AEROSPACE ENGINEERING, B.S.

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

This major emphasizes the analysis, design, and operation of aircraft and spacecraft. Students learn the theories and practices in the fundamental subjects of aeronautics, astronautics, aerodynamics and fluid dynamics, aerospace materials and structures, dynamics and automatic control, aircraft stability and control and/or orbital and attitude dynamics and control, air-breathing and rocket propulsion, aircraft systems design and /or spacecraft systems design. All of these place significant weight on the development and use of teamwork and communications skills for effective problem-solving. Graduates in aerospace engineering find employment in the customary settings such as government laboratories, large and small aerospace firms, and in nontraditional positions that also require the use of systems-engineering approaches to problem-solving; they can also pursue graduate study in aerospace engineering and related fields.

What is Aerospace Engineering?

Aerospace engineering is the primary field of engineering concerned with the design, development, testing, and production of aircraft, spacecraft, and related systems and equipment. The field has traditionally focused on problems related to atmospheric and space flight, with two major and overlapping branches: aeronautical engineering and astronautical engineering. Aerospace engineers develop leading-edge technologies and integrate them into aerospace vehicle systems used for transportation, communications, exploration, and defense applications. This involves the design and manufacturing of aircraft, spacecraft, propulsion systems, satellites, and missiles, as well as the design and testing of aircraft and aerospace products, components, and subassemblies. Successful aerospace engineers possess in-depth skills in, and an understanding of, aerodynamics, materials and structures, propulsion, vehicle dynamics and control, and software.

You Might Like This Program If...

- You are interested in developing leading-edge technologies and integrating them into aerospace vehicle systems used for transportation, communications, exploration, and defense applications.
- You want to obtain a solid understanding of the foundations of aerospace systems: aerodynamics, structures, propulsion, dynamics and controls, and software, as well as unmanned air vehicles (UAVs), nano-materials, autonomous systems, and wind energy.
- You want to develop professional excellence, engineering thinking, and gain deep technical knowledge in the core disciplines and integrative systems of aerospace engineering through an innovative curriculum and world-class instruction.
- You want to make a significant global impact.

Entrance to Major

This program currently has administrative enrollment controls. Administrative Enrollment Controls are initiated when limitations of space, faculty, or other resources in a major prevent accommodating all students who request them. Students must follow the administrative enrollment controls that are in effect for the semester that they enter the university.

First-Year Students Entering Summer 2018, Fall 2018, Spring 2019

In order to be eligible for entrance to this major, students must satisfy the following requirements:

- completed 40-59 credits at Penn State (actual credits taken at the University)
- completed with a grade of C or better: CHEM 110, MATH 140, MATH 141, MATH 250 (required for major) or MATH 251, PHYS 211, and PHYS 212
- earned a minimum of 3.20 cumulative GPA

Students Who Entered Prior to Summer 2018

Students who entered the University prior to the summer 2018 semester should view the administrative enrollment controls for the semester that they entered the university (http://advising.psu.edu/entrance-major-requirements) on the Academic Advising Portal.

Degree Requirements

For the Bachelor of Science degree in Aerospace Engineering, a minimum of 131 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	113

The first two years of study are similar to those in other engineering majors and provide students with a basic education for the engineering profession. Students need to complete EMCH 212, CMPSC 201, MATH 220, MATH 230, and MATH 250 prior to the start of the junior year in order to meet graduation requirements in the following two years. Six of the nine technical-elective credits taken in the senior year must be aerospace engineering courses.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Knowledge Domains

- **Arts (GA):** 6 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 6 credits

- **Social and Behavioral Sciences (GS):** 6 credits
- **Natural Sciences (GN):** 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)

- **Inter-Domain or Approved Linked Courses:** 6 credits

27 of these 45 credits are included in the Requirements for the Major.

