

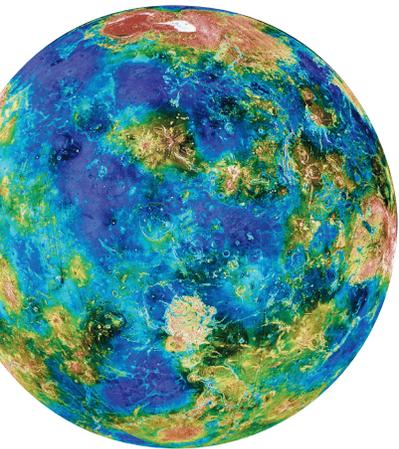
UNIVERSITY of WASHINGTON

WILLIAM E. BOEING

DEPARTMENT OF AERONAUTICS & ASTRONAUTICS



From the development of advanced autonomous vehicles and systems to new aerodynamic techniques, novel space propulsion concepts, and lightweight aerostructures and materials, the faculty and students of the William E. Boeing Department of Aeronautics & Astronautics are shaping the technologies that will drive air and space flight in the 21st century.



OUR MISSIONS



LAUNCHING CAREERS

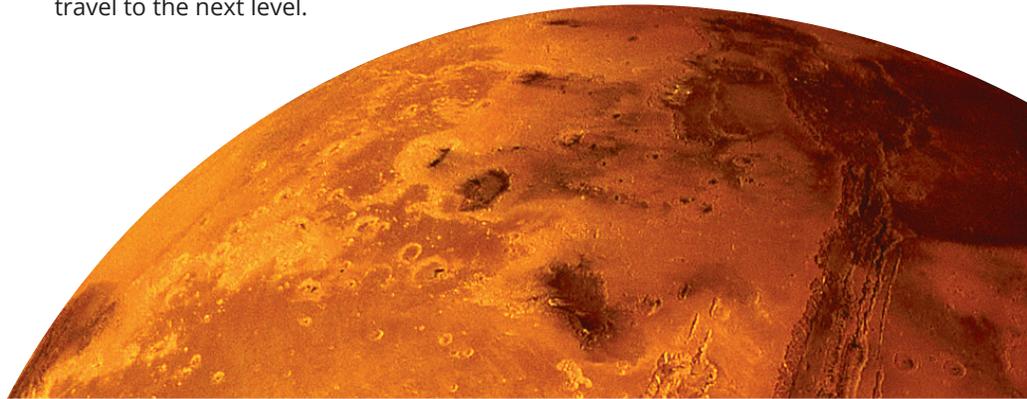
Educating tomorrow's aerospace leaders is our highest priority. Our graduates find employment throughout the aerospace industry. From Boeing to NASA our alumni pursue successful careers in diverse sectors of the economy.

HARNESSING THE POWER OF INVENTION

Our students and faculty push the boundaries of air and space flight every day. From exploring the mechanics of biological flight to testing new designs for more durable, lightweight structures, research in our department is opening doors to cutting-edge technology that will define the future of air and space travel. Our faculty members are leaders in education, economic development, and industry collaboration, and our students routinely show themselves to be the future leaders in both industry and academia—making our department and the University of Washington proud.

CROSSING BOUNDARIES

The history of air and space flight is filled with contributions from our faculty and students. Established as a department in 1929 and offering instructional classes in aeronautics as early as 1918, the William E. Boeing Department of Aeronautics & Astronautics was one of the first of its kind in the nation. Interdisciplinary work is the key to our department's continued growth. Our students and faculty foster a collaborative environment with partnerships across campus, with other universities, and with industry to take air and space travel to the next level.



