department of Mathematics and Statistics**  
Dr. Matthew Fickus and Dr. Edward (Tony) White

**Department of Electrical and Computer Engineering**  
Dr. Brett Borghetti and Dr. Richard Martin

**Department of Engineering Physics**  
Lt Col Anthony Franz and Dr. John McClory

**Department of Operational Sciences**  
Dr. Raymond Hill and Dr. Brian Lunday

**Department of Systems Engineering & Management**  
Dr. Jeremy Slagley and Dr. John Elshaw

**Department of Aeronautics & Astronautics**  
Dr. Marc Polanka and Dr. Marina Ruggles-Wrenn

## AFIT Center for Directed Energy Collaboration with NASA

The Center for Directed Energy (CDE) will be installing a state-of-the-art sun/lunar photometer device and become part of an international aerosol measurement network of sites.



The AERONET (Aerosol RObotic NETwork) project is a federation of ground-based remote sensing aerosol networks established by NASA and PHOTONS (PHotométrie pour le Traitement Opérationnel de Normalisation Satellitaire). For more than 25 years, the project has provided a long-term, continuous and readily accessible public domain database of aerosol optical, microphysical and radiative properties for aerosol research and characterization, validation of satellite retrievals, and synergism with other databases.

The AERONET collaboration provides globally distributed observations of spectral aerosol optical depth (AOD), inversion products, and precipitable water in diverse aerosol regimes. AFIT now has its own site (currently on an old Area B taxiway, later planned for a rooftop location at AFIT) with a state-of-the-art solar/lunar photometer that will allow data to be collected at night during certain moon phases.

FIND MORE INFORMATION ONLINE AT:

<https://aeronet.gsfc.nasa.gov/> or [www.afit.edu/cde](http://www.afit.edu/cde)



## CDE Director Participates in Workshop at Texas A&M

Dr. Steven Fiorino, Professor and Director, Center for Directed Energy, participated in the Ballistic, Aero-Optics, and Materials (BAM) Testing Range Design Workshop at Texas A&M, Sept. 17-18, 2019. Fiorino serves as a national atmospheric propagation subject matter expert to the Joint Directed Energy Transition Office (DE-JTO); the DE-JTO is interested in any technology that can aid in the understanding of high energy laser (HEL) propagation in any environment worldwide.



**Dr. Steven Fiorino**

One potential pitfall to HEL propagation is a phenomenon called "thermal blooming" where the HEL can heat the air it is traveling through so much the beam can no longer be focused. Different weather conditions can mitigate or make the thermal blooming worse; Texas A&M has proposed, and gathered significant funding for, building an indoor/outdoor controllable facility up to one kilometer long where such laser beam propagation effects could be studied and quantified.



## Researching Partnerships



### OAK RIDGE NATIONAL LABORATORY

Four Graduate School faculty members (Drs. Weeks, Dr. Merkle, Dr. Pak and Dr. Patnaik) from AFIT's Quantum Information Group visited Oak Ridge National Laboratory (ORNL) in Oakridge, Tenn., on Oct. 30, 2019. The groundwork for the trip was initiated by Graduate School Dean Dr. Adedeji Badiru's call to connect AFIT's group with the Quantum Information Science (QIS) group at ORNL.



**Dr. Michael Pak, Dr. Anil Patnaik, Dr. David Weeks and Dr. Larry Merkle visiting "Summit," the fastest Supercomputer Facility at ORNL on Oct. 30, 2019.**

The day-long meeting was filled with presentations of research initiatives on quantum computing, informatics and sensors by both groups in order to identify common interests. Other successful highlights of the trip include:

- A tour of QIS group laboratories by AFIT members.
- Discussion between the groups regarding how to establish a future strategic partnership and secure funding sources.
- Identification of an immediate opportunity to leverage the experimental capabilities of the ORNL group to train AFIT students (with AF funding or DOE fellowship) and, also, to write white papers/research proposals with support letter from the group.
- A plan to explore a formal agreement of MOU/MOA between AFIT and ORNL.