University Degree Requirements

First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major

This includes 27 credits of General Education courses: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

Code	Title	Credits
Prescribed Courses		
EDSGN 100	Introduction to Engineering Design	3
ME 201	Introduction to Thermal Science	3
MATH 220	Matrices	2-3
MATH 230	Calculus and Vector Analysis	4
PHYS 214	General Physics: Wave Motion and Quantum Physics	2
AERSP 304	Dynamics and Control of Aerospace Systems	3
AERSP 305	Aerospace Technology Laboratory	3
AERSP 312	Aerodynamics II	3
EMCH 315	Mechanical Response of Engineering Materials	2
EMCH 316	Experimental Determination of Mechanical Response of Materials	1
AERSP 410	Aerospace Propulsion	3
ENGL 202C	Effective Writing: Technical Writing	3
Prescribed Courses: Require a grade of C or better		
CHEM 110	Chemical Principles I	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
PHYS 211	General Physics: Mechanics	4
EMCH 212	Dynamics	3
MATH 250	Ordinary Differential Equations	3
PHYS 212	General Physics: Electricity and Magnetism	4
AERSP 301	Aerospace Structures	3
AERSP 306	Aeronautics	3
AERSP 309	Astronautics	3
AERSP 311	Aerodynamics I	3
AERSP 313	Aerospace Analysis	3
Additional Courses		
Select 1 credit of First-Year Seminar		1
AERSP 413 or AERSP 450	Stability and Control of Aircraft Orbit and Attitude Control of Spacecraft	3
CAS 100A or CAS 100B	Effective Speech Effective Speech	3
CMPSC 201 or CMPSC 202	Programming for Engineers with C++	3
ENGL 15 or ENGL 30	Rhetoric and Composition Honors Freshman Composition	3
Select 3 credits of the following:		3
ECON 102	Introductory Microeconomic Analysis and Policy	
ECON 104	Introductory Macroeconomic Analysis and Policy	
ECON 14	Principles of Economics	
Select 5 credits of the following:		5
EMCH 210	Statics and Strength of Materials	
EMCH 211	Statics	
EMCH 213	Strength of Materials	
Select one of the following sequences:		5
AERSP 401A & AERSP 401B	Spacecraft Design--Preliminary and Spacecraft Design--Detailed	

AERSP 402A & AERSP 402B	Aircraft Design--Preliminary and Aircraft Design--Detailed	
Select 3 credits of the following:		3
AERSP 440	Introduction to Software Engineering for Aerospace Engineers	
EE 210	Circuits and Devices	
EE 212	Introduction to Electronic Measuring Systems	
Supporting Courses and Related Areas		
Select 9 credits of Aerospace Technical Elective (ATE) courses from department list		9
Select 3 credits of Limited Elective (LE) courses from department list [1]		3

[1] Students who complete Basic ROTC may substitute 6 of the ROTC credits for 3 credits of LE and 3 credits of GHW.

Program Educational Objectives

Two to three years after obtaining a B.S. in aerospace engineering, graduates will be

1. employed in the customary settings such as government laboratories, large and small aerospace firms, and nontraditional positions that also require the use of systems engineering approaches to problems-solving, or
2. pursuing graduate study in aerospace engineering and related fields.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Aerospace Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information need to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)

University Park

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Suggested Academic Plan

Aerospace Engineering-ending at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

If you are starting at a campus other than the one this plan is ending at, please refer here:

http://advising.engr.psu.edu/degree-requirements/academic-plans-by-major.aspx

First Year

Fall	Credits	Spring	Credits
CHEM 110 (GN)*#†	3	EDSGN 100	3
ECON 102 or 104 (GS)†	3	ENGL 15, 30, or ESL 15 (GWS)‡†	3
MATH 140 or 140E (GQ)*‡#†	4	MATH 141 or 141E (GQ)*‡#†	4
PHYS 211 (GN, PHYSICS 211L & PHYSICS 211R)*#†	4	PHYS 212 (GN, PHYSICS 212L & PHYSICS 212R)*#†	4
AERSP 1 or 97 (or First Year Seminar)†	1	General Education Course†	3
	15		17

