

TO: Randy Smith, Vice Provost for Academic Programs

FROM: Graduate School Curriculum Services

DATE: **12/20/2023**

RE: Proposal to **Establish a Professional Master in Applied Aeronautics** in **College of Engineering**

The **Department of Mechanical and Aerospace Engineering** in the **College of Engineering** is proposing a **Professional Master's of Applied Aeronautics**.

The proposal was received by the Graduate School on **10/11/2023**. The combined GS/CAA subcommittee first reviewed the proposal on **12/14/2023** and requested revisions. Revisions were received on **12/20/2023**. Associate Dean Miriti reviewed and accepted the revisions on **12/20/2023**. The proposal is now forwarded to CAA for review.

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20-December 2023

Dr. Maria N. Miriti
Associate Dean of Academic Excellence
Graduate School
230 N Oval Mall
Columbus, OH 43210

RE: Proposal for a Professional Master of Applied Aeronautics

Dear Dr. Miriti and Combined GS/CAA Subcommittee,

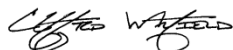
Thank you for reviewing the proposal for a Professional Master of Applied Aeronautics in the College of Engineering on December 14th, 2023. This letter is in response to the feedback provided via email on Monday December 18th, 2023. The review meeting feedback email is attached below for your reference. The subcommittee's review includes one (1) contingency and two (2) recommendations to the proposal.

The contingency identified in the review was addressed in the revised proposal immediately following the Curriculum and Instructional Design sub-section 1. Curricular content table of courses. Additional details were provided in the second paragraph and a third paragraph was added, both on page 7 of the revised proposal, which clarify specifics regarding the status of the courses within the degree program. In summary, three (3) courses are online ready, and three (3) are new to the program. The remaining courses are regularly taught in-person by the associated faculty in the proposed program, of which 13 courses are currently scheduled by the College to be prepared for asynchronous online instruction during the 2024 calendar year, prior to the start of the program, followed by the remaining eight (8) courses during the 2025 calendar year.

The two recommendations were added to the revised proposal. An additional paragraph was added to the Statewide Alternatives question 1. in support of the first recommendation concerning the uniqueness of the proposed degree program. The paragraph is on page 5, last paragraph in the sub-section, and emphasizes that the proposed program will be the first fully online degree in the technical area in the state, as well as the first professional masters in aeronautics and similar fields throughout the nation. Additional statements were added to demonstrate the opportunity Ohio State has to make a significant contribution and impact for working professionals in Ohio and across the nation. For the second recommendation concerning impacts on existing degree programs, an additional paragraph was added on page 2 under sub-section 6 of the Basic Characteristics of the Educational Program section. We are confident that the proposed professional master degree program, with its applied aeronautics focus and targeted audience, will significantly complement the existing general Master of Science degree programs in the department, and is anticipated to not negatively influence specific enrollments within the existing degree programs.

Thank you again for your time and provided feedback. Please let me know if you have any questions.

With kind regards,



Clifford A. Whitfield
Professor of Practice, Aerospace Engineering

GS/CAA Review Meeting Feedback

Kowalsky, Lisa <kowalsky.10@osu.edu>

Mon 12/18/2023 2:43 PM

To: Whitfield, Clifford <whitfield.22@osu.edu>

Cc: Miriti, Maria <miriti.1@osu.edu>

Dear Cliff,

Good afternoon! We hope that you are doing well. We are reaching out to let you know that on December 14th, 2023, the combined Graduate School – Council on Academic Affairs (GS/CAA) reviewed a proposal for a Professional Master of Applied Aeronautics in the College of Engineering. GS/CAA thought this was a thoughtful and well-written proposal and were generally supportive of the proposal pending a few revisions prior to advancing to Council of Academic Affairs (CAA). Congratulations!

The proposal was approved pending the following revisions:

- Contingency:
 - Please clarify what courses are newly offered online and the status of new courses listed in the curriculum portion of the proposal.
- Recommendations:
 - The uniqueness of this program to others that already exist in the state (table beginning on pg. 48) is not clear. Can this be more strongly stated?
 - Please include the extent to which the creation of this degree is expected to influence enrollment in the existing master's programs. Is there the possibility that this will reduce enrollment in the existing degree programs?

Once these revisions are completed, please include a cover letter that points the subcommittee to the pages where the proposal has been revised. Please send the updated proposal at your earliest convenience and Dean Miriti will review the updated proposal, if accepted, the proposal will be sent directly to CAA.

Best,

Lisa



THE OHIO STATE UNIVERSITY
GRADUATE SCHOOL

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PROFESSIONAL MASTER OF APPLIED AERONAUTICS

Mode of Delivery: Fully Online

**Department of Mechanical and Aerospace Engineering
and College of Engineering**
in partnership with the
Aerospace Research Center

BASIC CHARACTERISTICS OF THE EDUCATIONAL PROGRAM

1. Brief description of the disciplinary purpose and significance of proposed degree.

We are seeking approval for a graduate program to award students a Professional Master's degree in Applied Aeronautics. The program's primary goals are to support and supply highly-skilled individuals in the aerospace workforce in Ohio and across the nation. Graduates will be trained in well-established and emerging areas of aeronautics and meet the rapidly growing demand for well-trained professionals. A primary focus of the proposed degree program is the training of professionals in the workforce who seek to become experts in aeronautics. This program is designed as a professional master's degree, as opposed to a research-oriented degree, in that it focuses on imparting aeronautics knowledge and skill sets relevant to existing and emerging positions in the workforce. The training is heavily tilted towards application of these skills and knowledge to solving problems encountered at the workplace on a daily basis. With the provided training, the graduates will be ready and better trained for employment in various aerospace industry and government divisions, especially in Ohio.

The program will be offered fully online, which will lay the foundation of growth into national and global markets without being geographically constrained. The application nature of the subject is carefully adapted to the online learning modalities and supplemented with experimental platforms that are globally available. The graduates of the program will be trained by experts of The Ohio State University. Equipped with both theoretical as well as practical skillsets, the graduates will have opportunities to rapidly transition to high-skill aerospace engineering positions and become leaders in their organizations.

2. Definition of the focus of the program.

The focus of the program will be to educate and train students and working professionals in the area of aeronautics, with the flexibility of selecting courses within three focus areas that are aligned with the prominent research areas of the affiliated faculty at the Aerospace Research Center: aircraft design and performance, propulsion and power, and fluid dynamics. The curricular tracks are designed consistently with the program's mission of educating and training students with skills necessary in the workforce. The tracks of the program reflect the workplace needs of aeronautics expertise and allow the participants to be trained in discipline-specific topics that match their interests and backgrounds.

3. Rationale for degree name.

The ***Professional Master of Applied Aeronautics*** has been chosen for this program as it reflects the program's objective of educating students with a deeper level of the fundamentals in aeronautics areas

with cutting-edge knowledge in design, analysis, and testing in order to better prepare them in the workforce.

4. Duration of the program.

a. Total credit hours.

A minimum of 30 semester credit hours will be required to earn the Professional Master of Applied Aeronautics degree. Per the market landscape scan conducted in April 2023, this minimum number is on-par with other online master's degrees in aeronautics or related fields. The program is structured to build in-depth knowledge with both theoretical and application-oriented courses. The application of aeronautics principles to problems encountered in various workplace scenarios is central to the design of all courses.

The Professional Master of Applied Aeronautics degree requirement is the completion of the requirements of three (3) core courses and one (1) engineering analysis elective for 12-credit hours of coursework, and 15-credit hours of technical elective coursework selected from three aeronautics topics that align with the prominent research areas at the Aerospace Research Center. In addition, students will be required to take a 3-credit hour course to complete a capstone project associated with one of the three aeronautic topic areas. The capstone project is designed to have students apply their gained knowledge and skills to solve larger scale aeronautics problems.

b. Normal or typical length of time for students to complete the program.

The curriculum is designed to be completed in one year or three semesters. However, the curriculum has been designed to accommodate students taking courses at a slower pace (e.g., 6-credit hours per semester for five semesters), specifically catering to the needs of students who are already in the workforce.

5. Admission timing.

Pending final approval in autumn of 2024, we are anticipating that the program admit 10-20 student in its initial offering, with average expected enrollment of 40-50 students each academic year. Students will only be admitted during autumn and spring terms.

6. Primary target audience for the program and admission requirements.

There are two primary target audiences for this program: (1) professionals employed in the workforce and (2) individuals who recently received their Bachelor's of Science degrees in aerospace or mechanical engineering or related fields. Since the program is offered fully online, students can complete the courses while being employed full or part time and can spread the course load over two years by reducing the load per semester.

The Professional Master of Applied Aeronautics will complement the department's Masters of Science degree programs and will grow overall enrollment by expanding student target audiences to include working professionals. The department's current Master of Science degree programs broadly cover all aerospace and mechanical engineering topics, and are focused generally in theory and research; whereas the professional master degree program focuses on engineering practice specifically within applied aeronautics. We do not expect the professional master degree program to negatively influence enrollment in the Masters of Science degree programs.

Students accepted to the professional master degree program would be expected to hold a Bachelor's of Science degree in aerospace or mechanical engineering or a related field. Students with Bachelor's

of Science degrees in other degrees will be accommodated if they provide evidence of in-workforce experience and training in relevant topics.

Recruitment and processing of applications will be managed through the Professional and Distance Education Programs office and adhere to an application process with the following qualifications:

- A cover letter, on letter head if applicable, providing a personal statement of why the applicant is applying to the program
- A professional resume, 2-page maximum
- An official transcript with proof of completed Bachelor's Degree (or higher) in any of the areas related to the program, or a Bachelor's degree supplemented with proof of completion of professional training and experience in related areas
- Two letters of recommendations
- All international applicants whose native language is not English will be required to take the Test of English as a Foreign Language and have an official score report sent directly to the Associate Dean for Graduate Studies from Educational Testing Service.

Evaluation of applicants for admission to the program will be managed by the Professional Master of Applied Aeronautics Graduate Studies Committee. The committee will adhere to the principles of individualized holistic review.

7. Special efforts to enroll and retain underrepresented groups.

We plan to coordinate our efforts in recruitment, admission, and retention of underrepresented groups with the Department's and College of Engineering's ongoing and emerging initiatives. A key part of our efforts will include collaborations with employers to reduce the financial burden on underrepresented minority students through scholarships and employee contributions.

INSTITUTIONAL PLANNING FOR THE PROGRAM

1. What are the physical facilities, equipment and staff needed to support the program?

The Professional Master of Applied Aeronautics program will be housed in The Ohio State University Department of Mechanical and Aerospace Engineering in the College of Engineering. The program is being proposed by the Department of Mechanical and Aerospace Engineering in partnership with the Aerospace Research Center. The program will be executed in collaboration with the Professional and Distance Education Program in the College of Engineering.

The Professional Master of Applied Aeronautics degree will be administered by the College of Engineering through the Professional and Distance Education Programs Office. The Professional Master of Applied Aeronautics Graduate Studies Committee will be established within the department to coordinate the oversight of the program.

a) Graduate Studies Committee

A Professional Master of Applied Aeronautics Faculty Director will act as the chair of the Graduate Studies Committee. The committee will be responsible for all curricular oversight, assessment of the degree, and the evaluation of applicants for admission to the degree. The committee will consist of the following voting members: the Faculty Director, the Associate Chair for Graduate Programs of the Department of Mechanical and Aerospace Engineering, one representative from the Department of Mechanical and Aerospace Engineering, and one representative from the Aerospace Research Center. The committee will include the College of Engineering Director of Professional and Distance Education Programs, as a non-voting member.

b) Office of Technology and Digital Trust (OTDI)

The proposed program will be developed in partnership with the Office of Technology and Digital Trust.

c) Administration

The Director of Professional and Distance Education Programs in the College of Engineering and staff will be responsible for the overall administration and day-to-day operations of the degree.

2. What is the evidence that a market for the new program(s) exists? How has estimated program demand been factored into realistic enrollment projections? How has this evidence been used in planning and budgeting processes to develop a quality program that can be sustained?

Per the market survey report conducted in April 2023, there is a growing nationwide demand for skilled employees in the aeronautics and aerospace fields, with Ohio clearly recognized as a hotspot for current and future growth. Ohio has seen the fourth highest number of unique job postings for aerospace engineers, aerospace engineering and operations technologists and technicians, materials engineers, and mechanical engineers, with Ohio's average number of job postings exceeding the national average. General Electric, National Aeronautics and Space Administration, Wright-Patterson Air Force Base, and Honeywell are the top aeronautics employers in Ohio, while OSU is also recognized as a top supplier to Boeing and Airbus.

Based on 2021 U.S. Department of Education and National Center for Education Statistics, when looking at the landscape of master's degrees around applied aeronautics, 115 institutions reported 3,614 master's degree completions in 2021. Thirty-two of the 115 institutions reporting completions had programs that were classified as "distance offered". A distance offered program is defined as a "program for which all the required coursework is able to be completed via distance education courses." It is worth noting that although only 28% of the institutions classified their programs as "distance offered" they accounted for 49% of all completions in 2021. There are no distance offered programs reported in aeronautics or similar fields provided by Ohio institutions.

The Ohio State University's plan to launch the program online aligns with the competitive market. Master's degrees completions in aeronautics and similar fields have steadily increased from 2017 to 2021. There was a 7% increase in the number of total completions, from 3,370 (both distance and non-distances) in 2017 to 3,614 in 2021. The number of institutions competing in this space has also increased by 6% from 2017 to 2021. The absence of distance offered programs in applied aeronautics within Ohio, provides Ohio State University an opportunity to secure enrollments due to a strong national brand in a state that is recognize as a hotspot for current and future growth.

The curriculum offered provides considerable alignment with top in-demand regional and national skills with unique capability compared to competitor programs. Furthermore, the proposed Professional Masters of Applied Aeronautics are supported by a majority faculty that are in the Department of Mechanical and Aerospace Engineering and associated with the Aerospace Research Center. The combined faculty have extensive background across the applied aeronautics discipline, strong ties with Ohio industries, and the experience to provide a high quality sustainable program, along with full support from the department, college and center, and aerospace industries.

STATEWIDE ALTERNATIVES

1. What programs are available in other institutions and how do they differ from the program being proposed?

According to the market survey report conducted in April 2023, the competitor scan indicates that all

distance offered aeronautics-related programs provide traditional Masters of Science degrees. The institution reporting the most online master's degree completions was Embry-Riddle Aeronautical University with 385 completions in 2021 from various Masters of Science programs, which corresponded to a 21.7% share of the distance-degree completion market. Other institutions that provide distance offered Masters of Science programs include, but not limited to: Purdue University, University of Illinois Urbana-Champaign, University of Colorado Boulder, Kansas State University, and University of Southern California. There are no distance offered programs reported in Ohio for this field. The majority of distance offered programs require 30 credit hours with a 1 to 2 year average time for completion.

The Professional Master of Applied Aeronautics is a fully online professional master's program that is consistent to other university requirements with 30 credit hours and a projected 1 to 2 year average for completion. However, the professional masters is specifically targeted towards working professionals with curriculum that emphasize engineering practice and the further development of cross-cutting industry-specific skills. The Masters of Science generally has an emphasis on research and theory. The application focus of the professional master's program curriculum culminates with a capstone project, which students directly apply their developed skills and knowledge towards industry-based projects supportive of their career goals.

The market landscape scan and survey report demonstrates an opportunity for Ohio State to make a significant contribution and impact for working professionals in Ohio and across the nation. The Professional Master of Applied Aeronautics degree will be the first fully online program in the technical area throughout the state of Ohio, and the first professional masters in aeronautics and similar fields throughout the nation.

2. Address appropriateness of specific locale for the new program.

While the program has a nation-wide access through its online structure, our primary target is the state of Ohio with its high number of rich employment opportunities in aeronautics. Regional employer demand trends suggest strong need for program graduates. Furthermore, the professional relationships between Ohio State University and Ohio aerospace industries, provides sustainable opportunity to support the growth of the workforce.

At a national level, employer demand trends also suggest strong need for program graduates. The program's unique opportunity to provide an application-focused professional masters compared to other nationwide institutions indicates favorable student and industry support at a national level.

3. Address opportunities for inter-institutional collaboration.

Inter-institutional collaborations are possible across the state. Potential collaborators include, but are not limited to: University of Cincinnati, University of Dayton, Wright State University, and Air Force Institute of Technology. Further collaborations can include joint workforce education activities, open houses bringing together students and employers, and technical content development.

GROWTH OF THE PROGRAM

1. What future growth do you anticipate over several years, and how do you plan to manage this growth? When do you expect the program to be self-sufficient?

We expect to start this program with 10-20 students in its initial offering. The steady-state enrollment is expected to be around 40-50 students per year. Students are only admitted to the program during the autumn and spring terms. The program is expected to be self-sufficient during its second year at the latest.

The program can handle larger class sizes due to the flexibility online programs provide. However, additional support in teaching (e.g., additional graduate teaching associates and/or instructors) may be needed as the class sizes grow. Such growth is included in the projected budget plans.

To maximize the success of each enrolled student, graduate, and future student, the program will maintain an active self-assessment process. This will include: annual recording of application and admission data; student academic performance indices; student evaluations of instruction (course satisfaction), semester-based student performance evaluations (reviewed by the program director and a committee of program faculty); annual evaluations of the program by faculty members; annual student evaluations of the program; exit surveys; time-to-degree tracking; and career recording of alumni. These assessment data will be collected by the Director of Professional and Distance Education Programs and staff annually and provided for review by the Graduate Studies Committee and used to continually refine the program. These data will also serve as support of applications seeking program funding.

CURRICULUM AND INSTRUCTIONAL DESIGN

1. Curricular content.

Course #	Title	Credits
Required courses for degree (15 credits)		
<i>Core courses (9 credits)</i>		
AE 5751	Advanced Air Breathing Propulsion	3
AE 6560	Advanced Aerodynamics	3
AE 7721	Advanced Flight Mechanics	3
<i>Engineering analysis electives (3 credits)</i>		
AE 6518	Applied Engineering Analytical Methods	3
ME 6507	Intermediate Numerical Methods	3
<i>Capstone project (3 credits)</i>		
AE 8900	Aerospace Engineering Experiential Learning Masters Project	3
Elective courses for degree (15 credits)		
<i>Performance and design</i>		
AE 5612	Aircraft Performance and Flight Test Engineering	3
AE 5620	Stability and Control of Flight Vehicles	3
AE 6645	Introduction to Structural Dynamics and Aeroelasticity of Aerospace Vehicles	3
AE 7616	Optimal Design for Flight Vehicles	3
<i>Propulsion and power</i>		
AE 5752	Advanced Space Propulsion	3
ME 7527	Jet Propulsion	3
ME 7255	Turbomachinery Dynamics	3
ME 7384	Principles of Electrification for Vehicle Propulsion Systems	3

<i>Fluid dynamics and heat transfer</i>		
AE 5775	Hypersonic Flows	3
ME 6501	Gas Dynamics	3
ME 6510	Intermediate Heat Transfer	3
AE 7875	Introduction to Turbulence	3
<i>Complementary and cross-cutting</i>		
AE 5624	Estimation Theory for Aerospace Systems	3
ME 7250	Vibration of Discrete Systems	3
ME 7383	Energy Conversion and Storage Sys. for Electrified Propulsion	3
AE 6193	Individual Studies in Aerospace Engineering	
AE 8193	Individual Studies in Aerospace Engineering	

All courses will be delivered online. The faculty have first-hand experience in preparing instructional material, and the experience of many aspects of instruction associated with traditional in-person application-focused learning, such as laboratory sections and experiments. In computer-based practical work, course design for online teaching is well-established. These experiences, combined with the Program of Distanced Education Program's support, positions the program development on an accelerated successful track.

