

TO: The Engineering Faculty
FROM: School of Aeronautics and Astronautics
RE: New Engineering Major

The School of Aeronautics and Astronautics is in the process of approving the following new major as part of the Dean of Engineering's Space initiative and announcement in July 2025. This action is now submitted to the Engineering Faculty with a recommendation for approval.

TITLE:

Major in Space Systems Engineering, Aeronautics and Astronautics Engineering MS/MsAA

DESCRIPTION:

The M.S. in Aeronautics and Astronautics degree, with a major in Space Systems Engineering will provide students with the opportunity to study and gain skills in the tools, methods, and processes of designing, analyzing, controlling, and improving complex engineered space systems. The program has been designed to produce students with firm grounding in space systems engineering and well prepared to lead and execute transdisciplinary processes that result in space systems that are responsive to stakeholder's needs. Specifically, the program will educate students to develop new products, services, and organizations to address grand challenges facing society in space.

RATIONALE:

The Space Systems Engineering major within the AAE program stands out as a sought-after course of study. The enthusiasm among our current, former and potential graduate level students for a more comprehensive major in Space Systems Engineering is evident from the requests for the degree and major at conferences, in person and from aerospace companies. They seek deeper immersion beyond the existing 12-credit structure, aspiring to hone their expertise and bolster their transcripts and resumes with a more obvious acknowledgment of their proficiency in multifaceted engineering space systems.

Employers across the aerospace industry (national security, commercial and civil) have expressed interest in having a clearly defined program for the design, analysis, improvement, and control of the next generation of complex space systems to address the challenges facing organizations and society. Conversations among faculty, staff, and representatives from various segments of the aerospace industry—ranging from government agencies, large scale integrators, small emerging space companies, private equity capital, and aerospace consulting—underscore the pressing need for a workforce proficient in space systems engineering principles.

In response, the School of Aeronautics and Astronautics is poised to address these industry and government imperatives with this comprehensive major tailored to the demands of modern space systems engineering, ensuring our graduates are equipped to tackle the complex challenges of tomorrow.



Uhrig & Vournas Head of Aeronautics and Astronautics

Link to Curriculog entry:

MS Space Systems Engineering Additional Information

Target Audience

The students will generally include returning graduate students who are seeking additional knowledge and expertise in space systems engineering, within an interdisciplinary context. These returning students generally will be active professionals on site at their place of employment. Students in the program will have a strong interest in space systems, with the intent of becoming “deep generalists” who will ultimately lead efforts that assure our national security in space, develop the products and services needed for a sustainable space economy, and further space exploration to Mars and beyond the solar system. Their organizations will design, analyze, improve, and control the next generation of complex space systems for the benefit of all on earth.

Major in Space Systems Engineering Requirements

Degree Requirements

- Complete 30 credit hours
- 2 core courses in Space Systems Engineering within Purdue Aeronautics and Astronautics (6 credits) and 2 courses from the Space Systems Engineering Electives (or, equivalent 6 credits)
- 2 courses (6 credits) to meet the math requirement (any graduate level course from Math or Statistics; ME 581, ME 539, PHYS 600, PHYS 601, CHE 630, CHE 632, CS 515, or AAE 590 (Aerospace Engineering Probability & Estimation))
- Remaining courses defined by the student in collaboration with advisor. Courses must be from the Colleges of Engineering, Science, or the School of Business
- GPA is expected to be 3.0 or higher at all times and no major class (Core or Space Systems Engineering Elective) receive less than B-

Core Courses

- AAE56000 System of System Modeling and Analysis
- AAE59000 Systems Engineering for Space

Space Systems Engineering Electives

- AAE51800 Low-Gravity Fluid Dynamics*
- AAE52300 Intro to Remote Sensing
- AAE53200 Orbit Mechanics
- AAE53300 Space Traffic Management
- AAE53400 Spacecraft Electric Propulsion
- AAE53900 Advanced Rocket Propulsion (requires AAE43900 as prerequisite)
- AAE54600 Aerospace Structural Dynamics and Stability*
- AAE 55000 Multidisciplinary Design Optimization
- AAE56400 Systems Analysis and Synthesis
- AAE56500 Guidance and Control of Aerospace Vehicles*
- AAE57100 Complex System Safety
- AAE57300 Aerospace Human Factors
- AAE57500 Intro to Satellite Navigation and Positioning
- ~~AAE59000 Satellite Constellations and Formation~~
- ~~AAE59000 Aerospace Propulsion~~

- ~~AAE 59000 Applied Control in Astronautics~~
- ~~AAE59000 Space Flight Operations~~
- ~~AAE59000 Spacecraft Attitude Dynamics~~
- ~~AAE59000 Principles and Methods of Safe Aerospace System Design~~
- ~~AAE59000 Space Policy~~
- AAE63200 Advanced Orbital Dynamics
- AAE67500 Advanced Signals and Systems for Satellite Navigation
- ~~GRAD59000 Program Management: A Comprehensive Overview of the Discipline~~
- IE 53300 Industrial Applications of Statistics
- IE 54500 Engineering Economic Analysis
- IE 54600 Economic Decisions in Engineering
- IE 57700 Human Factors in Engineering
- IE 58000 Systems Simulation
- ~~IE59000 Project Management~~
- ME4100 Engineering Design: A Decision-Based Perspective
- ME 57100 Reliability Based Design
- SYS 51000 Tools and Methodologies for Designing Systems
- SYS 53000 Practical Systems Thinking
- ~~SYS 59000 Systems Engineering Processes and Professional Competencies~~

*In-person only

Additional courses may be added to this list as deemed appropriate by the Space Systems Engineering Area Committee of the School of Aeronautics and Astronautics.

Will new faculty expertise or new faculty members be needed to launch this major?

No. There is already a wealth of faculty expertise and teaching in, or adjacent to space systems engineering within the College of Engineering and the School of Aeronautics and Astronautics.