NEW PROGRAM PROPOSAL

Name of Institution
University of South Carolina
College of Engineering and Computing
Mechanical Engineering

Name of Program ((include concentrations, options, and tracks)
Bachelor of Science in Engineering, Aerospace Engineering.

Program Designation

- ☐ Associate's Degree
- ☐ Master's Degree
- ☒ Bachelor's Degree: 4 Year
- ☐ Specialist
- ☐ Bachelor's Degree: 5 Year
- ☐ Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)
- ☐ Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Does the program qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- ☒ Yes
- ☐ No

Proposed Date of Implementation
Fall 2018

CIP Code
14.0201

Delivery Site(s)
Columbia

Delivery Mode

- ☒ Traditional/face-to-face*
  *select if less than 50% online
- ☐ Distance Education
  - ☐ 100% online
  - ☐ Blended (more than 50% online)
  - ☐ Other distance education

Program Contact Information
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Institutional Approvals and Dates of Approval
ME Department approval New Program, September 9th, 2016
Pre-authorization provost November 14th, 2016
ME Department approval New Courses, December 1st, 2016
USC Faculty Senate, November 1, 2017

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Background Information

The primary mission of the University of South Carolina Columbia is the education of the state's citizens through teaching, research, creative activity, and community engagement.

The primary mission of the University of South Carolina – Columbia is the education of the state's citizens through teaching, research, creative activity, and community engagement. The Aerospace Engineering bachelor's degree will help achieve that mission. Aerospace is the second largest industry cluster in the state, after the automotive industry. There are close to 500 Aerospace-related companies in the state which support over 102,000 jobs. The employment growth rate is 8 times higher than the state average. Currently there is no undergraduate aerospace program in the state and South Carolina is 1 of only 10 states in the nation without an aerospace undergraduate major program.

In 2014, a survey was sent out to over 400 companies of which 34 responses (8% response) were analyzed. The results showed that 77% of respondents thought that a Bachelor of Science in Aerospace Engineering would be beneficial to their company and 87% of respondents thought that the proposed Aerospace Engineering BS curriculum was sufficient to meet their needs. The demand for enrollment in an aerospace program is growing amongst the youth in SC; 1 in 10 high school students visiting USC's College of Engineering and Computing ask about an aerospace major.

Within USC the demand for graduate students with an aerospace background is increasing to be able to resource all of the research programs of the university in this area. The demand for graduates with an aerospace engineering degree with a concentration in materials and structures is growing due to the growing materials and structures industry in the state.

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Program Objectives

The aerospace engineering program teaches students skills that will help them to be successful for life and work in the 21st century. In addition to engineering courses, students will learn to work in project groups, acquiring social skills to work in a multi-disciplinary environment and learn how to present their work. Through the design and lab work, they will gain hands-on real life experience that will shape them into responsible and innovative individuals. Students that successfully complete the aerospace program will be ready for employment in a knowledge-based economy and be competitive in a global society. In addition, the program prepares students for the existing master and future PhD program in aerospace engineering that is available at USC, ensuring the natural flow of students to the graduate and post-graduate programs.

Program Educational Objectives
Within a few years of graduation, our graduates are expected to achieve the following milestones:

- Advance professionally in the aerospace industry, automotive industry, technical consultancy or in any other chosen career field
- Earn advanced degrees in aerospace engineering, (or a related technical discipline such as automotive engineering), business, law
- Attain leadership positions in today's rapidly changing, increasingly technological, global society.
- Be agents of innovation and function effectively as responsible members of professional teams.

Assessment of Need

The Boeing Company indicated that USC should become the University of Washington's equivalent for Education and Research in Aerospace Engineering on the East Coast. If successful, being associated with the wide range of science based innovation in the aerospace industry and the players in this industry such as Boeing will be beneficial for USC's reputation.

The department of Mechanical Engineering has been running a Minor in Aerospace Engineering as well as an MS Aerospace Program for the last 3 years. Centers such as the McNAIR Center, The Center for Predictive Maintenance and the Center for Friction Based Manufacturing are examples of research entities that are successful in aerospace related research. The individuals within these Centers are current if not leading personalities in the field.

The program will lead to an additional influx of undergrad students leading to tuition fee increases. The program will lead to an increase in graduate students in the MS and PhD programs, leading to additional tuition fees as well as additional industrial and state/federal research grants including coverage of overhead and faculty involvement.

