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Alum Commands Discovery's Final Space Shuttle Mission

AFIT's legacy aboard the Discovery

It was a bittersweet launching of Space Shuttle Discovery on 24 February 2011. It marked the 39th and final flight of Discovery and the 133rd flight of the Space Shuttle program. Commanding the spaceflight to the International Space Station (ISS) was AFIT alum Steven W. Lindsey (Col, USAF, Ret.). This was Lindsey's third flight on Discovery including piloting mission STS-95 in 1998 and commanding mission STS-121 in 2006. Lindsey earned his master's degree in Aeronautical Engineering from AFIT in 1990.

The Space Shuttle Discovery is very special to AFIT. Including Lindsey's multiple missions, Discovery has carried seven AFIT alumni to space on 11 missions.

In 1984, the crew of the Discovery's first flight included Retired USAF Col Richard "Mike" Mullane who earned an

M.S. in Aeronautical Engineering from AFIT in 1975. This was Mullane's first space flight. He served as the mission specialist for the STS-41-D mission launching two communication satellites.

In 1985, Dr. John Fabian (Col, USAF, Ret.) served as a mission specialist for STS-51-G which included the first Saudi Arabian in space. Fabian earned an M.S. in Aerospace Engineering from AFIT in 1964.

In 1991, Dr. Guion S. Bluford Jr. (Col, USAF, Ret.) the first African-American in space, served as a mission specialist for Discovery's mission STS-39. This was his third space flight. In 1992, Dr. Bluford returned to space aboard Discovery's mission STS-53 as a mission specialist. Dr. Bluford is a distinguished graduate of AFIT having earned his master's degree in 1974 and his doctorate in 1978 in Aerospace Engineering.

Also in 1991, retired USAF Col Mark N. Brown served as mission specialist for Discovery's mission STS-48. Brown earned his master's degree in Astronautical Engineering in 1980 from AFIT. The primary payload for this flight was the Upper Atmosphere Research Satellite (UARS)



AFIT alum Steve W. Lindsey onboard the International Space Station during Space Shuttle Discovery Mission STS-133 in March 2011.

built to conduct the most extensive study of the Earth's troposphere.

In 2006, USAF Col Michael E. Fossum, made his first spaceflight as a mission specialist of Discovery's mission STS-121 to the ISS. Also aboard was fellow AFIT alum Steven Lindsey, making his fourth space flight as commander. Fossum is a 1981 graduate of AFIT earning his master's degree in Systems Engineering. During this flight, Fossum completed three spacewalks. He returned to the ISS aboard Discovery's mission STS-124 in 2008 as a mission specialist where he completed a 7.5 hour spacewalk making a repair to the ISS.

In 2009, AFIT alum Dr. Kevin A. Ford (Col, USAF, Ret.) made his first spaceflight as the pilot of Discovery's mission STS-128 to the ISS carrying the Multi-Purpose Logistics Module Leonardo, as the primary payload. Ford earned his Ph.D. from AFIT in Astronautical Engineering in 1997.

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Dean Wins DOD Women's History Month Role Model Award

Dr. Heidi Ries, Dean for Research, Graduate School of Engineering and Management, Air Force Institute of Technology was awarded the DOD 2011 Women's History Month Foreign Language and STEM Role Model Award.

Dr. Ries is an outstanding role model for women in the science, technology, engineering and math (STEM) career fields. Her work includes exemplary leadership in support of the recruitment, retention, promotion, and career development of women STEM faculty in the Dayton region as the institutional coordinator for the Launching Equity in the Academy across the Dayton Entrepreneurial Region (LEADER) Consortium National Science Foundation ADVANCE program; public service to the STEM educational community; and engagement with middle school science activities.

Joining the AFIT faculty in 1999, Dr. Ries has served as the Dean for Research since 2005. Under her leadership, AFIT established designated research centers and successfully increased external research and educational funding from \$2.6 million in FY00 to nearly \$20 million in FY10. She acquired more than \$15 million in funding to support research and education projects in the areas of nonlinear optical materials, radiation effects, electron paramagnetic resonance spectroscopy and laser processing of materials.

Commander of AFMC Addresses March 2011 AFIT Graduates

AFIT's Graduate School of Engineering and Management awarded nine doctorate degrees and 221 master's degrees on 24 March 2011 at the National Museum of the United States Air Force.



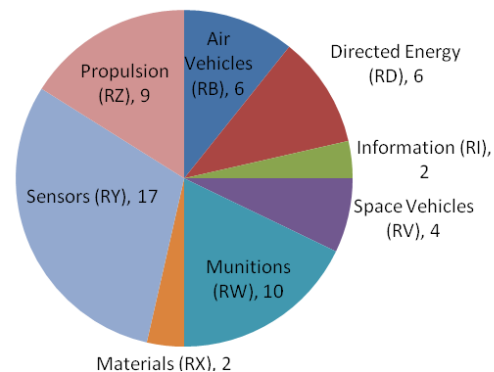
Key note speaker, Gen Donald J. Hoffman, Commander, Air Force Material Command, Wright-Patterson AFB.

