

APPROVED BY SENATE
04/22/2019



Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE: Establish Graduate Concentration in Aerospace Systems Engineering within the Master of Engineering in Engineering Degree in the College of Engineering

SPONSOR: Philippe Geubelle, Department Head of Aerospace Engineering, 217-244-7648, geubelle@illinois.edu.

COLLEGE CONTACT: Harry Dankowicz, Associate Dean for Graduate, Professional and Online Programs, 217-244-1231, danko@illinois.edu

BRIEF DESCRIPTION:

This proposal seeks to establish a Concentration in Aerospace Systems Engineering in the Master of Engineering (M.Eng.) in Engineering degree in the College of Engineering (CoE). This concentration is professionally oriented and aimed at providing students a solid foundational knowledge of an interdisciplinary approach and relevant tools for enabling the realization of successful aerospace systems. It focuses on defining market- or mission-based customer needs and functionalities early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem: Operations, Performance, Test, Manufacturing, Cost and Schedule, Training and Support, Disposal. Most importantly, the Concentration in Aerospace Systems Engineering considers both the business and the technical needs of potential customers and prepares its graduates accordingly.

Emphasis will be placed on the aerospace vehicle development process through a general introduction to structures and materials, optimization, aerodynamics, flight mechanics, orbital mechanics, control, propulsion, industrial design, and human-computer interaction in addition to the emerging disciplines of data analytics and network science. Students in this concentration will gain interdisciplinary competence by taking elective coursework in the disciplines listed above from departments across the College of Engineering. As each design problem may require specialties available only in particular departments, this program will allow students to customize their Aerospace Systems Engineering concentration to their desired focus of study.

This concentration will be housed in the Department of Aerospace Engineering (AE). This concentration will require 32 hours organized as follows (see Appendix A for details):

- 16 credit hours of core coursework;
- 8 credit hours of elective coursework;
- 8 credit hours of professional development;
- at least 12 credit hours at the 500 level.

In addition, AE is requesting an on-campus program code, as well as online program code, to be established to complete this concentration either on-campus or online. The concentration will be offered to distance learners through video capture and online office hours.

JUSTIFICATION: *(Please provide a brief but complete rationale for your request.)*

In today's environment, complex aerospace systems are commonly integrated with a variety of other data-based information systems (GPS, satellite communications, satellite TV), transportation, freight, and service systems. Modern aircraft, spacecraft, satellites, and launch systems all are expected to operate flawlessly (or gracefully degrade when failing) to provide exceptional user service levels. In addition to flawless operation, buyers, operators, and users expect that aerospace products demonstrate high reliability, long life, low cost, and ease of use. From satellite television to GPS-driven aids in transportation and communication, real-time globally interdependent aerospace systems are the norm. An understanding of the resulting "system of systems" is necessary to adequately tailor and engineer products for a particular use. There is a growing demand for experts that are able to take the system-of-systems approach to the design of aerospace systems.

The concentration in Aerospace Systems Engineering focuses on aerospace systems analysis and the application of techniques for developing market and mission based aerospace systems from the initial identification of customer needs to the delivery of an integrated product. Students are exposed to requirement development, concepts of operations definition, functional decomposition, interface identification, trade studies, hazard and risk analysis, and other tools and processes used in evaluating system-of-systems solutions. As part of the core curriculum and through elective coursework, students will be expected to gain a breadth of knowledge in aerospace system development outside of the undergraduate focus. Relevant disciplines include aerodynamics, structural design, material science, electrical system design, control system design, software development, and optimization. Additional elements of the curriculum require students to integrate this knowledge in the design of complex aerospace systems through requirements development, optimization, and validation.

This concentration is designed for students interested in a non-research, industry position in the field of aerospace system engineering. As aerospace undergraduate curricula are routinely filled with required subjects, most undergraduates have not been taught nor have had the time to study the specific discipline of aerospace systems engineering. This puts them at a disadvantage when competing for related career opportunities with a large pool of similarly qualified graduates from other universities. Students in research oriented programs often lack the systems perspective as they are experts in details of the aerospace engineering discipline.

