Florida State University
Ph.D. Aerospace Engineering
CIP 14.0201

Proposal document included:

Abbreviated Degree Proposal*

Documents available upon request:

Course Descriptions
Budget and Headcount Tables
Consultant's Report and Institution Response
Letter of Intent
Faculty Curriculum Vitae
Student Surveys
Non-Faculty Resources
Planning Process
Reviews and Accreditation
Program Collaborations
Specialized Equipment and Space
Additional Specialized Equipment and Space

*Complete degree proposal is available in the resources section in Onboard

Form Updated September 2023

STATE UNIVERSITY SYSTEM OF FLORIDA

State University System of Florida Board of Governors
REQUEST TO OFFER A NEW DEGREE PROGRAM
In accordance with Board of Governors Regulation 8.011
(Please do not revise this proposal format without prior approval from Board staff)

Florida State University Institution Submitting Proposal	Fall 2025 Name of Department(s)/Division(s)
FAMU-FSU College of Engineering Name of College(s) or School(s)	Aerospace Engineering Complete Name of Degree
Aerospace Engineering Academic Specialty or Field	Proposed Program Type ☒ E&G Program ☐ Market Tuition Rate Program ☐ Self-Supporting Program
Proposed CIP Code (2020 CIP) 14.0201 Proposed Implementation Term	

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met before the program's initiation.

6/20/24 Date Approved by the University Board of Trustees	5/29/24 President's Signature Date
6/20/24 Board of Trustees Chair's Signature Date	5/27/24 Provost's Signature Date

Projected Enrollments and Program Costs
Provide headcount (HC) and full-time equivalent (FTE) student estimates for Years 1 through 5. HC and FTE estimates should be identical to those in Appendix A – Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Appendix A – Table 3A or 3B. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 by dividing the total E&G by FTE.

Implementation Timeframe	HC	FTE	E&G Cost per FTE	E&G Funds	Contract & Grants Funds	Auxiliary/ Philanthropy Funds	Total Cost
Year 1	25	18	$17,101	$307,825	$456,871		$764,696
Year 2	45	35					
Year 3	51	48					
Year 4	67	67					
Year 5	75	61	$11,531	$703,375	$1,158,849		$1,862,223

Programs of Strategic Emphasis Waiver *(for baccalaureate programs only)*

Does the program fall under one of the CIP codes listed below?

☐ Yes
☐ No

If yes, students in the program will be eligible for the Programs of Strategic Emphasis (PSE) waiver. See Board Regulation 7.008 and the PSE Waiver Guidance for additional details.

CIP CODE	CIP TITLE	CATEGORY
11.0101	Computer and Information Sciences	STEM
11.0103	Information Technology	STEM
13.1001	Special Education	EDUCATION
13.1202	Elementary Teacher Education	EDUCATION
14.0801	Civil Engineering	STEM
14.0901	Computer Engineering	STEM
14.1001	Electrical and Electronics Engineering	STEM
27.0101	Mathematics	STEM
40.0801	Physics	STEM
52.0301	Accounting	GAP ANALYSIS
52.0801	Finance	GAP ANALYSIS
52.1201	Management Information Systems	STEM

Additional Required Signatures

I confirm that I have reviewed and approved Need and Demand Section III.F. of this proposal.

DocuSigned by:

Signature of Equal Opportunity Officer **Date of Signature**

I confirm that I have reviewed and approved Non-Faculty Resources Section IX.A. and IX.B. of this proposal.

DocuSigned by:
Gale Ebenhoeier

Signature of Library Dean/Director **Date of Signature**

Introduction

I. Program Description and Relationship to System-Level Goals

A. Describe within a few paragraphs the proposed program under consideration and its overall purpose, including:

- **degree level(s)**
- **majors, concentrations, tracks, specializations, or areas of emphasis**
- **total number of credit hours**
- **possible career outcomes for each major (provide additional details on meeting workforce needs in Section III)**

Florida A&M and Florida State Universities propose to offer graduate degree programs in Aerospace Engineering (AE) beginning Fall 2025 at the master's and doctoral level. The proposed programs will be offered jointly within the FAMU-FSU College of Engineering and operate within the FAMU-FSU Mechanical Engineering Department. It will use faculty that currently teach within the existing Mechanical Engineering program at the FAMU-FSU College of Engineering. Additional faculty hires are proposed to expand the program in strategic directions that build upon existing strengths and future challenges in aerospace fields.

The AE graduate program will consist of one major for both levels. Completion of the master's program, whether thesis or non-thesis, requires a minimum of 30 credits. For students holding a master's degree, completion of the doctoral program requires 48 credits. Alternatively, for students entering the doctoral program immediately after their bachelor's degree, completion requires 60 credits. In their first year, students will gain a firm grounding in the fundamentals of AE through existing core courses (12 credits) taught by faculty members within the Mechanical Engineering department. The students and their research advisors will determine which elective specialization courses are best for their research. Students will also register for the existing weekly Mechanical Engineering Graduate Seminar Series, taken every semester through graduation (0 credits). In this seminar series, students will be exposed to FAMU and FSU faculty and external researchers working in areas highly relevant to aerospace engineering (e.g., fluid dynamics, controls, robotics, thermal transport, large-scale computations, mechanics of materials). This seminar series also includes discussions about professional development skills given by industry speakers, government laboratory researchers, and academics about leadership strategies and tactics.

As background information, Aerospace Engineering primarily revolves around creating, advancing, testing, and manufacturing aircraft, spacecraft, and associated systems and structures. Historically, the discipline has centered on challenges about atmospheric and space travel, encompassing two key and interconnected branches: aeronautical engineering, which concentrates on the theory, technology development, and application of flight within Earth's atmosphere, and astronautical engineering, which delves into the science and technology of spacecraft and launch vehicles. Aerospace engineers play a crucial role in advancing technologies and incorporating them into aerospace vehicle systems for various purposes such as transportation, communication, exploration, and defense. Their responsibilities encompass the creation and production of aircraft, spacecraft, propulsion systems, satellites, and missiles. Additionally, they are involved in

designing and testing various components and subassemblies related to aircraft and aerospace products. The AE program at FAMU and FSU will advance the State and Federal calls to increase competence in science, technology, engineering, and math (STEM) in upcoming generations and to promote advanced aerospace engineering to solve fundamental problems that have immediate technical applications. In Florida, the aerospace industry is an essential component of the State's economy. Furthermore, there are several federal research laboratories in the Panhandle region, including Eglin and Tyndall Air Force Bases, the Naval Surface Warfare Center—Panama City Division and the Naval Air Station in Pensacola, that need new, well-trained AE graduates in their workforce. In addition, many industries in Florida, like defense and aerospace contractors, need aerospace engineers at the master's and doctoral level. With the advanced knowledge attained in aerospace engineering, graduates of the program will demonstrate the application of acquired knowledge through analyzing, synthesizing, evaluating, and creating solutions in various disciplines such as materials, thermal management, fluid dynamics, acoustics, controls, solid mechanics, among others. They will effectively transfer this knowledge to innovate future aerospace technologies, both locally in the State of Florida and globally. Furthermore, doctoral-trained graduates are also eligible for careers in academia.

B. If the proposed program qualifies as a Program of Strategic Emphasis, as described in the Florida Board of Governors 2025 System Strategic Plan, indicate the category.

