AEROSPACE ENGINEERING

More so than most other disciplines, aerospace engineering (AERSP) is defined largely by reference to a specific industry, one that is increasingly global and competitive. Aerospace engineers develop leading-edge technology and integrate it into aerospace vehicle systems for exploration, infrastructure, and defense applications. The work of aerospace engineers improves our quality of life and contributes to the solution of societal issues like climate change and renewable energy. Examples include air travel and overnight delivery, satellite-based remote sensing and global positioning, and wind energy. The study of aerospace engineering prepares students for the design, analysis, and testing of aeronautical and astronautical vehicles and their components, including airplanes, helicopters, launch vehicles, satellites and other spacecraft, as well as jet- and rocket-propulsion systems. A few graduates even go on to careers as pilots or astronauts! About 1 in 30 new B.S. aerospace engineers in the U.S. is a Penn State graduate.

The traditional discipline of aerospace engineering builds on the four technical pillars of aerodynamics, propulsion, structures, and controls; however, information (computing/communications) is taking on an increasingly important role. Students take courses, including laboratories, in all of these foundational areas. In the senior year, students can choose to emphasize aircraft or spacecraft applications. Students also have a liberal choice of technical electives with which to expand their knowledge in these and more specialized subjects, such as airplane performance, flight testing, space propulsion, composite structures, automatic controls, orbital mechanics, and computational methods. The overall curriculum emphasizes the integration of core knowledge, practices, and technologies in vehicle systems engineering. Many hands-on elective projects serve as capstones to the vehicle design experience.

About a fifth of all engineers in the aerospace industry hold degrees in aerospace engineering, the rest having backgrounds mainly in mechanical, civil, electrical, or computer engineering. However, the aerospace engineers have the broad, multi-disciplinary understanding needed to play an important role as architects and integrators of increasingly sophisticated vehicle systems.

Is Aerospace Engineering for You?

Students in this major are often motivated by a strong interest in aeronautics and/or astronautics. The curriculum emphasizes fundamentals in mathematics and the technical disciplines, bringing them together to address vehicle performance and design. Since engineers work in teams as part of larger organizations, strong communications and people skills are also very important. To enable graduates to compete successfully in a truly global economy, the faculty has set high standards and students strive to meet them. Some students also elect to pursue specialized graduate training in one or more of the technical pillars of aerospace. Graduate degrees in aerospace engineering are highly valued in the industry, as the more thorough preparation enables new hires to perform at a higher level.

Aerospace engineering graduates find employment in a wide range of companies and governmental organizations and research laboratories. These include manufacturers of engines, aircraft, helicopters, missiles, launch vehicles, and spacecraft, as well as commercial airlines, satellite service companies, simulation software developers, government-supported contractors, NASA, the FAA, and a number of military research laboratories.

Examples of typical entry-level jobs include: analysis, construction, and testing of various components and systems, such as wing sections, rocket engines, composite structural parts, flight control systems, and embedded software. Additional positions involve planning, conducting, and analyzing flight tests of aircraft or spacecraft. Other possible assignments include monitoring and controlling satellites from a ground station, planning and monitoring space shuttle missions, and developing diagnostic procedures and software to monitor system performance and health. With some experience, graduates can expect to participate in vehicle configuration design and systems engineering.

Detailed Program Objectives

Aerospace Engineering B.S. graduates will be able to:

1. Analyze the dynamics and control characteristics of aerospace vehicles, including the basic translational and rotational dynamics, and the basic theory and practice used to control these motions,
2. Analyze fluid dynamics, including the regimes of subsonic, transonic, and supersonic flows, inviscid and viscous flows, and laminar and turbulent flows,
3. Apply knowledge of the fundamentals of aeronautics, including aerodynamic characteristics or aircraft, propulsion systems, airplane performance, and elementary aircraft stability & control,
4. Apply knowledge of the fundamentals of astronautics, including orbital mechanics, attitude dynamics & control, rocket propulsion, and the space environment,