### OHIO UNIVERSITY COLLEGE OF ENGINEERING

In early November, an AFIT delegation (consisting of Dr. Adedeji Badiru, Dean, Graduate School of Engineering and Management, Dr. Amy Magnus, Mathematics and Statistics, Dr. Sanjeev Gunawardena, Electrical and Computer Engineering, and Dr. George Peterson, Engineering Physics) traveled to Ohio University. The team was hosted by Dr. Mei Wei, Ohio University Dean of Engineering, Dr. Scott Miller, Associate Dean for Industry Partnerships, and Dr. Mike Deis, Director of Business Development for Russ Research Center.

The Russ College of Engineering has several ongoing research initiatives that align well with the STEM graduate-education focus of AFIT. The emerging area of building a collaborative center for

innovation is high on the list of near-term partnerships with long-term benefits for economic development and national defense workforce development. Faculty sabbatical exchange is another area that the respective institutional leaders are exploring. Collaborative discussions also included the Ohio's multi-institutional Digital Engineering initiative.

### CENTRAL STATE UNIVERSITY COLLEGE OF ENGINEERING

November 19, 2019 marked the first time that the Graduate School of Engineering and Management has hosted leadership from Central State University to discuss research partnership initiatives. AFIT Graduate School academic department leadership and Dr. Badiru welcomed Dr. Alton Johnson, Dean, College of Engineering, Science, Technology and Agriculture, and Dr. Ibrahim Katampe, Director, CSU-Net Incubator Assistant Director.

With its designation as land grant institution, the College of Engineering, Science, Technology, and Agriculture (CESTA) at Central State University offers a unique blend of technical capabilities that can create a win-win partnership with AFIT. The college offers degrees in ten critical areas of Science, Technology, Engineering and Mathematics (STEM). CESTA offers minors in many of these same programs as well as in interdisciplinary fields such as Environmental Science, Forensic Science, Computational Science and Nuclear Engineering. Unique to Ohio, and the Nation, CESTA offers an interdisciplinary degree program in Water Resources Management. These are areas where AFIT faculty have demonstrated expertise and world recognition. The geographical proximity of CESTA to AFIT is expected to facilitate speedy collaborative engagements.

### IBM RESEARCH-AI

On Dec. 11, 2019, the Graduate School of Engineering and Management welcomed Dr. Peter Santhanam, Principal Research Staff Member, IBM Research-AI and the Honorable Zachary Lemnios, VP Government Programs, IBM to the AFIT campus. This visit opened discussions between AFIT and IBM on Quantum and AI initiatives and allowed the team to explore future collaborative avenues.

The Graduate School presented an overview of AFIT high-priority research areas and provided IBM with an opportunity to speak to the leaders involved in the planning and deployment of AI technology in Air Force missions. Additionally, Graduate School leadership and faculty were invited to join briefings conducted by the IBM delegation: "Introduction to IBM, AI & Quantum in the context of the DoD directives"; "Building an Ecosystem to Accelerate the Use of AI in DoD"; and "Challenges in AI Engineering."

# AFIT Quantum Computation and Information Group (QuanTech Group) Initiatives

By Dr. Anil Patnaik  
Associate Professor  
Department of Engineering Physics

## HOW DID QUANTECH BEGIN?

In response to the call for S&T strategy 2030 on quantum technologies and at the call of Maj Gen William Cooley, Air Force Research Laboratory commander, AFIT has undertaken the development of a short course on quantum computers and informatics. The mission is to create broader awareness among STEM researchers and to support development of the critical quantum workforce for the US Air Force's strategic posturing and national security challenges. With a broader goal to foster interaction between AFIT faculty members who have teaching and research interests in quantum technologies, an informal group (QuanTech) was formed in early 2018. Dr. Larry Merkle, Assistant Professor of Computer Engineering, leads QuanTech Group meetings each Friday at AFIT.