- **Critical Workforce**
  - ☐ Education
  - ☐ Health
  - ☐ Gap Analysis
- **Economic Development**
  - ☐ Global Competitiveness
  - ☒ Science, Technology, Engineering, and Math (STEM)

☐ **Does not qualify as a Program of Strategic Emphasis.**

II. Strategic Plan Alignment, Projected Benefits, and Institutional Mission and Strength

A. Describe how the proposed program directly or indirectly supports the following:

- **System strategic planning goals (see the link to the 2025 System Strategic Plan on the New Program Proposals & Resources webpage)**
- **the institution's mission**
- **the institution's strategic plan**

The AE program contributes directly to several of the State University System (SUS) Strategic Planning Goals in the 2025 System Strategic Plan. The specific areas in which the PhD in AE will impact or contribute are:

- Teaching and Learning
  - Strengthen the Quality and Reputation of the Universities
  - Increase Degree Productivity & Program Efficiency

    - Increase the Number of Degrees Awarded in Programs of Strategic Emphasis
- Scholarship, Research and Innovation
    - Increase Research Activity and Attract More External Funding

The new AE program also aligns well with the mission of Florida State University (FSU) which involves incorporating elements that preserve, expand, and disseminate knowledge in various disciplines while emphasizing a philosophy of learning rooted in the liberal arts tradition. For example, the AE program will adopt an interdisciplinary approach, integrating the physics of fluids, materials, mathematics, technology, and professional development. This approach ensures a well-rounded education, aligning with the university's commitment to preserving and expanding knowledge across diverse fields. While this program heavily focuses on engineering, liberal arts will also be components within the aerospace curriculum. This will involve including courses and training that foster critical thinking, communication skills, and ethical considerations, thereby ensuring graduates possess a holistic education that extends beyond their technical knowledge.

The program will also include a curriculum that emphasizes excellence in teaching and research. We will provide students with opportunities to engage in cutting-edge research, collaborate with industry professionals, and participate in hands-on projects that contribute to advancements in aerospace engineering and technology. The AE program will also foster a culture of creativity and innovation within the program. It will encourage students to explore novel ideas, pursue entrepreneurial endeavors, and contribute to developing new technologies and solutions in the aerospace industry. This program will also include service-learning components that allow students to apply their aerospace knowledge to address real-world challenges. Many opportunities exist within the Department of Engineering via the Mechanical Engineering Graduate Student Association (MEGSA—RSO [Recognized Student Organization]) to encourage community engagement, partnerships with local industries, and outreach programs, such as the Challenger Learning Center, that contribute to the betterment of society. As part of the College of Engineering and Department of Mechanical Engineering's mission of leadership and professional development, we will also emphasize the development of ethics, skill, and character in students. We will provide opportunities for personal and professional growth, instilling a commitment to lifelong learning from coursework and research experiences. We will foster an environment that encourages personal responsibility and sustained achievement through active engagements with faculty throughout their graduate program. The new AE graduate program will cultivate a program that embraces diversity and inclusion. This includes creating a supportive and inclusive learning environment that reflects the university, college and department's commitment to a community fostering free inquiry.

By incorporating these elements, the aerospace graduate program can effectively align with Florida State University's mission, contributing to the preservation, expansion, and dissemination of knowledge while fostering a commitment to excellence, diversity, and community engagement.

The AE program is also consistent with FAMU's mission. Florida Agricultural and Mechanical University (FAMU) is an 1890 land-grant institution dedicated to the advancement of knowledge, the resolution of complex issues, and the empowerment of

citizens. FAMU's distinction as a doctoral/research institution will continue to provide mechanisms to address emerging issues through local and global partnerships. Expanding upon the University's land-grant status will enhance the lives of constituents through innovative research, engaging cooperative extension, and public service.

In direct support of its mission, the proposed AE program aligns with FAMU's dedication to the "advancement of knowledge and resolution of complex issues." There are several ways in which aerospace engineering contributes to these advancements including:

1. Technological Innovation: Aerospace engineering is at the forefront of technological innovation. The field constantly pushes the boundaries of flow physics, materials and structures operating in extreme environments, and complex control theories, leading to developing cutting-edge technologies and solutions. This innovation not only improves aerospace systems but often has broader applications in other industries.

2. Scientific Discovery: The pursuit of aerospace engineering often involves exploring unknown frontiers in both space exploration and atmospheric research. This exploration leads to new scientific discoveries and motivates a deeper understanding of fundamental principles in physics, materials science, computational science, and other related disciplines.

3. Environmental Sustainability: Aerospace engineers work towards making air and space travel more environmentally sustainable. This involves developing fuel-efficient propulsion systems, light-weight materials, and exploring alternative energy sources. As air and space vehicles are pushed to high speeds and more frequent use, addressing the environmental impact of aerospace activities contributes to important global sustainability challenges.

4. National Security and Defense: Aerospace engineering is integral to the development of defense and security technologies. Advancements in aircraft design, missile systems, and satellite technology contribute to national defense capabilities and strategic security.

5. Space Exploration and Colonization: Aerospace engineering drives advancements in developing spacecraft, propulsion systems, life support systems, and robotics for exploring other planets. The knowledge gained from these endeavors contributes not only to space science but also to potential future human colonization of other celestial bodies.

6. Communication and Connectivity: Aerospace engineering is instrumental in the development of satellite systems that enable global communication, weather monitoring, navigation, and Earth observation. These systems contribute to enhanced connectivity, disaster management, and a greater understanding of global climate patterns.

7. Medical and Biological Research: Space missions often involve experiments in microgravity environments. The results of these experiments can have applications in medical and biological research on Earth. For example, studying the effects of space travel on the human body contributes to our understanding of physiology and potential medical advancements.

8. Global Collaborations: Many aerospace projects involve international collaborations. Working together on projects such as space exploration or satellite programs fosters global cooperation and the sharing of knowledge and resources, contributing to peaceful relations and diplomacy.

Overall, aerospace engineering contributes to the advancement of knowledge and the resolution of complex issues by driving technological innovation, exploring new frontiers, addressing environmental challenges, enhancing national security, enabling global connectivity, inspiring education, and fostering global collaboration. The interdisciplinary nature of aerospace engineering ensures that its impact extends far beyond the confines of the field itself.

Along with the Board of Governors' 2025 Strategic Plan and the FSU and FAMU missions, the proposed AE program aligns well with FAMU's goal for High Impact Research, Commercialization, Outreach, and Extension Services. Specific to Strategic Priority 3 of FAMURising, the graduate program in AE will address the following goals:

- Goal 1: Expand and enhance cutting-edge research and creative scholarship for the benefit of the State of Florida, the nation, and the world.
- Goal 2: Increase research productivity, commercialization and return on investment.
- Goal 3: Increase the number of nationally recognized graduate programs.

A graduate program in Aerospace Engineering will add opportunities for FAMU and the Joint College faculty to engage in cutting-edge research to keep pace with constantly changing societal needs for safe and efficient aircraft and provide a workforce that can design, test and manufacture aerospace technology for the benefit of the nation as a whole. Faculty associated with the program are already active in research. The graduate program will serve to increase their research contributions to FSU, FAMU and the State of Florida, and train graduates who can also use advanced knowledge in positions that require advanced decision-making and skills necessary to implement effective solutions around the development and deployment of aerospace systems and structures. Having a strong research-oriented doctoral program attracts increased numbers of students with diverse backgrounds, which is also aligned with FAMU's mission.