Second Year

Fall	Credits	Spring	Credits
CMPSC 201	3	CAS 100A or 100B (GWS)‡†	3
EMCH 210	5	EMCH 212*	3
MATH 220	2	EMCH 315	2
MATH 250*#	3	EMCH 316	1
General Education Course†	3	MATH 230	4
		ME 201	3
	16		16

Third Year

Fall	Credits	Spring	Credits
AERSP 301*	3	AERSP 304	3
AERSP 309*	3	AERSP 305†	3

AERSP 311*	3	AERSP 306*	3
AERSP 313*	3	AERSP 312	3
ENGL 202C (GWS)‡†	3	PHYS 214 (GN)	2
General Education Course (GHW)†	1.5	General Education Course†	3
	16.5		17

Fourth Year

Fall	Credits	Spring	Credits
AERSP 401A or 402A	3	AERSP 401B or 402B	2
AERSP 410	3	AERSP 440, EE 210, or EE 212	3
AERSP 413 or 450	3	AERSP Technical Elective	3
AERSP Technical Elective	3	Limited Elective	3
Technical Elective	3	General Education Course†	3
General Education Course (GHW)†	1.5	General Education Course†	3
	16.5		17

Total Credits 131

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

College Notes

AERSP 401A/AERSP 401B and AERSP 402A/AERSP 402B: Students may schedule either the spacecraft design sequence (AERSP 401A and AERSP 401B) or the aircraft design sequence (AERSP 402A and AERSP 402B). The appropriate control course (AERSP 413 or AERSP 450) should be scheduled accordingly.

AERSP Technical Elective: Select from department list. Students who complete the Cooperative Education Program may substitute 3 co-op credits for a Technical Elective and 3 co-op credits for a Limited Elective.

Health and Physical Activity Elective (GHW): Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Limited Elective.

Limited Elective: Select from department list. Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Limited Elective. Students who complete the Cooperative Education Program may substitute 3 co-op credits for a Technical Elective and 3 co-op credits for a Limited Elective.

These courses offered at University Park in fall semester only:

- AERSP 301
- AERSP 309
- AERSP 311
- AERSP 313
- AERSP 401A
- AERSP 402A
- AERSP 410
- AERSP 413
- AERSP 450

These courses offered at University Park in spring semester only:

- AERSP 304
- AERSP 305
- AERSP 306
- AERSP 312
- AERSP 401B
- AERSP 402B
- AERSP 440

Career Paths

Aerospace engineers work primarily in the aerospace industry, at systems and software suppliers, corporate labs, government labs, and universities. Their skill set is extremely broad and multidisciplinary, and the experience of aerospace engineers as systems architects and engineers allows them to make contributions in many diverse sectors. Our graduate programs provide outstanding research opportunities across a broad spectrum of topics, and encompass both computational and experimental research approaches. Students may embrace traditional fields like aerodynamics, propulsion, flight science, vehicle dynamics, aeroacoustics, and rotorcraft engineering, as well as leading-edge research areas such as UAVs, commercial space, nanomanufacturing, and wind energy.

Careers

The industries that employed the most aerospace engineers are:

- Aerospace product and parts manufacturing.
- Engineering services.
- Federal government, excluding postal service.
- Research and development in the physical, engineering, and life sciences.
- Navigational, measuring, electromedical, and control instruments manufacturing.

MORE INFORMATION (http://career.engr.psu.edu)

Opportunities for Graduate Studies

The aerospace engineering department offers the following graduate degree options: " Master of Engineering (M.Eng.) " Master of Science (M.S.) " Doctor of Philosophy (Ph.D.) Students may also earn a graduate minor in computational science and/or a graduate certificate in wind energy.

MORE INFORMATION (http://www.aero.psu.edu/academics/graduate/prospective-students.aspx)

Professional Resources

- AHS International (https://vtol.org)
- American Institute of Aeronautics and Astronautics (https://www.aiaa.org)
- American Astronautical Society (http://astronautical.org)

Accreditation

The baccalaureate program in Aerospace Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

MORE INFORMATION (http://www.abet.org)

Contact

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