AFIT QuanTech research initiatives and the short course were discussed by Dean Badiru and the group with AFOSR program managers Dr. Grace Metcalfe and Dr. Ali Sayir in May of 2019. These AFOSR PMs who have programs in Quantum Information Sciences endorsed and encouraged this initiative. Additionally, Dean Badiru hired Dr. Michael Pak, an expert in quantum computing physics, to serve as a technical expert for AFIT QuanTech curriculum development.

## GROUP MEMBERS

QuanTech consists of faculty, researchers and students from the Graduate School's Departments of Engineering Physics,

Electrical and Computer Engineering and Systems Engineering and Management. In addition to the Friday meetings, a separate working group meets every Thursday to discuss the development of the curriculum, materials and logistics of the short course.

## MISSION & GOALS

The primary goals of the group are to discuss and learn from each other on the frontiers of quantum computers, informatics and technology, share research results of various groups at AFIT, and foster a collaborative environment for all parties involved in the quantum initiatives.



## AIR FORCE IMPACT

The collaborative projects both on the teaching and research front will train a new workforce urgently needed for the frontiers of quantum technology. In the long term, AFIT's quantum initiative will significantly contribute to national security and warfighter preparedness against our adversaries.

In the short term, Dr. David Weeks, Professor of Physics, has offered a full quarter course on quantum computers. And the quantum information short course (mentioned earlier) is being planned for Air Force-

wide participation during the last week of January. The course is being developed with support from the Information Directorate (RI) and will be offered to all of the AFRL Technical Directorates (TDs). The primary topics to be addressed are state-of-the-art developments in the quantum computation and introduction to other quantum technologies such as quantum entanglement, quantum cryptography and communications etc. The five-day course is designed to introduce typical quantum systems, followed by qubits, quantum gates, quantum circuits, and quantum algorithms essential for quantum computers. As part of the hands-on implementation of the course material, modalities are being worked out to allow participants to use IBM's state-of-art 20-qubit quantum computer in collaboration with RI. The short course will enable the participants to get a first-hand experience on quantum computing resources, their operation and quantum technologies in general.

## FUTURE INITIATIVES

- The week-long Quantum information short course is planned to be held at TechEdge during Jan 27-31, 2020.
- Faculty and students have formed a quantum computer user group that meets weekly to gain direct experience running the IBM quantum computer.
- Research prospects are being discussed via telecom with Air Force Research Laboratory (AFRL), Rome, NY. The expectation is to further develop collaborative ties between AFIT and AFRL, Rome.

## HOW TO JOIN QUANTECH

Anyone at AFIT with interest in quantum computation and information is welcome to attend QuanTech weekly meetings. Please email Dr. Merkle at [Laurence.Merkle@afit.edu](mailto:Laurence.Merkle@afit.edu) for more information.

## Outstanding Hypersonic Testing Support

AFIT's Scientific Test & Analysis Techniques Center of Excellence (STAT COE) was recently recognized for providing outstanding hypersonic testing support to the Air Force Research Laboratory (AFRL).

Col Timothy West, Deputy Director Aerospace Systems Directorate, AFRL sent congratulations to the STAT COE team, which included Gina Sigler, Corey Natoli, Seth Guldin, and Mike Harman, for the critical support that contributed to the success of a three-week wind tunnel test campaign at the NASA Langley Research Center for AFRL's HIFIRE-6 vehicle.

The STAT COE team developed the test matrix through a design of experiments approach that was tailored to fit within the limitations of the test facility, allowing AFRL to maximize the data collected per facility run.

Over 800 test points were collected, each at 200 KHz, demonstrating the usefulness of design of experiments for wind tunnel testing. On-site test support was also provided which allowed for efficient test matrix adjustments and real-time data analysis.



AFIT's Scientific Test & Analysis Techniques Center of Excellence team.

The team also provided guidance to the NASA Langley Data Sciences Team on their development of an adaptive sampling algorithm for high-speed inlet unstart avoidance. Data collected from the test campaign will be used to validate hypersonic design codes, critical to improving the performance and operability of future hypersonic systems.