B. Describe how the proposed program specifically relates to existing institutional strengths. This can include:

- **existing related academic programs**
- **existing programs of strategic emphasis**
- **institutes and centers**
- **other strengths of the institution**

The Department of Mechanical Engineering (ME) at FAMU-FSU has a long history of excellence in research and teaching in the fields of fluid dynamics, aerodynamics, and flow control. Current ME faculty are internationally recognized in aerodynamics research and are very active in a wide range of federally funded research programs in both experimental and computational aerodynamics. The research enterprise has been successful not only because of excellent faculty, but also for very talented and well-trained graduate and undergraduate students. The ME Department offers a wide range of fundamental core and technical electives in fields ranging from fluid dynamics theory, gas dynamics, fluid-structure interactions, smart materials, uncertainty quantification, and flow

control. These courses are offered to graduate students to support their research. Our undergraduate courses in areas related to aerodynamics start at the sophomore level and continue through senior technical electives to prepare these students for successful careers in industry and graduate school.

With respect to strategic interest, aerodynamic engineering is well aligned with STEM and supports the overall strategic vision of the State of Florida. It is also well aligned with both universities as FSU has a strong interest in expanding aerodynamics research in the Panhandle through the new Triumph program in Panama City. This program will require support from faculty to help guide the research and develop academic programs to support this major external investment of $98M. FAMU is highly committed to expanding STEM initiatives aimed at boosting the number of African American graduates in aerospace engineering. These initiatives are expected to draw more students, postdoctoral researchers, and funding, helping FAMU reach its goal of Carnegie R1 research status.

Aerospace graduate education and research is also well aligned with institutes and centers at FAMU and FSU. The Aero-Propulsion, Mechatronics, and Energy (AME) Building supports the educational and research mission of the Florida Center for Advanced Aero-Propulsion (FCAAP) Center within the FAMU-FSU College of Engineering. FCAAP is a state-funded center that started in 2008 to support research and workforce development in the State of Florida. This center is headquartered at FSU and includes faculty at multiple universities across the state including FAMU, the University of Florida, the University of Central Florida, and Embry-Riddle. Additional long-running research centers have been spun off of FCAAP, including a Federal Aviation Administration Center of Excellence on Commercial Space Transport (2011-2021) and a more recent Air Force Office of Scientific Research (AFOSR) Center of Excellence AEROMORPH on morphing high speed aircraft (awarded 2023). These research centers provide excellent experimental and computational resources and exceptional faculty that will be leveraged in this program.

Additional strengths worth noting include recently developed aerospace educational programs within the Mechanical Engineering Department. This includes an online Aerospace Certificate program available through the College for both FAMU and FSU students that started in the fall of 2021. Given its relevance to the proposed graduate program, key dates associated with this online certificate are included in the planning process table. Several faculty members within the Mechanical Engineering Department (led by Prof. Rajan Kumar) are also involved with an Air Force Research Laboratory (AFRL) Scholars program where undergraduate and graduate students take courses and conduct experiments within the ME department during fall and spring semesters and spend summers working with AFRL scientists at Eglin and Wright Patterson Air Force Bases. This collaboration may be in the form of on-site work at AFRL or conducting experiments at FCAAP and reporting to AFRL scientists. A similar program exists through a FAMU NASA MUREP program to support minority students interested in aerospace research. This program is led by a former department chair within the ME Department, Prof. Chiang Shih, and Co-PI Prof. Carl Moore. Lastly, the ME Department also runs a NASA University Leadership Initiative, led by Prof. Lance Cooley, which focuses on hydrogen-based aero-propulsion concepts. This not only aligns with the mission of the aerospace program but also the broader mission of FSU to support hydrogen energy applications. In summary, there are a large number of programs focused on aerospace

engineering which provide excellent opportunities for graduate students interested in this field.

C. Provide the date the pre-proposal was presented to the Council of Academic Vice Presidents Academic Program Coordination (CAVP ACG). Specify any concerns raised and provide a narrative explaining how each concern has been or will be addressed.

No concerns were raised in the CAVP ACG on 11/15/2023.

Institutional and State-Level Accountability

III. Need and Demand

A. Describe the workforce need for the proposed program. The response should, at a minimum, include the following:

- **current state workforce data as provided by Florida's Department of Economic Opportunity**
- **current national workforce data as provided by the U.S. Department of Labor's Bureau of Labor Statistics**
- **requests for the proposed program from agencies or industries in the university's service area**
- **any specific needs for research and service that the program would fulfill**

National and Florida Workforce Demand

Complete the table below and summarize its contents in narrative form. Include data for all linked occupations, including those in the table above. Use data from the Search by CIP or SOC Employment Projections Data Tool provided periodically by Board staff.

Labor Market Demand, CIP Code 14.0201

Occupations	in Job Openings		Job Openings		Total # of New Jobs		Education Level Needed for Entry
	FL 2023-31	U.S. 2022-32	FL 2023-31	U.S. 2022-32	FL 2023-31	U.S. 2022-32	
Aerospace Engineer	18.4%	6.1%	499	3,800	1,085	3,900	Bachelor's
Engineering Teachers, Post secondary	15.8%	9.3%	89	4,100	128	4,200	Doctoral Degree (Ph.D.)

Sources:
Date Retrieved: 02/21/2024
U.S. Bureau of Labor Statistics - https://data.bls.gov/projections/occupationProj Florida Department of Economic Opportunity - http://www.floridajobs.org/labor-market-information/data-center/statistical-programs/employment-projections

Aerospace engineering includes interdisciplinary graduate training in fluid dynamics, structures, thermal transport, dynamics, control, and materials which relies heavily on experimental, computational, and theoretical research. Graduate research and workforce development is a pivotal driver for creating novel aerospace systems and enhancing existing ones, critical for the evolution of technologies in aerospace transportation as well as energy, avionics, communications, information, homeland security, and national defense. Major federal funding agencies, such as the National Science Foundation, Department of Energy, Department of Defense, and NASA, allocate significant resources to support extensive research programs in aerospace engineering. Moreover, many industries, particularly in the State of Florida, are invested in aerospace and are actively seeking knowledgeable professionals in this field.

The demand for aerospace engineers is particularly pronounced in high-technology sectors that support aircraft development such as manufacturing, electronics, human performance in space, and sensing. The Bureau of Labor Statistics anticipates a 6% percent growth in the employment of aerospace engineers from 2022 to 2032 (https://data.bls.gov/projections/occupationProj). Florida, with its significant presence in aerospace, defense, marine, and space industries, hosts major players like Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics, all of which employ aerospace engineers. These professionals are crucial for the development and application of new materials and structures for lighter, fuel efficient, and agile military aircraft and cutting-edge commercial planes. Nationally renowned companies like Boeing, General Dynamics, GE, Lockheed Martin, and Northrop Grumman heavily involve aerospace engineers in key roles. The anticipated percent growth in employment of aerospace engineers from 2023-2031 is 18.4% in Florida – which is **three** times the national growth rate.

Aerospace engineering (AE) graduates find opportunities not only in corporate settings but also in national and industrial labs, contributing to research and development. The expanding budgets of federal agencies' Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs in AE fields indicate a growing demand for AE graduates. Recent placements from FAMU and FSU's Mechanical Engineering program highlight the strength of the job market, with graduates assuming leadership roles in big and small high-tech businesses. Notable employers include Space-X, Boeing, Northrop Grumman, and various national labs.