Maj Gen Walter D. Givhan, AFIT Commandant, began the ceremony with a verbal salute to the graduates; "As you graduate we recognize each and every one of you as champions. We count on you, the graduates of today, to be both the technical and military leaders of tomorrow's science and technology."

Gen Donald J. Hoffman, Commander of Air Force Material Command, delivered the commencement address to the graduates. He encouraged graduates to think outside of the box to effectively and efficiently support the warfighter.

AFIT graduates have filled technical positions requiring advanced academic degrees in their respective fields of study across the DOD. Thirty-eight percent of March 2011 graduates now work at AFMC and nearly 25% are at AFRL Technology Directorates.

Breakdown of AFIT March 2011 Graduates by AFRL Technology Directorate



Commandant’s Award Winning M.S. Thesis: Capt Brian Bohan, “Analysis of Flow Migration in an Ultra-Compact Combustor”

The Commandant’s Award was presented to Capt Brian Bohan, who demonstrated the most exceptional individual master’s thesis research.

The Air Force is continually interested in reducing the weight of its systems and in particular the weight of the engines – without losing thrust! One means of accomplishing this objective is an Ultra Compact Combustor (UCC). The UCC attempts to shorten the overall combustion length (thereby reducing weight) by performing the combustion in the circumferential direction along the outside diameter of the core flowpath. One of the major benefits of this design is enhanced combustion due to the establishment of a high-g field in the circumferential cavity. AFIT and AFRL have teamed for several years in understanding the fundamental aspects of this design. Prior research has focused around small-scale missile-sized combustors. There is a current push within AFRL to investigate this system for a larger, fighter-sized engine. AFIT has led this push by performing Computational Fluid Dynamic (CFD) simulations to scale the UCC. Capt Bohan’s research outlines this overall effort.

Increasing the diameter of the UCC presents several challenges including how to control the fluid velocity in the circumferential cavity and how to turn the centrifugal combustion flow back to the axial direction into the high-pressure turbine rotor while presenting a uniform temperature across

the turbine blades. Several numerical parameter studies have been conducted to establish relationships to predict tangential velocity based on cavity inlet conditions and determine a configuration that minimizes pressure losses through the combustor section.

As a result of these investigations a 0.75m diameter UCC combustor design has been developed along with a hybrid turning vane which replaces the last compressor vane and high-pressure turbine vane. The issue of cooling the hybrid vane in the exhaust of the UCC, where not all the fuel is combusted within the circumferential cavity causing additional reactions within the vane section, was investigated. A film cooling experimental study was conducted in an effort to reduce or remove the negative effects that result from secondary combustion of unburned fuel with oxygen in the film coolant.

Capt Bohan’s research was conducted in support of the AFRL Highly Efficient Embedded Turbine Engine (HEETE) program which is a subset of the ADVENT program. The 3-year program aims to achieve a huge leap in engine compressor technology. The UCC will be paired with the high-pressure compressor for a combined efficiency as high as 95-99%.

Capt Bohan’s thesis advisor was Dr. Marc Polanka, Associate Professor in the Department of Aeronautics and Astronautics.

AFIT Faculty/Liaison Appointed to National Position

The Executive Branch’s Office of Science and Technology Policy (OSTP) appointed Lt Col Paul Kladitis as a chair of the National Nanotechnology Initiative (NNI), Signature Initiative on “Sustainable Nanomanufacturing – Creating the Industries of the Future” task force. The mission of the NNI Signature Initiative is to accelerate nanotechnology development in support of the President’s national priorities and innovation strategies with regards to establishing manufacturing technologies for economical and sustainable integration of nanoscale building blocks into complex, large-scale systems. The NNI Signature Initiatives are explained in the February 2011 NNI Strategic Plan. Lt Col Kladitis was appointed based on his contributions to the field in his work as the Nanotechnologies Branch Chief, Advanced Systems and Technology Directorate, National Reconnaissance Office (NRO). Lt Col Kladitis is also the AFIT liaison to the NRO.

Dean’s Award Winners

The Dean’s Award is presented to the top M.S. thesis in each AFIT department. The theses are judged by a faculty committee with representation from each department. The top thesis from the Dean’s Award nominees is awarded the Commandant’s Award.

Capt Brian Bohan, “Analysis of Flow Migration in an Ultra-Compact Combustor”

Ms. Alexis Xaviera Hurst, “Modeling of Bacillus Spores: Inactivation and Outgrowth”

Capt Paul Dolce, “A Statistical Approach to Fusing 2-D and 3-D LADAR Systems”

Capt Whitman Dailey, “Ray Next Event Estimator Transport of Primary and Secondary Gamma Rays”

Capt Adam Messer, “Contextual Detection of Anomalies in Hyperspectral Images”

Capt Craig Holder, “Development of Optimized Guidelines for Therapeutic Strategies for Organophosphate Poisoning”

Upcoming Events

AF Systems Engineering Conference

16-18 August 2011
Crowne Plaza Hotel
Dayton, OH

CBRNE Research and Education Symposium

21-23 September 2011
Calamityville
National Center for Medical Readiness
Fairborn, OH

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