The courses offered in the Professional Master of Applied Aeronautics program are offered through the Department of Mechanical and Aerospace Engineering. There are three (3) courses already prepared for online instruction (ME 6510, ME 7383, and ME 7384), and three (3) new courses being proposed in support of the program (AE 6518, AE 5624, and AE 8900). All other courses are commonly offered in the department with in-person instruction by the faculty, and online sections for the courses are in the process of being prepared. All courses will be developed for asynchronous access by students. When taught exclusively asynchronously, both lectures as well as practical assignments will be paced closely by instructors. Students will have goals to achieve and have access to instructors through online office hours.

There are 13 courses scheduled by the College of Engineering to be prepared for asynchronous online instruction during the 2024 calendar year, prior to the start of the program, which include five (5) core courses and 10 technical elective courses. The remaining eight (8) courses, one (1) core and seven (7) electives, are scheduled to be prepared for asynchronous online instruction during the 2025 calendar year.

2. What are the requirements students must fulfill to complete the program successfully?

The requirements for degree completion are as follows:

- 30 semester credit hours
- Completion of the requirements from the above list of core and elective courses
- Completion of an independent capstone project in applied aeronautics

3. Description of a required culminating, or integrated learning, experience.

The Professional Master in Applied Aeronautics program achieves a balance of theoretical and hands-on learning experiences throughout the duration of study. The required courses for each track involve significant practical experiences, which prepare the students for the workforce requirements and demands. The knowledge attained throughout the study leads to a final capstone project. The capstone

project course will focus on track-specific open-ended projects, and be administered by the course coordinator and various faculty focusing on different aspects of aeronautics.

INSTITUTIONAL STAFFING, FACULTY, AND STUDENT SUPPORT

1. Faculty.

The courses offered in this program will be taught by the faculty currently employed at The Ohio State University. The proposed program includes a number of courses that have already been offered multiple times. These courses are expected to be taught mainly by tenure-track, clinical-track, and research-track faculty that are directly involved with the Aerospace Research Center. A total of 15 faculty members will be involved in the program. No new faculty lines will be needed to maintain the program going forward.

2. Administration and Support.

a) Faculty Director

The Professional Master of Applied Aeronautics Faculty Director will be selected by the Graduate Studies Committee. The Faculty Director will have graduate faculty status with the Graduate School.

b) Administrative Staff

The Director of Professional and Distance Education Programs who reports to the Dean of the College of Engineering, will act as the Professional Master of Applied Aeronautics Administrative Director. The existing staff including an Assistant Director and Program Coordinator for Degrees will manage the day-to-day operations, processing of applications and coordination with the Graduate Studies Committee and provide student advising and support. The marketing specialist will provide program marketing of the degree.

c) Graduate Studies Committee

All voting members of the Graduate Studies Committee will have graduate faculty status with the Graduate School. The committee will handle all tasks normally associated with a graduate studies committee (admissions, new courses, monitory progress of students, etc.).

ADDITIONAL PROPOSAL SECTIONS

FOR ENTRY LEVEL GRADUATE PROGRAMS, PROFESSIONAL GRADUATE PROGRAMS, AND PROFESSIONAL SCIENCE MASTERS

PROFESSIONAL GRADUATE DEGREE PROGRAMS

- a. *What admission criteria, in addition to the traditionally required transcripts, standardized test scores, letter(s) of recommendation, and personal statements of purpose, are relevant to assess the potential for academic and professional success of prospective students? Will there be special consideration of student experience and extant practical skills within the admission process? If so, please elaborate.***

The Professional Master of Applied Aeronautics program is a professional master's program. While a Bachelor's of Science degree is required for admission, the expectation is to focus on the relevance of the applicants' professional experience and professional goals. This information will be clearly communicated to the applicants. Moreover, a significant share of the program's attendees will be

recruited from the workforce directly. Therefore, professional experiences, positions they hold in the industry, and any existing professional certificates will be included in their admission assessment. A combination of applicants' professional experiences, academic credentials, statements of purpose, and letters of recommendation will be used in a holistic evaluation process to assess their suitability to the program composition and their future career prospects.

- b. Is field/clinical experience subsumed within the academic experience? If so, how does that experience relate to the academic goals of the professional graduate degree program? Provide a description of the involvement of supervisory personnel. Describe the nature of the oversight of the field/clinical experience by the academic department. Provide an outline of the anticipated student activities as well as student requirements for competencies and hours of experience.**

Not applicable.

- c. Are the faculty qualifications associated with the professional graduate degree program appropriate for such faculty? Provide the specific qualifications for such faculty.**

The proposed professional degree program has both theoretical as well as practice-oriented components. The expertise required to run both aspects are already prerequisites for tenure-track and clinical-track, and research-track faculty employed at The Ohio State University.

- d. How does accreditation by the appropriate professional organization relate to the academic curriculum and experience outlined in the program plan? Describe the specific aspects of the program plan, if any, that are necessary to achieve professional accreditation. Is completion of the degree program required for professional accreditation in the field?**

While the graduates of the Professional Master of Applied Aeronautics program will be well-prepared for accreditation programs, accreditation is not an explicit or immediate goal of the program.

- e. How are theory and practice integrated within the curriculum?**

The courses are designed to integrate both theoretically-based instruction as well as engineering-practice experiences. The program includes a final capstone project where the curriculum topics are used to solve an open-ended, industry-focused problems.

- f. What is the national credit hour norm for this degree program in your field? How was this norm derived? Is the number of credit hours required for graduation influenced by mandated professional experiences? If so, how?**

Our market research revealed that 30 credit hours of work is typical for master's degree programs focusing on related topics. This number is generally not influenced by any mandated professional experiences.

- g. Describe how the required culminating academic experience will contribute to the enhancement of the student's professional preparation.**

The culminating academic experience will allow the students to view aeronautics topics from a wider vantage point. In practice, professionals employed in aerospace positions have a narrow field of expertise, which is known to inhibit their ability to assess multi-faceted nature of complex aeronautics problems. The Professional Master of Applied Aeronautics program provides the breadth required to appreciate, identify, and act on the aforementioned complexity and the interdependence of multiple problem instances in the workplace. The depth conveyed prepares the students to tackle these complex problems at an expert level. Graduates of the Professional Master of Applied Aeronautics program, will

be ready for employment with larger number of prospects, preparing them for future professional growth and advancement opportunities.

PROFESSIONAL MASTER OF APPLIED AERONAUTICS

Mode of Delivery: Fully Online

**Department of Mechanical and Aerospace Engineering
and College of Engineering**
in partnership with the
Aerospace Research Center

APPENDICES

For questions contact:

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Master of Applied Aeronautics

100% Online

The professional Master of Applied Aeronautics (MAA) degree offers working professionals and graduate students the opportunity to acquire the knowledge that supports advanced concepts in aeronautics across the entire Mach number range. The advanced aeronautics courses provide students with the ability to immediately apply the knowledge to professional practice.

The Master of Applied Aeronautics degree consists of 30 credit hours. The curriculum provides a formalized structure to gain a deeper respect and understanding of key integrated elements of advanced topics in air breathing propulsion, aerodynamics, performance and flight mechanics applied for both manned and unmanned aircraft.

This degree is offered fully online and in conjunction with the [Aerospace Research Center at The Ohio State University, College of Engineering](#).

STUDENTS WILL LEARN TO:

1. Quantify flight vehicles by identifying key flight characteristics.
2. Apply advanced methods of flight analysis across the entire Mach number range.
3. Develop advanced numerical analysis techniques involved in applied aeronautics.
4. Understand best practices in experimental testing and apply analysis techniques to test results common to ground testing, wind tunnel testing, and flight testing.

ADMISSIONS REQUIREMENTS

A bachelor's degree in aerospace or mechanical engineering or a related field is required.



CURRICULUM (30 credit hours)

Required Core Courses (12 credit hours)

AE 5751 Advanced Air Breathing Propulsion
 AE 6560 Advanced Aerodynamics
 AE 7721 Advanced Flight Mechanics
 AE 8900 Aerospace Engineering Experiential Learning Masters Project

Technical Electives (15 credit hours)

Performance and Design

AE 5612 Aircraft Performance & Flight Test Engineering
 AE 5620 Advanced Stability & Control of Flight Vehicles
 AE 6645 Structural Dynamics & Aeroelasticity of Aerospace Vehicles
 AE 7616 Optimal Design for Flight Vehicles & Systems

Propulsion and Power

AE 5752 Rocket Propulsion
 ME 7527 Jet Propulsion
 ME 7255 Turbomachinery Dynamics
 ME 7384 Principles of Electrification for Vehicle Propulsion Systems

Fluid Dynamics

ME 6510 Intermediate Heat Transfer
 ME 6501 Gas Dynamics
 AE 5775 Hypersonic Flows
 AE 7875 Introduction to Turbulence

Complementary and Cross-cutting

AE 5624 Estimation Theory for Aerospace Systems
 ME 7250 Vibration of Discrete Systems
 ME 7383 Energy Conversion and Storage Sys. for Electrified Propulsion
 AE 6194/8194 Group Studies in Aerospace Engineering

Math electives (3 credit hours)

AE 6518 Applied Engineering Analytical Methods
 ME 6507 Intermediate Numerical Methods

CONTACT

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THE OHIO STATE UNIVERSITY
 COLLEGE OF ENGINEERING

Appendix A. Faculty Matrix

Please see Appendix B for the corresponding 2-page faculty vitae. The current faculty breakdown for the program is 11 Tenure-track, 2 Clinical-track, and 2 Research-track.

Instructor Name	Rank or Title	Full-Time (FT) or Part-Time (PT)	Instructor Qualification			Courses taught in the proposed program (Include course number and title)
			Degree Title, Discipline, Institution, Year	Years of Teaching Experience In the Discipline/Field	Additional qualifications (e.g., licenses, certifications)	
<i>Igor ADAMOVICH</i>	<i>Professor</i>	<i>FT</i>	<i>PhD, Chemical Physics, Ohio State Univ., 1993</i>	<i>29</i>	<i>None</i>	<i>MECHENG 6501 Gas Dynamics</i>
<i>Marcello CANOVA</i>	<i>Professor</i>	<i>FT</i>	<i>PhD. Mech. Engr., Ohio State Univ., 2006</i>	<i>13</i>	<i>None</i>	<i>MECHENG 7383-Energy Conversion and Storage Sys. for Electrified Propulsion</i>
<i>Kiran D'SOUZA</i>	<i>Associate Professor</i>	<i>FT</i>	<i>PhD. Mech. Engr. Univ. of Michigan, 2009</i>	<i>14</i>	<i>None</i>	<i>MECHENG 7255 Turbomachinery Dynamics</i> <i>MECHENG 7250 Vibration of Discrete Systems</i>
<i>Lian DUAN</i>	<i>Associate Professor</i>	<i>FT</i>	<i>PhD., Mech. and Aero. Engr., Princeton Univ., 2011</i>	<i>11</i>	<i>None</i>	<i>AEROENG 7875 Introduction to Turbulence</i>
<i>Datta GAITONDE</i>	<i>Professor</i>	<i>FT</i>	<i>PhD, Mech. & Aero., Engr., Rutgers University, 1989</i>	<i>14</i>	<i>Senior Develop. Educ. in the Prof. Military Educ. Prgm; Level III Certified Acquisition Professional</i>	<i>AEROENG 5775 Hypersonic Flows</i>

John HORACK	Professor	FT	PhD, Astrophysics, University of Alabama in Huntsville, 1993	14	FAA Licensed Commercial Pilot; FAA Certified Flight Instructor	AEROENG 5752 Advanced Space Propulsion
Mrinal KUMAR	Professor	FT	PhD Aero. Engr., Texas A&M Univ., 2009	14	None	AEROENG 5624 Estimation Theory for Aerospace Systems
Randy MATHISON	Associate Professor	FT	PhD. Mech. Engr., Ohio State Univ., 2009	14	None	AEROENG 5751: Advanced Air Breathing Propulsion AEROENG 7527 Jet Propulsion
Sandip MAZUMDER	Professor	FT	PhD, Mechanical Engineering, Penn State University, 1997	23	None	MECHENG 6510 Intermediate Heat Transfer
Matthew McCRINK	Assistant Research Professor	FT	PhD. Aero. and Astro. Engr., Ohio State Univ., 2016	5	Private pilot with instrument rating	AEROENG 5612 Aircraft Performance and Flight Test Engineering AEROENG 5620 Advanced Stability and Control of Flight Vehicles
Jack McNAMARA	Professor	FT	PhD: Aero. Engr., University of Michigan, 2005	17	None	AEROENG 6645 Structural Dynamics and Aeroelasticity of Aerospace Vehicles
Golnazalsadat MIRFENDERESGI	Assistant Professor of Practice	FT	PhD. Civil, Env.. and Geodetic. Engr., Ohio State Univ., 2017	4	None	MECHENG 6507 Intermediate Numerical Methods

<i>Giorgio RIZZONI</i>	<i>Professor</i>	<i>FT</i>	<i>PhD, University of Michigan Electrical and Computer Engineering, 1986</i>	<i>33</i>	<i>None</i>	<i>MECHENG 7384 Principles of Electrification for Vehicle Propulsion Systems</i>
<i>Clifford WHITFIELD</i>	<i>Professor of Practice</i>	<i>FT</i>	<i>PhD. Aero. and Astro. Engr., Ohio State Univ., 2009</i>	<i>14</i>	<i>none</i>	<i>AEROENG 6560 Advanced Aerodynamics AEROENG 7721 Advanced Flight Mechanics AEROENG 7616 Optimal Design of Flight Vehicles AEROENG 6518 Applied Engineering Analytical Methods</i>

Appendix B. Faculty Vitae

The following are 2 page vitae for each faculty involved in the program.

- *Igor Adamovich*, Professor
- *Marcello Canova*, Professor
- *Kiran D'Souza*, Associate Professor
- *Lian Duan*, Associate Professor
- *Datta Gaitonde*, Professor
- *John Horack*, Professor
- *Mrinal Kumar*, Professor
- *Randy Mathison*, Associate Professor
- *Sandip Mazumder*, Professor
- *Mathew McCrink*, Research Assistant Professor
- *Jack McNamara*, Professor
- *Golnazalsadat Mirfendersgi*, Assistant Professor of Practice
- *Giorgio Rizzoni*, Professor
- *Clifford Whitfield*, Professor of Practice

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Education

MS: Aerospace and Mechanical Engineering, Moscow Institute of Physics and Technology, 1987

PhD: Chemical Physics, The Ohio state University, 1993

Academic experience

- 2022-current, John B. Nordholt Professor of Mechanical Engineering, Department of Mechanical and Aerospace Engineering, OSU
- 2009-2022, Professor, Department of Mechanical and Aerospace Engineering, Chemical Physics Graduate Program, OSU
- 2019, Visiting Professor (sabbatical leave), Clean Combustion Research Center, King Abdullah University of Science and Technology (KAUST), Jeddah, Saudi Arabia
- 2018, Gaspard Monge Visiting Professor (sabbatical leave), Laboratory of Plasma Physics, Ecole Polytechnique, Paris, France
- 2011, Japan Society for Promotion of Science Fellow (sabbatical leave), Department of Energy Science, Tokyo Institute of Technology, Japan
- 2010-2011, Visiting Professor (sabbatical leave), Department of Physics and Astronomy, Ruhr University Bochum, Germany
- 2001-2009, Associate Professor, Department of Mechanical Engineering, Department of Aerospace Engineering and Aviation, Chemical Physics Graduate Program, OSU
- 1994-2001, Research Scientist, Post-Doctoral Researcher, Visiting Assistant Professor, Nonequilibrium Thermodynamics Laboratories, Department of Mechanical Engineering, OSU
- 1991-1993, Graduate Research Associate, Molecular Energy Transfer Laboratory, Chemical Physics Graduate Program and Department of Mechanical Engineering, OSU
- 1987-1991, Research Associate, Aerothermodynamics Laboratory, A.V. Lykov Heat and Mass Transfer Institute of Soviet Academy of Sciences, Minsk, USSR
- 1981-1987, BS/MS student, Department of Aerophysics and Space Research, Moscow Institute of Physics and Technology, Moscow, USSR

Related teaching experience

- Gas Dynamics
- Advanced Engineering Thermodynamics
- Advanced Heat Transfer Statistical Thermodynamics
- Physical Gas Dynamics
- Plasmas and Gas Discharges
- Aerodynamics of Chemically Reacting Fluids

Honors and awards

- AIAA Aerodynamic Measurement Technology Technical Committee Walter Lempert Best Student Paper Award (2020)
- AIAA Plasmadynamics and Lasers Technical Committee Best Student Paper Award (2020, 2017)
- Gaspard Monge Visiting Professor, Laboratory of Plasma Physics, Ecole (2018)
- AIAA Plasmadynamics and Lasers Technical Committee Best Paper Award (2018, 2015, 2004, 1997)

- AIAA Plasmadynamics and Lasers Technical Committee 2015 Best Paper Award:
- Distinguished Paper, New Technology Colloquium, International Symposium on Combustion (2015, 2013)
- JSPS (Japan Society for Promotion of Science) Invitation Fellowship (2011)
- OSU College of Engineering Lumley Research Award (2011, 2006)

Principal publications (Most significant during last 5 years)

- E.R. Jans, I. Gulko, D.C.M. van den Bekerom, T.A. Miller, and I.V. Adamovich, "Measurements of Metastable N₂(A³Σ⁺,v) Molecules in Nonequilibrium Supersonic Flows", *Journal of Thermophysics and Heat Transfer* 36 (2022) 196
- E.R. Jans, X. Yang, I.W. Jones, T.A. Miller, J.F. Stanton, and I.V. Adamovich, "Time-Resolved Measurements of HO₂ Radical in a Heated Plasma Flow Reactor", *Combustion and Flame* 241 (2022) 112097
- X. Yang, E. Jans, C. Richards, S. Raskar, D. van den Bekerom, and Igor V. Adamovich, "Measurements of Atoms and Metastable Species in N₂ and H₂-N₂ Ns Pulse Plasmas", *Plasma Sources Science and Technology* 31 (2022) 015017
- C. Richards, E. Jans, I. Gulko, K. Orr, and I.V. Adamovich, "N₂ Vibrational Excitation in Atmospheric Pressure Ns Pulse and RF Plasma Jets", *Plasma Sources Science and Technology* 31 (2022) 034001
- Adamovich, S. Agarwal, E. Ahedo, L.L. Alves, S. Baalrud, N. Babaeva, A. Bogaerts, A. Bourdon, P. J. Bruggeman, C. Canal, E.H. Choi, S. Coulombe, Z. Donkó, D. B. Graves, S. Hamaguchi, D. Hegemann, M. Hori, H.-H. Kim, G.M.W. Kroesen, M. J. Kushner, A. Laricchiuta, X. Li, T. E. Magin, S. Mededovic Thagard, V. Miller, A. B. Murphy, G. S. Oehrlein, N. Puac, R. M. Sankaran, S. Samukawa, M. Shiratani, M. Simek, N. Tarasenko, K. Terashima, E. Thomas Jr, J. Trieschmann, S. Tsikata, M. M. Turner, I. J. van der Walt, M. C. M. van de Sanden, and T. von Woedtké, "The 2022 Plasma Roadmap: Low Temperature Plasma Science and Technology", *Journal of Physics D: Applied Physics* 55 (2022) 373001
- S. Raskar, K. Orr, I.V. Adamovich, T.L. Chng and S.M. Starikovskaia, "Spatially Enhanced Electric Field Induced Second Harmonic (SEEFISH) Generation for Measurements of Electric Field Distributions in High-Pressure Plasmas", *Plasma Sources Science and Technology* 31 (2022) 085002
- C. Richards, E. Jans, D. Mignogna, and I.V. Adamovich, "Time-Resolved CO₂, CO, and N₂ Vibrational Population Measurements in Ns Pulse Discharge Plasmas", *Plasma Sources Science and Technology* 31(2022) 094011
- D. Mignogna, E. Jans, S. Raskar, and I.V. Adamovich, "Generation and Decay of N₂(A³Σ⁺) Molecules in Reacting CO₂ and CH₄ Plasmas", *Plasma Sources Science and Technology* 31 (2022) 115005
- H. Telfah, E. Jans, S. Raskar, and I.V. Adamovich, "Kinetics of HO₂ Radical Formation and Decay in Ns Pulse O₂-He Plasmas over a Liquid Water Surface", *Plasma Sources Science and Technology* 31 (2022) 115019
- S. Raskar, K. Orr, X. Yang, and I.V. Adamovich, "Electric Field Distribution in a Non-Self-Sustained RF Discharge with Ionization Generated by Ns Discharge Pulses", *Plasma Sources Science and Technology* 31 (2022) 124001

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics

PROFESSIONAL MASTER OF APPLIED AERONAUTICS

Mode of Delivery: Fully Online

**Department of Mechanical and Aerospace Engineering
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in partnership with the
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APPENDICES

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Appendix A. Faculty Matrix

Please see Appendix B for the corresponding 2-page faculty vitae. The current faculty breakdown for the program is 11 Tenure-track, 2 Clinical-track, and 2 Research-track.