The Mechanical Engineering Department Chair has engaged with select companies and the Eglin Air Force Research Laboratory to explore their potential hiring of MS and PhD graduates in Aerospace Engineering. Positive responses indicate a demand for MS and doctoral-prepared graduates in AE. The salary outlook for these graduates is promising, with recent Ph.D. recipients from the existing program earning upwards of approximately $126,880 per year (**http://www.floridajobs.org/labor-market-information/data-center/statistical-programs/employment-projections**).

B. Provide and describe data that support student demand for the proposed program. Include questions asked, results, and other communications with prospective students.

Prospective students are drawn to the prospect of enrolling in a graduate degree program in aerospace engineering due to the diverse career opportunities available in commercial aviation, defense, space exploration, and research. Pursuing a graduate degree is seen as a pathway to acquiring specialized knowledge and skills that can unlock lucrative and thrilling career paths. Florida, recognized as a hub for aerospace opportunities, provides an array of possibilities, including:

- NASA and Space Industry: The presence of the esteemed Kennedy Space Center offers aerospace engineers the chance to engage in various NASA missions, encompassing spacecraft launches and maintenance, research initiatives, and contributions to space exploration. Leading private space industry players like SpaceX, Blue Origin, and Boeing have firmly established themselves in Florida.
- Defense and Military: Florida is home to key military bases such as Eglin, Tyndall, and MacDill Air Force Research Laboratories, presenting opportunities in defense projects and technology. Aerospace engineers can contribute to defense-related initiatives, including the development of military aircraft, missile systems, and other defense technologies.
- Commercial Aviation: Prominent companies like Embraer, Spirit AeroSystems, and Lockheed Martin have a significant presence in Florida, offering compelling career opportunities for Ph.D. graduates.
- Space Tourism: The emerging sector of space tourism, led by companies like Virgin Galactic and Blue Origin, presents exciting prospects for aerospace engineers with graduate degrees to contribute to this groundbreaking industry.
- Education and Research: Aerospace engineers holding a PhD can explore opportunities in teaching, research, and curriculum development, contributing to the academic and research landscape of aerospace engineering.

The FAMU-FSU College of Engineering conducted a survey to assess students' interest in pursuing graduate studies in Aerospace Engineering. The survey questions and responses from 289 individuals are available upon request.

C. Complete Appendix A – Table 1 (1-A for undergraduate and 1-B for graduate) with projected student headcount (HC) and full-time equivalents (FTE).

- **Undergraduate FTE must be calculated based on 30 credit hours per year**
- **Graduate FTE must be calculated based on 24 credit hours per year**

In the space below, explain the enrollment projections. If students within the institution are expected to change academic programs to enroll in the proposed program, describe the anticipated enrollment shifts and impact on enrollment in other programs.

Year One

New students (PhD HC=6, FTE=6, MS HC=19, FTE=12) for the doctoral and masters programs are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. After full implementation and development of marketing strategies, the program anticipates growing the program each year until it reaches approximately 24 PhD students (FTE=18) and 65 masters students (FTE=51) by year five. These estimates are based on five year historical numbers at the University of Florida and the University of Central Florida. With additional marketing efforts, the program may expand enrollment in the out years.

Year Two

New students (PhD HC=9, FTE=9, MS HC=34, FTE=26) for the doctoral and masters programs are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. These students are largely distributed among: 1) Individuals who have recently graduated from preceding degree programs at this university, 2) Individuals who graduated from preceding degree programs at other Florida public universities, and 3) Individuals who graduated from preceding degree programs at non-public Florida institutions.

Year Three

New students (PhD HC=14, FTE=10, MS HC=48, FTE=37) for the doctoral and masters programs are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. These students are largely distributed among: 1) Individuals who have recently graduated from preceding degree programs at this university, 2) Individuals who graduated from preceding degree programs at other Florida public universities, and 3) Individuals who graduated from preceding degree programs at non-public Florida institutions.

Year Four

New students (PhD HC=20, FTE=16, MS HC=63, FTE=53) for the doctoral and masters programs are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. These students are largely distributed among: 1) Individuals who have recently graduated from preceding degree programs at this university, 2) Individuals who graduated from preceding degree programs at other Florida public universities, and 3) Individuals who graduated from preceding degree programs at non-public Florida institutions.

Year Five

New students (PhD HC=24, FTE=18, MS HC=65, FTE=51) for the doctoral and masters programs are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. These students are largely distributed among: 1) Individuals who have recently graduated from preceding degree

programs at this university, 2) Individuals who graduated from preceding degree programs at other Florida public universities, and 3) Individuals who graduated from preceding degree programs at non-public Florida institutions.

Anticipated Enrollment Shifts and Impact on Other Programs

The launch of the new program is anticipated to cause a shift in enrollment from the current Mechanical Engineering (ME) program to the newly introduced Aerospace Engineering (AE) program. Below is a detailed overview of the expected changes and their impacts:

1. Transfer Trends:
    - Initial Phase: In the initial phase, we anticipate several students transferring from the Mechanical Engineering (ME) program to the Aerospace Engineering (AE) program. This shift is driven by the program's appeal and the alignment of student interests with aerospace applications.
    - Long-Term Trends: Over time, the transfer rate is expected to stabilize. As students who are interested in aerospace enroll in the AE program, the internal transfers should significantly decrease once the initial interest surge has been accommodated.
2. Impact on Enrollment in Other Programs:
    - Mechanical Engineering (ME): The ME program may experience a temporary decrease in enrollment numbers due to the transfer of students to AE. However, since the ME and AE programs share many foundational courses and faculty, the impact on ME should be minimal in the long run.
3. Resource Management:
    - Shared Resources: The shared courses and faculty between ME and AE will facilitate a smooth transition. The overlap in resources will help manage the changes effectively and ensure that the quality of education is maintained.

D. Describe the anticipated benefits of the proposed program to the university, local community, and the state. The benefits of the program should be described both quantitatively and qualitatively.

Anticipated benefits of introducing a program in aerospace engineering are extensive, promising numerous advantages for FAMU, FSU, the Panhandle region, the State of Florida, and the nation. These encompass the following:

- Create avenues for recruiting students interested in pursuing Aerospace Engineering and establish an educational framework for them to obtain a graduate degree.
- Leverage significant investments from FAMU and FSU in start-up packages and infrastructure support for faculty researching emerging fields.
- Introduce a cost-effective STEM program.
- Enhance research visibility for the FAMU-FSU College of Engineering.
- Expand opportunities for FAMU and FSU to secure more substantial funding for aerospace research, especially interdisciplinary grants.
- Address the pressing educational need to produce more engineers in the U.S. and

Florida, particularly in aerospace.

Contribute to research, economic development, and job creation in the Panhandle region and across the State.

- Enhance the Nation's technical capability by attracting researchers and supporting new product development.
- Support efforts to address the lack of minority representation in STEM, especially in engineering. The FAMU-FSU College of Engineering has made strides in this field, achieving a national ranking of fourth in producing PhDs for African Americans.

E. If other public or private institutions in Florida have similar programs at the four- or six-digit CIP Code or in other CIP Codes where 60 percent of the coursework is comparable, identify the institution(s) and geographic location(s). Summarize the outcome(s) of communication with appropriate personnel (e.g., department chairs, program coordinators, deans) at those institutions regarding the potential impact on their enrollment and opportunities for possible collaboration in the areas of instruction and research.