According to studies completed in 2014 and 2016 on the economic impact of the aerospace industry cluster in South Carolina, the annual economic impact of the aerospace cluster resulting from the private sector activity totals nearly $8 billion in total economic output. When combined with the economic activities of the military facilities in SC, the joint impact totals over $17 billion in economic output and over 10,000 jobs, representing approximately 5.9% of SC's total annual gross state product. The net annual contribution that the aerospace cluster

makes to SC gross state product is approx. $10.4 billion, implying that the aerospace cluster generates economic activity (directly and indirectly) that brings over $532 million in tax revenue annually for the State that would not exist otherwise.

Employment Opportunities

Is specific employment/workforce data available to support the proposed program?

☒Yes

☐No

If yes, complete the table and the component that follows the table on page 4. If no, complete the single narrative response component on page 5 beginning with "Provide supporting evidence."

Employment Opportunities			
Occupation	**Expected Number of Jobs**	**Employment Projection**	**Data Source**
Aerospace Core (as defined by the Data Source through references to NAICS codes)	17,117	See total growth number at bottom of the table	Uncovering the Stealth Cluster, Economic Impact of Civilian and Military Aerospace on South Carolina, 2014 *)
Shaw Airforce Base	9,585	Idem	Idem
McEntire Joint National Guard base	1,742	Idem	Idem
Charleston Airforce Base	20,315	Idem	Idem
Beaufort Marine Corps Air Station	5,012	Idem	Idem
	The numbers in this column are current job numbers	Total growth per year 1,032. Assuming 10% of these jobs require and undergrad degree, the growth is around 100 jobs per year.	

Provide additional information regarding anticipated employment opportunities for graduates. (1000 characters)

*) Economic impact studies by the Darla Moore School for Business, USC **) in 2014 and 2016 showed that:

- The aerospace cluster experienced one of the highest growths rates in employment among all industries in South Carolina over the last decade, with annual employment growth in the aerospace cluster averaged 11.4%, which is approximately 8x higher than the average annual growth rate for the state overall (2014).
- The impact of aerospace on SC's economy has grown to $19 billion in 2016, an increase of $2 billion since last measured in 2014
- Because of the large focus of aircraft manufacturing on advance composite materials, precision metal parts and systems integration, the jobs supported by the aerospace cluster require expertise in many special fields related to aerospace science and engineering. Positions are typically high skilled, high waged jobs, paying an annual of $70,749, which is approx. 72% higher than the average total compensation and 46% higher than the average total compensation of manufacturing jobs in SC.
- The total economic impact resulting from the private sector component of the aerospace cluster implies that for every 10 jobs created in the private sector component of the SC aerospace cluster an additional 12 jobs are created elsewhere in the state. In 2016 this increased to 13 jobs.
- SC's employers indicate that they will rely heavily upon the high school education system to prepare these workers, but companies stress that post-secondary education is desirable for the high-demand job categories
- The aerospace industry cluster continues to outpace the state average in terms of employment growth, and it continues to grow at a rate comparable to the automotive industry cluster.

The demand for graduates with an aerospace background is necessary to be able to effectively utilize resources through the engineering research programs at the university. The demand for enrollment in an aerospace program is growing amongst the youth in SC. The demand for graduates with an aerospace engineering degree with a concentration in materials and structures is growing due to the growing materials and structures industry in the state.

The program is intended to train students in the field of aerospace engineering such that they are well prepared for a career as multidisciplinary engineer in the aerospace industry or any other industry that requires the abilities specified by ABET for engineers at the BS level.

The information in the table refers only to employment opportunities directly associated with the aerospace sector. Many additional employment opportunities could be listed. Data shows that aerospace engineering graduates can find employment in every industry requiring multi-disciplinary knowledge and skills, entrepreneurial spirit and creativity. The aerospace engineering undergrad program will also prepare students for graduate school in various disciplines.

**Source: Studies are available through scaerospace.com

Provide supporting evidence of anticipated employment opportunities for graduates, including a statement that clearly articulates what the program prepares graduates to do, any documented citations that suggests a correlation between this program and future employment, and other relevant information. Please cite specific resources, as appropriate. (3000 characters)

Note: Only complete this if the Employment Opportunities table and the section that follows the table on page 4 have not previously been completed.

Will the proposed program impact any existing degree programs and services at the institution (e.g., course offerings or enrollment)?

☒Yes

☐No

If yes, explain. (500 characters)

Currently, students interested in the aerospace industry opt for the Mechanical Engineering or Electrical Engineering programs. Once the aerospace program becomes available, a percentage of this target group might enroll in the aerospace major program. However, the larger part of the enrollment is expected to be additional to the current enrollment numbers for Mechanical and Electrical Engineering.

The first two years of the Aerospace Engineering program are similar to the Mechanical Engineering program. Therefore, class sizes/number of sections per course will increase. The courses in the tracks related to Electrical Engineering and Integrated Information Technology will also see an increase in class size/number of sections. The other units are aware of this future need are prepared to handle the increases.

