Division of Engineering and Weapons

Aerospace Engineering Department
Electrical and Computer Engineering Department
Mechanical Engineering Department
Naval Architecture and Ocean Engineering Department
Weapons and Systems Engineering Department

THE U.S. NAVAL ACADEMY HAS PRODUCED MORE ASTRONAUTS THAN ANY OTHER UNIVERSITY IN THE COUNTRY.

Aerospace Engineering Department

Aerospace Engineering Major

The aerospace engineering department offers one of the most exciting and challenging academic programs at the Naval Academy. The program is structured to produce naval officers who will serve in the forefront of the inception, development and employment of naval air and space assets. The curriculum provides a background in engineering fundamentals through courses in chemistry, physics, mathematics, engineering mechanics, thermodynamics and electrical engineering. With these subjects as a base, students study aerospace engineering topics in aeronautics or astronautics tracks infused with airplane or spacecraft design studies.

While graduates of all majors are prepared for careers in naval aviation, the aerospace engineering major is intended for those who are fascinated by flight and want to understand the technology enabling air and space flight.

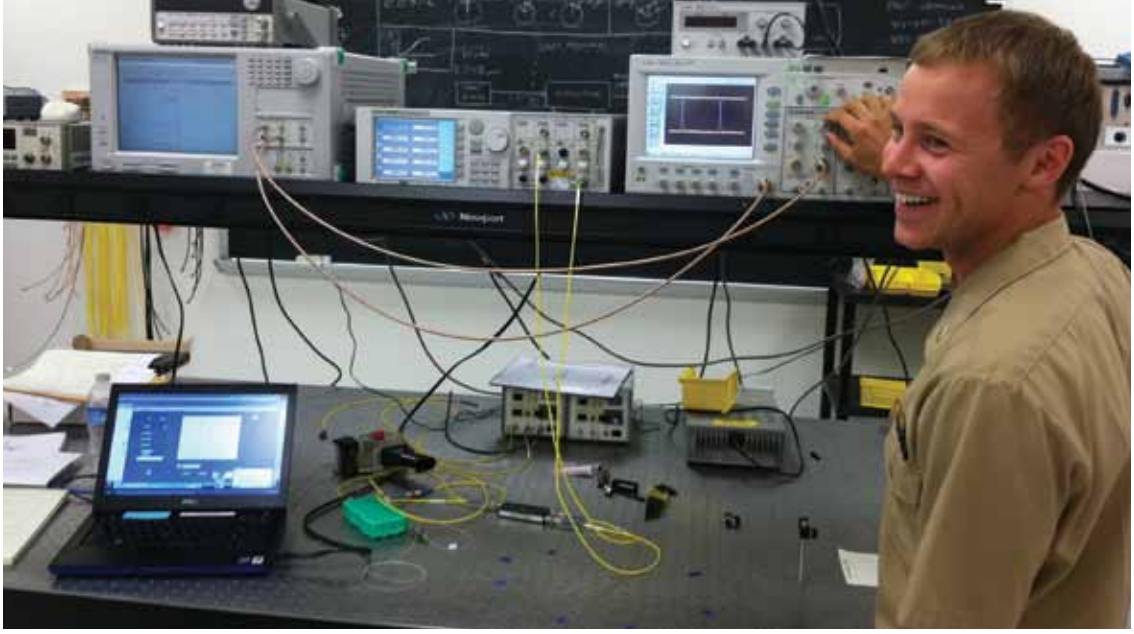
The program embraces contextual learning, whereby student engineers learn the business of engineering by behaving as engineers in progressively more complex design studies. Starting sophomore year with the redesign of small RC airplanes and rockets, students are exposed simultaneously to the technical content and the professional skills necessary in government and industry. From the outset, student engineers will be working in teams to design aerospace systems to suit a mission need, and reporting on their efforts both in formal presentations and reports.

Both tracks culminate with a capstone design course of one- or two-semester duration, allowing midshipmen to apply their engineering knowledge in the design and construction of an air or space flight vehicle, usually for clients external to the Naval Academy. Design/Build activities and engineering science courses are served by outstanding lab facilities including high and low speed wind tunnels, machine shop, composite lay-up facilities, and spacecraft operation and fabrication labs.