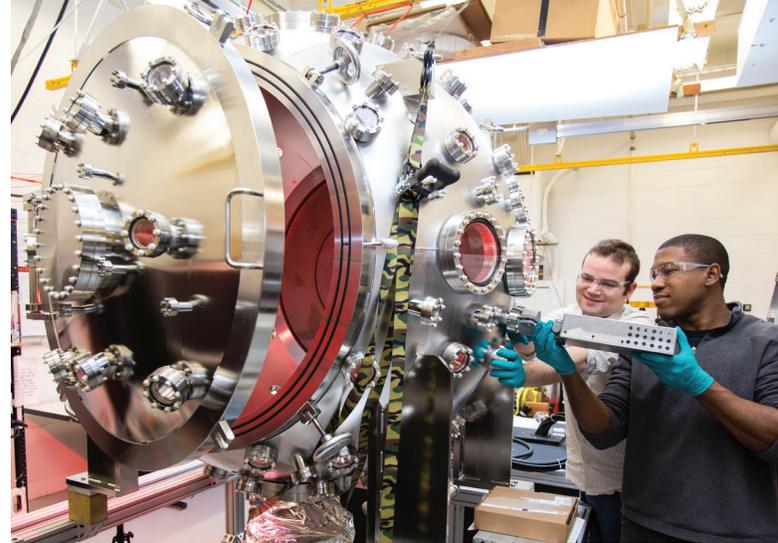
DEGREE PROGRAMS ////////////////

Bachelor of Science (BSAAE) - prepares students for graduate work or careers in the aerospace industry

Master of Science (MSAA) - research-oriented program prepares students for careers in industry and government, or for further graduate studies toward a PhD

Master of Aerospace Engineering (MAE) - multidisciplinary, professionally oriented part-time degree program prepares students for advanced careers in industry

Doctor of Philosophy (PhD) - trains engineers for research leadership roles in academia, industry, and research institutions



UNDERGRADUATE EDUCATION

PROGRAM FEATURES

- Strength in core fundamentals
- Knowledge integration and application through hands-on laboratory experience and world-class senior design capstone
- Real-world focus on teamwork, communication and problem solving, systems analysis, interdisciplinary collaboration, leadership, and creativity

STUDENT DEMOGRAPHICS

- 60 BSAAEs awarded in 2016
- 226 current undergraduates, 19% women, 10% underrepresented minorities

GRADUATE EDUCATION

PROGRAM FEATURES

- Graduate concentrations available in: Controls, Fluids, Propulsion/Plasma/Power, Structures, and Composites
- Thesis and dissertation research opportunities for cutting-edge, interdisciplinary work
- Available research and teaching assistantships, supplementary stipends

STUDENT DEMOGRAPHICS

- 77 graduate degrees awarded in 2016 (34 MAE, 33 MSAA, and 10 PhD)
- 2016 graduate enrollment included 18% women, 13% underrepresented minorities
- 234 graduate students enrolled in 2016



STUDENT EXCELLENCE

- Air Force Research Laboratory Space Scholar
- Clean Energy Institute Graduate Fellow
- College of Engineering Dean's Fellows
- Department of Defense SMART Scholar
- Lemelson-MIT Student Prize
- Lindau Nobel Laureate Young Scientist
- National Science Foundation Graduate Research Fellows
- Society of Women Engineers Region J Scholar
- UW Husky 100 Awardee

FACULTY ////////////////

COMPOSITION

- 19 core tenured and tenure-track faculty and 4 research faculty
- 8 faculty adjunct with other UW engineering and science departments
- 26 affiliate faculty representing industry and outside research institutions
- 10 post-doctoral research associates

FACULTY EXCELLENCE & LEADERSHIP

- More than \$9.5M in Research Awards in 2015-2016
- Executive Director: Washington State Joint Center for Aerospace Technology Innovation (JCATI)
- President: University Fusion Association
- Editor-in-Chief: AIAA Journal of Aircraft
- Chair Elect: AIAA Technical Committee on Guidance, Navigation and Control
- Multiple Early Career Awards from NSF and Department of Energy

