Undergraduate Programs

Students in the department may major in either aerospace or ocean engineering or may choose to combine the programs of study in a double major program with either major as their primary. Students completing 30 credit hours beyond that required for a single degree may earn two separate degrees. The department also offers an undergraduate minor in naval engineering open to all students in the College of Engineering.

In offering both majors, the department builds on the common interests in both fields related to the design and analysis of vehicles and structures that operate in a fluid. While the earth’s atmospheres, its oceans, and the highly rarified flowfields of space present aircraft, ships, and spacecraft with fluids of very different densities in which they must operate, many of the same basic laws of physics apply to all of them. Aerospace engineering is in itself a combination of the disciplines of aeronautical engineering and astronautics. Ocean engineering emphasizes the older fields of naval architecture and marine engineering at Virginia Tech.

The department’s undergraduate programs of study emphasize propulsion, aerohydrodynamics, stability and control, vehicle performance, and vehicle structures, which instructional material then leads to a year-long capstone design experience in the senior year. Design project assignments are developed by government and industry experts as part of international design competitions in which teams of aerospace and ocean engineering students have won numerous awards for their aircraft, spacecraft, and ship designs.

Program Objectives

The aerospace and Ocean Engineering undergraduate program seeks to:

- Prepare students for entry-level positions and graduate study in the fields of aerospace engineering or ocean engineering.
- Provide students with a strong background in fundamentals, including theoretical, experimental, and computational aspects of science and engineering, which will facilitate lifelong learning and the ability to pursue advanced study.
- Provide students with a broad education in the aerospace or ocean vehicle field with coverage of the areas of fluid dynamics, vehicle dynamics and control, propulsion, and structures, including an emphasis on design and synthesis in a team environment.

Accreditation

ABET is the recognized accreditor for college and university programs in applied science, computing, engineering, and technology. Among the most respected accreditation organizations in the U.S., ABET has provided leadership and quality assurance in higher education for over 75 years.

The Aerospace and Ocean Engineering Department is unique in offering Bachelor of Science degrees in both aerospace engineering and ocean engineering. Both of these engineering programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Areas of Focus

Ocean engineering is a diverse field. At Virginia Tech, the major focus areas are ocean energy systems and ocean vehicles and structures, which include ships, advanced marine vehicles, offshore platforms, and submarines.

For more information, visit our website at http://www.aoe.vt.edu or call 540-231-6699.
Undergraduate to Graduate Degree Programs
Aerospace and ocean engineering seniors who have an overall GPA of at least 3.3 may be eligible for Undergraduate/Graduate (UG/G) Status or Dual Status. Undergraduate/Graduate Status allows students to count up to 12 credits of coursework for both the undergraduate and graduate degree programs during the last two semesters of their undergraduate degree. Dual Status allows students to count up to 12 credits of coursework for the graduate degree program during the last semester of their undergraduate degree. Participants must be accepted into the AOE Department’s UG/G Program or Dual Program prior to the final two semesters of the undergraduate program. The AOE Department offers the following degree options.

Undergraduate/Graduate Status Program
• B.S./M.S. (thesis or non-thesis option) in Aerospace Engineering
• B.S./M.S. (thesis or non-thesis option) in Ocean Engineering
• B.S./Direct-Ph.D. in Aerospace Engineering

Dual Status Program
• M.S. (thesis or non-thesis option) in Aerospace Engineering
• M.S. (thesis or non-thesis option) in Ocean Engineering
• Direct-Ph.D. in Aerospace Engineering (with specialization in Ocean Engineering)

Courses that are counted toward both a B.S. and M.S. degree under the UG/G program or an M.S. degree under the Dual Status program may subsequently be counted toward a Ph.D. in aerospace engineering, provided the student is accepted into the Ph.D. program. Guidelines for the UG/G and Dual Status Programs are on the AOE Department website at http://www.aoe.vt.edu/undergrad/undergrad-advising/index-undergrad-advising.html.

Ship Design of the Future is Here
Both undergraduate and graduate programs focus on computer-aided analysis and design of ships, using methods based on first principles.

• Hydrodynamics: The flow of water around a ship’s hull, into the propeller, and over the rudder are critical to its performance, as are stability, slamming, and minimizing resistance.
• Structures: Loads on ocean vehicles are severe, ranging from extreme diving pressures to huge storm waves, to thousands of tons of cargo. Detailed analysis is used to design structures to withstand these loads.
• Vehicle Dynamics: An understanding of the motions of ships in a seaway and ship maneuverability is important to designing a functional and comfortable ship.

Computer Based Design Tools
Virginia Tech is the home of MAESTRO, today’s most advanced computer-based method for the structural analysis and optimization of ship, submarine, and offshore platform structures. Other computer tools include Rhino/GRICAD for geometry definition, NAVCAD for powering, NEACALC4 for stability, and many other industry standard ship design programs.

Employment
The ocean engineering industry is in a phase of transition in the U.S. Several new concepts for reducing cost as well as increasing safety and speed are under development (surface effect ships, open-top container ships, double hull ships). Our graduates compete very successfully in today’s job market.

Naval Engineering Minor
Naval engineering is defined as a field of study and expertise that includes all engineering and sciences as applied in the research, development, design, construction, operation, maintenance, and logistic support of surface and subsurface ships, craft, aircraft, and vehicles (manned and autonomous) used by the U.S. Navy for the nation’s defense. It is inherently multidisciplinary involving all departments from the College of Engineering. This minor will enable undergraduate students throughout the College of Engineering to prepare for and aspire to this critical profession.

This minor consists of 9 credits of required courses (AOE 2204, AOE 4264, and AOE 4994) and 9 credits of approved electives. A 2.0 in-major GPA on a 4.0 scale is required with a minimum grade of C- or better in the designated courses. Students submit the Minor in Naval Engineering Checksheet to Dr. Alan Brown. This minor supports the requirements of the Naval Engineering Education Consortium in which students may also participate.

Dedicated to Excellence in Instruction
The faculty/student ratio on the ocean engineering program is about 1 to 25, allowing each faculty member to really get to know the students. Ocean engineering faculty bring a variety of professional backgrounds to the classroom. Diverse and extensive experience in aerospace industry design, NASA Research, flight testing, and many other developing fields greatly enhance the classroom and lab experience with state-of-the-art and up-to-the-minute reality. Many are active members of professional societies involved with the improvement of engineering education, and all are dedicated to excellence in engineering instruction, several having won teaching and research awards.

Points of Interest
Number of Active Faculty: 21
Number of Undergraduate Students: More than 500
Unique Facilities: Stability, Open-Jet, Boundary-Layer, Low Speed, Transonic, Supersonic, and Hypersonic Wind Tunnels, new propulsion laboratory, new Space@VT building, new KES Laboratory, Corrosive Engineering Design Teams at the VME Laboratory, BFF Team, AUV Team, USV Team

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