Instructor Name	Rank or Title	Full-Time (FT) or Part-Time (PT)	Instructor Qualification			Courses taught in the proposed program (Include course number and title)
			Degree Title, Discipline, Institution, Year	Years of Teaching Experience In the Discipline/Field	Additional qualifications (e.g., licenses, certifications)	
<i>Igor ADAMOVICH</i>	<i>Professor</i>	<i>FT</i>	<i>PhD, Chemical Physics, Ohio State Univ., 1993</i>	<i>29</i>	<i>None</i>	<i>MECHENG 6501 Gas Dynamics</i>
<i>Marcello CANOVA</i>	<i>Professor</i>	<i>FT</i>	<i>PhD. Mech. Engr., Ohio State Univ., 2006</i>	<i>13</i>	<i>None</i>	<i>MECHENG 7383-Energy Conversion and Storage Sys. for Electrified Propulsion</i>
<i>Kiran D'SOUZA</i>	<i>Associate Professor</i>	<i>FT</i>	<i>PhD. Mech. Engr. Univ. of Michigan, 2009</i>	<i>14</i>	<i>None</i>	<i>MECHENG 7255 Turbomachinery Dynamics</i> <i>MECHENG 7250 Vibration of Discrete Systems</i>
<i>Lian DUAN</i>	<i>Associate Professor</i>	<i>FT</i>	<i>PhD., Mech. and Aero. Engr., Princeton Univ., 2011</i>	<i>11</i>	<i>None</i>	<i>AEROENG 7875 Introduction to Turbulence</i>
<i>Datta GAITONDE</i>	<i>Professor</i>	<i>FT</i>	<i>PhD, Mech. & Aero., Engr., Rutgers University, 1989</i>	<i>14</i>	<i>Senior Develop. Educ. in the Prof. Military Educ. Prgm; Level III Certified Acquisition Professional</i>	<i>AEROENG 5775 Hypersonic Flows</i>

John HORACK	Professor	FT	PhD, Astrophysics, University of Alabama in Huntsville, 1993	14	FAA Licensed Commercial Pilot; FAA Certified Flight Instructor	AEROENG 5752 Advanced Space Propulsion
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Randy MATHISON	Associate Professor	FT	PhD. Mech. Engr., Ohio State Univ., 2009	14	None	AEROENG 5751: Advanced Air Breathing Propulsion AEROENG 7527 Jet Propulsion
Sandip MAZUMDER	Professor	FT	PhD, Mechanical Engineering, Penn State University, 1997	23	None	MECHENG 6510 Intermediate Heat Transfer
Matthew McCRINK	Assistant Research Professor	FT	PhD. Aero. and Astro. Engr., Ohio State Univ., 2016	5	Private pilot with instrument rating	AEROENG 5612 Aircraft Performance and Flight Test Engineering AEROENG 5620 Advanced Stability and Control of Flight Vehicles
Jack McNAMARA	Professor	FT	PhD: Aero. Engr., University of Michigan, 2005	17	None	AEROENG 6645 Structural Dynamics and Aeroelasticity of Aerospace Vehicles
Golnazalsadat MIRFENDERESGI	Assistant Professor of Practice	FT	PhD. Civil, Env.. and Geodetic. Engr., Ohio State Univ., 2017	4	None	MECHENG 6507 Intermediate Numerical Methods

<i>Giorgio RIZZONI</i>	<i>Professor</i>	<i>FT</i>	<i>PhD, University of Michigan Electrical and Computer Engineering, 1986</i>	<i>33</i>	<i>None</i>	<i>MECHENG 7384 Principles of Electrification for Vehicle Propulsion Systems</i>
<i>Clifford WHITFIELD</i>	<i>Professor of Practice</i>	<i>FT</i>	<i>PhD. Aero. and Astro. Engr., Ohio State Univ., 2009</i>	<i>14</i>	<i>none</i>	<i>AEROENG 6560 Advanced Aerodynamics AEROENG 7721 Advanced Flight Mechanics AEROENG 7616 Optimal Design of Flight Vehicles AEROENG 6518 Applied Engineering Analytical Methods</i>

Appendix B. Faculty Vitae

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- *Clifford Whitfield*, Professor of Practice

Igor V. Adamovich

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- 2011, Japan Society for Promotion of Science Fellow (sabbatical leave), Department of Energy Science, Tokyo Institute of Technology, Japan
- 2010-2011, Visiting Professor (sabbatical leave), Department of Physics and Astronomy, Ruhr University Bochum, Germany
- 2001-2009, Associate Professor, Department of Mechanical Engineering, Department of Aerospace Engineering and Aviation, Chemical Physics Graduate Program, OSU
- 1994-2001, Research Scientist, Post-Doctoral Researcher, Visiting Assistant Professor, Nonequilibrium Thermodynamics Laboratories, Department of Mechanical Engineering, OSU
- 1991-1993, Graduate Research Associate, Molecular Energy Transfer Laboratory, Chemical Physics Graduate Program and Department of Mechanical Engineering, OSU
- 1987-1991, Research Associate, Aerothermodynamics Laboratory, A.V. Lykov Heat and Mass Transfer Institute of Soviet Academy of Sciences, Minsk, USSR
- 1981-1987, BS/MS student, Department of Aerophysics and Space Research, Moscow Institute of Physics and Technology, Moscow, USSR

Related teaching experience

- Gas Dynamics
- Advanced Engineering Thermodynamics
- Advanced Heat Transfer Statistical Thermodynamics
- Physical Gas Dynamics
- Plasmas and Gas Discharges
- Aerodynamics of Chemically Reacting Fluids

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- S. Raskar, K. Orr, I.V. Adamovich, T.L. Chng and S.M. Starikovskaia, "Spatially Enhanced Electric Field Induced Second Harmonic (SEEFISH) Generation for Measurements of Electric Field Distributions in High-Pressure Plasmas", *Plasma Sources Science and Technology* 31 (2022) 085002
- C. Richards, E. Jans, D. Mignogna, and I.V. Adamovich, "Time-Resolved CO_2 , CO , and N_2 Vibrational Population Measurements in Ns Pulse Discharge Plasmas", *Plasma Sources Science and Technology* 31(2022) 094011
- D. Mignogna, E. Jans, S. Raskar, and I.V. Adamovich, "Generation and Decay of $N_2(A^3\Sigma_u^+)$ Molecules in Reacting CO_2 and CH_4 Plasmas", *Plasma Sources Science and Technology* 31 (2022) 115005
- H. Telfah, E. Jans, S. Raskar, and I.V. Adamovich, "Kinetics of HO_2 Radical Formation and Decay in Ns Pulse O_2 -He Plasmas over a Liquid Water Surface", *Plasma Sources Science and Technology* 31 (2022) 115019
- S. Raskar, K. Orr, X. Yang, and I.V. Adamovich, "Electric Field Distribution in a Non-Self-Sustained RF Discharge with Ionization Generated by Ns Discharge Pulses", *Plasma Sources Science and Technology* 31 (2022) 124001

Current membership in professional organizations

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Education

MS: Mechanical Engineering, University of Parma, Italy, 2002

PhD: Mechanical Engineering, University of Parma, Italy, 2006

Academic experience

- 2021-Present: Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2016-2021: Associate Professor with Tenure, Mechanical and Aerospace Engineering, The Ohio State University
- 2011-2016: Tenure-Track Assistant Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2011- Present: Associate Fellow, Center for Automotive Research, The Ohio State University
- 2009-2010: Research Scientist, Center for Automotive Research, The Ohio State University
- 2008-2009: Senior Research Associate, Center for Automotive Research, The Ohio State University
- 2006-2008: Research Associate, Center for Automotive Research, The Ohio State University

Related teaching experience

- Energy Conversion and Storage Sys. for Electrified Propulsion

Related curriculum development

- Energy Conversion and Storage Sys. for Electrified Propulsion (in-person)
- Energy Conversion and Storage Sys. for Electrified Propulsion (online)

Honors and awards

- Lumley Interdisciplinary Research Award, College of Engineering, The Ohio State University (2020, 2016, 2012)
- Michael J. Moran Award for Excellence in Teaching, The Ohio State University (2017)
- AE Ralph E. Teetor Education Award, Society of Automotive Engineers (2016)
- CAREER Award, The National Science Foundation (2016)
- Kappa Delta Distinguished Faculty Award, The Ohio State University (2011)
- SAE (Society of Automotive Engineers) 2009 Vincent Bendix Automotive Electronics Engineering Award (2011)

Related Department, College, and University committees and leadership positions

- Associate Chair for Graduate Studies, Mechanical and Aerospace Engineering (2021-Present)
- Associate Director for Research and Education, Center for Automotive Research (2018-Present)
- Associate Director for Graduate and Continuing Education, Center for Automotive Research (2018- Present)

Principal publications (Most significant during last 5 years)

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Education

MS: Mechanical Engineering, University of Parma, Italy, 2002

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Academic experience

- 2021-Present: Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2016-2021: Associate Professor with Tenure, Mechanical and Aerospace Engineering, The Ohio State University
- 2011-2016: Tenure-Track Assistant Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2011- Present: Associate Fellow, Center for Automotive Research, The Ohio State University
- 2009-2010: Research Scientist, Center for Automotive Research, The Ohio State University
- 2008-2009: Senior Research Associate, Center for Automotive Research, The Ohio State University
- 2006-2008: Research Associate, Center for Automotive Research, The Ohio State University

Related teaching experience

- Energy Conversion and Storage Sys. for Electrified Propulsion

Related curriculum development

- Energy Conversion and Storage Sys. for Electrified Propulsion (in-person)
- Energy Conversion and Storage Sys. for Electrified Propulsion (online)

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- Associate Chair for Graduate Studies, Mechanical and Aerospace Engineering (2021-Present)
- Associate Director for Research and Education, Center for Automotive Research (2018-Present)
- Associate Director for Graduate and Continuing Education, Center for Automotive Research (2018- Present)

Principal publications (Most significant during last 5 years)

- Zhu, N. Pivaro, S. Gupta, A. Gupta, M. Canova, "Safe Model-based Off-policy Reinforcement Learning for Eco-driving in Connected and Automated Hybrid Electric Vehicle". IEEE Transactions on Intelligent Vehicles (2022). Impact Factor: 6.72
- Gupta, S. Rajakumar Deshpande, M. Canova, "An Algorithm to Warm Start Perturbed (WASP) Constrained Dynamic Programs", IEEE Open Journal of Control Systems (2022). Impact Factor: N/A
- S. Scaravonati, M. Sidoli, G. Magnani, A. Morengi, M. Canova, J. Kim, M. Riccò, D. Pontiroli, "Combined Capacitive and Electrochemical Charge Storage Mechanism in High-performance Graphene-based Lithium-ion Batteries", Materials Today Energy 24 (2022): 100928. Impact Factor: 7.311
- S. Rajakumar Deshpande, S. Gupta, A. Gupta, M. Canova, "Real-time Eco-Driving Control in Electrified Connected and Autonomous Vehicles using Approximate Dynamic Programming", ASME Journal of Dynamic Systems, Measurements and Control (2021). Impact Factor: 1.372
- D. Kibalama, Y. Liu, S. Stockar, M. Canova, "Model Predictive Control for Automotive Climate Control Systems via Value Function Approximation", IEEE Control Systems Letters 6 (2021): 1820-1825.
- Impact Factor: 3.698 7. S. Rajakumar Deshpande, D. Jung, M. Canova. "Integrated Approximate Dynamic Programming and Equivalent Consumption Minimization Strategy for Eco-Driving in a Connected and Automated Vehicle." IEEE Transactions on Vehicular Technology, Vol. 7 (11) (2021). Impact Factor: 5.978
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- Z. Salyer, M. D'Arpino, M. Canova. Extended Physics-Based Reduced-Order Capacity Fade Model for Lithium-Ion Battery Cells. ASME Letters in Dynamic Systems and Control, 1(4), 041002 (2021). Impact Factor: 1.825
- K. Pan, F. Zou, M. Canova, Y. Zhu, J-H. Kim, "Comprehensive Electrochemical Impedance Spectroscopy Study of Si-Based Anodes", Journal of Power Sources, 479, 229083- (2020). Impact Factor: 9.127
- Y. Liu, M. Canova, Y-Y Wang, "Distributed Energy and Thermal Management of a 48V Diesel Mild Hybrid Electric Vehicle with Electrically Heated Catalyst", IEEE Transactions on Control Systems Technology, 28(5), 1878-1891, 2020. Impact Factor: 5.312
- Z. Zhu, S. Midlam-Mohler, M. Canova. "Development of physics-based three-way catalytic converter model for real- time distributed temperature prediction using proper orthogonal decomposition and collocation." International Journal of Engine Research, 1468087419876127, 2019. Impact Factor: 2.272

Current membership in professional organizations

- Society of Automotive Engineers
- American Society for Mechanical Engineers
- International Federation of Automatic Control

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Education

BS: Mechanical Engineering, University of Michigan, 2003

MS: Mechanical Engineering, University of Michigan, 2004

PhD: Mechanical Engineering, University of Michigan, 2009

Academic experience

- 2020- Present: Associate Professor of Mechanical and Aerospace Engineering, The Ohio State University
- 2014-2020: Assistant Professor of Mechanical and Aerospace Engineering, The Ohio State University
- 2012-2014: Assistant Research Scientist, Mechanical Engineering, University of Michigan
- 2010-2012: Post-doctoral Fellow, Mechanical Engineering, University of Michigan

Non-academic experience

- 2002: Summer Engineering Internship at Pratt and Whitney
- 1999-2001: Summer Engineering Internships with Reliable Analysis

Related teaching experience

- Turbomachinery Dynamics
- Vibration of Discrete Systems

Related curriculum development

- Turbomachinery Dynamics
- Vibration of Discrete Systems

Honors and awards

- Paper won 2nd Place in MSNDC 2021 Student Paper Competition at the 17th International Conference on Multibody Systems, Nonlinear Dynamics, and Control (2021)
- Paper won 1st Place in TCVS Student Paper Competition at the 32nd Conference on Mechanical Vibration and Noise (2020)
- Ivor K. McIvor Award from the UofM College of Engineering for demonstrated excellence in research and scholarship in applied mechanics (2009)
- Jefferson Goblet Best Student Paper Award at the *48th AIAA/ASME/AHS/ASC Structures, Structural Dynamics and Materials Conference* (2007)
- National Science Foundation Fellowship (2005)

Related Department, College, and University committees and leadership positions

- Graduate Studies, member (2022-present)
- Continuous Quality Improvement, member (2020-present)
- System Dynamics and Vibration Qualifying Exam Committee, member (2016-2022)
- Graduate Admissions, member (2016-2020, 2022)
- Kinematics and Dynamics Qualifying Exam, member (2017-2020), chair (2022-present)
- FAST class, panelist (2020-present)

- Fiscal Oversight, member (2018-2020)

Outreach Programs

- Translating Engineering to K-8 (TEK8) undergraduate research mentor
- OSU Louis Stokes Alliances for Minority Participation (LSAMP) mentor
- NSF RISE program mentor
- Summer Research Opportunity Program (SROP) mentor
- Aerospace Engineering High School internships
- Metro High School Cap Stone project mentor
- Minority Engineering Program Discovering Engineering with Faculty speaker

Principal publications (Most significant during last 5 years)

- Shahhosseini, M. Tien, and **K. D'Souza**, Poincare Maps: A Modern Systematic Approach Toward Obtaining Effective Sections, *Nonlinear Dynamics*, 2022, <https://doi.org/10.1007/s11071-022-07864-y>.
- E. Kurstak, and **K. D'Souza**, Experimental Investigation of Bladed Disk Dynamics at Design Speed Under Synchronous Vibration, *AIAA Journal*, 59(10), Pages 4123-4133, 2021, <https://doi.org/10.2514/1.J059827>.
- **K. D'Souza**, E. Kurstak, K. Ruff, and M. Dunn, A New Experimental Facility for Characterizing Bladed Disk Dynamics at Design Speed, *AIAA Journal*, 58(6), 2020, <https://doi.org/10.2514/1.J058682>.
- E. Kurstak, and **K. D'Souza**, An Experimental and Computational Investigation of a Pulsed Air-Jet Excitation System on a Rotating Bladed Disk, *Journal of Engineering for Gas Turbines and Power*, 143(1), 2021, <https://doi.org/10.1115/1.4049014>.
- M. Tien and **K. D'Souza**, Method for Controlling Vibration by Exploiting Piecewise-Linear Nonlinearity, *Philosophical Transactions of the Royal Society of London: A - Mathematical, Physical and Engineering Sciences*, 2020, 476(2233), <https://doi.org/10.1098/rspa.2019.0491>.
- M. Tien, T. Hu, and **K. D'Souza**, Statistical Analysis of the Nonlinear Response of Bladed Disks with Mistuning and Cracks, *AIAA Journal*, 57(11), 2019, <https://doi.org/10.2514/1.J058190>.
- T. Lyons and **K. D'Souza**, Parametric Study of an UAV Ingestion into a Business Jet Size Fan Assembly Model, *ASME Journal of Engineering for Gas Turbines and Power*, 141(7), 2019, <https://doi.org/10.1115/1.4042286>.