Two programs in the State of Florida have Aerospace Engineering graduate programs - the University of Florida and the University of Central Florida. The Chair, William S. Oates, has spoken to both department chairs at these universities to discuss potential impact and collaboration opportunities with these existing programs; see Appendix B.

F. If the proposed program substantially duplicates a program at Florida Agricultural and Mechanical University (FAMU), a letter of support from FAMU must be provided. The letter must address whether the proposed program may adversely affect FAMU's ability to achieve or maintain student diversity in its existing program. The institution's Equal Opportunity Officer shall review this section of the proposal, sign, and date the additional signature page to indicate that all requirements of this section have been completed.

There is currently no Aerospace Engineering program offered through the FAMU-FSU College of Engineering. FAMU offers undergraduate Architecture and Engineering Technology degrees; however, these programs are distinctly different from aerospace engineering.

IV. Curriculum

A. Describe all admission standards and all graduation requirements for the program. Hyperlinks to institutional websites may be used to supplement the information provided in this subsection; however, these links may not serve as a standalone response. For graduation requirements, describe any additional requirements that do not appear in the program of study (e.g., milestones, academic engagement, publication requirements).

Master's Program

Prospective students must have a BS degree (or a recognized equivalent) in Mechanical or Aerospace Engineering or any one of the following related fields: Any Engineering

Major, Chemistry, Computer Science, Materials Science, Mathematics/Applied Mathematics, or Physics/Applied Physics. Non-majors, students without a BS degree in Mechanical Engineering, may be required to take up to twelve credit hours of remedial coursework in Mechanical Engineering as a condition of admission.

Applicants must have at least a 3.0 upper-division GPA and GRE General Exam scores or an approved GRE waiver. International students must take the TOEFL exam and score at least 550 on the paper-based exam, 213 on the computer-based exam, or 80 on the Internet-based exam. Other acceptable English Language Proficiency Exam scores are as follows: Pearson Test in English (50), Duolingo (120), Cambridge C1 Advanced Level (180), and Michigan Language Assessment (55). Applicants must also submit a personal/research statement, résumé, and three letters of recommendation. Please visit the department website for additional details: https://eng.famu.fsu.edu/me.

Note: Effective August 2011, the GRE Revised General Test replaced the GRE General Test. To learn more about this test, go to https://ets.org/gre.

Ph.D. Program

Prospective students must have an MS degree in Mechanical or Aerospace Engineering or any one of the following related fields: any Engineering Major, Chemistry, Computer Science, Materials Science, Mathematics/Applied Mathematics, or Physics/Applied Physics. Non-majors, students without a BS degree in Mechanical or Aerospace Engineering, may be required to take up to 12 credit hours of remedial coursework in Mechanical Engineering as a condition of admission.

Applicants must have at least a 3.0 graduate GPA and GRE General Exam scores or an approved GRE waiver. International students must take the TOEFL Exam and score at least 550 on the paper-based exam, 213 on the computer-based exam, or 80 on the Internet-based exam. Other acceptable English Language Proficiency Exam scores are as follows: Pearson Test in English (50), Duolingo (120), Cambridge C1 Advanced Level (180), and Michigan Language Assessment (55). Applicants must also submit a personal statement, résumé, and three letters of recommendation. Please visit the department website for additional details: https://eng.famu.fsu.edu/me.

Note: Effective August 2011, the GRE Revised General Test replaced the GRE General Test. To learn more about this test, go to https://ets.org/gre.

BS to PhD Program

In addition to the standard PhD program the department offers a direct BS to PhD program. This program is limited to students with excellent academic transcripts and demonstrated potential for advanced research. Applicants must submit strong letters of recommendation from professors or persons qualified to evaluate their academic potential. Admission to the program is finalized at the end of the second semester. During their first two semesters, students must maintain a minimum graduate GPA of 3.50. Final admission to the PhD program is granted by the Graduate Committee.

Students initially admitted to the master's program may request a transfer to the BS-PhD program at the end of their second semester. The student must have maintained a graduate GPA of 3.50 or better during their first two semesters.

B. Describe the specific expected student learning outcomes associated with the proposed program and include strategies for assessing the proposed program's learning outcomes. If the proposed program is a baccalaureate degree, include a hyperlink to the published Academic Learning Compact and the document itself as Appendix C.

Program Learning Outcomes (PLO) - Aerospace Engineering – PhD

1. Job placement upon completion
   a. Objective/Outcome: Upon completion of the course of instruction, the student can apply their knowledge and skills in Aerospace Engineering in a job setting.
      i. Assessment measure type: Indirect – exit survey. Each doctoral student must complete his/her doctoral studies and complete an exit survey indicating a job or academic placement upon graduation.
      ii. Criterion: Each doctoral student will secure research or employment in their field of study upon graduation.
   b. Objective/Outcome: Doctoral graduates will secure research, academic, or industry employment upon graduation.
      i. Assessment measure type: Direct – Dissertation.
      ii. Criterion: Doctoral graduates will secure research or academic employment upon graduation. Student transcripts, journal articles, peer-reviewed publications and a successful dissertation defense will make students competitive in securing placement after graduation.
2. 5-Year Graduation Rate
   a. Objective/Outcome: Doctoral Students in Aerospace Engineering are expected to graduate on average within five years.
      i. Assessment measure type: This performance objective will be assessed by official FAMU-FSU College of Engineering enrollment and graduation statistics.
      ii. Criterion: The academic progression of doctoral students will be assessed: (1) completion of required coursework (24-credits in year one and two), (2) formation of doctoral committee at beginning of year two, (3) preliminary exam in year two, (4) prospectus presentation in year four, (5) dissertation submission and oral presentation in year five.
3. Communication Skills
   a. Objective/Outcome: Upon completion of the course of instruction, the student will have the ability to communicate effectively through written, oral, and visual means.
      i. Assessment measure type: Direct – Dissertation
      ii. Criterion:

- The dissertation and the presentation will be assessed by the dissertation committee (at least 5 members, among them one outside the department) and the overall quality of the program will be reviewed annually by the Graduate Committee.
- Students will successfully present research at national and international conferences and publish it in peer- reviewed journals.

Program Learning Outcomes (PLO) - Aerospace Engineering – MS

1. 2-Year Graduation Rate
   a. Objective/Outcome: Masters students in the Aerospace Engineering program are expected to graduate on average from FAMU-FSU College of Engineering within two years.
      i. Assessment measure type: This performance objective will be assessed by official FAMU-FSU College of Engineering enrollment and graduation statistics.
      ii. Criterion: Students will graduate nominally within two academic years from both FAMU and FSU.
2. Communication Skills
   a. Objective/Outcome: Upon completion of the course of instruction, the student will be able to communicate effectively with written, oral, and visual means.
      i. Assessment measure type: Direct – Master's Thesis
      ii. Criterion: Each student must produce either a report (BS/MS and non-thesis students) or a thesis (thesis-major),and perform relevant dissemination tasks (e.g. public seminar presentation, conference presentation, journal article, etc.) according to regulations set by the department, the college and the university. The written report and the presentation will be assessed by a group of faculty (2 for BS-MS students, 3 for thesis-major) and the overall quality of the program will be reviewed annually by the Graduate Committee.

C. If the proposed program is an AS-to-BS capstone, provide evidence that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as outlined in State Board of Education Rule 6A-10.024. Additionally, list any prerequisites and identify the specific AS degrees that may transfer into the proposed program.