Graduates from the aerospace engineering major are fully prepared to undertake postgraduate education programs in engineering disciplines. Naval officers with degrees in aerospace engineering are commonly assigned to billets involving the research, development, test and evaluation of Navy aircraft or spacecraft projects. Locations for these challenging technical billets include the Naval Air Systems Command, Naval Research Laboratory, Test Pilot School, the Naval Network Warfare Command, the Navy Space Cadre, and NASA's Astronaut Office.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL300, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221;
Physics: SP211, SP212;
Humanities: HH215, HH216, two electives including one at the 300/400 level;
Engineering: EE331, EE334, EM211, EM232, EM321, EM319, ES300, ES410;
Major: ***Aeronautics Track*** - EA203, EA204, EA301, EA303, EA304, EA308, EA322, EA332, EA401, EA413, EA429, EA440, plus two major electives; ***Astronautics Track*** - EA203, EA204, EA305, EA308, EA322, EA362, EA364, EA365, EA461, EA465, EA467, EA470, plus two major electives.

Aerospace Engineering courses



Electrical and Computer Engineering Department

Electrical Engineering Major

Electrical Engineering is one of the cornerstone disciplines that will shape many aspects of the Navy for the foreseeable future. The major offers a solid grounding in the fundamentals of electrical engineering, as well as the opportunity to investigate advanced topics in communication systems, digital computers, fiber optic systems, microwaves, digital signal processing, and instrumentation. The Navy needs officers trained in these electrical engineering subspecialties to lead in the development, integration, and operation of advanced warfare systems. The electrical engineering major is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) and leads to a bachelor of science in electrical engineering.

Electrical engineering majors apply classroom concepts in the laboratory throughout the program. The Department has extensive well-equipped laboratories to provide excellent hands-on support for every course in the major. Dedicated laboratories support courses in analog and digital hardware, fiber optics, electronics, communications, electro-mechanical energy conversion, and advanced electrical engineering project design. The Department places special emphasis on individual learning at a lab station to ensure thorough understanding of required skills, and the team approach to solving more open-ended, real-world design problems. Labs are continually updated with leading-edge technology.

The electrical engineering major culminates in the capstone senior design laboratory sequence (EE411 and EE414). In these courses, midshipman majors must integrate the many skills acquired in preparatory courses to be able to design, implement, test, and demonstrate a significant project. Annual prizes include the Steinmetz Prize for innovative work in the electrical and computer engineering design laboratory course sequences, the General Michael W. Hagee Prize for the design team showing the highest standards of military leadership, and the Captain Boyd R. Alexander Prize for the outstanding graduate in the electrical engineering major.

Graduates of the electrical engineering program are well prepared for any of the many jobs they may be assigned in the operating forces of the Navy and Marine Corps. The major also provides an excellent foundation for continued, more specialized study in electrical engineering at the graduate level on active duty after commissioning at the Naval Postgraduate School or any other academic institution.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL310, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221, SM313;
Science: SP211, SP212;
Humanities: HH2XY, HH216, plus two elective courses, including one at the 300/400 level;
Engineering: EM316, EM317, ES300, ES410;
Major: SI204, EE221, EE241, EC262, EE320, EE322, EE354, EE361, EE372, EE411, EE414, plus three major electives.

Electrical Engineering courses

Computer Engineering Major

Computer engineering is a fairly recent, but highly significant and relevant sub-discipline of electrical engineering. Smaller, faster, and cheaper are words that describe the revolutionary changes associated with computer engineering. The computer engineering major closely follows the electrical engineering major for the first year, but diverges thereafter. A solid grounding in the fundamentals of electrical and computer engineering is followed by the opportunity to investigate advanced topics in computer interfacing, computer networking, operating systems, fiber optic systems, and digital signal processing. The Navy is certain to need officers trained in computer engineering to lead in the development, integration, and operation of advanced computer-based systems. The computer engineering major leads to a bachelor of science in computer engineering. The Department is seeking early ABET accreditation of the new computer engineering major by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) at the earliest permissible time.

Computer engineering majors apply classroom concepts in the laboratory throughout the program. They are able to take advantage of the Department's well-equipped laboratories in gaining hands-on experience in nearly every course in the major. The Department uses a two-pronged strategy to empha¬size skills needed by computer engineering majors: a) encouragement of individual learning at a lab station to ensure thorough understanding of required skills and b) reliance on team efforts in solving design problems. Labs are regularly updated with leading-edge technology.

The computer engineering capstone senior design laboratory sequence (EE411 and EC415) is the culmination of the computer engineering major. These courses integrate the many skills acquired in preparatory courses so that students can design, implement, test, and demonstrate a significant project. Annual prizes include the Steinmetz Prize for innovative work in the electrical and computer engineering design laboratory course sequences, the General Michael W. Hagee Prize for the design team showing the highest standards of military leadership

Graduates of the computer engineering program are well prepared for any of the many jobs they may be assigned in the fleet and fleet marine force. The major also provides an excellent fundamental back¬ground and foundation for continued, more specialized study in computer engineering at the graduate level after commissioning at Naval Postgraduate School or any other academic institution.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL310, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221, SM313;
Science: SP211, SP212;
Humanities: HH2XY, HH216 plus two elective courses, including one at the 300/400 level;
Engineering: EM316, EM317, ES300, ES360;
Major: SI204, SI221, EE221, EE241, EC244, EC262, EE322, EE354, EC361, EC362, EE411, EC415, plus three major electives.

