

**TO:** The Engineering Faculty  
**FROM:** The Faculty of the Interdisciplinary Engineering Program  
**RE:** New Engineering Major

The Faculty of the Interdisciplinary Engineering Program have approved the following new Major from the College of Engineering. This action is now submitted to the Engineering Faculty with a recommendation for approval.

**TITLE:**  
Master of Science in Defense and Security

**DESCRIPTION:**

The Defense and Security major will be a new graduate major within the Interdisciplinary Engineering Degree. This major will be offered fully online to participants from several Naval Warfare centers across the country starting with the Indian Head Naval Warfare center. This major will be interdisciplinary in nature with focus areas on Propulsion, AI/ML, Manufacturing, and Materials. The program will not be related to the other IDE majors. Only those with approval to be in the program through Department of Defense documentation will apply. This program will not be advertised to the general public.

**RATIONALE:**

The US Naval Surface Warfare Centers are the Navy's principal research, development, test and evaluation assessment for surface ship and submarine systems. In addition, they provide people, engineering services, operations, and technology to support the fleet. As such, there is a large demand for engineering talent in both the Navy and with its associated contractors. The Defense and Security offering will provide cross-disciplinary course work to upskill engineers specifically to support this mission in high needs areas. The US Department of Defense would provide letters of recommendation for individuals to enroll. Program outcomes:

Knowledge and Scholarship - To build the capacity to identify and conduct original research, scholarship or creative endeavors.

Critical Thinking - To think critically, creatively and to solve problems in the field of study.

Communication - To be able to effectively communicate their field of study.

Ethical and Responsible Research - Students in the major are coursework only, however should have the basic understanding and knowledge about responsible conduct in research and coursework.

Professional Development - To demonstrate attributes of professional development consistent with expectations within their field of study.

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Dana Weinstein, Professor of Electrical and Computer Engineering  
Associate Dean of Graduate Education Electrical And Computer Engineering

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Stephen P. Beaudoin, Professor of Chemical Engineering  
Director, Purdue Energetics Research Center

Link to Curriculog entry:  
<https://purdue.curriculog.com/proposal:21995/form>

**Purdue University Online Interdisciplinary Professional Master of Science in the new Engineering Major in Defense and Security**

**What is the focus of the degree?**

This is a defense engineering degree that will be exclusively staff and contractors associated with the Naval Warfare Centers.

**What might the demand be from students?**

We anticipate enrollment of 5-10 new starts per semester with a steady state enrollment of 70-80 students.

**Proposing University Unit**

Purdue College of Engineering is proposing this new major.

**Required Courses**

The degree requires 30 credit hours.

The major will have 4 required core courses with 6 additional elective courses selected from the 4 focus areas outlined below. (Table shows courses *currently* available online.) Up to 2 approved Math & Statistic courses may be included, as well as needed, for course prerequisites.

The core courses are:

ME 52500 - Combustion

ME 53900 - Introduction to Scientific Machine Learning

MSE 51000 - Microstructural Characterization Techniques

MSE 53000 - Materials Processing in Manufacturing

<b>Courses identified currently online</b>	
<b>Propulsion</b>	<b>AI/ML</b>
<b>ME 52500 – Combustion (required)</b>	<b>ME 53900 - Introduction to Scientific Machine Learning (required)</b>
AAE 53400 - Spacecraft Electric Propulsion	ECE 57000 - Artificial Intelligence
AAE 53700 - Hypersonic Propulsion	ECE 59500 - Introduction to Data Mining
AAE 53800 - Air Breathing Propulsion	ECE 59500 - Introduction to Deep Learning
AAE 53900 - Advanced Rocket Propulsion	STAT 59800 - Statistical Machine Learning
AAE 51900 - Hypersonic Aerothermodynamics	ECE 50024 - ML Fundamentals
ME 597/AAE556 - Aeroelasticity	
ME 60800 - Numerical Methods in Heat, Mass and Momentum Transfer	
AAE 59000 - Aerospace Propulsion	
<b>Manufacturing</b>	<b>Materials</b>
<b>MSE 53000 - Materials Processing in Manufacturing (required)</b>	<b>MSE 51000 - Microstructural Characterization Techniques (required)</b>
IE 57000 - Manufacturing Process Engineering	AAE 55400 - Fatigue Of Structures And Materials
IE 57900 - Design And Control Of Production And Manufacturing Systems	ME 57100 - Reliability Based Design
MSE 51200 - Powder Processing	MSE 52400 - Mechanical Behavior of Polymers
MSE 59700 - Lean Manufacturing	AAE 55000 - Mechanics of Composite Materials
IE 53000 - Quality Control	AAE 55200 - Nondestructive Evaluation of Structure and Materials
SYS 53000 - Practical Systems Thinking	AAE 59000 - Design of Composite Materials and Structure

IE 54600 - Economic Decisions in Engineering	AAE 54800 - Mechanical Behavior of Aerospace Materials
	AAE 65400 - Fracture Mechanics
	ME 55900 - Micromechanics of Materials
	MSE 59700 - Additive Manufacturing of Materials
	MSE 59700 - Mechanical Properties and Behaviors of Polymers
	MSE 59700 - Superalloys - High Temperature
	MSE 59700 - Ceramics for Hypersonic Applications

Note: the same course cannot be counted in more than once to fulfill the major requirements. Students must choose one designate for the course in their study plan.