☒ **Not applicable to this program because it is not an AS-to-BS Capstone.**

D. Describe the curricular framework for the proposed program, including the following information where applicable:

- **total number of semester credit hours for the degree**
- **number of credit hours for each course**
- **required courses, restricted electives, and unrestricted electives**
- **a sequenced course of study for all majors, concentrations, tracks, or areas of emphasis**

FAMU and FSU students will follow an identical curriculum as is typical within the joint

College. Throughout their Aerospace Engineering program, students will participate in the Interdisciplinary Seminar Series (0 credits). The curricular framework for MS and PhD programs is detailed below.

Master's Program

I. *Thesis Option*

Aerospace Engineering students must take the following minimum distribution of courses for a total of 30 credit hours:

Core Courses
Nine credit hours:

- EML 5060 Analysis in Mechanical Engineering, and
- Two core courses in the major area (either Dynamics and Controls, Fluid Mechanics and Heat Transfer, or Solid Mechanics and Materials Science)

Core courses in Dynamics and Controls:

- EGM 5444 Advanced Dynamics
- EML 5317 Advanced Design and Analysis of Control Systems
- EML 5361 Multivariable Control
- EML 5930r Special Topics in Mechanical Engineering

Core courses in Fluid Mechanics and Heat Transfer:

- EML 5152 Fundamentals of Heat Transfer
- EML 5155 Convective Heat and Mass Transfer
- EML 5709 Fluid Mechanics Principles with Selected Applications
- EML 5930r Special Topics in Mechanical Engineering

Core courses in Solid Mechanics and Materials Science:

- EGM 5611 Introduction to Continuum Mechanics
- EML 5930r Special Topics in Mechanical Engineering

Aerospace Engineering Courses

- Six credit hours: two courses in Aerospace Engineering.

Electives
Nine credit hours:

- Select three graduate-level courses in any engineering field, mathematics, or any science discipline (computer science, physics, etc.).
- Courses must be selected in consultation with the student's major professor.
- One of the three electives may include EML 5905 Directed Individual Study or EML 5910 Supervised Research.

Thesis
Six credit hours:

- EML 5971 Thesis, and
- EML 8976 Master's Thesis Defense

II. Non-Thesis Option

The non-thesis option requires 30 credit hours, of which at least 27 credit hours must be letter-graded courses. Students must complete 21 credit hours of coursework within aerospace or mechanical engineering. Nine credit hours may be taken outside the department in any of the following areas: engineering, mathematics, or any science discipline (computer science, physics, etc.).

Ph.D. Program

The standard PhD program requires 48 credit hours of coursework, of which at least 24 credit hours must be dissertation hours. The remaining letter-graded credit hours are divided into three areas:

General Engineering and Mathematics

Students must complete six credit hours of general engineering and advanced mathematics courses. One of those courses must be EML 5061 Analysis in Mechanical Engineering II. The remaining course must be from the approved course list. See the department website for the approval list.

Electives

Students must complete 18 credit hours of graduate-level, letter-graded electives. Courses may be taken in any engineering program, mathematics, and/or any science discipline.

BS to PhD Program

The BS-PhD program requires 60 credit hours of coursework, of which at least 24 credit hours must be dissertation hours. The remaining 36 letter-graded credit hours are divided into five areas:

General Engineering and Mathematics

Students must complete 9 credit hours of general engineering and advanced mathematics courses at the 5000 or higher level. One of those courses must be EML 5061 Analysis in Mechanical Engineering II. The remaining course must be from the approved course list. See the department website for the approval list.

Core Courses

Students must complete EML 5060 Analysis in Mechanical Engineering I and two courses in their chosen depth area for 9 semester hours.

Aerospace Engineering Courses

Students must complete 6 credit hours of general aerospace-engineering courses.

Electives

Students must complete 12 credit hours of electives. Courses may be taken in any engineering program, mathematics, and/or any science discipline. Students may substitute one elective course with a Directed Individual Study (DIS) course or Supervised Research (SR) course.

Additional Requirements

Preliminary Examination

All PhD students must register for and pass EML 8968 (Preliminary Examination) before their fourth semester ends. The exam is designed to evaluate a student's grasp of a specified spectrum of Aerospace Engineering (at the undergraduate level) and their ability to think creatively. It consists of an oral examination following a written research proposal and is administered each term. After passing the exam, the student will be granted doctoral candidacy status, allowing them to register for dissertation credit hours.

Prospectus Defense

Within one year of obtaining candidacy status each PhD student must present a prospectus to their committee on a research project suitable for a doctoral dissertation. A forty-five-minute presentation of the proposed dissertation topic will be presented to the students' graduate committee for approval.

Dissertation Defense

Demonstrated ability to perform original research at the forefront of mechanical engineering is the final and major criterion for granting the doctoral degree. The candidate's dissertation serves, in part, to demonstrate such competence; on completion it is defended orally in a public seminar before the doctoral dissertation committee, which may then recommend the awarding of the degree.

F. For degree programs in medicine, nursing, and/or allied health sciences, identify the courses with the competencies necessary to meet the requirements in Section 1004.08, Florida Statutes. For teacher preparation programs, identify the courses with the competencies required in Section 1004.04, Florida Statutes.

☒ **Not applicable to this program because the program is not a medicine, nursing, allied health sciences, or teacher preparation program.**

G. Describe any potential impact on related academic programs or departments, such as an increased need for general education or common prerequisite courses or an increased need for required or elective courses outside of the proposed academic program. If the proposed program is a collaborative effort between multiple academic departments, colleges, or schools within the institution, provide letters of support or MOUs from each department, college, or school in Appendix D.

As a graduate program, general education courses will be minimal; however, a strong mathematical background is required to understand fluid dynamics, nonlinear solid mechanics, and computational materials science. The Department of Mechanical Engineering has a long track record of working with several faculty within FSU's Mathematics Department. This has continued up to the present day through Mechanical Engineering seminars from faculty within the Math Department and meetings between faculty from Mechanical Engineering and Mathematics to build research partnerships. In certain instances, graduate students will take mathematics courses to supplement AE courses. This may be required to build a deeper understanding of numerical methods, interpret data with advanced statistics, machine learning algorithm development, and various other techniques to solve partial differential equations. We will continue to build these relationships to strengthen AE research via faculty collaborations and better educate our students with important mathematics courses. New partnerships with faculty at FAMU's College of Science and Technology are being formed to better prepare students for graduate studies in aerospace engineering, especially in math and science. These collaborations will also offer students valuable research opportunities and practical experience.

H. Identify any established or planned educational sites where the program will be offered or administered. Provide a rationale if the proposed program will only be offered or administered at a site(s) other than the main campus.

This program will be offered as part of the FAMU-FSU College of Engineering in Tallahassee Florida. Students will take classes on the FAMU main campus, in the FAMU-FSU College of Engineering, and on the FSU main campus. Students will do their research where their advisor has their research labs on the FAMU main campus, in buildings in the FAMU-FSU College of Engineering, and in research buildings in Innovation Park (in Tallahassee).

I. Describe the anticipated mode of delivery for the proposed program (e.g., face-to-face, distance learning, hybrid). If the method(s) of delivery will require specialized services or additional financial support, describe the projected costs below and discuss how they are reflected in Appendix A – Table 3A or 3B.

The courses will be delivered in the traditional face-to-face manner at the FAMU-FSU College of Engineering, FAMU main campus, or on the FSU campus as part of the cooperative agreement between the two universities.