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics
- American Society of Mechanical Engineers

Lian Duan

Associate Professor, Mechanical and Aerospace Engineering

Phone: 614.292.5078

E-Mail: duan.322@osu.edu

Education

BS: Engineering Mechanics, Beihang University, 2005

MS: Aero. And Astro. Engineering, Princeton University, 2008

PhD: Aero. and Astro. Engineering, Princeton University, 2011

Academic experience

- 2019- Present: Associate Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2019- Present: Honda Endowed Chair in Transportation: College of Engineering, The Ohio State University
- 2013-2019: Aerospace Engineering, Missouri University of Science and Technology
- 2009-2013: Research Scientist, National Institute of Aerospace

Related teaching experience

- Intermediate Fluid Dynamics
- Turbulent Flows

Related curriculum development

- Intermediate Fluid Dynamics
- Turbulent Flows

Honors and awards

- AIAA Associate Fellow (2021)
- Honda Chair in Transportation (September 2019 - Present)
- Henry J. E. Reid Award, 3rd place winner, NASA Langley Research Center (2017)
- AIAA St. Louis Section Young Professional Engineer Award (2015)
- Air Force Office Scientific Research Young Investigator Program (YIP) Award (2014)
- AIAA Hampton Roads Section Laurence J. Bement Award (1st place winner) (2012)
- Crocco Award for Teaching Excellence, Princeton University (2008)

Related Department, College, and University committees and leadership positions

- Program Member, Aerospace Admissions Committee
- Chair, AE Fellowship Committee Member
- Member, Search committee for Research Assistant Professor (Dr. Matthew McCrink)

Principal publications (Most significant during last 5 years)

- M. Barone, G. Nicholson, and L. Duan, "Internal Energy Balance and Aerodynamic Heating Predictions for Hypersonic Turbulent Boundary Layers", *Physical Review Fluids*, Phys. Rev. Fluids 7, 084604, 2022
- E. Benitez, J. Hill, M. Borg, M. Aultman and L. Duan, C. Running, and J. Jewell, "Quantitative Focused Laser Differential Interferometry with Hypersonic Turbulent Boundary Layers ", *Applied Optics* 61, 9203-9216, 2022.
- J. Huang, L. Duan, and M. Choudhari, "Direct Numerical Simulation of Hypersonic Turbulent Boundary Layers: Effect of Spatial Evolution and Reynolds Number". *Journal of Fluid Mechanics*, vol. 937, A3, 2022.

- N. Hildebrand, M. M. Choudhari, C. P. Deegan, J. Huang, and L. Duan “Direct Numerical Simulation of Acoustic Disturbances in a Hypersonic Two-Dimensional Nozzle Configuration”, *AIAA Journal*, vol. 60, No. 6, pp. 3452-3463, 2022.
- M. Aultman, Z. Wang, R. Auza-Gutierrez, and L. Duan. “Evaluation of CFD methodologies for prediction of flows around simplified and complex automotive models”. *Computers & Fluids*, vol. 236, 105297, 2022.
- M. Choudhari, F. Li, P. Paredes, and L. Duan, “Evolution of high-frequency instabilities in the presence of azimuthally compact crossflow vortex pattern over a yawed cone.” *Theoretical and Computational Fluid Dynamics*, vol. 36, pp. 181-204, 2022.
- M. Aultman, R. Auza-Gutierrez, K. Disotell, and L. Duan, “Effects of Wheel Rotation on Long-Period Wake Dynamics of the DrivAer Fastback Model”. *Fluids*, 2022; 7(1):19.
- M. Aultman, Z. Wang, and L. Duan. “Effect of time-step size on flow around generic car models.” *Journal of Wind Engineering and Industrial Aerodynamics*, vol. 219, 104764, 2021.
- H. Xiao, J.-L. Wu, S. Laizet, and L. Duan, “Flows Over Periodic Hills of Parameterized Geometries: A Dataset for Data-Driven Turbulence Modeling From Direct Simulations”, *Computers & Fluids*, vol. 200, 104431, 2020.
- J.-X. Wang, J. Huang, and L. Duan, and H. Xiao, “Prediction of Reynolds Stresses in High-Mach-Number Turbulent Boundary Layers using Physics-Informed Machine Learning”, *Theoretical and Computational Fluid Dynamics*, vol. 33, Issue 1, pp. 1-19, 2019.
- L. Duan, M. M. Choudhari, A. Chou, F. Munoz, R. Radespiel, T. Schilden, W. Schroeder, E. C. Marineau, K. M. Casper, R. S. Chaudhry, G. V. Candler, K. A. Gray, and S. P. Schneider, “Characterization of Freestream Disturbances in Conventional Hypersonic Wind Tunnels”, *Journal of Spacecraft and Rockets*, Vol. 56, No. 2, pp. 357-368, 2019.
- C. Zhang, L. Duan and M. M. Choudhari, “Direct Numerical Simulation Database for Supersonic and Hypersonic Turbulent Boundary Layers”, *AIAA Journal*, vol. 56, No. 11, pp. 4297-4311, 2018

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics
- American Physical Society
- American Society of Mechanical Engineers
- Society for Industrial and Applied Mathematics

Datta V. Gaitonde

Professor, Mechanical and Aerospace Engineering Glenn Chair/Ohio Research Scholar

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Education

- B.Tech: Mechanical Engineering, Indiana Institute of Technology, Bombay, 1983
- MS: Mechanical and Aerospace Engineering, Rutgers University, 1986
- PhD: Mechanical and Aerospace Engineering, Rutgers University, 1989

Academic experience

- 2010- Present: Professor of Aerospace Engineering, The Ohio State University

Non-academic experience

- 1997-2010: Air Force Research Laboratory, Principal Aerospace Engineer, Technical Area Leader (High-Speed Flows), Wright-Patterson Airforce Base
- 1989-1997: Research Scientist, UES, Inc. and Ohio Aerospace Institute, Wright-Patterson Airforce Base

Related teaching experience

- Hypersonic Flows
- Advanced Computational Fluid Dynamics

Related curriculum development

- Hypersonic Flows
- Advanced Computational Fluid Dynamics

Honors and awards

- Outstanding Professor, Aerospace Engineering (2011, 2016, 2017)
- Gerald M Gregorek Outstanding Teaching Award (2021)
- AIAA Thermophysics Award (2010)
- USAF Exemplary Service Award (2011)
- Affiliate Societies Council: Outstanding Professional Achvmt Award, Research (2007)
- Gen. Benjamin Foulois Award (2000, 2007)
- AIAA Outstanding Technical Contribution Award (2003),
- AIAA: Best Paper Award (2002- Plasmadynamics, 2014 - Air Breathing Prop. Award)
- ASME Robert Knapp Best Paper Award (2015)

Related Department, College, and University committees and leadership positions

- Associate Chair, Aerospace Engineering (2015-2016)
- Promotion and Tenure Committee Chair (2014-2016)
- Promotion and Tenure Committee Member (2013-2014)
- Faculty Search Committee(s)

Principal publications (Most significant during last 5 years)

- Gaitonde, D.V. and Adler, M.C., 2022. Dynamics of Three-Dimensional Shock-Wave/Boundary-Layer Interactions. Annual Review of Fluid Mechanics, 55.
- Miotto, R., Wolf, W., Gaitonde, D. and Visbal, M., 2022. Analysis of the onset and evolution of a dynamic stall vortex on a periodic plunging aerofoil. Journal of Fluid Mechanics, 938.

- Stahl, S.L., Prasad, C. and Gaitonde, D.V., 2021. Distinctions between single and twin impinging jet dynamics. *The Journal of the Acoustical Society of America*, 150(2), pp.734-744
- Unnikrishnan, S. and Gaitonde, D.V., 2020. Linear, nonlinear and transitional regimes of second-mode instability. *Journal of Fluid Mechanics*, 905.
- Shinde, V., McNamara, J. and Gaitonde, D., 2020. Control of transitional shock wave boundary layer interaction using structurally constrained surface morphing. *Aerospace Science and Technology*, 96, p.105545.
- Riley, L.P., Gaitonde, D.V., Hagenmaier, M.A. and Donbar, J.M., 2018. Isolator dynamics during unstart of a dual-mode scramjet. *Journal of Propulsion and Power*, 34(6), pp.1409-1427.
- Stack, C.M. and Gaitonde, D.V., 2018. Shear layer dynamics in a supersonic rectangular multistream nozzle with an aft-deck. *AIAA Journal*, 56(11), pp.4348-4360.
- Goparaju, H., Unnikrishnan, S. and Gaitonde, D.V., 2021. Effects of nose bluntness on hypersonic boundary-layer receptivity and stability. *Journal of Spacecraft and Rockets*, 58(3), pp.668-684.
- Ranjan, R. and Gaitonde, D., 2020. Hysteresis in slanted-base-cylinder afterbody flows. *Aerospace Science and Technology*, 106, p.106138.

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics
- American Society of Mechanical Engineers

John Horack

Professor, Mechanical and Aerospace Engineering

Professor, John Glenn College of Public Affairs

Neil Armstrong Chair in Aerospace Policy

Phone: 256.665.3356

E-Mail: horack.1@osu.edu

Education

- BS: Physics and Astronomy, Northwestern University, 1987
- MS: Astrophysics, University of Alabama in Huntsville, 1992
- PhD: Astrophysics, University of Alabama in Huntsville, 1993

Academic experience

- 2019-2022: Senior Associate Dean of Engineering, The Ohio State University
- 2016- Present: Professor, Department of Mechanical and Aerospace Engineering, The Ohio State University
- 2016- Present: Professor, John Glenn College of Public Affairs, The Ohio State University
- 2009-2012: Vice President for Research, and Associate Professor of Physics with Tenure, University of Alabama in Huntsville

Non-academic experience:

- 2012-2015: Teledyne Brown Engineering, Vice President for Space Systems, Huntsville, Alabama
- 2005- 2009: Director of the Science and Mission Systems Office, NASA/Marshall Space Flight Center, NASA
- 2000-2005: Co-Founder, President, and Chief Product Architect, Mobular Technologies, INC.
- 1987-2000: Research Scientist, High-Energy Astrophysics, NASA/Marshall Space Flight Center, NASA

Related teaching experience

- Advanced Space Propulsion

Related curriculum development

- Advanced Space Propulsion

Honors and awards

- Associate Fellow, American Institute of Aeronautics and Astronautics (AIAA) (2022)
- Fellow, Royal Aeronautical Society (2021)
- NASA Exceptional Achievement Medal (2008)
- University of Alabama in Huntsville: Alumni of Achievement Award (2007)
- University of Alabama in Huntsville: College of Science Distinguished Alumnus (2006)

Related Department, College, and University committees and leadership positions

- Program Director, Keystone Space Collaborative Board Member (2022 - present) External Advisory Board, Edison Welding Institute (2020-present)
- Ohio Aviation and Aerospace Technology Committee (State of Ohio, 2020 - present)
- Member, Ohio State University Distinguished Teaching Award Selection Committee (2020 - present)
- Chair, Mechanical and Aerospace Engineering Diversity Committee (2016-2021)

- Ohio State University International Opportunities Committee (2017-present)
- Vice President and Member of the Bureau, International Astronautical Federation (2014-2021)

Principal publications (Most significant during last 5 years)

- J. M. Horack, "Development of the Burst and Transient Source Experiment," NASARP-1268, (1991)
- C. A. Meegan, G. J. Fishman, R. B. Wilson, W. S. Paciesas, G. N. Pendleton, J. M. Horack, M. N. Brock, C. Kouveliotou, "Spatial Distribution of Gamma-Ray Bursts Observed by BATSE," *Nature*, 355, p. 143, (1992)
- J. M. Horack, C. A. Meegan, G. J. Fishman, W. S. Paciesas, M. N. Brock, G. N. Pendleton, "Effects of Location Uncertainties on the Observed Angular Distribution of Gamma-Ray Bursts Detected By BATSE," *Astrophysical Journal*, 413, p.293-297, (1993)
- J. M. Horack, T. M. Koshut, R. S. Mallozzi, S. D. Storey, A. G. Emslie, "Implications of the BATSE data for a Heliocentric Origin of the Gamma-Ray Bursts," *Astrophysical Journal*, 429, 319, (1994)
- J. M. Horack, A. G. Emslie, & C. A. Meegan, "Constraints on the Luminosity Function of Gamma-Ray Bursts Detected by BATSE," *Astrophysical Journal Letters*, 426, L5, (1994)
- G. J. Fishman, P. N. Bhat, R. S. Mallozzi, J. M. Horack, et. al, "Discovery of Intense Gamma-Ray Flashes of Terrestrial Origin," *Science*, 264, 1313, (1994)
- J. M. Horack, A. G. Emslie, T. M. Koshut, R. S. Mallozzi, C. A. Meegan, "The Compatibility of Friedmann Cosmological Models With Observed Properties of GammaRay Bursts and a Large Hubble Constant," *Astrophysical Journal*, 472, 25, (1996)
- C.W. F. Everitt, B. Muhlfelder, D. B. DeBra, et al. "The Gravity Probe B test of general relativity." *Classical and Quantum Gravity*. Vol. 32, 22 (2015)
- Eckardt, J. M. Horack, F. Lehmann, et al. "DESI (DLR Earth Sensing Imaging Spectrometer for the ISS-MUSES Platform)." 2015 IEEE International Geoscience and Remote Sensing Symposium (IGARSS). Vol. 1 (2015): 1457-1459.

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics
- Royal Aeronautical Society
- International Aeronautical Federation
- American Association for the Advancement of Sciences

Mrinal Kumar

Professor, Mechanical and Aerospace Engineering

Phone: (614) 292-5027

E-Mail: kumar.672@osu.edu

Education

- B.Tech: Aerospace Engineering, Indian Institute of Technology, Kanpur, India, 2004
- PhD: Aerospace Engineering, Texas A&M University, 2009

Academic experience

- 2023- Present: Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2016- Present: Associate Professor, Mechanical and Aerospace Engineering, The Ohio State University
- 2022-Present: Elizabeth Martin Tinkham Endowed Professor of Aeronautical and Astronautical Engineering
- 2010- 2016: Assistant Professor, Mechanical and Aerospace Engineering, University of Florida
- 2009- 2010: Post-doctoral Fellow, Aerospace Engineering, Texas A&M University

Non-Academic Experience

- 2020- Present: Founding Member and Chief Technology Officer, PointPro Inc.

Related Teaching Experience

- Advanced Mathematical Methods
- Random Dynamic Systems

Related Curriculum Development

- Foundational Astronautics
- Advanced Mathematical Methods
- Random Dynamic Systems

Honors and Awards

- Elizabeth Martin Tinkham Endowed Professor of Aeronautical and Astronautical Engineering (2022-2027)
- Associate Fellow of the American Institute of Aeronautics and Astronautics (2020)
- Gerald M. Gregorek Excellence in Teaching Award (2020)
- Finalist in AIAA GNC Best Graduate Student Paper Competition (advised Ph.D. students) (2021, 2022)
- Air Force Research Lab Summer Faculty Fellow (2019-2020)
- AIAA Sensor System and Information Fusion Best Paper Award (2019)
- AFOSR Young Investigator Award (2015)
- NSF CAREER Award (2013)
- Best Paper in Session Award at AIAA GNC Conference (2012)
- AIAA Open Topic Research Award (2007)
- George Bush Presidential Library Foundation Travel Grant (Texas A&M University) (2007)
- Best Paper in Conference at the AIAA/AAS Astrodynamics Specialist Conference (2006)

Related Department, College, and University committee and leadership positions

- Teaching Mentor Program for Junior Faculty (2021- Present)
- Undergraduate Studies Committee Member (2020- Present)
- Ph.D. Qualifying Exam Committee Chair (Math, 2018-Present)
- Ph.D. Qualifying Exam Committee Chair (Aerospace Dynamics and Control, 2018-21)
- Junior Faculty Mentor (2022-Present)
- Aerospace Graduate Admissions Committee Chair (2017-2021)
- MAE Curriculum Revision Committee Member (Dec 2018 – 2020)
- Graduate Studies Committee Member (2016- 2021)
- Faculty Search Committee Chair, Autonomous Aerospace Systems (Aug 2021-2022)
- Faculty Search Committee Member (2016- 2017)

Principal Publications (Most significant during last 5 years)

- Ford, B., Aggarwal, R., Kumar, M., Manyam, S.G., Casbeer, D., and Grymin, D., “Backtracking Hybrid A* for Resource Constrained Path Planning”, *AIAA Journal of Guidance, Control and Dynamics*, under review
- Cortez, A., Ford, B., Nayak, I., Narayanan, S. and Kumar, M., “Hybrid A* Path Search with Resource Constraints and Dynamic Obstacles”, *Frontiers in Aerospace Engineering, Sp. Issue on Enabling Tech. for Advanced Air Mobility*, accepted
- VanFossen, A., and Kumar, M., “Efficient Forecasting for High Dimensional Nonlinear Dynamic Systems in Adaptive Monte Carlo”, *IEEE Access*, under review
- Aggarwal, R., Soderlund, A., Kumar, M. and Grymin, D. J., “Risk-Aware Path Planning for Unmanned Aerial Systems in a Spreading Wildfire”, *AIAA Journal of Guidance, Control and Dynamics*, Vol. 45, No. 9, Sep 2022, pp. 1692-1708
- Soderlund, A. and Kumar, M., “Estimating the Spread of Wildfires via Evidence-based Information Fusion,” *IEEE Transactions on Control Systems Technology*, 2022, doi: 10.1109/TCST.2022.3183645
- Keil, R. E., Kumar, M. and Rao, A. V., “Warm Start Method for Solving Chance Constrained Optimal Control Problems Using Biased Kernel Density Estimators”, *Journal of Dynamic Systems, Measurement, and Control*, Vol. 143, Issue 12, December 2021, pp. 124502: <https://doi.org/10.1115/1.4052173>
- Nayak, I., Kumar, M. and Teixeira, F., “Detection and prediction of equilibrium states in kinetic plasma simulations via mode tracking using reduced-order dynamic mode decomposition”, *Journal of Computational Physics*, Vol. 447, 15 December 2021, pp. 110671: <https://doi.org/10.1016/j.jcp.2021.110671>
- Aggarwal, R., Kumar, M., Keil, R. E. and A. V. Rao “Chance-constrained path planning in narrow spaces for a Dubins vehicle”, *International Robotics & Automation*, Vol. 7, Issue 2, July 2021, pp. 46-61

Membership in Professional Organizations

- American Institute of Aeronautics and Astronautics (AIAA) – Associate Fellow
- Institute of Electrical and Electronics Engineers (IEEE) - Member

Randall M. Mathison

Associate Professor, Mechanical and Aerospace Engineering

Phone: (614) 636-0293

E-Mail: mathison.4@osu.edu

Education

BS: Mech. Engr., Iowa State University, 2002

MS: Mech. Engr., The Ohio State University, 2004

PhD: Mech. Engr., The Ohio State University, 2009

Academic experience

- 2019 – Present: Associate Professor, Mechanical and Aerospace Engineering, OSU
- 2013-- 2019: Assistant Professor, Mechanical and Aerospace Engineering, OSU
- 2009 – 2013: Senior Research Engineer, Gas Turbine Laboratory, OSU
- 2013-- 2019: Assistant Professor of Mechanical and Aerospace Engineering, OSU
- 2019 – Present: Associate Professor of Mechanical and Aerospace Engineering, OSU