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List of Similar Programs in South Carolina

Program Name	Institution	Similarities	Differences
No similar programs are available in the State			

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Description of the Program

Projected Enrollment						
Year	Fall		Spring		Summer	
	Headcount	Credit Hours (class credit hours)	Headcount	Credit Hours (class credit hours)	Headcount	Credit Hours
2018	30	15+	30	15	0	0
2019	60	30+	60	30	0	0
2020	90	45+	90	45	0	0
2021	120	60+	120	60	0	0
2022	120	60+	120	60	0	0
		*)		*)		

*) The Fall semester of the Freshmen year has a maximum of 18 credit hours of classes. All subsequent fall and spring semester have 15 credit hours of classes.

Besides the general institutional admission requirements, are there any separate or additional admission requirements for the proposed program?

☐Yes

☒No

If yes, explain. (1000 characters)

Are there any special articulation agreements for the proposed program?

☐Yes

☒No

If yes, identify. (1000 characters)

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Curriculum

Select one of the following charts to complete: Curriculum by Year **or** Curriculum by Category

Curriculum by Year					
Course Name	**Credit Hours**	**Course Name**	**Credit Hours**	**Course Name**	**Credit Hours**
Year 1					
Fall		**Spring**		**Summer**	
Calculus I	3	Calculus II	3	NA	
Critical Reading and Composition	3	Rhetoric and Composition	3		
General Chemistry I	3	General Chemistry II	3		
General Chemistry I Laboratory	1	General Chemistry II Laboratory	1		
Social Science Elective	3	Aesthetic and Interpretive Understanding	3		
Introduction to Aerospace Engineering	3	Introduction to Engineering Graphics and Visualization	3		
Foreign Language	0-6				
Total Semester Hours	16-22	Total Semester Hours	16	Total Semester Hours	
Year 2					
Fall		**Spring**		**Summer**	
Vector Calculus	3	Statistics for Engineers	3	NA	
Elementary Differential Equations	3	Introduction to the Mechanics of Solids	3		
Essentials of Physics I	3	Essentials of Physics II	3		
Essentials of Physics I Lab	1	Essentials of Physics II Lab	1		
Statics	3	Aerodynamics I Incompressible Flow	3		
Introduction to Applied Numerical Methods	3	Thermodynamic Fundamentals	3		
Total Semester Hours	16	Total Semester Hours	16	Total Semester Hours	
Year 3					
Fall		**Spring**		**Summer**	
Aerospace Lab 1	3	Flight and Orbital Mechanics	3	NA	
Engineering Materials	3	Mechanical Vibrations	3		
Track 1 **)	3	Track 2 **)	3		
Linear Algebra	3	Aerospace Systems	3		
Dynamics	3	Aerospace Structures I	3		
	15		15		
Total Semester Hours		Total Semester Hours		Total Semester Hours	

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Curriculum by Year					
Course Name	**Credit Hours**	**Course Name**	**Credit Hours**	**Course Name**	**Credit Hours**
Year 4					
Fall		**Spring**		**Summer**	
Aerospace Lab 2	3	Values, Ethics and Social Responsibility	3	NA	
Manufacturing Processes	3	Flight Dynamics and Control	3		
Track 3 **)	3	Track 4 **)	3		
Energy, Power and Propulsion	3	Track 5 **)	3		
Historical Thinking	3	Design	3		
Total Semester Hours	15	Total Semester Hours	15	Total Semester Hours	
Year 5					
Fall		**Spring**		**Summer**	
NA		NA		NA	
Total Semester Hours		Total Semester Hours		Total Semester Hours	

**) The program includes electives in 5 tracks of 15 credit hours each:
Track 1: **Aeromechanical Systems**. All of: Aircraft Design I, Introduction to Composite Materials, Introduction to Finite Element Stress Analysis, Plus two of: Kinematics and Dynamics of Machines, Heat Transfer, Robotics in Mechanical Engineering, Compressible Fluid Flow, Engineering Optimization
Track 2: **Integrated Information Technology**. All of: Introduction to Computer Hardware and Software Support, Introduction to Networking, Plus two of: Introduction to Human-Computer Interaction, Advanced Networking, Information Technology Security for Managers, Plus one of: Database Systems in Information Technology, Management of Information Technology

Track 3: Power Electronics Systems. All of: Circuits, Signals and Systems, Electronics, Control Systems, Power Electronics

Track 4: Control Systems. All of: Circuits, Signals and Systems, Electronics, Control Systems, Digital Control Systems