J. Provide a narrative addressing the feasibility of delivering the proposed program through collaboration with other institutions, both public and private. Cite any specific queries of other institutions concerning shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.

FAMU and FSU will jointly offer the Ph.D. in Aerospace Engineering through their joint College. No other institutions will participate in the course offerings at this time. With the recent Triumph award for additive manufacturing and aerospace given to FSU Panama City Campus, research expansion at this facility will be considered once infrastructure is in place.

K. Describe any currently available sites for internship and/or practicum experiences. Describe any plans to seek additional sites in Years 1 through 5.

☒ Not applicable to this program because the program does not require internships or practicums.

C. For appropriate degree programs, discuss how employer-driven or industry-driven competencies were identified and incorporated into the curriculum. Additionally, indicate whether an industry or employer advisory council exists to provide input for curriculum development, student assessment, and academic-force alignment. If an advisory council is not already in place, describe any plans to develop one or other plans to ensure academic-workforce alignment.

An advisory council currently exists for the Department of Mechanical Engineering which includes several aerospace industry engineers and Air Force Research Laboratory research scientists. Given the strong overlap of this advisory council, they will assist in providing input to our curriculum and other graduate student support such as internships and scholarships.

VI. Faculty Participation

A. Use Appendix A – Table 2 to identify existing and anticipated full-time faculty who will participate in the proposed program through Year 5, excluding visiting or adjunct faculty. Include the following information for each faculty member or position in Appendix A – Table 2:

- **the faculty code associated with the source of funding for the position**
- **faculty member's name**
- **the highest degree held**
- **academic discipline or specialization**
- **anticipated participation start date in the proposed program**
- **contract status (e.g., tenure, tenure-earning, or multi-year annual [MYA])**
- **contract length in months**
- **percent of annual effort that will support the proposed program (e.g., instruction, advising, supervising)**

This information should be summarized below in narrative form. Additionally, provide the curriculum vitae (CV) for each identified faculty member in Appendix E.

The source of funding for all faculty within this program is associated with the Mechanical Engineering Budget 218000110 budget. Faculty members involved in the program are listed below along with details describing their background and amount of participation. All existing faculty members will start supporting the program in year 1 and they are projected to continue supporting the program in year 5.

Alexandre Berger has a PhD in Aerospace Engineering. He specializes in experimental fluid dynamics at both low and high (hypersonic) speeds. He is a tenure-earning faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 4% for the first year and 13% for the fifth year.

Brandon Krick has a PhD in Mechanical Engineering. He specializes in experimental mechanics and tribology. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 15% for the fifth year.

Carl Moore has a PhD in Mechanical Engineering. He specializes in dynamics and haptic systems. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 10% for the fifth year.

Chiang Shih has a PhD in Mechanical Engineering. He specializes in experimental fluid dynamics. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 8% for the first year and is anticipated to retire by the fifth year.

Christian Hubicki has a PhD in Mechanical Engineering. He specializes in robotics and optimal control. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 15% for the fifth year.

David Larbalestier has a PhD in Physical Metallurgy. He specializes in experimental characterization of superconducting materials. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and is anticipated to retire by the fifth year.

Eric Hellstrom has a PhD in Materials Science & Engineering. He specializes in experimental characterization of ceramics and superconductors. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and is anticipated to retire by the fifth year.

Farrukh Alvi has a PhD in Mechanical Engineering. He specializes in experimental fluid dynamics. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year

and 5% for the fifth year since he is on a reduced teaching load while working in the FSU Provost office.

Fumitake Kametani has a PhD in Materials Science & Engineering. He specializes in characterization and microscopy of advanced materials. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 5% for the fifth year.

Huixuan Wu has a PhD in Mechanical Engineering. He specializes in experimental fluid dynamics and instrumentation development. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 18% for the fifth year.

Jizhe Cai has a PhD in Aerospace Engineering. He specializes in experimental characterization of extreme materials. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 15% for the first year and 40% for the fifth year.

Juan Ordonez has a PhD in Mechanical Engineering. He specializes in modeling of advanced energy systems for naval and aerospace applications. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 15% for the fifth year.

Kourosh Shoele has a PhD in Mechanical Engineering. He specializes in modeling of fluid-structure interactions. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 15% for the fifth year.

Mohd Ali has a PhD in Mechanical Engineering. He specializes in experimental fluid dynamics. He is a teaching faculty member on a twelve-month appointment. His percentage of annual effort that will support the aerospace graduate program is 10% for the first year and 18% for the fifth year.

Neda Yaghoobian has a PhD in Mechanical Engineering. She specializes in modeling of fluid dynamic, atmospheric behavior, and fire dynamics. She is a tenured faculty member on a nine-month appointment. Her percentage of annual effort that will support the aerospace graduate program is 10% for the first year and 40% for the fifth year.

Rajan Kumar has a PhD in Aerospace Engineering. He specializes in experimental characterization of fluid dynamics. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 10% for the first year and 20% for the fifth year.

Unnikrishnan Sasidharan Nair has a PhD in Mechanical Engineering. He specializes in modeling of high speed fluids. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 15% for the fifth year.

Wei Guo has a PhD in Physics. He specializes in characterizing quantum turbulence and quantum computing hardware. He is a tenured faculty member on a nine-month

appointment. His percentage of annual effort that will support the aerospace graduate program is 5% for the first year and 12% for the fifth year.

William Oates has a PhD in Mechanical Engineering. He specializes in modeling and experimental characterization of smart materials and adaptive structures. He is a tenured faculty member on a nine-month appointment. His percentage of annual effort that will support the aerospace graduate program is 15% for the first year and 20% for the fifth year. The larger percentage listed here is in anticipation of administrative duties as Department Chair.

Additional faculty members are proposed to be hired over the five-year build-up period. This includes 2 faculty on existing lines that are unfilled. One of these is expected to be at the Assistant Professor level in the field of aerospace structures. This person must have a PhD in aerospace, mechanical engineering or closely related field. They are expected to be hired into Mechanical Engineering in the fall of 2024 (as part of an ongoing search) and start in the fall of 2025 in the Aerospace Engineering graduate program. His/her percent effort will increase from 20% in year one to 30% in year 5. The second position is expected to be at the Associate Professor level. This person will also have a PhD in aerospace or mechanical engineering or a closely related field. This person is expected to start within the program in the fall of 2025. This existing line is associated with the departure of Prof. Lou Cattafesta from the Mechanical Engineering department in 2023. He/she is expected to commit 30% of their time to this program. Nine additional new faculty lines are proposed (4 tenure-earning Assistant Professors, 2 Associate Professors and 3 Research Faculty). These faculty members are also expected to have PhDs in aerospace or mechanical engineering or a closely related field. They are all expected to contribute 30% of their time to the program by year 5. The hiring will be distributed over years 1-5. In 2026, we plan to hire one Associate Professor and one Assistant Professor. In 2027, we expect to hire 2 Assistant Professors and 1 Research Faculty. In 2028, we expect to hire 2 Research Faculty.

B. Provide specific evidence demonstrating that the academic unit(s) associated with the proposed program has been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, and other qualitative indicators of excellence (e.g., thesis, dissertation, or research supervision).