The proposed concentration will provide Illinois graduates, as well as other US and international students, with a competitive advantage when seeking employment. By offering a breadth of knowledge in a number of system disciplines, in conjunction with interdisciplinary competence, in as little as two semesters, our aerospace systems engineering concentration places Illinois in at the front of this competitive field. Importantly, in contrast to similarly-labeled degree offerings at competitors (e.g., Johns Hopkins, MIT, Cornell, and Georgia Tech), the proposed curriculum provides a unique combination of breadth and depth aimed at professionally-oriented degree students, rather than those on a research track.

Lastly, offering this concentration online, as well as on-campus, will allow working professionals to complete the Concentration in Aerospace Systems Engineering in the Master of Engineering (M.Eng.) in Engineering degree entirely online on a part-time basis without having to leave their current job or community. Students who enroll in the online program code will have the necessary support to be successful in the program through the resources in the College of Engineering Office of Graduate, Professional, and Online Programs and through the College of Engineering's Center for Professional and Executive Training and Education.

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources

a. **How does the unit intend to financially support this proposal?**

The unit is requesting self-supporting program status for this concentration within the degree of Master in Engineering (M.Eng.) in Engineering. Students enrolled in this concentration will pay tuition. The College of Engineering will use some of the graduate tuition dollars to provide the AE department with resources needed to support the proposed curriculum. Graduate tuition funds are considered state, recurring funds that may be used to fund faculty and lecturer salaries, support instruction, or at the discretion of the AE Department Head in a manner consistent with campus policy on use of such funds.

b. **How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?**

The proposed curriculum groups together existing courses currently available for student enrollment. Existing capacity and controlled enrollments will ensure the overall quality of experience for students in the program. No changes are necessary to existing functions or programs.

c. **Will the unit need to seek campus or other external resources? If so, please provide a summary of the sources and an indication of the approved support.**

No campus or other external funding sources are needed. Resources previously made available to the college as a result from a successful Investment for Growth Proposal to support growth in professionally-oriented master's programs, as well as tuition resources, will be sufficient to develop and offer the concentration.

d. **Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.**

The submission of this proposal by the College of Engineering will verify the financial arrangement in answer 1a, above. See attached MOU in Appendix D.

2) Resource Implications

a. **Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.**

The proposed core curriculum is built from courses currently taught in AE, along with electives chosen from courses offered by AE or other departments in the College of Engineering. There is no anticipated impact on faculty resources. The concentration is also strategically aligned with the expansion of AE's footprint in research and education in systems engineering as evidenced by planned tenure-track hiring in this area.

b. **Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units.**

It is anticipated that enrollment in the Concentration in Aerospace Systems Engineering in the Master of Engineering (M.Eng.) in Engineering will ramp up to 15-20 students in the first two years, with a long-term steady-state of 40-50 students. Students enrolled in this concentration will have a large range of options available to fulfill the elective course requirement, implying minimal impact on enrollments in courses offered by units outside AE.

c. Please address the impact on the University Library

See attached letter from the Library.

d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)

No impact on research labs and minimal impact on engineering workstations labs are expected.

For new degree programs only:

3) Briefly describe how this program will support the University's mission, focus, and/or current priorities. Include specific objectives and measurable outcomes that demonstrate the program's consistency with and centrality to that mission.

The proposed concentration will position the University as a unique destination for prospective students interested in a professionally-oriented aerospace systems engineering curriculum and will ensure our continued national leadership in education and research in every aspect of aerospace engineering. It will also attract attention of employers from across the public, private, and nongovernment sectors who will be engaged as part of a deliberate effort to develop internship and career opportunities for students and graduates in this concentration. By its nature, the proposed concentration is consistent with campus priorities that emphasize cooperation among multiple disciplines. Finally, as an element of a revenue-generation strategy, the proposed concentration will provide resources for enhancing scholarship and educational opportunity also outside its disciplinary focus. Measurable outcomes include meeting enrollment, graduation, and placement objectives, but also indirect effects on the hiring of aerospace systems engineering scholars and researchers, as well as external funding for research and educational innovation at the nexus of aerospace systems engineering.