Track 5: Communication Systems. All of: Circuits, Signals and Systems, Plus three of: Digital Signal Processing, Electromagnetics, Wireless Communications, RF Circuit Design for Wireless Communications

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Curriculum by Category*				
Carolina Core (34-36 hours)	**Other General Requirements (22 hours)**	**Lower Division Engineering (18 hours)**	**Aerospace Engineering Major (39 hours)**	**Track Electives (15 hours)**
ENGL 101 - Critical Reading and Composition	MATH 241 - Vector Calculus	AESP 101 - Introduction to Aerospace Engineering	AESP 265 - Aerodynamics I Incompressible Flow	Five 3-credit courses in a coherent area of student.
ENGL 102 - Rhetoric and Composition	MATH 242 - Elementary Differential Equations	EMCH 111 - Introduction to Engineering Graphics and Visualization	AESP 314 - Energy, Power and Propulsion	
MATH 141 - Calculus I	MATH 344 - Linear Algebra	EMCH 200 - Statics	AESP 350 - Aerospace Systems	
MATH 142 - Calculus II	STAT 509 - Statistics for Engineers	EMCH 201 - Introduction to Applied Numerical Methods	AESP 361 - Aerospace Laboratory I	
CHEM 111 - General Chemistry I	CHEM 112 - General Chemistry II	EMCH 260 - Introduction to the Mechanics of Solids	AESP 362 - Aerospace Laboratory II	
CHEM 111L - General Chemistry I Laboratory	CHEM 112L - General Chemistry II Laboratory	EMCH 290 - Thermodynamic Fundamentals	AESP 420 - Flight and Orbital Mechanics	
PHYS 211 - Essentials of Physics I	PHYS 212 - Essentials of Physics II		AESP 428 - Design I	
PHYS 211L - Essentials of Physics I Lab	PHYS 212L- Essentials of Physics II Lab		AESP 466 - Flight Dynamics and Control	
Any GFL Elective			EMCH 310 - Dynamics	
Any GHS Elective			EMCH 330 - Mechanical Vibrations	
Any GSS Elective			EMCH 371 - Engineering Materials	
Any CMS Electives			EMCH 377 - Manufacturing Processes	
Any VSR Elective			EMCH 577 - Aerospace Structures I	
Any INF Elective				

* Add category titles to the table (e.g., major, core, general education, concentration, electives, etc.)

Total Credit Hours Required **126-138 hours**

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Course Descriptions for New Courses

Course Name	Description
AESP 101 - Intro into Aerospace Engineering	Introduction to Aerospace Engineering is a three-credit course that presents an overall picture of the aerospace domain. Through a short historical overview air and space flight, the different stakeholders and their interests are discussed as well as the basic principles behind flight and the characterization of the atmosphere and space. This is followed by a discussion of the major past, current and possible future flight vehicle concepts. The final part introduces students to the main disciplines within the aerospace engineering domain including aerodynamics, materials & structures, propulsion, flight mechanics, control, aircraft systems, and design.
AESP 265 - Aerodynamics I (Incompressible)	Aerodynamics I is a three-credit course that focuses on aerodynamics aspects related to subsonic (incompressible) flows. The course covers fundamentals of inviscid, incompressible flow; two dimensional flow over airfoils, airfoil characteristics; thin airfoil theory, finite wing theory; wing-body interaction; aerodynamic drag characteristics and boundary layers.
AESP 314 – Energy Power and Propulsion	Energy Power and Propulsion is a three-credit course focused on aircraft and rocket engines with emphasis on the performance and characteristics of various types of propulsion systems, including turbojet, turbofan, turboprop, ramjet, scramjet and liquid & solid propellant rockets.
AESP 350 - Aerospace Systems	Aerospace Systems is a three-credit course that presents the physics and the physical design of aircraft subsystems such as the control system, the fuel system, the landing gear (shock absorption and breaks), avionics, electrical system, environmental control system, de-/anti-icing, and lightning strike protection. The course will also introduce embedded software development. The propulsion system and airframe will be only briefly discussed since they are extensively discussed in separate AESP courses.
AESP 361 - Aerospace Laboratory I	Aerospace Laboratory I is a three-credit course that focuses on experimental determination of the aerodynamics and material aspects of aerospace. Students will determine a drag polar and a Cm-alpha curve for an airfoil they design themselves with a simple tool and printed with a 3D printer. Students will also determine drag for a fuselage and a landing gear. Student will use a simple model with snap on wings/landing gear/tail on a fuselage. Student will determine compliance matrix of an isotropic and a laminated composite materials. Student will determine the mechanical and thermal properties of aerospace materials. The experiments listed in this course intend to expose students to the material and structural mechanics aspect of aerospace. The backgrounds for these experiments are available in the existing course, aerodynamics, solid mechanics, and materials.
AESP 362 - Aerospace Laboratory II	Aerospace Laboratory 2 is a three-credit course that focuses on experimental determination of Structures, Propulsion and Systems aspects of aerospace. Students will determine bending, shear center, buckling of composite and meatal structures fabricated by themselves. Students will also determine combustion parameters using engine demo, efficiency of electrical engine power systems and propeller. Student an opportunity to build a simple electrical system, a hydraulic system/pneumatic system, a retractable landing gear, a controller and similar systems. The backgrounds for these experiments are exit in the existing course, aerospace Structures, propulsion and aircraft systems.