Related Teaching Experience

- Stability and Control of Flight (Sp 2017, Sp 2019)
- Flight Vehicle Dynamics (Au 2017)
- Robust Control with Applications (Au 2017)
- Random Dynamical Systems (Sp 2018, Sp 2020)
- Advanced Mathematical Methods (Au 2018, Au 2019)
- Orbital Mechanics for Engineers (Au 2019, Au 2020)

Related Curriculum Development

- Advanced Mathematical Methods
- Random Dynamical Systems
- Introduction to Random Dynamical Systems

Honor and awards

- Fellow of ASME (2021)
- The Ohio State University College of Engineering Lumley Research Award (2019)
- ASME International Gas Turbine Institute Dillip R. Ballal Early Career Engineer Award (2017)
- IGTI/ASME Heat Transfer Committee Best Paper Award (2010, 2007)

Service activities (within and outside of the institution)

- Graduate Admissions Committee (2014- present)
- Undergraduate Recruiting Committee (2013-2014)
- Curriculum Revision Committee Chair (2017- present)
- Aerospace Strategic Planning Steering Committee, member (2018- present)
- Graduate Studies Committee (2019-2017)
- Aerospace Engineering Curriculum Committee, member (2013-2016)
- Advisor for senior design team working on US Air Force Aerospace Propulsion Outreach Project (2013- present)

Principal Publications (Most significant during last 5 years)

- Sperling, S. and Mathison, R.M., "Time-Accurate Evaluation of Film Cooling Jet Characteristics for Plenum and Crossflow Coolant Supplies," *Journal of Thermal Science and Engineering Applications*. April 2022, 14(4):041007.
- Christensen, L.E., Celestina, R.A., Sperling, S.J., Mathison, R.M., Aksoy, H., Liu, J.S. "Infrared Temperature Measurements of the Blade Tip for a Turbine Operating at Corrected Engine Conditions", *J. Turbomach.* October 2021, 143(10): 101005. doi: 10.1115/1.4050675
- Nickol, J.B., Mathison, R.M., Dunn, M.G., Liu, J.S., Malak M.F., "Unsteady Heat Transfer and Pressure Measurements on the Airfoils of a Rotating Transonic Turbine With Multiple Cooling Configurations", *J. Eng. Gas Turbines Power*. April 2017, 139(9):092601-092601-10. doi: 10.1115/1.4036059
- Nickol, J.B., Mathison, R.M., Dunn, M.G., Liu, J.S., Malak M.F., "An Investigation of Coolant Within Serpentine Passages of a High-Pressure Axial Gas Turbine Blade", *J. Turbomach.* April 2017, 139(9):091006-091006-8. doi: 10.1115/1.4036109

Current membership in professional organizations

- American Society of Mechanical Engineers
- American Society for Engineering Education
- American Institute of Aeronautics and Astronautics

Sandip Mazumder

Professor, Mechanical and Aerospace Engineering

Phone: 614.247.8099

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Education

- B.Tech: IIT- Kharagpur, 1991
- MS: Mechanical Engineering, Penn State, 1993-
- PhD: Mechanical Engineering, Penn State, 1997

Academic experience

- 2021-Present: Professor and Associate Chair of Administration, Department of Mechanical and Aerospace Engineering, The Ohio State University
- 2018-2021: Professor, Department of Mechanical and Aerospace Engineering, The Ohio State University
- 2010-2018: Associate Professor (with Tenure), Department of Mechanical and Aerospace Engineering, The Ohio State University
- 2004-2010: Assistant Professor (Tenure Track), Department of Mechanical and Aerospace Engineering, The Ohio State University

Non-academic experience

- 2003-2004: Manager, CFD Research Corporation in Huntsville, AL
- 2001-2002: Group Leader, CFD Research Corporation in Huntsville, AL
- 1999-2000: Senior Engineer, CFD Research Corporation in Huntsville, AL
- 1997-1998, Project Engineer, CFD Research Corporation in Huntsville, AL

Related teaching experience

- Intermediate Heat Transfer
- Intermediate Numerical methods
- Computational Fluid Dynamics

Honors and awards

- Exemplary Service Award as Associate Editor for ASME Journal of Thermal Science and Engineering Applications (2021)
- Distinguished Graduate Faculty Award, OSU Department of Mechanical and Aerospace Engineering (2019)
- Certificates of Outstanding Contributions as Reviewer from Journal of Quantitative Spectroscopy and Radiative Transfer (2017), International Journal of Heat and Mass Transfer (2017), and International Journal of Thermal Sciences (2018)
- First Place, Flash Talk Presentation Contest, Ohio Supercomputer Center's Statewide User Group Meeting (2017)
- Lumley Research Award, OSU College of Engineering (2017)
- David C. McCarthy Teaching Award, OSU College of Engineering, (2014, 2022)
- Michael J. Moran Teaching Excellence Award, OSU Department of Mechanical and Aerospace Engineering, (2013)
- Fellow of the American Society of Mechanical Engineers (ASME) (2011-)
- Second Place (co-author to student Derek Endres), Young Engineer Paper Award, ASME Fluids Engineering Division (2011)
- Access Award from Office of Disability Services, Ohio State University (2008)

- Inducted as an Honorary Member into TEXNIKOI, a society of engineering students at Ohio State
- Listed in Marquis Who's Who in America, 56th Edition.
- Phi Kappa Phi Honor Society Fellow
- Graduate Fellow, The Pennsylvania State University (1995-1996)
- Research/Teaching Assistantship from Penn State University (1992-1995)
- All India top scorer in Mathematics in Indian School Certificate Examination (1987)

Related Department, College, and University committees and leadership positions

- Associate Chair (Administration) (2021-present)
- AE of Journal of Thermal Science and Engineering Applications; Editorial Board of Energies.
- Chair of the Computational Heat Transfer committee of the ASME, 2018-2021.

Principal publications (Most significant during last 5 years)

- *Radiative Heat Transfer*, 4th Edition, M. F. Modest and S. Mazumder, 2021, Academic Press, ISBN: 978- 0323984065
- "On the Determination of Thermal Conductivity from Frequency Domain Thermoreflectance Experiments," (2022), S. Saurav and S. Mazumder, Journal of Heat Transfer, Vol. 144, p. 013501.
- "Development and Validation of a Model for Efficient Simulation of Freezing of Water in Large Tanks," (2021), V. Ramesh, S. Terala, S. Mazumder, G. Matharu, D. Vaishnav, and S. Ali, ASME Journal of Thermal Science and Engineering Applications, Vol. 13, Paper no. 011008.
- "Modeling Hydrogen Chloride and Aluminum Surface Interactions for Spacecraft Fire Safety Applications," (2020), J. Niehaus, S.A. Gokoglu, G. Berger, J. Easton, and S. Mazumder, AIAA Journal of Spacecraft and Rockets, Vol. 57(2), pp. 217-224.
- "Application of a variance reduction technique to Surface-to-Surface Monte Carlo radiation exchange calculations," (2019), S. Mazumder, International Journal of Heat and Mass Transfer, Vol. 131, pp. 424-431.
- Comparative assessment of deterministic approaches to modeling quasiballistic phonon heat conduction in multi-dimensional geometry," (2018), P. Allu and S. Mazumder, International Journal of Thermal Sciences, Vol. 127, pp. 181-193.

Current membership in professional organizations

- American Society of Mechanical Engineers
- American Association for the Advancement of Science
- American Society of Thermo-Fluids Engineers

Matthew McCrink

Assistant Research Professor, Mechanical and Aerospace Engineering

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E-Mail: mccrink.2@osu.edu

Education

- BS: Mechanical Engineering, Boise State University, 2007
- MS: Mechanical Engineering, Boise State University, 2009
- PhD: Aero. and Astro. Engr., The Ohio State University, 2015

Academic experience

- 2016-2021: Research Scientist, Aerospace Research Center, The Ohio State University
- 2010-2016: Post-Doc and Research Assistant, The Ohio State University
- 2005-2010: Research Assistant, Boise State University

Non-Academic experience

- 2007-2008: Research Engineer, Sandia National Laboratories

Related Teaching Experience

- Aircraft Performance and Flight Test Engineering

Related Curriculum Development

- Aircraft Performance and Flight Test Engineering

Honor and awards

- Charles F. Kettering Aerial Torpedo "Bug" Award for Autonomous Systems Design (2018)
- Society of Flight Test Engineers Best Paper Award (2018)
- Absolute World Record for Speed and Distance for an Autonomous Vehicle, FAI (2017)
- FAA ASSURE Center of Excellence Student of the Year (2015)
- Best presentation, Dayton-Cincinnati Aerospace Science Symposium (2011)
- Best student paper award IMAPS conference (2009)
- College of Engineering Student Choice Award for Excellence (2009)
- First place finish in Oral presentation at Aero Design West (2009)
- Engineering Honors Society board member (2007-Present)
- ASME Old Guard Oral presentation first place finish in the northwest district (2006)
- ASME Old Guard Oral fourth place finish at the national convention (2006)

Department, College, and University Committees and Leadership Positions

- Primary faculty mentor for Design Build Vertical Flight team (2019-present)
- Faculty mentor for AIAA Design Build Fly team (2015-present)

Principal Publications (Most significant during last 5 years)

- Zhu, W, McCrink, MH, Bons, JP, and Gregory, JW, 2020, "The unsteady Kutta condition on an airfoil in a surging flow," Journal of Fluid Mechanics, v. 893, n. R2. doi: 10.1017/jfm.2020.254. IF 3.137

- McCrink, Matthew H., and James W. Gregory. "Design and Development of a High-Speed UAS for beyond Visual Line-of-Sight Operations." *Journal of Intelligent & Robotic Systems* 101.2 (2021): 1-16.
- Wang, Z.; Henricks, Q.; Zhuang, M.; Pandey, A.; Sutkowy, M.; Harter, B.; McCrink, M.; Gregory, J. Impact of Rotor–Airframe Orientation on the Aerodynamic and Aeroacoustic Characteristics of Small Unmanned Aerial Systems. *Drones* 2019, 3, 56.
- Stark, David B., Arrianna K. Willis, Zach Eshelman, Yun-Seok Kang, Rakshit Ramachandra, John H. Bolte IV, and Matthew McCrink. *Human response and injury resulting from head impacts with unmanned aircraft systems*. No. 2019-22-0002. SAE Technical Paper, 2020.
- Valasek, John, Joshua Harris, Shawn Pruchnicki, Matthew McCrink, James Gregory, and David G. Sizoo. "Derived Angle of Attack and Sideslip Angle Characterization for General Aviation." *Journal of Guidance, Control, and Dynamics* 43, no. 6 (2020): 1039-1055.
- Semke, W., Allen, N., Tabassum, A., McCrink, M., Moallemi, M., Snyder, K., & Wing, M. G. "Analysis of Radar and ADS-B Influences on Aircraft Detect and Avoid (DAA) Systems", *Aerospace*, Vol. 4 Iss. 3, pg 1-49. DOI: 10.3390/aerospace4030049
- Gregory, JW and Liu, T, 2021, Introduction to Flight Testing, submitted to John Wiley & Sons on September 7, 2020. Published July 16, 2021. Co-Author on Autonomous Systems Flight Testing chapter.
- McCrink, Matthew H., Seth, D., and Herz, S., "Flight Test Measurement of Quadrotor Performance at Varying Sideslip Angles", *Vertical Flight Society Forum* 78, 2022.
- McCrink, Matthew H., Seth, D., and Herz, S., "Quadrotor Performance Measurement during Wake and Gust Encounters", *AIAA AVIATION 2022 Forum (AIAA 2022-4064)*. 2022. doi: 10.2514/6.2022-4064
- Bensignor, Isaac, Dhuree Seth, and Matthew McCrink. "Rotor Propulsion Modeling for Low Reynolds Number Flow ($Re < 105$) for Martian Rotorcraft Flight." *AIAA AVIATION 2022 Forum (AIAA 2022-3958)*. 2022. doi: 0.2514/6.2022-3958

Current membership in professional organizations

- Senior member AIAA, Member of General Aviation TC and Unmanned Systems and Unmanned Systems Integration and Outreach Committee, reviewed 10+ journal papers
- Vertical Flight Society Member
- Honorary member Society of Flight Test Engineers
- IEEE Member, reviewed 10+ journal papers

Jack J. McNamara

Professor, Mechanical and Aerospace Engineering

Phone: (614) 292-6778

E-Mail: mcnamara.190@osu.edu

Education

- BS: Aero. Engr., University of Michigan, 1999
- MS: Aero. Engr., University of Michigan, 2000
- PhD: Aero. Engr., University of Michigan, 2005

Academic experience

- 2006 - 2012: Assistant Professor of Mechanical & Aerospace Engineering, OSU.
- 2012 - 2018: Associate Professor of Mechanical & Aerospace Engineering, OSU.
- 2018 – Present: Professor of Mechanical & Aerospace Engineering, OSU.

Non-Academic experience

- 2007, 2009-2011, 2013, 2021: Summer Faculty Fellow, Air Force Research Laboratory, WPAFB, OH

Related teaching experience

- Structural Dynamics and Aeroelasticity of Aerospace Vehicles

Related curriculum development

- Structural Dynamics and Aeroelasticity of Aerospace Vehicles

Honor and awards

- IDA Defense Science Study Group, 2014-2015
- Lumley Engineering Research Award, OSU, 2015
- Royal Aeronautical Society Silver Award, 2011
- AFOSR Young Investigator Award, 2011
- AIAA/SGT Outstanding Teaching Award, OSU, 2008
- ASME/Boeing Structures and Materials Award, 2004
- NASA GSRP Fellowship, 2001-2004
- Tau Beta Pi, 1999
- Sigma Gamma Tau, 1996

Service activities (within and outside of the institution)

- Promotion & Tenure Committee, Mechanical & Aerospace Engineering (2022- Present)
- Graduate Studies Committee, Mechanical & Aerospace Engineering (2016-2022)
- Graduate Studies Committee, Aerospace Engineering, (2006-2013)
- Undergraduate Recruitment Committee, Mechanical & Aerospace Engineering (2012-2013)
- AIAA Student Chapter Faculty Advisor (2007-2015)
- Undergraduate Studies Committee, Aerospace Engineering (2006-2010, 2014-2016)
- Computer Committee, Mechanical & Aerospace Engineering (2011-Present)
- Faculty Search Chair, Clinical Position in Aerospace Engineering (2012)
- Faculty Search Committee (2014-2015, 2016)
- Faculty Search Co-Chair, Computational Mechanics (2012-2013)
- Honors Committee, College of Engineering (2007-2009)

- Space Allocation Committee, Mechanical & Aerospace Engineering (2014-2016)
- Academic Standards & Progress Committee, College of Engineering (2006-2009)

Principal Publications (Most significant during last 5 years)

- Thayer, J., McNamara, J. and Gaitonde, D., “Numerical Investigation of a Turbulent High-Speed Flow Separating from a Deforming Cantilever Plate,” AIAA Journal (in press)
- Shinde, V., McNamara, J., and Gaitonde, D., “Dynamic Interaction Between Shock Wave Turbulent Boundary Layer and Flexible Panel,” Journal of Fluids and Structures, V113, 2022. doi.org/10.1016/j.fluidstructs.2022.103660
- Becks, A., McNamara, J., and Gaitonde, D., “Linking Supersonic Boundary Layer Separation to Structural Deformation Using the Kármán-Pohlhausen Momentum-Integral Equation,” Physics of Fluids, V34, N8, 2022. doi.org/10.1063/5.0101269
- Shinde, V., Becks, A., Deshmukh, R., McNamara, J., Gaitonde, D., Neet, M., Austin, J., “Spatially Developing Supersonic Turbulent Boundary Layer Subjected to Static Surface Deformations,” European Journal of Mechanics -B/Fluids, 89:485-500, 2021. doi.org/10.1016/j.euromechflu.2021.07.002
- Shilt, T., O’Hara, P., and McNamara, J., “Stabilization of Advection Dominated Problems Through a Generalized Finite Element Method,” Computer Methods in Applied Mechanics and Engineering, 383, 2021. doi.org/10.1016/j.cma.2021.113889
- Dreyer, E., Grier, B., McNamara, J., and Orr, B., “Rapid Steady-State Hypersonic Aerothermodynamic Loads Prediction Using Reduced Fidelity Models,” Journal of Aircraft, 58(3):663-676, 2021. doi.org/10.2514/1.C035969
- Shinde, V., Gaitonde, D., and McNamara, J., “Supersonic Turbulent Boundary Layer Separation Control Using a Morphing Surface,” AIAA Journal, 59(3):912-926, 2021. doi.org/10.2514/1.J059773-
- Currao, G., McQuellin, L., Neely, A., Sudhir, G., O’Byrne, S., Zander, F., Buttsworth, D., McNamara, J., Jahn, I., “Hypersonic Oscillating Shock-Wave/Boundary-Layer Interaction on a Flat Plate,” AIAA Journal, 59(3):940-959, 2021. doi.org/10.2514/1.J059590
- Boyer, N., McNamara, J., Gaitonde, D., Barnes, C., and Visbal, M., “Features of Shock-Induced Panel Flutter in Laminar and Transitional Flow Conditions,” Journal of Fluids & Structures, 101, 2021. doi.org/10.1016/j.fluidstructs.2020.103207
- Shilt, T., O’Hara, P., Deshmukh, R., and McNamara, J., “Solution of Nearly Incompressible Field Problems Using a Generalized Finite Element Approach,” Computer Methods in Applied Mechanics and Engineering, V38, N15, August 2020, <https://doi.org/10.1016/j.cma.2020.113165>

Current membership in professional organizations

- Associate Fellow, American Institute of Aeronautics and Astronautics

Golnaz Mirfernderesgi

Assistant Professor of Practice, Mechanical and Aerospace Engineering

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Education

- *BSE: Civil. Engr., Isfahan University of Technology, 2008*
- *MSE: Civil. Engr., AmirKabir University of Technology, 2011*
- *PhD: Civil. Engr., Ohio State University, 2017*

Academic Experience

- 2017-2018: Postdoctoral Fellow, Civil Engineering, OSU
- 2018-2023: Assistant Professor of Practice, OSU.

Non-Academic Experience

- Organization for Development, Renovation and Equipping schools of I.R. IRAN, Summer 2007
- Tara Tahlil Saze Consulting Summers 2006 & 2007
- Saraman Isfahan, Summer 2008

Related teaching experience

- Numerical Methods in Aerospace Engineering

Related curriculum development

- Numerical Methods in Aerospace Engineering

Certificate or Professional Registrations

- Course Design Institute, Michael V. Drake Institute for Teaching and Learning Course Design Institute, Ohio State University, 2022
- Scientific Teaching Fellow, Mobile Institute for Scientific Teaching (MOSI), 2022
- Inclusive Excellence Community Building Workshop Series, College of Engineering, Ohio State University, 2022
- Earthquake-Safe Housing, Bergische Universität Wuppertal (BUW), 2007

Current Membership in Professional Organizations

- Membership in societies: ASEE (Fellow), Engineering Unleashed (KEEN)
- Membership in committees: ASEE Engineering Design Graphics Division (EDGD) Committee

Honor and Awards

- Redfield-Merry Scholarship Travel Award, Department of Civil, Environmental & Geodetic Engineering, The Ohio State University, 2015
- Keith W. Bedford Travel Grant, Department of Civil, Environmental & Geodetic Engineering, The Ohio State University, 2014
- Student Volunteer Award, AGU Fall meeting, 2014.