4) Please provide an analysis of the market demand for this degree program. What market indicators are driving this proposal? What type of employment outlook should these graduates expect? What resources will be provided to assist students with job placement?

According to Indeed.com and LinkedIn, there are 10,000+ jobs available today for aerospace systems engineers at companies like Boeing, NESCO Avionics, Airborne Navigations Systems/Rockwell Collins, and the National Aeronautics and Space Administration. According to Job Outlook (<https://www.bls.gov/ooh/architecture-and-engineering/aerospace-engineers.htm#tab-6>) on the Bureau of Labor Statistics (BLS) site, the demand for aerospace systems engineers is expected to continue to increase by six percent over the next 10 years. There is also growth in new corporate ventures whose business is to design, develop and implement systems for unmanned aerial vehicles. The BLS further indicates that companies need employees who have the knowledge and background to improve safety, efficiency, and environmental soundness of aircraft systems. Graduates from a professionally oriented master's degree with a concentration in aerospace systems engineering will have a strong competitive advantage compared to those with only a BS degree. College of Engineering resources intended to help students with accessing this job market include a designated

M.Eng. Career Services Coordinator, as well as a designated M.Eng. Capstone Project Coordinator. The latter will also facilitate opportunities for off-campus placement as an option for independent study and/or capstone design experiences as part of the professional development requirement.

- 5) [If this is a proposed graduate program, please discuss the programs intended use of waivers. If the program is dependent on waivers, how will the unit compensate for lost tuition revenue?](#)

Self-supporting status will be requested for this concentration, i.e., students under this program code will not be eligible for BOT tuition waivers. This will be a fast-paced, 1-year professionally-oriented master's degree.

DESIRED EFFECTIVE DATE: Fall 2019

STATEMENT FOR PROGRAMS OF STUDY CATALOG: See Appendix B

CLEARANCES: (Clearances should include signatures and dates of approval. These signatures must appear on a separate sheet. If multiple departments or colleges are sponsoring the proposal, please add the appropriate signature lines below.)

Signatures:



Unit Representative:

10-5-2018
Date:



College Representative:

2-1-2019
Date:

Graduate College Representative:

Date:

Council on Teacher Education Representative:

Date:

Appendix A:

Proposed Concentration in Aerospace Systems Engineering Curriculum

Concentration Degree Requirements

| Program Component | Hours |
|---|-----------|
| Core coursework <ul style="list-style-type: none"> • AE 542, Aerospace Systems Engineering I • AE 543, Aerospace Systems Engineering II • Select two additional courses from approved list | 16 |
| Elective coursework selected from an approved list in the following areas: optimization, design, reliability, data analysis, human interfaces, and networks | 8 |
| Professional development coursework selected from approved lists - 4 credit hours from List A and 4 credit hours from List B | 8 |
| Aerospace Seminar Series AE 590 (all semesters) | 0 |
| Total Hours | 32 |
| Minimum of 12 hours of 500-level coursework | |

Approved List for Additional Core Coursework

- AE 402, Orbital Mechanics
- AE 403, Spacecraft Attitude Control
- AE 416, Applied Aerodynamics
- AE 419, Aircraft Flight Mechanics
- AE 434, Rocket Propulsion
- AE 502, Advanced Orbital Mechanics
- AE 504, Optimal Aerospace Systems
- AE 508, Optimal Space Trajectories
- AE 511, Transonic Aerodynamics
- AE 512, Molecular Gas Dynamics
- AE 515, Wing Theory
- Or other appropriate course selected with approval of advisor

Approved Lists of Professional Development Coursework

Students must complete 4 credit hours from List A and 4 credit hours from List B.

List A

- AE 597, Independent Study
- TE 401, Developing Breakthrough Projects
- ENG 572, Professional Practicum
- ENG 573, Capstone Project

List B

- TE 450, Startup: Inc, Fund, Contracts, IP
- TE 460, Lecture in Engineering Entrepreneurship
- TE 461, Technology Entrepreneurship
- TE 466, High-Tech Venture Marketing
- TE 560, Managing Advanced Technology I
- TE 565, Technology Innovation & Strategy
- TE 566, Finance for Engineering Management
- TE 567, Venture Funded Startups

Students may select a different course with professional development components in consultation with advisor.