AESP 415 - Aircraft Design I	Aircraft Design I is a three-credit course that is focusing on the aircraft design process and principles. Students will be taken step by step through the aircraft design process and will be asked to apply the methods and tools to design an aircraft. Students can select and aircraft specification of their liking from a list presented at the beginning of the course. Students can opt for a manned or an unmanned vehicle. The student deliverable is a conceptual/preliminary aircraft design which has to be completed by the end of the semester. The aircraft design has to be presented in a written report and a short oral presentation.
AESP 420 – Flight and Orbital Mechanics	Flight and orbital mechanics is a three-credit course that introduces the fundamentals of flight vehicle performance. The course covers the development of equations of motion, aircraft stability, flight maneuvers, equations of motion with wind gradient, phases of space flight, launch vertical flight, burn out height, staging; gravity perturbations to satellite orbits, space trajectory, interplanetary travel.
AESP 428 - Design	Design is a three-credit course and is part of the Capstone Design Project. The course a) prepares students for Capstone Design project in the areas of Project Management (PM) and Systems Engineering (SE) principles and tools. Topics include: Project Planning and Risk Management with elements of R&D, innovation and Systems Engineering; Requirements Analysis and Specification; Market Analysis; Introduction to Applied Systems Theory; Functional and Operational analysis; Design specification; Technical Resource Budgets and Technical Risk Assessment; Economic factors, Safety and Reliability aspects; and Ethics and social impact. b) guides students in the Capstone Design project in the areas of PM and SE as well as teach them design for manufacturability, ergonomic and aesthetic considerations, prototype construction and testing, statistical methods/ design of experiments, ethics/ product liability and social/environmental impact. The student deliverable is a final engineering design (specifications, drawings, including assessment of economics) and has to be completed by the end of the semester. Both written and oral reports are to be provided during and at the end of the course. Projects will be assigned by the department or can be suggested by the students.
AESP 466 - Intro Flight Dynamics and Control	Flight Dynamics and Control is a three-credit course that covers the dynamics of aircraft motion, methods of analysis and design for stability and control, longitudinal motions, lateral-directional motions, and coupled longitudinal and lateral-directional motions.

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Faculty

Faculty and Administrative Personnel				
Rank	**Full- or Part-time**	**Courses Taught or To be Taught, Including Term, Course Number & Title, Credit Hours**	**Academic Degrees and Coursework Relevant to Courses Taught, Including Institution and Major**	**Other Qualifications and Comments (i.e., explain role and/or changes in assignment)**
Professor M.J.L. van Tooren	**Part-time**	AESP101 Intro into Aerospace Engineering	PhD in Aerospace Engineering, Delft University of Technology.	Dr. van Tooren is Director of the McNAIR Center for Aerospace Innovation and Research; Director of SmartState Center for Multifunctional Materials and Structures. Program Director Aerospace Studies USC
Associate Professor T. Farouk	**Part-time**	AESP 265 - Aerodynamics I (Incompressible); AESP 314 – Energy Power and Propulsion	Ph.D., Mechanical Engineering, Drexel University	Dr. Farouk is currently teaching similar courses in the Aerospace Minor of the Mechanical Engineering Undergrad Program
Associate Professor A. Kidane	**Part-time**	AESP 361 - Aerospace Laboratory I; AESP 362 - Aerospace Laboratory II	Ph.D., Mechanical Engineering and Applied Mechanics, University of Rhode Island	Dr. Kidane is currently teaching Lab 1 and Lab 2 for the ME Undergrad Program. The Aerospace Labs will be jointly taught with the new Assistant Professors
New Assistant Professor #1 *	**Part-time**	AESP 350 - Aerospace Systems; AESP 361 - Aerospace Laboratory I; AESP 362 - Aerospace Laboratory II	TBD	
New Assistant Professor #2 *	**Part-time**	AESP 415 - Aircraft Design I; AESP 428 - Design	TBD	
New Assistant Professor #3 *	**Part-time**	AESP 420 – Flight and Orbital Mechanics; AESP 361 - Aerospace Laboratory I; AESP 362 - Aerospace Laboratory II	TBD	

New Assistant Professor #4 *	**Part-time**	AESP 466 - Intro Flight Dynamics and Control; AESP 361 - Aerospace Laboratory I; AESP 362 - Aerospace Laboratory II	TBD	

Note: Individuals should be listed with program supervisor positions listed first. Identify any new faculty with an asterisk next to their rank.