Computer Engineering courses

Mechanical Engineering Department

Mechanical Engineering Major

The mechanical engineering major, fully accredited by the engineering accreditation commission known as ABET, Inc., is the most broad-based of all engineering programs available at the Naval Academy. Current fleet examples of mechanical engineering include the structural mechanics of ships and aircraft; performance of gas turbine engines; conversion of nuclear energy; and advanced weapons systems such as electromagnetic rail-guns and directed energy weapons. These areas of interest require a fundamental understanding of the subjects covered by the mechanical engineering curriculum: solid mechanics, material science, energy conversion, fluids mechanics and the engineering design process. As part of the core curriculum, mechanical engineering majors also take a number of courses in electrical and systems engineering.

Mechanical engineers must be able to design systems that can withstand forces without breaking and/or utilize forces to produce power. Students begin by investigating how forces are distributed within solid structures and learn how to predict deformation and failure. This requires a fundamental understanding of materials and their properties. Mechanical engineers also need to be able to predict the deformation or flow of fluids; and the force that result from the interaction of fluids with solid objects. Students will also study energy and the conversion of chemical, nuclear or thermal energy into mechanical power.

The program takes seriously the need to develop graduates who have a sound understanding of the design process and its importance in the success of engineering activity. Design education in the program is developed through a sequence of courses, beginning in the first semester of the sophomore year and culminating in the capstone senior design project, which is a 2-semester endeavor involving teams of students. Each team is expected to design, build and test a mechanical system.

The Mechanical Engineering program prepares its graduates to assume responsibilities in the U.S. Navy and U.S. Marine Corps involving the operation and maintenance of highly technical systems. A Navy or Marine Corps officer with a bachelor's degree in mechanical engineering is well prepared for a wide variety of career assignments both ashore and afloat. Operational sea billets in surface ships, submarines, and aircraft squadrons provide many opportunities for a mechanical engineer to develop practical engineering experience. There is an abundant and continuing need for mechanical engineers throughout today's naval service.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL310, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221;
Science: SP211 and SP212;
Humanities: HH2XY, HH216, and two electives including one at the 300/400 level;
Engineering: EE331, EE310, EM211, EM217, EM232, EM324, ES300, ES410;
Major: EM215, EM313, EM319, EM320, EM371, EM375, EM415, EM471, EM472, plus three major electives.

Mechanical Engineering courses

General Engineering Major

The general engineering major provides a basic technical education in mathematics, science, engineering and naval professional subjects. It offers a broad engineering background for future naval service. Midshipmen completing the general engineering major receive a designated bachelor of science degree.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NN210, NE203, NN310, NL310, NL400, NS43X;
Mathematics: SM221, SM212, SM230;
Science: SP211, SP212;
Humanities: HH2XY, HH216 plus two electives including one at the 300/400 level;
Engineering: EE301, EE310, EE313, ES300, ES360, EN400;
Major: EM211, EM232, EM316, EM317, plus seven major electives, two technical electives and one free elective.

Naval Architecture and Ocean Engineering Department

Naval Architecture Major

One of the oldest engineering disciplines, naval architecture focuses on unique and complex end-products, vessels to travel the world's vast oceans, lakes and rivers. A special combination of knowledge and experience is needed to design and build these vessels. Variety exists not only in the work involved (research, design, fabrication, and management), but also in the types of craft from sailboats to aircraft carriers, hydrofoils to catamarans, submarines to surface-effect ships and tugs to supertankers.

Naval architects use both art and science in designing ships. Armed with imagination and experience, they convert functional requirements into a suitable, cost-effective design. They analyze and select the best dimensions, materials and hull form, calculate the power requirements and estimate the weights of the principal components. They design and analyze the hull structure and decide on the location of machinery spaces, living quarters, storage spaces, tankage and weapons systems. In addition, naval architects design in safety features such as watertight compartments so that, if damaged, the chances of the vessel sinking or capsizing are minimized.