Appendix B: Program of Study

College of Engineering

<http://engineering.illinois.edu/academics/graduate/>

Harry Dankowicz
Associate Dean for Graduate, Professional, and Online Programs
400 Engineering Hall
1308 West Green Street
Urbana, Illinois 61801
217-244-1231
E-mail: danko@illinois.edu

Major: Engineering

Degrees Offered: Master of Engineering

Graduate Concentration: Aerospace Systems Engineering

Graduate Degree Programs

The College of Engineering offers a professionally-oriented Master of Engineering (M.Eng.) degree program for students whose primary intent is a career in industry or government. This degree differs from the Master of Science degree in that it is a terminal degree and not a pathway to a doctoral program. The major in Engineering for the M.Eng. degree requires the selection of an interdisciplinary concentration.

Admission

Students with bachelor's or master's degrees in engineering or related fields will be considered for admission if they have a grade point average of at least 3.00 (A = 4.00) for the last two years of undergraduate study. Admission is possible for the spring term, but most admissions are for the fall term. Full details of admission requirements are on the web page of the department offering the concentration.

All applicants whose native language is not English must submit a minimum [TOEFL](#) score of 103 (iBT), 257 (CBT), or 613 (PBT); or minimum [International English Language Testing System \(IELTS\)](#) academic exam scores of 7.0 overall and 6.0 in all subsections. Applicants may be exempt from the TOEFL if [certain criteria](#) are met. [Full admission status](#) is granted for those meeting the minimum requirements and having taken the TOEFL or IELTS, since the scores required for admission to M.Eng. are above the minimum scores demonstrating an acceptable level of English language proficiency.

Master of Engineering in Engineering with a Concentration in Aerospace Systems Engineering

Degree Requirements

| Code | Hours |
|---|-----------|
| Core coursework | 16 |
| <ul style="list-style-type: none"> • AE 542, Aerospace Systems Engineering I (4 credit hours) • AE 543, Aerospace Systems Engineering II (4 credit hours) • Select two additional courses from approved list | |
| Elective coursework selected from an approved list in the following areas: optimization, design, reliability, data analysis, human interfaces, and networks | 8 |
| Professional development coursework selected from approved lists - 4 credit hours from List A and 4 credit hours from List B | 8 |
| Aerospace Seminar Series AE 590 (all semesters) | 0 |
| Total Hours | 32 |

Other Requirements and Conditions (may overlap):

| Requirement | Description |
|--|-------------|
| A minimum of 20 credit hours must be taken from the University of Illinois Urbana-Champaign campus. | |
| A minimum of 12 500-level credit hours required for the concentration, with a minimum of 8 500-level credit hours in AE. | |
| No courses used to fulfill any degree requirement may be taken using the "Credit/No Credit" option. | |
| Minimum GPA: | 3.0 |

* For additional details and requirements, please refer to the web page of the degree's home unit and the Graduate College Handbook.

Appendix C: MOU Agreement

MEMORANDUM OF UNDERSTANDING BETWEEN THE

COLLEGE OF ENGINEERING (CoE)

AND THE

DEPARTMENT OF AEROSPACE ENGINEERING (AE)

For the distribution of tuition funds for tuition-generating enrollments in a
Professional Master's Degree Program

This MOU applies to tuition paying MEng in Engineering with a concentration in Aerospace Systems Engineering students in the AE Department and establishes a formula for the transfer of tuition funds between the CoE and AE. This is a new agreement, which follows the CoE Guidance Document for Professional Master's Program Tuition ratified in July 2014. This agreement is not applicable to online programs or enrollments.

- For tuition generated by AE self-supporting MEng students, net tuition funds (those returned to CoE from campus) will be split as follows
 - 20% CoE
 - 80% AE

Using the Campus Budget Office's report on net tuition received, tuition as non-recurring funds will be distributed to AE at the end of each fiscal year. This agreement is effective August 16th, 2019 (or term the program is approved) and valid through August 15, 2022, assuming no future changes to the campus budget model.