RESEARCH AND INNOVATION

TECHNOLOGICAL CONTRIBUTIONS

- **Autonomous Vehicles and Systems** – An A&A team helped develop the Aerosonde, the first UAV to cross the Atlantic (1998), and continues to work on designs for mini-UAV systems and vehicles for a multitude of applications.
- **Aerospace and Energetics** – World-renowned research activity led to the development of key elements of high-power gas-dynamic lasers and advanced technologies for generating space and terrestrial energy.
- **Fluid Dynamics** – Innovations, such as development of novel 2D and 3D velocimetry methods, complex fluid flow diagnostics, and shock-induced cooling in supersonic jets have contributed to discoveries in the areas of vortex dynamics, turbulent mixing, computational fluid dynamics and combustion.
- **Composite Aerostructures** – Pioneering research in aerospace applications concerning smart materials and structures, structural health monitoring, damage tolerance and durability of composite structures, computational modeling of progressive damage and failure of composite structures, structural stability, aerothermoelasticity, multi-disciplinary optimization and nano-composites.
- **Plasma Science and Controlled Fusion** – Experimental and computational research on plasma science and controlled fusion, with particular emphasis on advanced alternative fusion concepts has applications in fusion energy and advance space propulsion.
- **Propulsion** – Contributions include the development of the ram accelerator, a chemically-propelled hypervelocity mass launcher based on the ramjet principle, and development of advanced plasma propulsion technologies for space exploration.

AREAS OF IMPACT

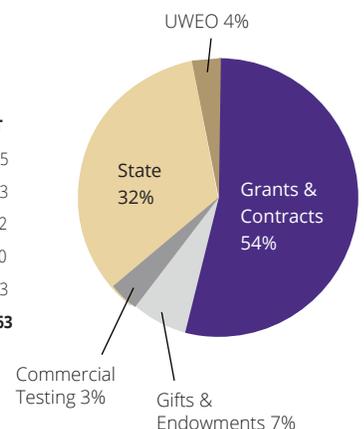
- Guidance and control systems
- Advanced composite materials and structures
- Aerodynamics and fluid mechanics
- Computational fluid dynamics
- Combustion and hypervelocity accelerators
- Microgravity science
- Autonomous vehicles and systems
- Space and terrestrial energy systems
- Plasma dynamics and fusion reactors
- Air breathing and space propulsion
- Multidisciplinary design optimization
- Flight systems integration
- Planetary science
- Damage and failure theories for composites
- Aeronautical design and testing
- Hypersonics

MAJOR FACILITIES

- **Kirsten Wind Tunnel** – A world-renowned subsonic facility with an 8-foot by 12-foot test section that produces highly accurate results.
- **Computational Fluid Mechanics Laboratory** – Fundamental research in single- and multi-phase as well as multi-species turbulent flows, with applications to internal and external aerodynamics and propulsion.
- **Autonomous Flight Systems Laboratory** – Research to advance guidance, navigation, and control (GN&C) of UAVs, with integration into the department's flight mechanics and controls courses, providing students with the experience of realistic GN&C systems.
- **Plasma Science and Innovation (PSI) Center** – Provides theoretical support for plasma research including extended magnetohydrodynamic (MHD) numerical codes to predict capabilities for fusion power experiments.
- **Robotics, Aerospace, and Information Networks (RAIN) Laboratory** – Multi-faceted research in the areas of guidance, control, and estimation for single and distributed systems; theoretical underpinnings of networked systems; and optimization and control.
- **Nonlinear Dynamics and Control Laboratory** – Research focuses on nonlinear, single and multi-vehicle autonomous systems, with particular focus on bio-inspired, underwater and air vehicles.
- **3D Printing Laboratory** – Research on the performance of 3D printed structures for aerospace applications.
- **Composite Structures Laboratory** – Fundamental research on the progressive damage and failure of advanced composite aerostructures including the characterization of high rate response, multi-axial load states and blast response.
- **Advanced Dynamics, Validation & Control Research Laboratory** - Investigating dynamical modeling and analysis tools to address the multiple temporal, spatial and nonlinear nature of increasingly autonomous systems.

ANNUAL OPERATING BUDGET FY17 (\$16.4M)

SOURCE	AMOUNT
Grants & Contracts	\$8,796,245
Gifts & Endowments	1,201,483
Commercial Testing	499,942
State	5,316,530
UWEO	612,063
TOTAL	\$16,426,263



RECENT A&A DISTINGUISHED ALUMNUS HONOREES



Dennis A. Muilenburg, MS 1990

Dennis Muilenburg is president and chief executive officer of The Boeing Company. Muilenburg joined Boeing in 1985, previously serving as president and chief executive officer of Boeing Defense, Space & Security. Prior to this, he held a progression of program management and engineering positions on a broad range of large-scale programs, including JAST/ASTOVL, F-22, AFX, EX surveillance

platform, 747 Airborne Laser, Advanced Tactical Fighter, High Speed Civil Transport, and the Condor reconnaissance aircraft. He also is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and a Fellow of the Royal Aeronautical Society.