- DAAD Travel Grant for Earthquake-Safe Housing Project, Bergische Universität Wuppertal (BUW), 2007

Service Activities (within and outside of the institution)

- OSU MAE Departmental Committees: Undergrad Studies Committee, member (2022- present); Mechanics of Materials and Aerospace Engineering Qualifying Exam, member (2020-present), and chair (2022-present); FAST class, panelist (2020-present); Course Coordinator for Statics and Mechanics of Materials (ME2040) (2020-present); Course Coordinator for Numerical Methods for Mechanical Engineering (ME2850) (2022- present).
- Conference Organization: ASEE Annual Conference (session chair, reviewer)
- Outreach and Diversity Equity and Inclusion Programs: Judge for the Ohio Academy of Science's State Science Day (Outreach program)

Principal Publications (Most significant during last 5 years)

- **Mirfenderesgi, G.**, Bohrer, G., Matheny, A.M (2018), "Hydrodynamic Trait Coordination and Cost-Benefit Tradeoffs throughout the Isohydic-Anisohydric Continuum in Trees", *Ecohydrology*, 12, doi:10.1002/eco.204.
- Rey-Sánchez, C., Bohrer, G., Morin, T. H., Sclomo, D., **Mirfenderesgi, G.**, Gildor, H., Genin, A, (2017), "Evaporation and CO2 flux in a coastal reef lagoon: Comparing eddy covariance measurements to model estimates", *Ecosystem Health and Sustainability*, 3, doi: 10.1080/20964129.2017.1392830
- J.C. Angle¹, T.H. Morin, G.J. Smith, L.M. Solden, A.B. Narrowe, M.A. Borton, R.A. Daly, D.W. Hoyt, A.C. Rey-Sanchez, **G. Mirfenderesgi**, W.R. Riley, C.S. Miller, G. Bohrer, K.C. Wrighton, (2017), "Methanogenesis in oxygenated soils is a substantial fraction of wetland methane emissions", *Nature Communications*, doi: 10.1038/s41467- 017-01753-4.

Professional Development Activities

- Regularly participating in variety of teaching, mentoring, and diversity and outreach training sessions, programs, and conferences.
- Regularly keeping up with technical conferences and reads technical literature.

Giorgio Rizzoni

Professor, Mechanical and Aerospace Engineering

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Education

Ph.D. in Electrical and Computer Engineering from the University of Michigan, 1986

M.S. in Electrical and Computer Engineering from the University of Michigan, 1982

B.S. in Electrical and Computer Engineering from the University of Michigan, 1980

Academic Experience (Current positions held in **bold**.)

The Ohio State University at Columbus.

The Ford Motor Company Chair in Electromechanical Systems	2002 to present
Director and Senior Fellow, Center for Automotive Research	1999 to present
Professor of Mechanical Engineering	2000 to present
Professor of Electrical and Computer Engineering	2002 to present
Graduate Faculty, Nuclear Engineering	1995 to present
Graduate Faculty, Aerospace Engineering	2012 to present
Associate Professor, Mechanical Engineering	1995 to 2000
Assistant Professor, Mechanical Engineering	1990 to 1995

In addition, served as a short-term visiting professor/scholar at multiple institutions.

Visiting Professor, Politecnico di Milano and Politecnico di Torino	2007
Visiting Professor, Swiss Federal Institute of Technology (ETHZ)	1998
Visiting Research Scientist, Italian National Agency for Technology, Energy and the Environment (ENEA) at Bologna	1997
Visiting Lecturer, Research Scientist and Professor, Università di Bologna, Istituto di Macchine (DIEM), annually (except 1992)	1990 to 1997

University of Michigan at Ann Arbor.

Research Fellow, Assistant Research Scientist & Adjunct Lecturer, EECS	1986 – 1990
Assistant Director, Vehicular Electronics Laboratory	1986 – 1990

Scientific and Professional Society Memberships

IEEE (*Fellow*) • SAE (*Fellow*) • ASME (*Fellow*) • AAAS • ASEE

Selected Honors and Awards

From The Ohio State University:

College of Engineering Faculty Mentoring Award	2021
The Scott Faculty Award for Excellence in Engineering Education	2021
MAE Distinguished Graduate Faculty Award	2016
College of Engineering Lumley Interdisciplinary Research Award	2012/2002
College of Engineering Lumley Research Award	2010/2004/1999/1995
MAE Excellence in Teaching Award	2010/2005/1993
Stanley Harrison Award for Excellence in Engineering Education	1996

From University of Michigan:

Tau Beta Pi Outstanding Teaching Award	1990
College of Engineering Commendation for Excellence in Teaching	1988/1989/1990

From other sources:

Research Institute of Automotive Engineering & Powertrain Systems Stuttgart (FKFS) Medal of Merit	2017
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TechColumbus Innovation Awards Outstanding Technology Team	2011
NSF Outstanding Long-Term Faculty Advisor Award	2007
Columbus Technical Council Technical Person of the Year Award	1995
SAE Ralph R. Teetor Educational Award	1992
NSF Presidential Young Investigator	1991 – 1996

Selected Service Activities

Within The Ohio State University:

NSF Innovation Engine Proposal Lead	2021 – present
Smart Mobility/Advanced Air Mobility (ERIK) Lead	
COE Research Committee	2012 – present
MAE Promotion and Tenure Committee	2016 – present
MAE Graduate Program Qualifying Exam Committee	2012 – 2022
MAE Faculty Search Committee	2021 – 2022
Hydrogen Sister City proposal with Office of International Affairs	2022
Energy Advisory Group (ERIK)	2022-present
Ford Alliance, Cummins and CNHi Master Agreements	2013 – 2023
COE Strategic Planning Committee Research Lead	2021-2022
Center for Electron Microscopy & Analysis Advisory Committee	2016 – present
Electroscience Lab Director Search Committee	2023
Subsurface Energy Resources Center Advisory Committee	2013 – 2019

Outside of The Ohio State University:

IFAC Technical Committee on Automotive Control (Chair, Executive Committee)	2012 – present
SAE COMVEC Executive Committee, Publications Committee	2016 – present
ASME Dynamic Systems & Control Conference General Chair	2015
FKFS Board of Directors	2012 – present
Chair, Oak Ridge National Lab National Transportation Research Center External Advisory Board	2019 - present
Swedish Electromobility Center Board Member	2018 - present
USDRIIVE Vehicle Systems Analysis Technical Team	2013 – present

Selected Publications within the Past 5 Years (include 25 journal and 35 conference papers)

1. G. Rizzoni, J. Kearns, Principles and Applications of Electrical Engineering, McGraw-Hill, 2021 (7th ed).
2. G. Rizzoni, “Control of Hybrid and Electric Vehicles,” Encyclopedia of Systems and Control, June 2021, pp. 1761-1770.
3. T. Zhao, E. Yurtsever, J. Paulson, G. Rizzoni, “Formal Certification Methods for Automated Vehicle Safety Assessment,” IEEE Transactions on Intelligent Vehicles, January 2023, 8 (1), 232-249.
4. K. Khodadadi Sadabadi, P. Ramesh, Y. Guezennec, G. Rizzoni, “Development of an Electrochemical Model for a Lithium Titanate Oxide||Nickel Manganese Cobalt Battery Module,” Journal of Energy Storage, June 2022, 50, 104046.

Recent Professional Development Activities

Attended and organized ASME, SAE, IFAC, IEEE and NSF conferences, workshops & symposia.

Clifford A. Whitfield

Professor of Practice, Mechanical and Aerospace Engineering

Phone: 614.292.1057

E-Mail: Whitfield.22@osu.edu

Education

BS: Aero. and Astro. Engr., The Ohio State University, 2004

MS: Aero. and Astro. Engr., The Ohio State University, 2006

PhD: Aero. and Astro. Engr., The Ohio State University, 2009

Academic experience

- 2023-Present: Professor of Practice, Mechanical and Aerospace Engineering
- 2018-2023: Associate Professor of Practice, Mechanical and Aerospace Engineering
- 2013-2018: Assistant Professor of Practice, Mechanical and Aerospace Engineering
- 2009-2013: Lecturer, Engineering Education Innovation Center, OSU.
- 2009-2013: Senior Researcher, Aeronautical and Astronautical Research Laboratories

Non-academic experience

- 2005-Present: Owner and Design and Test Engineer, Whitfield Aerospace LLC

Related teaching experience

- Design of Atmospheric Flight Vehicles I and II
- Aircraft Performance and Flight Test Engineering
- Advanced Flight Vehicle Design
- Advanced Aerodynamics

Related curriculum development

- Advanced Aerodynamics
- Aircraft Performance and Flight Test Engineering
- Advanced Flight Mechanics
- Optimal Design for Aerospace Vehicles and Systems
- Design of Atmospheric Flight Vehicles sequence

Active Design and Testing Research

- Highly-maneuverable high-speed active flow control enabled aircraft design and experimental research
- High altitude solar-regenerative morphing aircraft design and experimental research
- Bioinspired design and experimental research for high aerodynamic efficient adaptive flight
- Hypersonic turbine based combined cycle novel aircraft design
- Rocket deployed aircraft design for rapid on-station response

Honors and awards

- Gerald M. Gregorek Excellence in Teaching Award, Mechanical and Aerospace Engineering Department, (2019, 2023)
- Outstanding Service Award from the Industry Advisory Board, Mechanical and Aerospace Engineering Department, (2018)
- Distinguished Undergraduate Research Mentor, Nomination, (2015)

- Aerospace Engineering Outstanding Professor of the Year. American Institute of Aeronautics and Astronautics OSU Student Chapter, (2014, 2015)
- Alumni Award for Distinguished Teaching, Nomination, (2012, 2013)

Related Department, College, and University committees and leadership positions

- Program Director, Aerospace Engineering; Mechanical and Aerospace Engineering (2019-2023)
- University Senator, The Ohio State University (2018-2021)
- Continuous Quality Improvement, Mechanical and Aerospace Engineering (2015-Present)
- Undergraduate Studies Curriculum, Mechanical and Aerospace Engineering (2015-Present)
- Curriculum Reform Committee, Mechanical and Aerospace Engineering (2019-2021)
- Strategic Planning Steering Committee (2018-2020)
- Undergraduate Recruitment and Outreach, Aeronautical and Astronautical Engineering (2014-2018)
- Outcomes Committee, College of Engineering (2015-2018, 2019-Present)

Principal publications (Most significant during last 5 years)

- Whitfield, C.A., Trussa, C.W., "Optimal Flight Path Analysis of Receiver Aircraft for In-Flight Rearming", AIAA Aviation Forum and Exposition, June 2022, ITAR Session Invite
- Trussa, C.W., Whitfield, C.A., Duan, L., "Aerodynamic Characteristics of a Flat Plate Delta Wing with Deflected Wing Tips", AIAA Aviation Forum and Exposition, June 2022
- Trussa, C.W., Whitfield, C.A. Brandon, J.A., McCrink, M.H., "Low-Speed Aerodynamic Characteristics of a Delta Wing with Rotated Wing Tips" AIAA Aviation Forum and Exposition, June 2021.
- Whitfield, C.A., Trussa, C.W., "Final Technical Analysis Report", Radiance Technologies Inc., Challenge 1 Air Force In-Flight Rearming and Refueling, AF Explore, Sponsored Project No. AWD-110243, August 2021.
- Whitfield, C.A., Trussa, C.W., "Recommendations and Development Plans", Radiance Technologies Inc., Challenge 1 Air Force In-Flight Rearming and Refueling, AF Explore, Sponsored Project No. AWD-110243, August 2021.
- Whitfield, C.A., Trussa, C.W., "Qualitative Analysis for Proposed Concepts", Radiance Technologies Inc., Challenge 1 Air Force In-Flight Rearming and Refueling, AF Explore, Sponsored Project No. AWD-110243, July 2021.
- Whitfield, C.A., Trussa, C.W., "Problem Definition and Operational Requirements", Radiance Technologies Inc., Challenge 1 Air Force In-Flight Rearming and Refueling, AF Explore, Sponsored Project No. AWD-110243, May 2021.

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics

Appendix C. Course Descriptions

Required Core Courses (9 credit hours)

AEROENG 5751 Advanced Air Breathing Propulsion

Practical design considerations for air-breathing engines focused on turbomachinery applications, with elements of high-speed propulsion. 3-credit hours. Topics include: review of cycle analysis; non-ideal cycle analysis; diffusers, nozzles, ducts, and mixers; compressors; turbines; combustors; and off-design matching.

AEROENG 6560 Advanced Aerodynamics (new)

Advanced elements of aerodynamics across the entire Mach number range including using fundamental aerodynamic analysis tools, developing advanced numerical analysis techniques, and best practices in wind tunnel testing. 3-credit hours. Topics include: review of linearized theory and similarity; airfoil characteristics; high altitude, high angles-of-attack; transonic drag rise and lift characteristics; supersonic and hypersonic lift and drag characteristics; applications of computational aerodynamics; and best practices in wind tunnel testing. Not yet approved.

AEROENG 7721 Advanced Flight Mechanics

Advanced elements of flight mechanics across the entire Mach range including access-to-space and atmospheric reentry, and analyzing full representative flight mission profile characteristics and wind tunnel and flight testing results. 3-credit hours. Topics include: overview of aircraft aerodynamics, propulsion, and performance; review of static stability and trim; aircraft maneuverability, handling qualities and control responses; flight simulations; adaptive flight maneuvering; model reduction methods; best practices in wind tunnel testing and flight testing.

Engineering Analysis Elective Courses (3-credit hours required)

AEROENG 6518 Applied Engineering Analytical Methods (new)

Basic principles and methods of engineering mathematics focused on the phases of problem solving: modeling, solving, and interpreting, with emphasis on understanding the interrelations among theory, computing, and experimentation. 3-credit hours. Topics include: ordinary differential equation; Laplace transforms; matrices and linear systems; vector algebra and calculus; Fourier series and partial differential equations; introduction to complex analysis; optimization; graphs and combinatorial optimization; and probability and statistics. Not yet approved.

MECHENG 6507 Intermediate Numerical Methods

Numerical techniques and computer algorithms to solve initial and boundary value problems relevant to engineering applications, such as heat conduction and mass diffusion. 3-credit hours. Topics include: finite-difference equations, errors in difference approximations, and application of boundary conditions; direct solution techniques; treatment of non-linearity; iterative solution techniques; convergence analysis, multi-grid methods and analysis; higher-order methods; irregular geometries; and finite-volume method and discretization on unstructured mesh.

Required Capstone Project Course (3-credit hours)

AEROENG 8900 Aerospace Engineering Experiential Learning Masters Project (new)

Independent capstone project in applied aeronautics focused on industry best practices with analytical estimations, data collection and analysis, and technical documentation. Faculty advisor and instructor consent required. 3-credit hours. Not yet approved.

Elective Courses (15 credit hours required)

Design and performance

AEROENG 5612 Aircraft Performance and Flight Test Engineering

Advanced elements of flight performance including developing flight operational envelopes, performing mission analysis, and developing flight testing procedures and analyzing flight test results. 3-credit hours. Topics include: the aircraft and its flight environment; flight envelopes, maneuvers; data acquisition techniques, uncertainty analysis techniques; airspeed calibration, engine performance and noise performance; best practices in flight testing: takeoff and landing, power required and drag, climb and glide, static and dynamic longitudinal stability, stalls; pre-flight and post-flight analysis and presentation.

AEROENG 5620 Stability and Control of Flight Vehicles

Analysis and design of aircraft flight control systems and the associated guidance and navigation systems. 3-credit hours. Topics include: aircraft flight dynamics, equations of motion; aircraft transfer functions, state-space models with trim conditions determinations; flight control systems, stability and control augmentation systems, autopilots; flying qualities; inertial sensors and attitude determination; disturbance modeling; aircraft longitudinal and lateral autopilot design; flight path and management control systems; inertial cross coupling; and introduction to multivariable flight control.

AEROENG 6645 Structural Dynamics and Aeroelasticity of Aerospace Vehicles

Fundamental Concepts of Structural Dynamics, Unsteady Aerodynamics, and Aeroelasticity of Aerospace Vehicles. 3-credit hours. Topics include: principles of structural dynamics; natural modes of vibrations for continuous systems; natural modes of vibrations for discrete systems; dynamic response and normal mode transformation; static aeroelasticity; dynamic aeroelasticity and flutter; unsteady aerodynamic topics; methods for flutter wing calculations; and advanced aeroelasticity concepts: supersonic/hypersonic aeroelasticity, rotary aeroelasticity, and computational aeroelasticity.

AEROENG 7616 Optimal Design for Flight Vehicles (new)

Introduction to the fundamentals and applications of multidisciplinary design analysis and optimization for aerospace vehicles and systems, including optimization under uncertainty. 3-credit hours. Topics include: engineering systems modeling for design, analysis, and optimization; selection of design variables, objective functions and constraints; overview of principles, methods and tools; system identification; introduction to multidisciplinary design analysis and optimization

methods; computational modeling and analysis; multi-objective optimization and Pareto optimality; and sensitivity, tradeoff analysis, goal programming and isoperformance. Not yet approved.

Propulsion and power

AEROENG 5752 Advanced Space Propulsion

Analysis of different propulsion techniques for access to space: liquid, solid, hybrid, nuclear and electric. 3-credit hours. Topics include: basic considerations, types of engines and fuels, applications; fundamentals, governing equations; rocket propulsion metrics; thermodynamics of nozzle flows; practical considerations, heat transfer; combustion chemistry; and rocket performance evaluation and analysis. New title; not yet approved.

MECHENG 7527 Jet Propulsion

Characteristics and performance of air breathing flight vehicle power plants and their components (inlets, compressors, combustors, turbines, and nozzles). 3-credit hours. Topics include: review of aircraft aerodynamics; principle and layout of jet engines, creation of thrust in a jet engine, component characteristics; gas turbine cycle; turbomachinery; fluid mechanics of compressible gases; selection of bypass ratio; dynamic scaling and dimensional analysis; off design engine matching; lift, drag, and the effects of maneuvering; civil and combat engine design and design points; special topics in aeropropulsion.

MECHENG 7250 Turbomachinery Dynamics

Modeling dynamics of rotating cyclic structures found in turbomachinery, including traditional analysis methods such as cyclic analysis and small mistuning, and recent developments in modeling large mistuning, multi-stage systems, and friction damping. 3-credit hours. Topics include: turbomachinery dynamics fundamentals; modal analysis and model reduction; cyclic analysis; mistuning modeling; and advanced turbomachinery topics.

MECHENG 7384 Principles of Electrification for Vehicle Propulsion Systems

Fundamentals of advanced propulsion vehicles (HEV, PHEV, BEV, FCV), covering motivation, architectures, taxonomy and components, energy analysis, modeling, simulation, optimization, and supervisory control/energy management principles. 3-credit hours. Topics include: energy consumption of vehicles; motivation for advanced propulsion vehicles; review of energy conversions systems (engines, fuel cells, electric machines), energy storage systems (chemical fuels, batteries, supercapacitors, flywheels); review of transmission systems; energy modeling of advanced propulsion vehicle systems; design optimization of hybrid electric vehicles; and advanced propulsion supervisory control.

Fluid dynamics and heat transfer

MECHENG 6501 Gas Dynamics

A study of one-dimensional and two-dimensional steady and one-dimensional unsteady compressible flows. 3-credit hours. Topics include: compressible flows; conservation equations; wave propagation and normal shocks; flows with friction & heat transfer (Rayleigh and Fanno flows); oblique shock waves and expansion waves; nozzle and diffuser flows; numerical methods - conservation equations in differential form; unsteady wave motion; velocity potential equation.

