

Aeronautics and Astronautics

Course 16

The students, faculty, and staff in MIT AeroAstro share a passion for air and space vehicles, the technologies that enable them, and the missions they fulfill.

Aerospace is an intellectually challenging, economically important, and exciting field; it offers unique opportunities for students and researchers to contribute to the future of exploration, transportation, communication, and security. Our mission in AeroAstro is to prepare engineers for success and leadership in the conception, design, implementation and operation of aerospace and related engineering systems. We achieve this through our commitment to educational excellence; the creation, development and application of the technologies critical to aerospace vehicle and information engineering; and the architecture and engineering of complex high-performance systems.

Our department has a tradition of promoting strong scholarship and of contributing to the solution of the most challenging problems. Our reach within aerospace extends to high levels of policy and practice. Our community includes a former space shuttle astronaut, a former secretary of the Air Force, two former NASA associate administrators, three former Air Force chief scientists, 12 members of the National Academy of Engineering and 16 Fellows of the American Institute of Aeronautics and Astronautics. Department members have been executives in the aerospace industry and founders of companies.

Graduates with an MIT aerospace engineering degree find careers in commercial and military aircraft and spacecraft engineering, space exploration, air and space-based telecommunication industries, teaching, research, military service, and many related technology-intensive fields such as transportation, information, and the environment. The comprehensive technical education with its strong emphasis on understanding complex systems is also excellent preparation for careers in business, law, medicine, and public service.

Education

AeroAstro's undergraduate degree programs are guided by an educational initiative we developed that has since been adopted by more than 50 colleges and universities

throughout the world. Working with our students, alumni, industry, government, and academic stakeholders around the world, we developed a curriculum that exposes our students to *all* phases of the aerospace system life cycle: conceiving, designing, implementing, and operating. We motivate our students to master a deep working knowledge of the technical fundamentals while giving them the skills, knowledge, and attitudes necessary to lead in the creation and operation of products, processes, and systems. Our programs and activities are centered in a teaching laboratory that underwent a \$20 million state-of-the-art reconstruction specifically to support our curriculum.

The reconstruction of our teaching laboratories was manifested in the creation of our Learning Laboratory for Complex Systems. The Learning Laboratory provides enhanced opportunities for hands-on learning experiences closely integrated with the department's curriculum. The Learning Lab's Arthur Gelb Laboratory features a modern machine shop, composites fabrication facility, electronics design lab, and large team projects area with equipment for student projects. The Robert C. Seamans Jr. Laboratory is a community study area with meeting and discussion rooms, and an extensively IT-equipped design/conference room. The Design Studio, which replicates facilities at major aerospace companies, provides IT and software resources to support concurrent team engineering sessions and distance learning. The Gerhard Neumann Hangar includes low-speed and supersonic wind tunnels, computers equipped with flight simulation applications, engineering hardware displays, and workspace for large-scale student projects.

Research

The AeroAstro students, faculty, and staff work with each other, with colleagues across MIT, and with institutions throughout the world. Our linkages enable us to tackle challenging multidisciplinary problems. These relationships also amplify our contributions. As a result, our department is connected, busy, global, hectic, open, collegial, and fun.

The faculty and students are engaged in hundreds of research projects under the auspices of our department's laboratories and centers: Aerospace Computational Design Lab, Aerospace Controls Lab, Communications and Networking Research Group, Complex Systems Research Lab, Gas Turbine Lab, Humans and Automation Lab, International Center for Air Transportation, Lab for Information and Decision Systems, Lean Advancement Initiative, Man Vehicle Lab, Partnership for AiR Transportation Noise and Emissions Reduction, Robust Robotics Group, Space Propulsion Lab, Space Systems Lab, Technology Lab for Advanced Materials and Structures, and the Wright Brothers Wind Tunnel. Many of the department's research projects are open to undergraduates through the Undergraduate Research Opportunities Program. Also, research activities in other MIT laboratories and centers are open to students registered in Aeronautics and Astronautics.

Degrees

The Bachelor of Science (SB) degree is a four-year program designed to prepare the graduate for an entry-level position in the aerospace field and for further education at the master's level. Three degrees are available: Course 16-1 emphasizes the disciplines that relate to the engineering of aerospace vehicles, Course 16-2 defines a specialization in aerospace information technology, and Course 16-ENG where students develop a deeper level of understanding and skill in a field of engineering relevant to multiple disciplinary areas (e.g., robotics and control) or an interdisciplinary area (e.g., environment and sustainability). All three degrees retain an emphasis on the fundamentals and provide strong integration with the overarching conceiving, designing, implementing, and operating context. The program includes an opportunity for a year abroad.

The Master of Science (SM) degree is a one- to two-year graduate program with a beginning research or design experience represented by the SM thesis. This degree prepares the graduate for an advanced position in the aerospace field, and it forms a solid foundation for future doctoral study.

AeroAstro offers doctoral degrees (Ph.D. and Sc.D.) that emphasize in-depth study with a significant research project in a focused area. Admission to the doctoral program requires students to pass a graduate-level examination in a field of aerospace engineering as well as to demonstrate an ability to conduct research in the field. The doctoral degree is awarded after completion of an individual course of study, submission and defense of a thesis proposal, and submission and

defense of a thesis embodying an original research contribution.

In addition, the department participates in a variety of interdisciplinary graduate programs.

Our Grand Challenges and Plan for the Future

We have identified eight areas that present grand challenges and opportunities for aerospace, the nation, and the world: space exploration; autonomous systems; environment; communications and networks; computation, design, and simulation; air transportation; large-scale complex systems; and advancing engineering education. We are building our department's capabilities to contribute further to these areas by striving for excellence in the underlying core disciplines, and by emphasizing the collaborative problem solving required for tackling the complex, multidisciplinary problems that characterize our industry. We are positioned to pursue the opportunities of today, and the opportunities that will arise in our future.

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For a detailed description of degree programs and research activities, you can also visit our website:

<http://www.mit.aero>.

The MIT Bulletin, Courses and Degree Programs Issue, contains further information on the Institute, including all graduate and undergraduate courses and programs.

For details on ordering the course catalogue, please visit the MIT Press Bookstore website at

<http://mitpress.mit.edu/bookstore/bulletin.html>.

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