Total FTE needed to support the proposed program (i.e., the total FTE devoted just to the new program for all faculty, staff, and program administrators):

Faculty 5 Staff 1 Administration 0.5

Faculty /Administrative Personnel Changes

Provide a brief explanation of any additional institutional changes in faculty and/or administrative assignment that may result from implementing the proposed program. (1000 characters)

The new program will require support for program management, marketing, student administration and labs. The program will have its home in the ME department, while 2 of the 3 tracks are headed by EE and IIT respectively. This will require that the involved faculty and staff from EE and IIT work very closely with ME.

Library and Learning Resources

Identify current library/learning collections, resources, and services necessary to support the proposed program and any additional library resources needed. (1000 characters)

The following titles are required and suggested materials for the proposed program. These titles are all currently accessible by the University of South Carolina library:

- Progress in Aerospace Sciences
- IEEE Transactions on Aerospace and Electronic Systems
- AIAA Journal
- Journal of Aircraft
- Aerospace Science and Technology
- Acta Astronautica
- Journal of the American Helicopter Society
- IEEE Aerospace and Electronic Systems Magazine
- Annals of Public and Cooperative Economics
- Journal of Aerospace Engineering
- Aeronautical Journal
- Aircraft Engineering and Aerospace Technology
- International Journal of Flow Control
- International Journal of Vehicle Structures and Systems
- Academy of Entrepreneurship Journal
- Academy of Marketing Studies Journal
- Aviation
- Academy of Accounting and Financial Studies Journal
- Advances in Military Technology
- International Journal of Aerospace Engineering

There are a number of key titles still needed for the success of the proposed program. To start subscriptions for those titles that aren't currently accessible to the university would cost just under $14,000 annually. These are listed below.

- Navigation, Journal of the Institute of Navigation
- Journal of Guidance, Control, and Dynamics (AIAA title)
- Journal of Propulsion and Power (AIAA title)
- Journal of Spacecraft and Rockets (AIAA title)

- Journal of Traffic and Transportation Engineering
- Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering
- Journal of the Astronautical Sciences
- Zhongguo Guanxing Jishu Xuebao/Journal of Chinese Inertial Technology
- Journal of Aerospace Computing, Information and Communication (AIAA title)
- Transactions of the Japan Society for Aeronautical and Space Sciences
- Tuijin Jishu/Journal of Propulsion Technology
- Hangkong Dongli Xuebao/Journal of Aerospace Power
- Beijing Hangkong Hangtian Daxue Xuebao/Journal of Beijing University of Aeronautics and Astronautics
- Kongqi Donglixue Xuebao/Acta Aerodynamica Sinica
- Annals of Solid and Structural Mechanics
- Chinese Space Science and Technology
- Journal of Aerospace Technology and Management
- Journal of Aeronautics, Astronautics and Aviation, Series A
- AIAA/IEEE Digital Avionics Systems Conference - Proceedings
- SAE International Journal of Aerospace
- SEI Technical Review
- Nanjing Hangkong Hangtian Daxue Xuebao/Journal of Nanjing University of Aeronautics and Astronautics
- International Journal of Aeronautical and Space Sciences/Transactions of Nanjing University of Aeronautics and Astronautics
- International Journal of Turbo and Jet Engines
- Advances in the Astronautical Sciences
- Guti Huojian Jishu/Journal of Solid Rocket Technology
- Canadian Aeronautics and Space Journal
- Shiyan Liuti Lixue/Journal of Experiments in Fluid Mechanics
- IEEE Aerospace Conference Proceedings
- Journal of Spacecraft Technology
- Proceedings of the International Astronomical Union
- European Space Agency Bulletin
- SOLID MECHANICS AND ITS APPLICATIONS
- Journal of the Institution of Engineers (India): Aerospace Engineering Journal
- Vertiflite
- Proceedings - Annual SAFE Symposium (Survival and Flight Equipment Association)
- Journal of Aerospace Engineering, Sciences and Applications

An estimate for books is not included. In recent years the College of Engineering and Computing has not spent all of the annual book allocation. Only a few paper textbooks are needed for the program and could be included within the college budget.

c) PASCAL holdings and database offerings were taken into consideration in calculating the cost to the library of new resources for the Aerospace program. For example, Journal of the American Helicopter Society and International Journal of Flow Control, two of the important titles identified by the program, are provided through our membership in PASCAL and were not considered part of the additional cost estimate.