AEROENG 5775 Hypersonic Flows

Introduction to hypersonic inviscid and viscous flows, Newtonian theory, high-temperature effects and heat transfer. 3-credit hours. Topics include: unique features of hypersonic flows; classical theories; viscous-inviscid interactions in hypersonic flows; hypersonic transition and turbulence; statistical thermodynamics and concept of non-equilibrium; high-temperature effects: thermochemical nonequilibrium; reentry physics, including radiation, ablation, ionization; modern topics; electromagnetic flow control; scramjet and rocket propulsion; gas surface interactions

MECHENG 6510 Intermediate Heat Transfer

Principles governing heat transfer with an emphasis on formulation of problems. Mass transfer is also introduced. 3-credit hours. Topics include: modes and constitutive relations, conductivity tensors; conservation laws; 1-D and 2-D conduction; convection, thermal energy balance; boundary layer theory; viscous dissipation; heat transfer in internal flows; mass transfer; thermal radiation, gas radiation; and radiation exchange between surfaces and enclosures.

AEROENG 7875 Introduction to Turbulence

Introduction to turbulence in fluid mechanics with emphasis on understanding the physical mechanisms involved. 3-credit hours. Topics include: definition of turbulence, non-dimensional variables, scales; governing equations, statistical tools, correlations, spectra; homogeneous turbulence, implications of more complex flows; boundary layers, free shear flows, wakes; theoretical models, and computational and experimental results.

Complementary and cross-cutting

AEROENG 5624 Estimation Theory for Aerospace Systems (new)

Fundamental concepts of estimation theory, least squares estimation, estimation frameworks including minimum variance, maximum likelihood, maximum a posteriori, etc. 3-credit hours. Topics include: elements of probability theory, conditional probability, Bayes rule, continuous random variables; least squares estimation, projection theorem, Wahba's problem, constrained least squares, sequential least squares; elements of dynamic systems and measurement models, applications in aircraft and spacecraft tracking; estimation theory architectures, e.g., maximum likelihood, maximum a-posteriori, information theoretic estimation; sequential state estimation for linear systems: the Kalman filter in aerospace applications. Not yet approved.

MECHENG 7250 Vibration of Discrete Systems

Concepts of undamped and damped vibrations of single and multi-degree of freedom discrete systems. Principles of modal analysis, analytical dynamics and approximate methods. 3-credit hours. Topics include: summary of free and forced vibration analysis of damped single degree of freedom systems; viscous and Coulomb damping; response to periodic and arbitrary excitations; principle of virtual work and Lagrange's equations of motion; damped multi-degree of freedom systems, complex eigenvalue problem, orthogonality of modes; response to initial and external excitations by modal analysis; approximate methods (Rayleigh's quotient); and case studies on vibration modeling of real-life systems.

MECHENG 7383-Energy Conversion and Storage Systems for Electrified Propulsion

Electrochemical energy storage (batteries) and conversion (fuel cells) systems for automotive applications covering state of the art principles of operations and modeling. 3-credit hours. Topics include: review of principles of electrochemistry; introduction to secondary battery cells for automotive applications; introduction to capacitors; modeling of electrochemical battery cells; control of battery systems; fuel cell stacks; fuel cell systems; fuels for fuel cell systems; modeling of fuel cell systems; and low-level control of fuel cell systems

AEROENG 6193-Individual Studies in Aerospace Engineering

Special topics within applied aeronautics. Instructor consent required. 3-5-credit hours. Repeatable to a maximum of 9 credit hours.

AEROENG 8193-Individual Studies in Aerospace Engineering

Special topics within applied aeronautics. Instructor consent required. 3-5-credit hours. Repeatable to a maximum of 9 credit hours.

Appendix D. Fiscal Impact Statement

To be completed at a later date within the review process.

Appendix E. Market Analysis

The following Market Landscape Scan was conducted by the University's Office of Technology and Digital Innovation (OTDI) in April 2023. A summary of the market analysis is provided in the proposal document, please see the Institutional Planning for the Program and Statewide Alternative sections.

OTDI Contacts:

Joe Kline

Market Research Analyst

Digital Learning Team – Office of Academic Affairs

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Gail Martineau

Associate Director of Distance Education Marketing

Digital Learning Team – Office of Academic Affairs

Martineau.18@osu.edu

Market Landscape Scan

College of Engineering | Master's Degree in Applied Aeronautics

Objective

The Department of Mechanical and Aerospace Engineering within the College of Engineering is exploring offering both for-credit and non-credit certificates in Applied Aeronautics. In the for-credit space, the department specifically is considering a Master's Degree in Applied Aeronautics to be offered in conjunction with Ohio State's [Aerospace Research Center](#). Ohio is a leader within the aerospace industry, and thanks to existing College of Engineering partnerships, it is believed future offerings in Applied Aeronautics could be extremely successful when directly engaging with those in the field.

Aerospace Job and Occupational Landscape

Over the past 12 months (March 2022 to March 2023), Ohio has seen the fourth highest number of unique job postings for positions within the following four standard occupations:

- Aerospace Engineers ([17-2011](#))
- Aerospace Engineering and Operations Technologists and Technicians ([17-3021](#))
- Materials Engineers ([17-2131](#))
- Mechanical Engineers ([17-2141](#))

According to a [Job Posting by Location](#) report using [Lightcast](#), a web-based platform that brings together national educational data, industry and occupational reports, real-time job postings, and publicly available profile and CV (curriculum vitae) information, and to which OTDI (Office of Technology and Digital Innovation) subscribes, the 7,018 unique job postings in Ohio fell behind Michigan (8,272) and just ahead of New York (6,565). The map below highlights the greatest concentrations of jobs within the previously noted occupations.

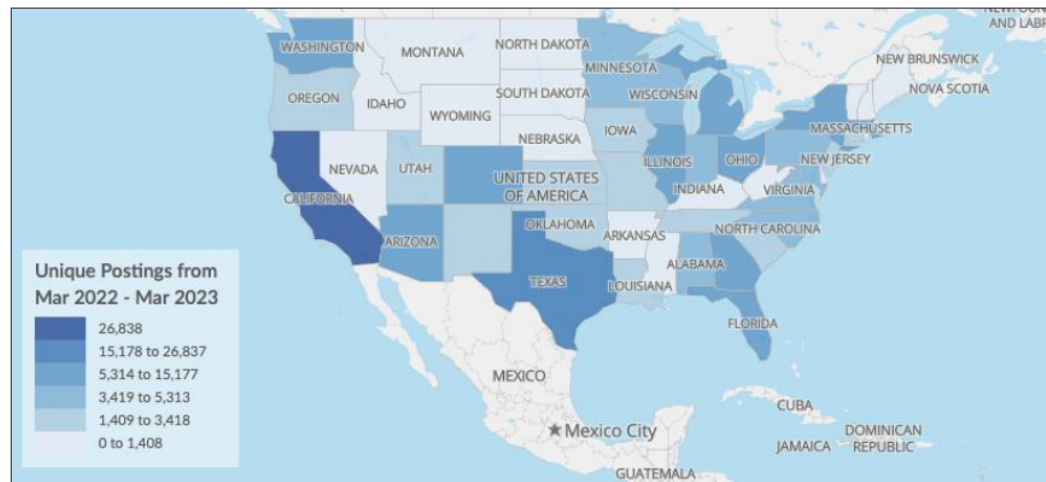


Figure 1 – States seeing the greatest number of jobs within the Aeronautics space.

Ohio is a hotspot for jobs within the four previously identified occupational codes, with Ohio's average number of job postings exceeding the national average. [Drilling down within the state](#), Cincinnati has seen the highest number of unique job postings in these occupations in the past 12 months compared to the Cleveland metro area, which has seen the second highest number (followed by the central Ohio region and the Dayton area). Projections show Ohio remaining a leader in these occupations for at least the next 10 years. Columbus is the only one of the four metropolitan areas where growth is expected over the next 10 years ([Figure 2](#)). Unfortunately, compensation in Ohio does not keep up with the national rates for those with these jobs in other states. The national median salary within these occupations is \$98,418 compared to Ohio's median salary of \$83,049.

[According to JobsOhio](#), GE (General Electric), NASA (National Aeronautics and Space Administration), the Wright-Patterson Air Force Base, and Honeywell are the top aeronautics employers in Ohio. Ohio is also touted as the top supplier to Boeing and Airbus. Information from Lightcast in [Figure 3](#) calls out Ohio employers with the greatest number of unique job postings within the past 12 months. The difference in companies here, compared to the JobsOhio website, may be a result of real-time job posting data as well as Bureau of Labor Statistics occupational categorization variation happening within each company.

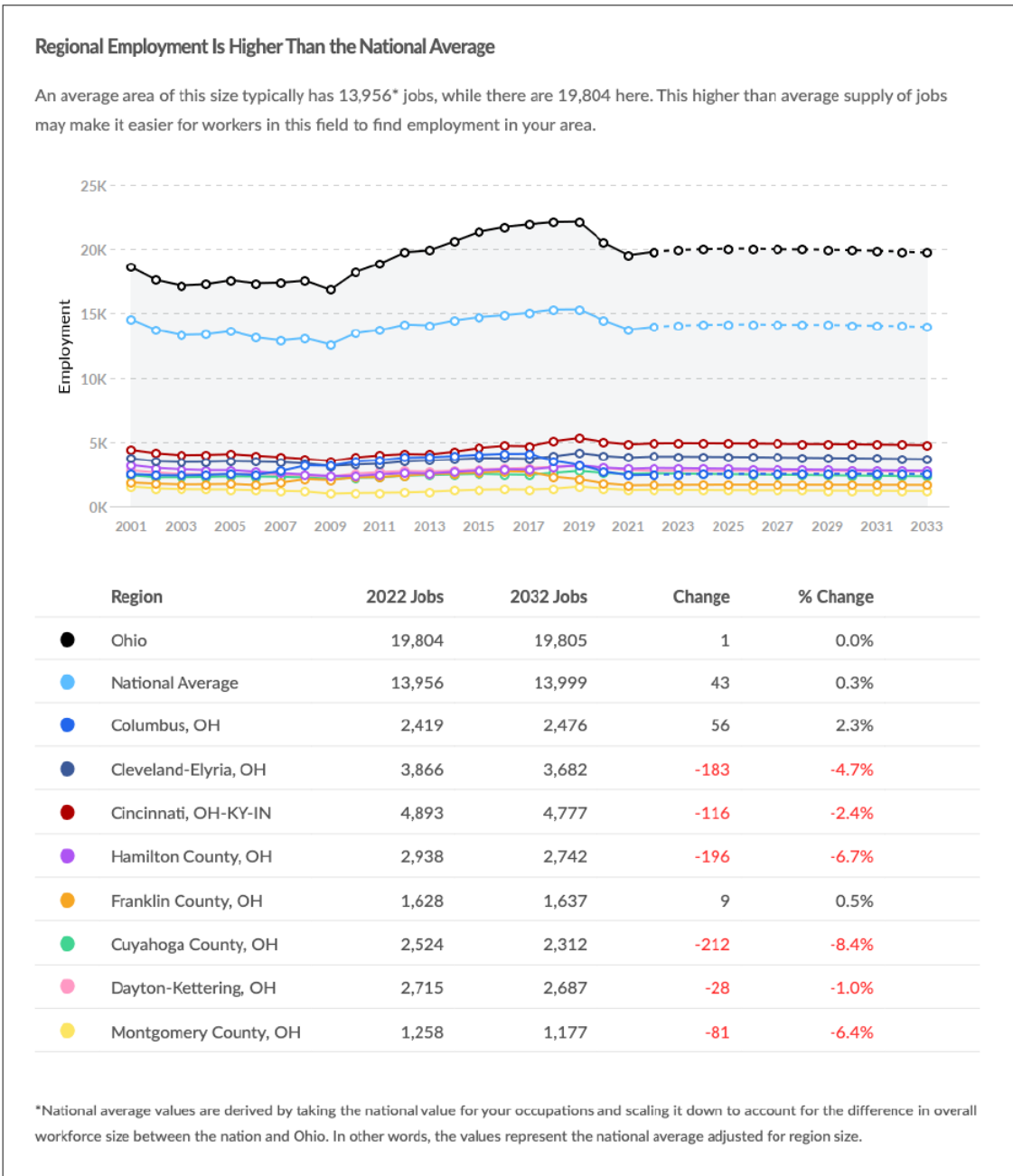


Figure 2 – Current and projected growth in the number of related jobs, broken down by Ohio metropolitan area.

[View an Occupation Overview report for these four occupations within Ohio](#)



Top Employers in Ohio

Employer	Unique Job Postings within the past 12 Months (Mar. 2022 – Mar. 2023)
General Electric	1,595
Owens Corning	409
Honda	404
Emerson Electric	203
L3Harris Technologies	156

Figure 3 – Top employers in Ohio for specified occupations based on number of unique job postings

[View an export of recent Ohio job postings within these occupations](#)

Desired Qualifications

Employers hiring for jobs within these occupations are looking for candidates adept in product design and development. [Nearly 2,000 unique postings](#) mentioned either “new product design” or “mechanical design” in the position descriptions. Lightcast provides a look at qualifications that employers desire in comparison with qualifications Ohioans/potential employees have posed on publicly available professional networking and CV sites like LinkedIn. Wide gaps in mention rates could signify potential gaps in workforce education. **Job postings for positions falling within the four previously mentioned occupations show misalignment between employer demand and employee knowledge of mechanical design. Mechanical design, both within program curriculum and program naming/promotion, could present an opportunity for Ohio State to close this gap in workforce knowledge.**

Other opportunities can be found within desired common or soft skills, such as leadership, operations, planning, and interpersonal communication. It is more common to find large supply and demand gaps in common skills due to their subjective nature, but in the case of more technical subject areas like

Applied Aeronautics, these gaps could represent opportunities of secondary focus within individual courses and/or the language used to promote a future offering. Currently, a wide gap exists between postings looking for employees with advanced communications, problem-solving, leadership, and writing skills and those jobseekers who have specifically noted those skills on a resume. The Department of Mechanical and Aerospace Engineering could consider tailoring curriculum to incorporate learning outcomes to help learners represent competency in this space for future employers.

Master's Degree in Aeronautics: Landscape Analysis

The following CIP codes were evaluated when looking at the landscape of master's degrees around applied aeronautics:

- [14.0201](#) – Aerospace, Aeronautical and Astronautical Engineering, General
- [14.0299](#) – Aerospace, Aeronautical and Astronautical Engineering, Other
- [14.1801](#) – Materials Engineering
- [15.0801](#) – Aeronautical/Aerospace Engineering Technology/Technician
- [49.0101](#) – Aeronautics/Aviation/Aerospace Science and Technology, General

Current Lightcast program completions data is based on 2021 U.S. Department of Education and National Center for Education Statistics data. 115 institutions reported 3,614 master's degree completions in 2021. Thirty-two of the 115 institutions reporting completions had programs that were classified as “distance offered.” A distance offered program is defined as a “program for which all the required coursework is able to be completed via distance education courses.” It is worth noting that although only 28% of institutions classified their programs as “distance offered” they accounted for 49% of all completions in 2021 ([Figure 4](#)).



Figure 4 – A look at campus-based and online master's degree programs in 2021.

The institution reporting the most online master's degree completions was the Embry-Riddle Aeronautical University with 385 completions from their various aeronautics master's programs. Programs that could be mapped to the profiled CIP codes and counting toward the 385 distance completions in 2021 include: [Master of Science in Aeronautics](#), [Master of Science in Aerospace Engineering](#), [Master of Science in Airworthiness Engineering](#), among others. As of 2021, Embry-Riddle maintained a share of [10.7% of the total degree-completion market](#) and a [21.7% share](#) of the distance-degree completion market.

According to the program website, the [Master of Science in Aeronautics](#) requires the completion of 30 credits. 21 of those credits are required core courses and 9 are specialization courses. Specializations listed on their website include: Aviation and Aerospace Sustainability, Small Unmanned Aircraft Systems (sUAS) Operations, Unmanned Systems, Space Operations, Aviation Safety, Human Factors, Aviation Maintenance, Aviation Cybersecurity, or Research. The program is designed to “help aerospace and aviation professionals pursue additional career opportunities” and is positioned as being able to “help advance (student) careers by offering specializations that help (students) excel.”

Master's degrees completions mapped to these CIP codes have steadily increased from 2017 to 2021. Total degree completions in 2017 (both distance and non-distance) were 3,370 while in 2021 they were 3,614 representing a 7% increase in the number of total completions. The number of institutions competing in this space has also increased by 6% from 2017 to 2021.

Noting that not all aeronautics-related programs may be captured within these CIP codes, the general growth trends in the market remain clear. Aside from a substantial increase in distance completions in 2012 (this could be due to programs reclassifying as distance or remapping to one of the analyzed CIP codes), completions have shown a steady increase since 2013 with completions split between distance and non-distance programs ([Figure 5](#)).

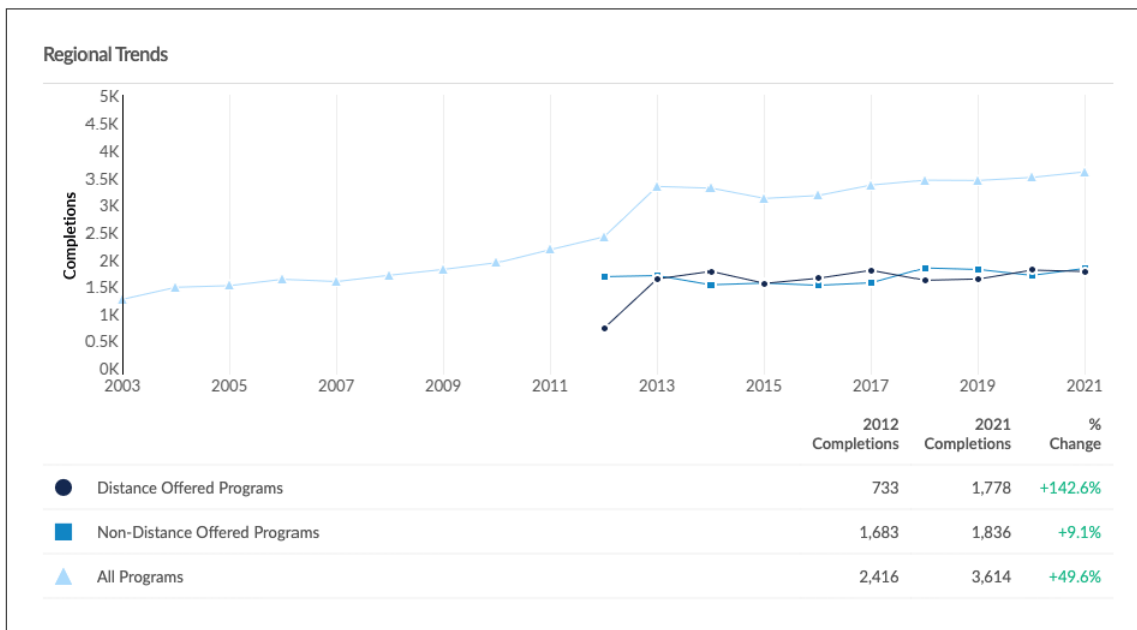


Figure 5 – Change in the number of total master's degree completions in Aeronautics or related field, broken down by distance and non-distance programs.