Gregory C. Johnson (Captain US Navy Ret.), BS 1977

Captain Gregory C. Johnson ("Ray J") attended the U.S. Air Force Test Pilot School after graduating from UW A&A. In 1990, Johnson accepted a position as an aerospace engineer and research pilot with NASA's Johnson Space Center Aircraft Operations division. Johnson was selected by NASA as an astronaut in June 1998. He served as the pilot for the final space shuttle mission to the Hubble Space Telescope

in 2009. Johnson is currently a management astronaut assigned as the acting chief, Aircraft Operations and is a qualified T-38 instructor pilot, T-38 examiner pilot, T-38 functional check flight pilot, WB-57F high altitude research pilot and KC-97 Super Guppy instructor pilot.



Leland Nicolai, BS 1957

Dr. Leland Nicolai is a renowned educator, author and aircraft designer. Nicolai went on to earn an MSAE from the University of Oklahoma, an MBA from Auburn University, and a PhD in Aeronautical Engineering from the University of Michigan. He spent 23 years in the U.S. Air Force as an R&D Officer, retiring as a Colonel in 1982, and 34 years in the aerospace industry developing and designing aircraft, and the Advanced Cruise Missile. Nicolai retired as

a Lockheed Martin Fellow. In addition to teaching courses on aircraft design, he has written four textbooks on the subject.



Lars Q. Andersen, BS 1968

After working at Pratt and Whitney Aircraft Engines, Lars Andersen began his career at Boeing in 1973 where he worked on the 7X7, 707/CFM-56 re-engine, 757, and the 7J7 programs, and received a U.S. patent for a noise-suppression engine exhaust mixer. In 1989, Andersen joined the 777 program as chief engineer for the Extended Range Twin Operations (ETOPS). In 2000, he became vice president of the 777 program. After retiring in

2007, he was called back to serve as the vice president of 777 Product Development, where he works closely with the CEO. He is an active participant on the Boeing Senior Advisory Group.

A&A STUDENTS IN THE SPOTLIGHT



Osazonamen Igbinosun

Osazonamen Igbinosun entered the PhD program in 2013, earning an MS in Aeronautics & Astronautics in 2015. She also received an MS in Earth & Space Sciences with a focus in planetary science in 2013 from the UW, and a BS in Physics and Astronomy from University of Rochester. Igbinosun served as a U.S. Naval Aviator, is a National Science Foundation Fellow, and is the recipient of the 2016 Society of Women Engineers Region J Scholarship.



Derek Sutherland

Derek Sutherland is a PhD student in plasma physics and fusion energy, working in the steady inductive helicity injected torus (HIT-SI) research group. Sutherland joined A&A in 2012 after completing his BS in nuclear science and engineering and physics from MIT. He plans to develop fusion energy into a feasible energy source and fossil fuel alternative. He was recently named as one of Forbes Magazine's "30 under 30" for his contributions to energy research.



Navdeep Sandhu

Navdeep Sandhu received his BS in 2016. As a senior, he was the UW AIAA Student Chapter outreach coordinator, worked in our Ram and Shockwave labs, interned with the Boeing Flight Test Instrumentation group and was the recipient of the Dale & Marjorie Myers Scholarship. Sandhu is now enrolled in our Master of Science degree program, and is researching the effects of ice accretions on subsonic swept wings.



Alexis Harroun

Alexis Harroun is the propulsion technical lead for the Society for Advanced Rocket Propulsion and the senior class president for the UW AIAA student chapter. Harroun worked on the design and testing of chemical propulsion systems while interning at Blue Origin and volunteering in the Ram Accelerator Lab. She is the recipient of the Robert Max Reynolds Endowed Scholarship and plans to study propulsion systems in graduate school.