5. Predict performance, and conduct preliminary design, of gas turbine and rocket-based propulsion systems and their components,
6. Analyze the detailed dynamics, stability and control of either aircraft or spacecraft,
7. Analyze the design structural elements such as bars, beams, plates and thin-walled structures,
8. Make measurements to test hypotheses or to characterize the performance of physical systems (aerodynamic, structural, and control), and analyze and interpret the data in written reports,
9. Complete the successive stages of conceptual, preliminary, and detailed design of an aircraft or spacecraft mission and the associated vehicles,
10. Function effectively on teams to solve problems in complex aerospace systems that require knowledge of multiple disciplines,
11. Apply an understanding of professional and ethical responsibility to realistic situations,
12. Make effective oral and written presentations in the format appropriate for the setting,
13. Explain how this profession affects society as a whole, and to demonstrate an appreciation of how technical issues guide societal actions,
14. Demonstrate an awareness of the need to stay abreast of technical developments throughout their working careers, and demonstrate that they are able to maintain and extend their learning, and
15. Make appropriate and effective use of computer software, hardware, and state-of-the-art laboratory instrumentation.

For additional information, visit the Department of Aerospace Engineering website at **www.aero.psu.edu** or contact Dr. Robert G. Melton at 814-865-1185 or by e-mail at rgmelton@psu.edu. Aerospace Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; **www.abet.org**.

Student Societies and Organizations
Advisor and contact information about the following departmental student organizations can be found at **http://www.engr.psu.edu/StudentOrganizations**

1. American Helicopter Society (AHS)
2. American Institute of Aeronautics and Astronautics (AIAA)
3. Sigma Gamma Tau (ΣΓΤ)

Aerospace Engineering

Starting at University Park

NOTE: *All AERSP courses are offered only once a year in the semester shown on the schedule , except AERSP 305W (odd numbered semesters correspond to Fall, even numbers to Spring).*

1st Semester

ENGL 15 or 30	Rhetoric & Comp. (or ECON)	3
•CHEM 110	***Chemical Principles***	***3***
•MATH 140 or ***140E***	***Calculus I***	***4***
•PHYS 211	***Mechanics***	***4***
First-Year Seminar		1
		15

2nd Semester

ECON 2, 4 or 14 (GS) (or ENGL 15/30)		3
•MATH 141 or ***141E***	***Calculus II***	***4***
PHYS 212	Electricity & Magnetism	4
EDSGN 100	Intro. to Engr. Design	3
GA, GH or GS course		3
		17

3rd Semester

MATH 230	Calc. & Vector Analysis	4
MATH 220	Matrices	2
E MCH 210 [A]	Statics & Str. of Materials	5
*CMPSC 201	Programming with C++	3
GA, GH or GS course		3
		17

4th Semester

MATH 250	Ordinary & Differential Eqns.	3
M E 201	Thermal Science	3
CAS 100 A/B	Effective Speech	3
+E MCH 212	**Dynamics**	**3**
E MCH 315, 316	Mech. Response of Materials	3
		15

5th Semester

+AERSP 301	**Aerospace Structures I**	**3**
+AERSP 309	**Astronautics**	**3**
+AERSP 311	**Aerodynamics I**	**3**
+AERSP 313	**Aerospace Analysis**	**3**
ENGL 202C	Technical Writing	3
Health & Physical Activity (GHA)		1.5
		16.5

6th Semester

AERSP 304	Dynamics & Control	3
+AERSP 306	**Aeronautics**	**3**
AERSP 305W	Aerospace Tech. Lab	3
AERSP 312	Aerodynamics II	3
Health & Physical Activity (GHA)		1.5
GA, GH or GS course		3
		16.5

7th Semester

** AERSP 401A or 402A	Vehicle Sys. Design I	3
AERSP 410	Aerospace Propulsion	3
AERSP 413 or 450	Flight Vehicle Dynamics	3
PHYS 214	Waves & Quantum	2
~AERSP Technical Elective		3
~AERSP Technical Elective		3
		17