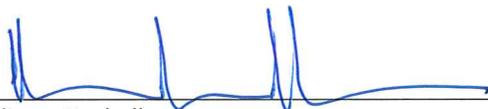
Signatures:



by Harry Dankowicz
Associate Dean for Graduate, Professional & Online Programs
College of Engineering

10-5-2018

Date



by Philippe Geubelle
Head, Department of Aerospace Engineering

10-5-2018

Date

Appendix E: Classification



The Graduate College | University of Illinois at Urbana-Champaign

REQUEST & JUSTIFICATION FORM FOR PROGRAM CLASSIFICATION TRADITIONAL, SELF-SUPPORTING or REIMBURSABLE

CURRENT PROGRAMS:

Current graduate programs can request a change in classification to Traditional or Reimbursable, but not to Self-supporting.

NEW PROGRAMS:

New programs seeking Traditional classification do not need to complete this form.

New programs seeking Self-supporting classification should be aware of the following:

- Students enrolled in Self-supporting programs are ineligible to hold waiver-generating appointments. NOTE: There is no mechanism within the Human Resources Front End system that restricts the appointment of a Self-supporting program student to an assistantship. Therefore, if a unit (faculty or staff) appoints a student, in error, significant problems result for everyone involved.
- Self-supporting status results in reduced flexibility for the program. Even if a student in the program is most qualified for a particular assistantship appointment and financing is available through the program, the program status makes the student ineligible.
- Because Traditional, Reimbursable and Self-supporting programs each yield 90% of net tuition, and the Reimbursable classification avoids the limitations above, a program might find the Reimbursable classification more advantageous than Self-supporting.

Please contact the Fellowship Office at the Graduate College if you have questions or seek clarifications, (217) 333-0036 or gradfellowships@illinois.edu.

COLLEGE OR SCHOOL: College of Engineering

IS THIS A NEW OR EXISTING PROGRAM:

New Program
 Existing Program Program Code: _____ Current Classification: _____

REQUESTED CLASSIFICATION: TRADITIONAL REIMBURSABLE SELF-SUPPORTING

JUSTIFICATION: On a separate sheet, please address the following.

- Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.
- Describe the expected impact of the requested classification to new students. How will these measures affect the affordability of the program? What type of financial aid, if any, will be offered? Note: Continuing students will not be affected as they are subject to the rules in effect at the time of their admission.
- What provisions will be made to communicate the implications of the classification to prospective and newly admitted students?
- Name the college and program contact persons in charge of implementing and communicating the classification and its consequences to students.

Unit Head Signature and Date  10-5-2018

College Dean Signature and Date _____

requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.

- (a) The proposed concentration is not a research-oriented program. It is designed so that it can be completed in two or three semesters in order to address an academic training gap at a professional level. The requested classification enhances the educational experience of students and employability of graduates who, after attaining a BS degree in engineering or equivalent field, will benefit from the differentiated value provided by this advanced professional degree. The requested classification is not expected to adversely impact recruitment of students interested in a research-oriented track with a traditional tuition model, nor significantly limit the potential pool of prospective students to the professionally-oriented track.
- (b) The requested classification will provide revenue streams that create new opportunities for the College of Engineering and AE to support strategic faculty recruitment and new academic initiatives within the area of systems engineering, as well as across other relevant disciplines, thereby strengthening our scholarly impact and leadership.

2) Describe the expected impact of the requested classification to new students. How will these measures affect the affordability of the program? What type of financial aid, if any, will be offered? Note: Continuing students will not be affected as they are subject to the rules in effect at the time of their admission.

This is a new program. No change that would affect any current or future students in the existing MS and PhD degree programs is proposed. All students entering this new M.Eng. concentration will need to pay tuition. We will not offer financial aid to any students who are enrolled in this M.Eng. program.

3) What provisions will be made to communicate the implications of the classification to prospective and newly admitted students?

The self-supporting classification will be clearly explained on the program's website and in any and all communications to prospective students.

4) Name the college and program contact persons in charge of implementing and communicating the classification and its consequences to students.