All faculty members engaged in this program are active in teaching, research, and service. The most active researchers have on the order of $1.2M-$1.3M research expenditures per year while the average annual research expenditure is on the order of $350,000. This includes basic research through Department of Defense programs (e.g., ARO, AFOSR, ONR, DARPA), the National Science Foundation (NSF), and the Department of Energy (DOE). One of our Assistant Professors, Prof. Unni Nair, received the ONR Young Faculty Award in 2023 which is a highly prestigious young faculty grant. He will be expanding research in computational fluid dynamics of high speed flows. Five other faculty within this cohort have been awarded the NSF CAREER and two have been awarded the DARPA Young Faculty Award (YFA). With respect to teaching, all tenured and tenure-track faculty teach a nominal 3 courses per year (2+1 or 1+2) excluding new faculty. We provide junior faculty with a reduced course load (1+1) so that they can spend

more time building their research program, recruiting students, and learning new pedagogical methods. Other exclusions to this teaching load are applied to faculty members with high research activity or high service load (e.g., department chair, center director). However, some faculty continue to teach despite large service and research loads. For example, Prof. Rajan Kumar created a new course on hypersonic flows which was co-taught with Prof. Unni Nair in the spring of 2023. Prof. Kumar is the Director of FCAAP and also had over $1M of research expenditures last year. Teaching instructors are expected to be on 12 month contracts and teach a full load of 3+3+2 courses. Exclusions to this rule are considered for courses that contain additional experimental laboratory elements or recitations. Additionally, the Mechanical Engineering Department created an online Aerospace Engineering Certificate through FAMU and FSU which included the creation of seven new online courses that are currently offered asynchronously. Additionally, four of the seven new courses are Quality Matters (QM) certified. These teaching activities are in addition to normal Mechanical Engineering course offerings. All faculty are required to participate in a variety of service activities including contributions to department, college, and university committees and contributions to the broader community which may include research communities and/or K-12 programs.

VII. Estimate of Investment

A. Use Appendix A – Table 3A or 3B to provide projected costs and associated funding sources for Year 1 and Year 5 of program operation. In narrative form, describe all projected costs and funding sources for the proposed program(s). Data for Year 1 and Year 5 should reflect snapshots in time rather than cumulative costs.

The base reallocation (E&G) for Year 1 is $237,825 of faculty salaries and benefits. Additional programmatic expenses are $10,000 for graduate student recruitment. The base reallocation (E&G) in Year 1 also includes $10,000 for 0.3 FTE A&P or OPS for support staff plus $50,000 OPS funds for assistantships and fellowships to help attract high-quality graduate students whose salary is primarily supported by C&G. *(Note that this is the only projected Year 1 expense relevant only to the doctoral level, since this type of support is generally reserved for doctoral students.)* The total E&G reallocated in Year 1 is $307,825. The estimated amount of C&G in Year 1 is $456,871. This estimate is based on five-year research expenditure averages of the faculty involved in the program times their percent effort to the new program. The C&G is assumed to be distributed across faculty summer salaries, student stipends, materials, and travel expenses.

In Year 5, the Continuing Base (E&G) includes $588,375 in faculty salaries and benefits, $15,000 for student recruiting events and other programmatic expenses, $50,000 in A&P/OPS staff support, and $50,000 OPS funds for assistantships and fellowships. *(Note that this is the only projected Year 5 expense relevant only to the doctoral level, since this type of support is generally reserved for doctoral students.)* The C&G in Year 5 is estimated to be $1,158,849 based on estimated research grants and contracts of new faculty members.

B. See Appendix A for details. Use Appendix A – Table 4 to show how existing Education & General (E&G) funds will be reallocated to support the

proposed

program in Year 1. Describe each funding source identified in Appendix A – Table 4, and justify below the reallocation of resources. Describe the impact the reallocation of financial resources will have on existing programs, including any possible financial impact of a shift in faculty effort, reallocation of instructional resources, greater use of adjunct faculty and teaching assistants, and explain what steps will be taken to mitigate such impacts.

The Mechanical Engineering Budget 218000110 includes $3,534,076 base before reallocation. The amount to be reallocated is $307,825. A negligible impact on the Mechanical Engineering Department is anticipated given the shared mission of engineering research and education between mechanical and aerospace engineering. Furthermore, aerospace engineering research and education are well aligned with other programs at the College of Engineering including Industrial and Manufacturing Engineering, Electrical and Computer Engineering, and Materials Science and Engineering. We expect the alignment of aerospace engineering with existing engineering programs to minimize any unforeseen impacts on resource allocation.

C. If the institution intends to operate the program as self-supporting, market tuition rate, or establish a differentiated graduate-level tuition, as described in Board of Governors Regulation 8.002, provide a rationale and a timeline for seeking Board of Governors' approval.

☒ Not applicable to this program because the program will not operate as self-supporting, market tuition rate, or establish a differentiated graduate-level tuition.

D. Provide the expected resident and non-resident tuition rate for the proposed program for both resident and non-resident students. The tuition rates should be reported per credit hour unless the institution has received approval for a different tuition structure. If the proposed program will operate as a continuing education program per Board of Governors Regulation 8.002, describe how the tuition amount was calculated and how it is reflected in Appendix A – Table 3B.

Registration and tuition fees are established by the Board of Education and the FSU and FAMU Board of trustees as required by the Florida Legislature. The program will apply the graduate tuition fees as outlined in the following schedule. The fees are subject to change without notice.

	In-State	Out-of-State
FSU*	$479.32	$1,110.72
FAMU**	$405.67	$1,022

*Per credit hour does not include the Student Facilities Use Fee assessed to Main Campus Students at the rate of $20 per semester.
**Per credit hour does not include a required fees of $70 for fall and spring semesters each and $33 for summer semester.

E. Describe external financial and in-kind resources available to support the proposed program and explain how this amount is reflected in Appendix A – Table 3A or 3B.

E. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Appendix A – Table 3A or 3B includes only I&R costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase due to the program, describe and estimate those expenses in narrative form below. High enrollment programs, in particular, are expected to necessitate increased costs in non-I&R activities.

☒ Not applicable to this program because no new capital expenditures are needed to implement or sustain the program through Year 5.

Similarly, no capital expenditures are requested here; however, investments that may need consideration to sustain the program include faculty start-up funds and a future

research building for space and propulsion applications. Whereas the start of a strong AE graduate program can be created with existing facilities at the Aero-Propulsion, Mechatronics, and Energy Building located near the FAMU-FSU College of Engineering, these facilities focus on subsonic, transonic, supersonic and hypersonic (Mach ~5-6) fluid dynamics and robotic applications. An additional research building should be considered in the long term to expand the program to space applications. This will be important for the growth of the graduate program and the future development of an undergraduate program.

F. Describe any additional special categories of resources needed to operate the proposed program through Year 5, such as access to proprietary research facilities, specialized services, or extended travel. Explain how those projected costs of special resources are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional special categories of resources are needed to implement or sustain the program through Year 5.

G. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5 and explain how those are reflected in Appendix A – Table 3A or 3B.

☐ Not applicable to this program because no fellowships, scholarships, and/or graduate assistantships will be allocated to the proposed program through Year 5.

Fellowships and/or scholarships are proposed for the first year $50,000 and similarly $50,000 in the fifth year, to attract highly qualified U.S. students into the aerospace field. These funds will be a small fraction of the expected C&G funds that will support graduate students as shown in Table 3A. These funds will provide additional salaries for highly qualified PhD students at competitive rates to top AE programs within the U.S. The students will be selected by the graduate committee in the Mechanical Engineering Department with input from a faculty member's recommendations who intends to mentor and support the student with a base salary.