## FY2019 Sponsored Funding for Large Awards

**\$450,000**

Cost Capability Analysis AFIT Support to Acquisition Intelligence Requirements Task Force (AIR-TF) and Headquarters Air Force A2 (HAF/A2); OSD; Principal Investigator: Dr. Jeffrey Weir.

**\$950,000**

AFSIM Modular Development to Support the Solar Space Power Initiative (SSPI); AFRL/RV; Principal Investigator: Dr. Darryl Ahner.

**\$663,000**

Support to TAP Lab Effort (STAPLES); SMC; Principal Investigator: Dr. Bryan Steward.

**\$759,917**

SatNav Signal Monitoring and Analysis Technology Development; AFRL/RV; Principal Investigator: Dr. Sanjeev Gunawardena.

**\$550,796**

Navigation for A2AD, Long Range, Over Water Ingress; AFRL/RV; Principal Investigator: Capt Aaron Canciani.

**\$400,000**

Nuclear Command, Control and Communications; AFRL/RI; Principal Investigator: Dr. Andrew Terzuoli.

**\$939,983**

Scientific Test and Analysis Techniques for the Department of Homeland Security; DHS; Principal Investigator: Dr. Darryl Ahner.

**\$550,000**

Test & Evaluation Strategy Development for T-X Advanced Pilot Trainer; AFLCMC; Principal Investigator: Dr. Darryl Ahner.



# AWARDS AND RECOGNITION

## AFIT Centennial Banquet Awards

The Air Force Institute of Technology honored alumni, faculty and staff Nov. 7 at an awards ceremony as part of the school's centennial celebrations. Maj Gen Carl Schaefer, Deputy Commander of Air Force Materiel Command and 2004 AFIT alum served as keynote speaker for the event. Award winners of the Graduate School of Engineering and Management are listed by category:

### AFIT INNOVATION AWARD WINNERS:

Junior Faculty category: **Maj Robert Bettinger**, Assistant Professor of Astronautical Engineering and Curriculum Chair for the Astronautical Engineering degree program, Graduate School of Engineering and Management

Senior Faculty category: **Dr. Marc Polanka**, Professor of Aerospace Engineering, Graduate School of Engineering and Management

Junior Staff category: **Mr. Sean Miller**, Engineering Technician, Department of Aeronautics and Astronautics, Graduate School of Engineering and Management

Senior Staff category: **Mr. Matthew Dever**, Director of the AF Cyberspace Technical Center of Excellence, Graduate School of Engineering and Management

### AFIT LEADERSHIP AWARD WINNERS:

Senior Faculty category: **Dr. John Colombi**, Professor and Program Chair of Systems Engineering, Graduate School of Engineering and Management

Senior Staff category: **Capt Brandon Johnson**, Executive Officer to the Dean, Graduate School of Engineering and Management

### AFIT MENTORSHIP AWARD WINNERS:

Faculty category: **Lt Col Jason Anderson**, Assistant Professor of Logistics and Supply Chain Management and Deputy Department Head, Operational Sciences Department, Graduate School of Engineering and Management

Staff category: **Dr. Alice Grimes**, Director of Faculty Development, Graduate School of Engineering and Management



AFIT award winners at the centennial banquet awards ceremony.

## Three AFIT Faculty Receive AFTAC Endowed Chair Awards

Congratulations to the 2019 recipients of the AFTAC Endowed Chair Awards: **Dr. John McClory**, chair of AFIT's Nuclear Engineering Program; **Lt Col Robert Tornay**, AFIT Assistant Professor of Atmospheric Science; and **Dr. Mark Oxley**, Professor of Mathematics in AFIT's Graduate School of Engineering and Management.

## AFIT Professor Elected as Fellow

**Dr. Glen Perram**, Professor of Physics, Department of Engineering Physics, was elected as a fellow of the Optical Society of America in Oct 2019. Dr. Perram is being awarded for laying the foundation for the Airborne Laser Missile Defense Program through pioneering work on the high power Chemical Oxygen Iodine Laser. Dr. Perram will receive the award at the Conference on Lasers and Electro-Optics, May 10-15, 2020 in San Jose, California, USA.