This is a new concentration within the M.Eng. in Engineering degree. No changes in classification are being requested to an existing program. Professor Greg Elliott, AE Associate Head of Graduate Programs, Staci McDannel, Coordinator for AE Graduate Programs, and the Academic Advisor of M.Eng. Programs in the Center for Professional and Executive Training and Education in the College of Engineering will be responsible for communicating the self-supporting classification and its consequences to prospective students. Additional College of Engineering contacts for this program are Professor Harry Dankowicz, Associate Dean for Graduate, Online and Professional Programs, and Rhonda McElroy, Executive Director of Engineering Graduate Programs.

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN

University Library

Office of University Librarian and Dean of Libraries
230 Main Library, MC-522
1408 West Gregory Drive
Urbana, IL 61801



September 12, 2018

Rhonda McElroy
Director of Graduate and Professional Programs
College of Engineering @ ILLINOIS
Engineering Hall 405
M/C 266

Dear Rhonda:

Thank you for providing the University Library with the opportunity to review the College of Engineering's proposal to the Senate's Committee on Educational Policy. The proposal to establish a Concentration in Aerospace Systems Engineering in the Master of Engineering (MEng) degree in the College of Engineering (CoE) is one that our Engineering Librarian feels as though the Library is well-positioned to support.

The University Library and the College of Engineering have a long history of working closely together. We look forward to utilizing the resources committed in order to grow in the areas necessary to provide support for this program.

Sincerely,



John P. Wilkin
Juanita J. and Robert E. Simpson
Dean of Libraries and University Librarian

c: Bill Mischo
Thomas Teper

Dr. Jason M Merret
Program Coordinator Aerospace Systems Engineering
306G Talbot Lab
104 South Wright Street
Urbana, IL 61801

October 4, 2018

Rhonda McElroy
Executive Director of Graduate Programs
Engineering Hall 400A
1308 West Green Street
Urbana, IL 61801

Rhonda,

On October 3, 2018 the attendees of the Aerospace Department Faculty Meeting voted to approve the concentration in Aerospace Systems Engineering under College of Engineering Master of Engineering program.

Sincerely,

Jason M Merret



COLLEGE OF ENGINEERING

Office of the Dean
306 Engineering Hall, MC-266
1308 W. Green St.
Urbana, IL 61801

February 1, 2019

Allison McKinney
Graduate College
204 Coble Hall
MC-322

Via: Rashid Bashir, Engineering College

Dear Allison,

The College of Engineering Executive Committee has reviewed and approved the following program revision. We now submit for campus approval.

**“Establish Graduate Concentration in Aerospace Systems Engineering
Within the Master of Engineering in Engineering Degree in the
College of Engineering”**

Attached is a copy of the request.

Sincerely yours,

Henrique Reis, Vice Chair
Executive Committee

Approval Recommended:

Rashid Bashir, Dean Designate
College of Engineering

Harry Dankowicz
Rhonda McElroy
Henrique Reis

2-1-2019

Date

Name of existing Illinois (UIUC) degree: _____

Name of non-Illinois partnering institution: _____

Location of non-Illinois partnering institution:

State of Illinois US State: _____ Foreign country: _____

- B. Proposal to create a new academic unit (college, school, department, program or other academic unit):

Name of proposed new unit: _____

- C. Proposal to rename an existing academic unit (college, school, department, or other academic unit):

Current name of unit: _____

Proposed new name of unit: _____

- D. Proposal to reorganize existing units (colleges, schools, departments, or program):

1. Proposal to change the status of an existing and approved unit (e.g. change from a program to department)

Name of current unit including status: _____

2. Proposal to transfer an existing unit:

Current unit's name and home: _____

Proposed new home for the unit: _____

3. Proposal to merge two or more existing units (e.g., merge department A with department B):

Name and college of unit one to be merged: _____

Name and college of unit two to be merged: _____

Proposed name and college of new (merged) unit: _____

4. Proposal to terminate an existing unit:

Current unit's name and status: _____

- E. **Other educational policy proposals** (e.g., academic calendar, grading policies, etc.)

Nature of the proposal: _____

Revised 10/2012