PASCAL Delivers is an interlibrary borrowing service. Journal articles not held in our collections may be requested through the Interlibrary Loan Department. If the article is

available from another PASCAL library, delivery can be expedited. Users can initiate a request for a book held at another PASCAL library through our library catalog. If the book is available at another PASCAL library it can usually be delivered to the library in 2-3 days.

PASCAL membership also provides access to more than 200,000 e-books. Users requesting books in the PASCAL e-book collection would be directed to the e-book rather than the library purchase the book.

Student Support Services

Identify academic support services needed for the proposed program and any additional estimated costs associated with these services. (500 characters)

Student services needs for the aerospace students will be mostly offered by the existing students' services personnel in the departments. In the budget 0.5 FTE additional administrative/student support is accounted for.

Physical Resources

Identify any new instructional equipment needed for the proposed program. (500 characters)

For the aerospace engineering program to be successful the following facilities and equipment are required:

- Wind tunnel: to demonstrate and experiment with aerodynamics. The ME department has allocated budget for the procurement of a wind tunnel once this new program is approved.
- Control and simulation lab. Lab exercises regarding aircraft flight controls will be held at the McNAIR Center 2nd Phase, which will be delivered beginning of 2018. A simulator will be donated by TruSimulation in FL.
- Design lab. The Aircraft Design course and the Design course require a Design Lab where students can design and build prototypes of their design. This design lab will be created in close cooperation with the industry (Siemens and Dassault System)

Will any extraordinary physical facilities be needed to support the proposed program?

☒Yes

☐No

Identify the physical facilities needed to support the program and the institution's plan for meeting the requirements, including new facilities or modifications to existing facilities. (1000 characters)

The three different labs (wind tunnel, control and simulation lab and design lab) need space that the college needs to acquire.

Financial Support

Estimated New Costs by Year						
Category	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
Program Administration	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Faculty and Staff Salaries	$278,747	$362,081	$528,747	$612,081	$612,081	$2,393,737
Graduate Assistants	$20,000	$40,000	$60,000	$80,000	$80,000	$280,000
Clerical/Support Personnel	---	---	---	---	---	---
Equipment	$100,000	$20,000	$10,000	$10,000	$5,000	$145,000
Facilities	---	---	---	---	---	---
Supplies and Materials	$20,000	$40,000	$60,000	$60,000	$60,000	$240,000
IT Support	---	---	---	---	---	---
Library Resources	$5,000	$8,000	$12,000	$14,000	$14,000	$53,000
Other* (Lab Technician)	---	---	---	---	---	---
Total	**$433,747**	**$480,081**	**$680,747**	**$786,081**	**$781,081**	$3,161,737
Sources of Financing						
Category	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
Tuition Funding to UNIV – not direct source for CEC	$335,904	$671,809	$1,007,713	$1,343,617	$1,343,617	$4,702,660
Tuition funding to CEC	$140,556	$281,111	$421,667	$562,223	$562,223	$1,967,780
Program-Specific Fees	$90,000	$180,000	$270,000	$360,000	$360,000	$1,260,000
State Funding (i.e., Special State Appropriation)*	---					
Reallocation of Existing Funds*	$203,192	$18,969				$222,161
Federal Funding*	---					
Other Funding*	---	$200,000				$ 200,000
Total	**$433,748**	**$480,080**	**$691,667**	**$922,223**	**$922,223**	$3,449,941
Net Total (i.e., Sources of Financing Minus Estimated New Costs)	$0	$0	$10,920	$136,142	$141,142	$288,204

*Provide an explanation for these costs and sources of financing in the budget justification.

NEW PROGRAM PROPOSAL

Budget Justification

Provide a brief explanation for the other new costs and any special sources of financing (state funding, reallocation of existing funds, federal funding, or other funding) identified in the Financial Support table. (1000 characters)

Note: Institutions need to complete this budget justification *only* if any other new costs, state funding, reallocation of existing funds, federal funding, or other funding are included in the Financial Support table.

Other funding:
USC has allocated $100,000 for the purchase of a wind tunnel (see budget line 'other funding'). Additional $122,142 from the existing CEC operating fund will be made available for this new program, of which $ 103,192 will be used during the first year.