Naval architecture at the Naval Academy approaches these topics in a fully integrated program of classroom sessions, hands-on laboratory work, field trips, projects and the latest in computer-aided ship design techniques. A naval architecture design room, two towing tanks, a circulating water channel, structural testing equipment and a static stability tank are some of the many facilities available to midshipmen majoring in naval architecture. Distinguished and innovative faculty complement these excellent facilities and contribute to making naval architecture an outstanding undergraduate engineering major. The major is fully accredited by the engineering accreditation commission known as ABET, Inc. A bachelor of science in naval architecture is awarded.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL310, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221;
Science: SP211, SP212;
Humanities: HH2XY, HH216 plus two electives including one at the 300/400 level;
Engineering: EE331, EE334, EM316, EM317, ES300, ES360;
Major: EN221, EN222, EN247, EN330, EN342, EN353, EN358, EN380, EN455, EN471, EN476, plus two major electives and one mathematics, science or engineering elective.

Naval Architecture courses

Ocean Engineering Major

Ocean Engineering holds the key to the last frontier on earth, the ocean depths. While marine scientists provide us with a basic knowledge of the ocean environment, the ocean engineer enables us to use this environment more effectively. By blending the fundamentals of mathematics, physics, chemistry and oceanography with knowledge of the engineering sciences, including ocean materials and wave mechanics, the ocean engineer plans, designs and builds a variety of coastal, harbor, and offshore structures; unmanned underwater vehicles and diver-support equipment; underwater acoustic systems; ocean energy and other marine-related environmental systems. Multi-disciplinary in nature, ocean engineering will appeal to civil, electrical, environmental and mechanical engineers who wish to practice in the ocean realm.

The ocean engineering major is fully accredited by the engineering accreditation commission known as ABET, Inc. The major offers an integrated program of study, using a balance between classroom theory, laboratory work and practical application providing midshipmen with the background to work effectively as ocean engineers. Laboratory experiments are conducted in the 120-foot and 380-foot wave and towing tanks and coastal engineering basin. These are equipped with electro-hydraulic wave-makers and instrumented with sophisticated sensors and on-line data acquisition and analysis equipment. A circulating water channel, hyperbaric test facility and an environmental chamber are also available. The Naval Academy's computer systems are used in solving design problems and preparing computer-aided designs. Supervising, directing and teaching this program is a team of professionals recognized for providing one of the finest undergraduate majors in ocean engineering available in the country. A bachelor of science in ocean engineering is awarded.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL310, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221;
Science: SP211, SP212;
Humanities: HH2XY, HH216, and two electives including one at the 300/400 level;
Engineering: EE331, EE334, EM211, EM217, EM232, EM317, EM324, ES300, ES360;
Major: EN245, EN330, EN380, EN441, EN461, EN462, EN475, SO221, plus four major electives.

Ocean Engineering courses

Weapons and Systems Engineering Department

Systems Engineering Major

Modern engineering designs, from automobile and spacecraft to missiles and robots, are complex systems of components such as motors, microcomputers, and sensors. Using these diverse components, the Systems Engineer designs a functional whole that meets given specifications and whose behavior is characterized by automatic decision-making. The scope of such designs necessitates that students of the major learn a breadth of topics encompassing electronics, mechanics, and computer programming.

Due to the characteristic automatic functionality of its designs, the core content of the major is the study of feedback control and intelligent sensing. Surrounding this core are many advanced courses in microprocessors, robotics, unmanned vehicles, computer vision, and relevant emerging technologies. To enrich their knowledge of a specific field, students of the major may take a couple of advanced courses from other engineering disciplines as well as mathematics, physics, and computer science. The Naval Academy's Systems Engineering program—rated number on in the country for more than ten years—is accredited by the Accreditation Board for Engineering and Technology (ABET). A bachelor of science in Systems Engineering is awarded; an honors program with a designated honors degree is available for selected students.

Systems Engineers are well-prepared to operate and maintain, particularly, the most sophisticated systems found in today's Navy. Knowledge gained in the major is directly applicable to missile guidance, radar, and propulsion systems. Many graduates go on to industry where they lead and manage interdisciplinary teams of engineers. The Systems Engineering major also provides an excellent foundation for postgraduate education in any engineering discipline.

Curriculum Requirements (in addition to the requirements of plebe year)
Professional: NE203, NL310, NL400, NN210, NN310, NS43X;
Mathematics: SM212, SM221, SM316;
Science: SP211, SP212, SI283;
Humanities: HH2XY, HH216, and two electives including one at the 300/400 level;
Engineering: EE331, EE332, EM211, EM232, EM318, EM319A, ES300;
Major: ES201, ES202, ES301, ES303, ES304, ES308, ES402, ES403, ES405,
plus five major electives.

Systems Engineering courses