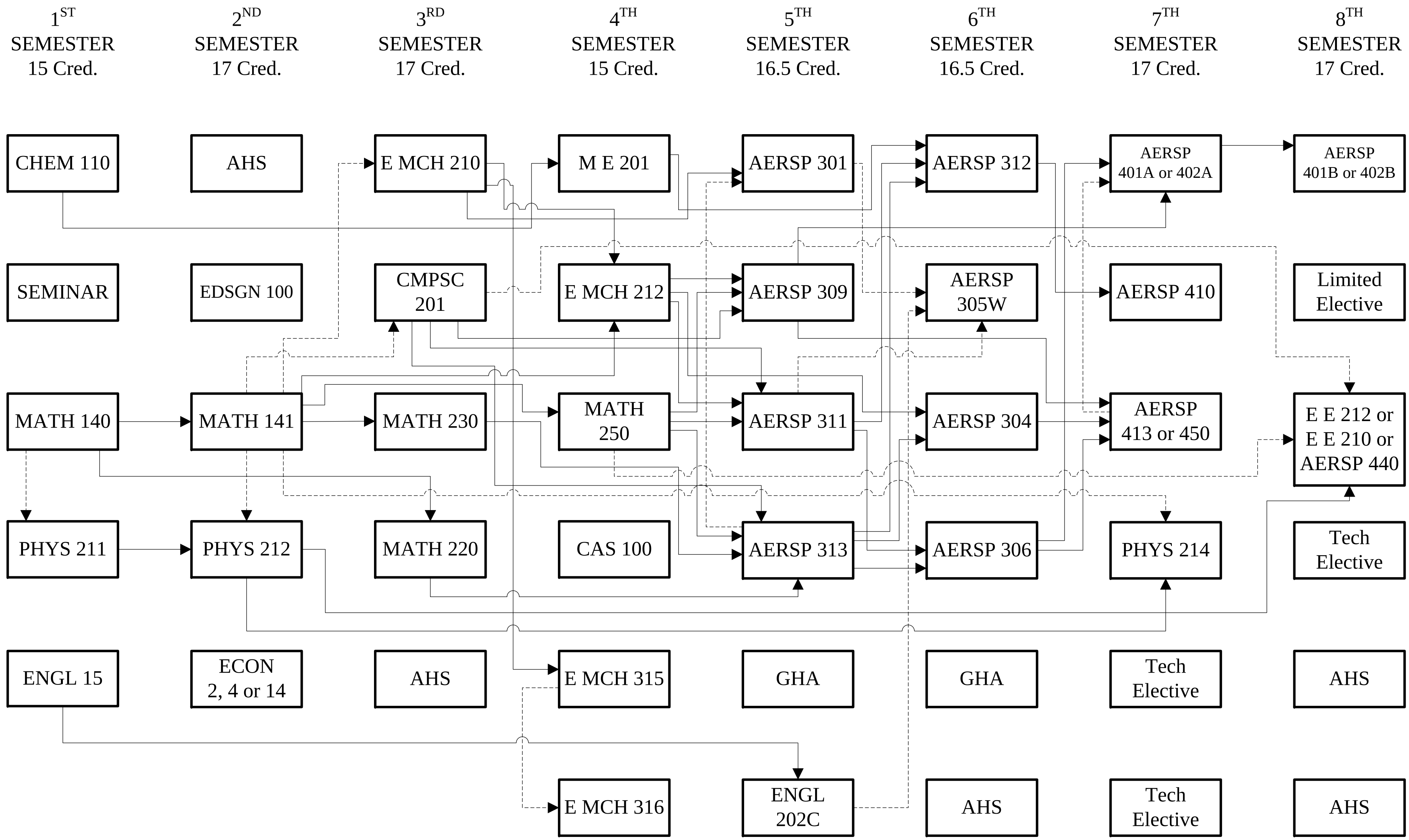
8th Semester

** AERSP 401B or 402B	Vehicle Sys. Design II	2
AERSP 440 or E E 212, or E E 210	Software Eng. or Electr. Meas. or Electr. Devices	3
~AERSP Technical Elective		3
Limited Elective (from dept. list)		3
GA, GH or GS course		3
GA, GH or GS course		3
		17

Total Credits - 131

• Courses listed in ***boldface italic type*** require a grade of C or better for entrance into this major
+ Courses listed in **boldface type** require a grade of C or better for graduation in this major.
[A] Students may substitute **E MCH 211** and **213** or **213D** for **E MCH 210**
* CMPSC 202 (Fortran) may be substituted
** Students may schedule either the spacecraft design sequence (401A & B) or the aircraft design sequence (402A & B). The appropriate control course (450 or 413) should be scheduled accordingly.
~ Up to 6 credits of Co-op, upon completion of the program, may be substituted for six of the nine required technical elective credits. For those students who complete the ROTC Program, 3 ROTC credits may be used to substitute for a technical elective and 3 ROTC credits may be used to substitute for the GHA requirement.

AEROSPACE ENGINEERING



= Prerequisite

= Prerequisite or Concurrent