Evaluation and Assessment

Programmatic Assessment: Provide an outline of how the proposed program will be evaluated, including any plans to track employment. Identify assessment tools or software used in the evaluation. Explain how assessment data will be used. (3000 characters) The program will follow a three year review cycle that integrates all the program constituents: Faculty, Student, Advisory Board, Industry Board, Exiting Students and Alumni. The latter two will be integrated as of the second assessment cycle. Within each assessment cycle, the program educational objectives and student outcomes will be revised and/or confirmed. Within each two assessment cycles, the mission and vision of the program will be revised and/or confirmed. The assessment cycle uses a bottom up approach where student outcomes are individually and, over the course of three years, assessed and evaluated in multiple stations spread throughout the different courses and academic activities. These student outcomes are stated in the following table. They follow the newly revised (1-7) ABET Engineering Accreditation Commission criterions. They will be evaluated in course embedded assessments to evaluate the achievement of each individual student outcome. A mapping between course outcomes and the student outcomes will be clearly defined. Similarly, mapping between the student outcomes and the program education objectives will also be identified.

The timeline of the programmatic assessment consists of:

- Every semester, the Program Review Committee – a subset of the Program Faculty led the undergraduate director of the program – meets and evaluates the assessment results based on the submitted course portfolios and individual course outcomes assessments. The Program Review Committee will also analyze and query the exiting students' body – when appropriate in the future – with respect to specific concerns or previously identified priority topics. The Program Review Committee will submit its findings to the faculty at large.
- On a yearly basis, the Program Faculty will hold a faculty retreat to evaluate the findings of the Program Review Committee. In their discussions, the Program Faculty will re-evaluate and confirm the Program Educational Objectives, Vision and Mission of the Program. The faculty retreat will generate a recommendation list to be discussed and confirmed by the Advisory Board. The latter is a council that integrates representatives from the advisory board, the industry board and alumni.
- The Advisory Board will convene at the end of the assessment cycle and receive three evaluation reports from the faculty relating to the previous three years. The advisory board will study the findings and confirm and/or reject changes and propositions made by the Program Faculty during the assessment cycle.

The program will include direct assessment tools such as tests embedded in coursework and evaluations rubrics, as well as indirect assessment tools such as focus groups with students, survey of current students, exiting students and alumni. A locally developed software in the department of Mechanical Engineering will be used to collect and analyze data and findings.

Student Learning Assessment

The program is intended to train students in the field of aerospace engineering such that they are well prepared for a career as multidisciplinary engineer in the aerospace industry or any other industry that requires the abilities specified by ABET for engineers at the BS level:

Expected Student Learning Outcomes	Methods of/Criteria for Assessment
An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	Multiple direct assessment stations such as individual exams administered over the core topics. The latter will be verified with respect to the introduction (I), the reinforcement (R) and the emphasis (E) of concepts.
An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	Design tasks embedded throughout the curriculum, specifically in the Design I and Design II courses. Tasks will be evaluated with appropriately conceived rubrics that demonstrates proficiency with respect to analysis and synthesis.
An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Evaluations of specific laboratory reports pre-selected to meet the multiple divisions of this outcome: Develop, Conduct, Analyze, Interpret and Conclude. These reports will be selecting from the three specific laboratory courses.
An ability to communicate effectively with a range of audiences.	Communication will be evaluated at multiple stations through the Professional Communication class as well as through Capstone Design presentations. Rubrics will be employed to assess Body Language, Voice Tonality, Slides and Audience Engagement.
An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Direct assessment embedded in multiple classrooms and rubrics evaluation in ethics classes. Individual evaluations with respect to Economics, Environmental and Societal contexts will be developed in different courses.
An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	Direct Assessment embedded in predefined student projects.
An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	Peer and faculty assessment rubrics during the Capstone classes.

NEW PROGRAM PROPOSAL

Will the proposed program seek program-specific accreditation?

☒Yes

☐No

If yes, provide the institution's plans to seek accreditation, including the expected timeline for accreditation. (500 characters)

ABET accreditation will be sought for 4 years after the start of the program with a frequency of renewal/visitation of once in every six years.

Will the proposed program lead to licensure or certification?

☐Yes

☒No

If yes, explain how the program will prepare students for licensure or certification. (500 characters)

A Bachelor's degree in Engineering from an ABET-accredited program is one criteria for licensure as a Professional Engineer.

NEW PROGRAM PROPOSAL

Teacher or School Professional Preparation Programs

Is the proposed program a teacher or school professional preparation program?

☐Yes

☒No

If yes, complete the following components.

Area of Certification

Please attach a document addressing the South Carolina Department of Education Requirements and SPA or Other National Specialized and/or Professional Association Standards.