## Mr. Hill Selected as Modern-Day Technology Leader

**Mr. Michael Hill**, Laboratory Supervisor for the Department of Electrical and Computer Engineering, has been selected as a 2020 Black Engineer of the Year Awards (BEYA) Modern-Day Technology Leader. Mr. Hill will be recognized at the 34th Annual BEYA STEM Conference Technology Recognition Luncheon in Washington D.C. in February 2020.

"As Lab Manager, Mr. Hill has displayed a strong dedication to safety and lab maintenance. He consistently and proactively ensures that our lab is both operational and up to date. He is a strong advocate for our department and its faculty, staff, and students," said Dr. Kenneth Hopkinson, Head of the Department of Electrical and Computer Engineering, Graduate School of Engineering and Management at AFIT.

## Recently Published

*The Journal of Guidance, Control, and Dynamics* has electronically published an article by **Dr. Bill Wiesel**, Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, and **Dr. Christopher Craft** (DS-16M), "Impulsive Control of Earth Satellites on Low-Eccentricity Kolmogorov-Arnold-Moser Tori."

## AFSPC Acquisition Cost Analyst of the Year

The Graduate School of Engineering and Management is pleased to announce that 2018 Cost Analysis program graduate, **Capt Deborah Kim**, has been awarded 2019 Air Force Space Command (AFSPC) Acquisition Cost Analyst of the Year. This is one of the many ways AFIT contributes to the acquisition cost bottom line for the US Air Force. Sending quota students to AFIT for an advanced education is an investment in the future of the Air Force and the nation. Capt Kim's award is a fine example of how an AFIT education is a return on investment (ROI) for the Air Force.

# UPCOMING EVENTS

## JANUARY 2020

**AFIT Graduate School Winter Quarter Classes Begin**  
AFIT Campus, WPAFB, OH | 6 Jan 2020

## FEBRUARY 2020

**AFIT Graduate School Spring Quarter Registration Opens**  
AFIT Campus, WPAFB, OH | 10 Feb 2020

## MARCH 2020

**Air University Board of Visitors AFIT Subcommittee Meeting**  
AFIT Campus, WPAFB, OH | 3-4 Mar 2020

**AFIT Graduate School Winter Quarter Classes End**  
AFIT Campus, WPAFB, OH | 13 Mar 2020

**AFIT Graduate School Commencement Ceremony**  
National Museum of the Air Force, WPAFB, OH | 26 Mar 2020

**AFIT Graduate School Spring Quarter Classes Begin**  
AFIT Campus, WPAFB, OH | 30 Mar 2020

## AFIT Annual Nuclear Program Trip

The annual Nuclear Program Field Trip took 14 visitors to Los Alamos National Lab (escorted by Jeremy Best, AFIT alumnus), Sandia National Lab, National Nuclear Security Administration, and Kirtland AFB in New Mexico, Sept. 8-14, 2019. The annual trip is a curriculum requirement for nuclear engineering students at AFIT.

The trip is designed to familiarize AFIT nuclear engineering students with the intricacies and capabilities of the Nuclear Security Enterprise. Most of the students will serve in this mission area following graduation. Lt Col

Edward Hobbs organized the trip this year and was accompanied by fellow faculty Lt Col Michael Dexter, both from the Department of Engineering Physics, and Dr. Michael Grimaila, Department of Systems Engineering and Management.

Department of Engineering Physics students in attendance were: 2dLt Aaron Burkhardt, Capt Ryan Chapman; Maj Lawton Drake; Maj Trenton Freeman; 2dLt Nathan Gale; 1stLt Daniel Gum; Civ Lansing Horan; Capt Andrew Owens; 2dLt Ashwin Rao; Maj Lorin Veigas and Lt Col Jason Wood.



## AFIT FACULTY SEARCH



For more information about research areas and AFIT faculty members, please visit us online at [www.afil.edu/BIOS](http://www.afil.edu/BIOS) and click on the new **Faculty Expertise Search Button**

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