[Jump to a program comparison table.](#)

Industry Partnerships

As identified by the College of Engineering faculty, industry partnerships represent the largest opportunity for a future master's program offering. Ohio is lucky to be home to leaders in the industry that regularly invest in their employees' education. An example of this is the [GE Advance Courses in Engineering \(ACE\) program](#) which couples traditional higher education with on-the-job training through the company's century's old Edison Engineering Development Program. Boeing, which has a strong presence in Ohio, similarly has its [Learning Together Program](#), which provides tuition assistance toward select professional certifications, individual courses, certificate programs, and degrees. The [University of Washington](#) is a preferred partner of Boeing, offering a number of upskilling opportunities for the company. [Embry-Riddle Aeronautical University](#) recently partnered with GE and is utilizing GE's Flight Operations Quality Assurance (FOQA) software in the classroom to ensure "Embry-Riddle students are highly competitive for safety and risk-management roles at every major airline in the world." Ohio State should identify existing university relationships in associated industries and work toward creating customized training for companies' employees to ensure graduate student enrollments.

Observations and Considerations

There is growing demand for skilled employees in the Aeronautics and Aerospace fields. This demand is nationwide, but Ohio is a hot spot for current and future growth. The Department of Mechanical and Aerospace Engineering is looking to develop both for-credit and non-credit certificate offerings to align with this growing demand. Applied Aeronautics presents a good direction for Ohio State's online portfolio, as the university is a leader in this space and home to the Aerospace Research Center.

- As previously mentioned, Ohio State should leverage its industry partnerships to create direct pathways to a graduate certificate and a master's degree for individual corporations. Like the University of Washington and Embry-Riddle Aeronautical University, Ohio State could become a "preferred partner" to leaders in the Aeronautics industry. **A direct focus on establishing and codifying these partnerships ahead of full program development would allow for customization and flexibility to align with market changes.**
- As an institution, Ohio State recently approved policies allowing 100% of the credits from a certificate to overlap with degree programs. This includes graduate certificates classified as 3a ("Stand-Alone Certificate") and 3b ("Embedded Certificate"). CAA approved these measures at the meeting on March 1st, 2023. Noting that the Department has expressed interest in a Graduate Certificate in Applied Aeronautics, the institution-wide policy change will be critical in marketing and communicating about the two future programs. **The Department should strongly consider applying for 100% credit overlap for its Graduate Certificate in Applied Aeronautics as this would ease prospective student "barriers to entry" into the master's program.**

Contact

Joe Kline

Market Research Analyst

Digital Learning Team – Office of Academic Affairs

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Gail Martineau

Associate Director of Distance Education Marketing

Digital Learning Team – Office of Academic Affairs

martineau.18@osu.edu

Master's Degree in Aeronautics or Related Field - Competitor Scan

Institution	Program Name	Program Level	Online	Completion Details	Start dates	Program Value Overview
Liberty University	M.S. in Aeronautics Online Degree	Master of Science	100% online	30 credits; 1-year to complete (on average)	8 start dates throughout the year	Our aeronautics master's degree is designed to help you advance in your knowledge and skill set so you can move on to more responsibilities and different positions in your field. We offer a general track as well as specializations in education, safety, and leadership. Whatever the next step is in your career, we have the degree that can help you get there.
Embry-Riddle Aeronautical University	Master of Science in Aeronautics	Master of Science	100% online	30 credits; 1 to 2 years to complete	5 start dates throughout the year	Although students in our online Aeronautics program may not always physically be in a classroom, they still gain personal, hands-on experience using tools like using our Virtual Hub to design and test fly a UAS or conduct an aviation accident investigation with the virtual crash lab. Students also have the opportunity to fly sUAS and get licensed through the sUAS Operations Specialization. Students earning their master's degree in Aeronautics also have

						the opportunity to complete research while working with faculty on their thesis project if they choose the Research Specialization. Other Specializations include: Aviation Safety, Human Factors, Space Systems, Unmanned Systems, Small UAS Operations, Maintenance, and Aviation and Aerospace Sustainability.
Purdue University	Online Master of Aeronautics and Astronautics Engineering	Master of Science	100% online	30 credits; 1 to 2 years to complete	Spring/Fall	Purdue's School of Aeronautics and Astronautics is one of the top aerospace engineering programs in the nation and is currently 5th in aerospace graduate programs by the U.S. News & World Report rankings of aerospace graduate programs, and Purdue's online graduate engineering program is consistently ranked among the top two in Best Online Master's in Engineering Programs by U.S. News & World Report (2023). The online master's program focus on aerospace engineering is specifically designed for working engineers and offers flexible plans of study with a format that allows you to study from where you are.
University of Illinois	Online MS/MEng in	Master of Science/Master of Engineering	100% online	32 credits; up to five	Fall Semester	The program is designed to provide students with a solid foundation in the fundamentals of Aerospace Engineering by requiring at least one core course in

Urbana-Champaign	Aerospace Engineering			years to complete		<p>each of the three branches of Aerospace Engineering (Fluid Mechanics, Solid Mechanics and Materials, Dynamics and Controls) as well as one course in mathematics.</p> <p>Specialization can then be made by taking additional courses in one or more of these, and other, areas: Aerodynamics, Fluid Mechanics, Combustion/propulsion, Structural Mechanics, Solid Mechanics and Materials, Dynamical Systems, Aerospace Control, Orbital Mechanics, and Spacecraft.</p> <p>Online students have access to the same lectures, class assignments, exams and projects as on-campus students. Online is an excellent option for students who want to pursue their graduate studies while working.</p>
University of Colorado Boulder	Professional Master's Degree in Aerospace	Master of Science	100% online or on-campus	30 credits;	Spring/Fall	<p>A Professional Master's degree (ProMS) in aerospace from CU Boulder is designed for working engineers and people planning to pursue a career in industry. We designed the program with industry partners to meet your needs, further your career, and with your location in mind -- the degree can be earned on campus or 100% online.</p>

Kansas State University	Aeronautics Master's Degree	Master of Science	100% online	30 credits;	Fall/Spring/Summer	<p>The Master of Science in Aeronautics provides a flexible learning style for working professionals. Courses will be taught by professionals working in the industry and university faculty members. The program has been designed by our industry advisory boards and a member of the Airworthiness Engineering Standards Committee who created the standards approved in 2022.</p> <p>You can choose from two options of study — aerospace certification or leadership and policy. The aerospace certification program option is for those working or desiring to work in aerospace manufacturing and/or maintenance in the areas of product certification, airworthiness and continued airworthiness. The leadership and policy program option is for emerging aviation/aerospace industry leaders who plan to work in the areas of business management or policymaking in any sector of aviation operations, including air carriers, airports, legislative bodies and large corporations, as well as many other public and private functions.</p>
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University of Southern California	Master of Science in Aerospace Engineering	Master of Science	100% online or on-campus	27 units; 1.5 to 2 years to complete	Spring/Fall	The MS degree in Aerospace Engineering is designed to give students exposure to at least two different areas of Aerospace Engineering through concentration and breadth requirements, while at the same time allowing students to pursue their interests through flexibility in the selection of technical electives.
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Appendix F. Letters of Support

The following are letters of support provided by:

Ayanna Howard

Dean, College of Engineering
The Ohio State University
Howard.1727@osu.edu

Robert Siston

Professor and Chair
Department of Mechanical and Aerospace Engineering
The Ohio State University
Siston.1@osu.edu

Marcello Canova

Professor and Associate Chair for Graduate Programs
Department of Mechanical and Aerospace Engineering
The Ohio State University
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Mrinal Kumar

Professor and Aerospace Engineering Program Director
Department of Mechanical and Aerospace Engineering
The Ohio State University
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Jim Lawson

Interim-Director
Aerospace Research Center
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Martha Gardner

Global Technical Capability Development Leader
GE Aerospace
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Richard C. Fox

Director, Ohio Unmanned Aircraft Systems Center
The Ohio Department of Transportation
richard.fox@dot.ohio.gov

Rob Scholl

President and CEO
Textron eAviation
www.eaviation.com



August 2, 2023

Vice Provost W. Randy Smith
Office of Academic Affairs
190 N. Oval Mall
Columbus, OH 43210

Dear Vice Provost Smith,

On behalf of the College of Engineering, I fully support the suggested online degree program, the "Professional Master of Applied Aeronautics." The College of Engineering and the Department of Mechanical and Aerospace Engineering will offer this program in partnership with the Aerospace Research Center. The program is designed to be fully online and aims to equip the aerospace industry with highly skilled individuals while complementing the department's research-oriented degrees. Moreover, the proposed degree program will expand the continuing education opportunities offered by the college, aiding both the college's aerospace industry partners and students. In addition, the Professional and Distance Education Program in the College of Engineering will provide administrative support for the program.

The Professional Master of Applied Aeronautics program was developed to offer an exciting curriculum to working professionals and directly addresses outcomes from a Market Landscape Scan conducted by the University's Office of Technology and Digital Innovation. Ohio is recognized as a hub for aerospace activity. The professional master's program will pioneer online activity in aerospace engineering within Ohio and offer unique opportunities for working professionals across the country due to the application-focused degree. Students in the program will benefit from a deeper level of understanding in applied aeronautic areas and the confidence to support this advancing and rapidly growing field.

Letters of support for the program have been provided by the Mechanical and Aerospace Engineering Department, the Aerospace Research Center, and multiple aerospace industries. The program has exciting and positive potential to make a lasting impact on the university and aerospace industries. I offer my support along with the College's Professional and Distance Education Program for the proposed Professional Master of Applied Aeronautics program.

Sincerely,

Ayanna Howard PhD
Dean, College of Engineering
Monte Ahuja Endowed Dean's Chair




Memo

To: Dean Maria Miriti, Graduate School
From: Rosie Quinzon-Bonello, Assistant Dean for Curriculum and Assessment
Date: October 11, 2023
Re: Professional Master of Applied Aeronautics Proposal

On Monday, October 9, 2023, the College of Engineering Committee for Academic Affairs unanimously approved the Department of Mechanical and Aerospace Engineering proposal to establish a *Professional Master of Applied Aeronautics*.

Attached is the proposal and executive summary.

Yours sincerely,


Rosie Quinzon-Bonello



June 29, 2023

Vice Provost W. Randy Smith
190 N Oval Mall
Columbus, OH 43210

To Whom It May Concern,

This letter is in support of the proposed online degree program, "Professional Master of Applied Aeronautics", led by Dr. Clifford Whitfield. The proposed program will be offered by the Department of Mechanical and Aerospace Engineering and the College of Engineering, and in partnership with the Aerospace Research Center. The proposed program will be offered fully online and designed to support and supply highly skilled individuals in the aerospace workforce. The professional master's degree program will complement the existing research-oriented degrees offered in the department.

Ohio is recognized as a leader within the aerospace industry, and the degree program will support and strengthen the university's statewide industry relations and outreach by expanding workforce development opportunities for our industry partners. Likewise, Ohio State is recognized as a top supplier for nationwide companies such as Boeing and Airbus, in which the program stands to make a positive national impact. With the program's objective of educating students with a deeper level of understanding in applied aeronautic areas, the program will provide working professionals with the technical knowhow and confidence to support this advancing and rapidly growing field.

I am excited about the proposed Professional Master of Applied Aeronautics program and the positive impact it will have for the university and aerospace industries. I fully support the program.

Please let me know if I can be of further assistance.

With kind regards,

Robert A. Siston
Professor and Department Chair
Department of Mechanical and Aerospace Engineering
Department of Biomedical Engineering (by courtesy)
Department of Orthopaedics (by courtesy)
School of Health and Rehabilitation Sciences (by courtesy)



May 26, 2023

Vice Provost W. Randy Smith
190 N Oval Mall
Columbus, OH 43210

To Whom It May Concern,

On behalf of the Graduate Studies Committee of the Department of Mechanical and Aerospace Engineering, I would like to express our strong support to the proposed program "Professional Master of Applied Aeronautics", led by Dr. Clifford Whitfield, submitted by the Department of Mechanical and Aerospace Engineering in partnership with the Aerospace Research Center.

The primary goals of this program are to provide specialized educational resources to the aerospace workforce in Ohio and across the nation in the form of a Professional Master Degree. Participants to this program will be trained in well-established and emerging areas of aeronautics and meet the rapidly growing demand for the aerospace industry. A Professional Master's degree will complement the research-oriented degree currently offered by our Department in a way that it will impart knowledge, skill sets and focused training towards solving practical problems encountered at the workplace on a daily basis.

The program will be offered fully online, which will lay the foundation of growth into national and global markets without being geographically constrained. The program will be coordinated and managed by the Department of Mechanical and Aerospace Engineering, in collaboration with the Aerospace Research Center.

Please let me know if I can be of further assistance.

With kind regards,

Marcello Canova, PhD

Associate Chair for Graduate Programs, Department of Mechanical and Aerospace Engineering
Professor, Department of Mechanical and Aerospace Engineering
Associate Director for Research and Education, Center for Automotive Research
Room 125, 930 Kinnear Road, Columbus, OH 43212

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College of Engineering
Peter L. and Clara M. Scott Laboratory
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Columbus, OH 43210-1142

Phone: 614-292-4143

Fax: 614-292-3163

Email: kumar.672@osu.edu

July 17, 2023

Vice Provost W. Randy Smith
190 N Oval Mall
Columbus, OH 43210

Dear Dr. Smith,

It is my pleasure to write this letter in support of the proposed program “Professional Master of Applied Aeronautics.” This program has been conceptualized and developed by Dr. Cliff Whitfield and submitted for consideration jointly by the Department of Mechanical and Aerospace Engineering and the Aerospace Research Center. Dr. Whitfield has had a distinguished career in teaching and mentorship in our Department. The program proposal reflects the unique perspectives Dr. Whitfield brings from his many years of service in student-centric committees and his experience as the Program Director of Aerospace Engineering.

The proposed program will undoubtedly strengthen the ties between the MAE Department and the thriving aerospace industry in the state of Ohio. It will bring greater visibility and attention to our Department and provide our faculty new pathways for industry outreach. This program will likely also become a stepping stone for other departments within the College of Engineering to join the effort to serve a wider, more interdisciplinary audience.

I have reviewed the curriculum of the proposed program and believe that it strongly aligns with the current and future needs of the workforce. The courses offered are an exciting blend of fundamentals and the leading edge of aerospace technology. As this program evolves over the years, it will allow our faculty to develop syllabi on additional new topics. I wholeheartedly support this program and hope to be an active participant in its deployment.

Please feel free to contact me if you have further inquiries or require additional information.

Sincerely,

Mrinal Kumar
Tinkham Endowed Professor of Aeronautical and Astronautical Engineering
Professor, Mechanical and Aerospace Engineering
Director, Laboratory for Autonomy in Data-Driven and Complex Systems
Aerospace Research Center
The Ohio State University



THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING

**College of Engineering
Aerospace Research Center**

2300 West Case Road
Columbus, OH 43235

614-292-5491 Phone
614-292-5552 Fax

arc.osu.edu

May 24, 2023

The Ohio State University
Office of Academic Affairs
Attention: W. Randy Smith, Vice Provost
190 N. Oval Mall
Columbus, Ohio 43210

Dear Mr. Smith,

I am pleased to be writing a letter in support of the Master of Applied Aeronautics professional and distance education programs being developed by Dr. Cliff Whitfield. I strongly support these programs focusing on the working professionals. The Aerospace Research Center has the faculty, staff and resources to support these programs and we are thrilled to support this opportunity.

As the interim director of the Aerospace Research Center, I am excited to see new courses that will further our goals with the aerospace industry. I fully support Dr. Whitfield's Master of Applied Aeronautics program and look forward to the kick off of the program.

Sincerely,



James H. Lawson

Interim Director, Aerospace Research Center



Martha M. Gardner, Ph.D.

Global Technical Capability Development Leader

One Neumann Way
MD J161
Evendale, OH 45215
U.S.A.

T 513 551 9554
martha.gardner@ge.com

August 14, 2023

The Ohio State University
Office of Academic Affairs
Attn: W. Randy Smith, Vice Provost
190 North Oval Mall
Columbus, OH 43210

Dear Dr. Smith:

I was excited to see the proposal from Dr. Clifford Whitfield and Dr. Randall Mathison for a new Master's of Applied Aeronautics offering from The Ohio State University. As you may be aware, here at GE Aerospace, we have a number of our early career employees who complete a Master's degree as part of their GE Advanced Course in Engineering (ACE) program. In addition to the content of this proposed program being relevant to potential career interests of our employees and our business needs, the asynchronous structure could be particularly attractive for working professionals. I look forward to seeing how this proposal progresses!

Regards,

A handwritten signature in cursive script that reads "Martha Gardner".

Martha Gardner, Ph.D.
Global Technical Capability Development Leader, GE Aerospace



OHIO DEPARTMENT OF TRANSPORTATION
Mike DeWine, Governor Jack Marchbanks, Ph.D., Director

1980 W. Broad Street, Columbus, OH 43223
614-466-7170
transportation.ohio.gov

August 25, 2023

Reference: Letter of Support for New Master's of Applied Aeronautics Offering From The Ohio State University

Dear Dr. Cliff Whitfield,

The Ohio Department of Transportation (ODOT) is pleased to support the proposal for a new Master's of Applied Aeronautics offering from the Ohio State University.

The Ohio Unmanned Aircraft Systems Center (Ohio UAS Center) serves as the state's one-stop shop for unmanned aircraft and advanced aviation technologies. The Ohio UAS Center operates as part of the Ohio Department of Transportation's DriveOhio initiative. Formed in 2013, the Ohio UAS Center manages and performs all unmanned aircraft operations for the Department of Transportation. In addition to ODOT operations, the UAS Center serves as a shared resource to local and state agencies for flight operations and UAS program development. Outside of flight operations and other services, the Center manages innovative initiatives and research projects focusing on enabling the lower altitude airspace and the integration of unmanned and autonomous aircraft technologies into the National Airspace System.

We strongly advocate for the proposal put forth by Dr. Clifford Whitfield and Dr. Matthew McCrink for a new Master's of Applied Aeronautics offering from The Ohio State University. As presented, the planned curriculum addresses many key skillsets important to us as a state entity engaged in supporting uncrewed aerial systems and the emerging advanced air mobility markets. In addition to the content of this proposed program being relevant to potential career interests of our employees and our business needs, the asynchronous structure could be particularly attractive for working professionals. The UAS Center strongly supports the development of this new professional Master's program.

For questions relating to this letter of support, please do not hesitate to contact me.

Sincerely,

Richard C. Fox

Richard C. Fox
UAS Director
richard.fox@dot.ohio.gov

Excellence in Government
ODOT is an Equal Opportunity Employer and Provider of Services



August 11, 2023

The Ohio State University
Office of Academic Affairs
Attn: W. Randy Smith, Vice Provost
190 North Oval Mall
Columbus, OH 43210

Dear Mr. Smith,

I have recently had the opportunity to be briefed by Dr. Cliff Whitfield on the Professional Master of Applied Aeronautics degree program. As presented, the planned curriculum addresses many key skills sets important to us as an aerospace company and I would view such a program favorably for prospective employees and possible skill development for current employees.

As the planning for the program continues, I look forward to learning more details. Thank you very much.

Best wishes,

A handwritten signature in black ink, appearing to read "Rob Scholl", written in a cursive style.

Rob Scholl
President and CEO

Appendix G. CCGS Blended/Online Delivery form

To be completed at a later date within the review process.