Program Proposal
For a
Masters Program
in
Aerospace Engineering

Master of Science with a Major in Aerospace Engineering
Master of Engineering with a Major in Aerospace Engineering

Submitted by

University of South Carolina, Columbia

Harris Pastides, President

University of South Carolina

Commission on Higher Education Program Proposal

Name of Institution: University of South Carolina – Columbia Campus

Designation: New Program Proposal

Name of Degree: Master of Science (MS) in Aerospace Engineering

Master of Engineering (ME) in Aerospace Engineering

Name of Program: Aerospace Engineering

Number of credit hours in program: 30 hours for MS (24 hours of graded course work and 6 hours of Thesis Preparation);

30 hours for ME (30 hours of graded course work)

If undergraduate, designation as four- or five-year program: N/A

Program qualifies for supplemental Palmetto Fellows Scholarship/LIFE Scholarship awards: No

Proposed date of implementation: Fall 2012

CIP Code: 14.0201

Justification of Need for the Proposed Program

Expansion in South Carolina's Aerospace Industry

The state of South Carolina is poised for explosive in-state growth of its aerospace industry. This growth is led by **Boeing**'s expansion of its fabrication facilities for the 787 Dreamliner aircraft to Charleston, SC, with construction and launch of the operations factory scheduled for later this year. Almost 6,000 jobs will be directly created by the construction and subsequent operational phase of the project. Jobs will also be created in those industrial sectors related to aerospace support, plus many other sectors, such as retail, health care, food and beverage, automotive, that support all these new employees. For example, the aerospace company **ACAS Landing Gear Services** already has announced locating a new facility in Marion County that will service Boeing's operations. Economists have estimated that the initial near-term increase in economic output of South Carolina, including the direct investment, indirect impact, and induced impact, will be approximately $1.4 billion[1]. The long-term impact by Boeing alone could bring many thousands of jobs and an investment totaling as much as $10 billion.

Additionally, **GE Aviation** has outgrown the building it is currently sharing with GE Energy in upstate SC and is making a multimillion-dollar investment in the Matrix Industrial Park[2]. It is apparent that a constellation of multi-tier aerospace suppliers will also follow shortly. In spite of the economic downturn, the aerospace industry is currently recruiting engineers in materials, mechanical design, computing, and electronic systems, and is seeking 40,000 specialists nationwide[3].

Expansion in Aerospace Industry Engineering Work Force

The aerospace industry's expansion in SC will create a demand for more engineers with competence and expertise in the aerospace sciences, engineering, and related topics. However, none of the universities in South Carolina offer aerospace engineering degrees or specialties. Thus, the proposed Masters Program in Aerospace Engineering offering Master of Science and Master of Engineering degrees will respond to the needs of the expanding SC aerospace industry for appropriately educated engineers. This will allow the industry to recruit engineers locally, as well as allowing the SC aerospace industry to become involved in ensuring the appropriate education of these USC engineering students.

Specifically, the establishment of this program will lead to curriculum and research activities that will provide our graduates with the skills and education needed to enter the aerospace workforce. Noteworthy features of the proposed program are:

- Responsiveness to the needs of the aerospace industry, contributing to its success
- Strengthening of the technical and knowledge bases of the state

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[1] Miley & Associates Inc., "Economic Impact of Boeing in South Carolina", May 2010, pp14-18, http://www.scribd.com/doc/31669003/Economic-Impact-of-Boeing

[2] Arend, M. "Boeing's South Carolina Strategy Takes Shape", *Site Selection*, Nov. 2009, pp. 770-772, www.siteselection.com

[3] Anon. "Aerospace Industry Seeks 40,000 specialists in 2010," *Site Selection*, Nov. 2009, pp. 778, www.siteselection.com.

- Promotion of SC in the select group of high-tech aerospace-related states
- Help provide high paying jobs for South Carolinians

Anticipated Program Demand

The proposed Masters Degree Program in Aerospace Engineering will be in demand from engineers interested in pursuing a career in the expanding aerospace industry in South Carolina. The aerospace master's degree will attract both new engineering graduates as well as engineers already in the workforce. The degree will be available to both on-campus and off-campus students. The off-campus students will be instructed via the existing USC distance learning program, APOGEE. All courses offered on-campus will be video streamed for off-campus students.

The pool of off-campus students will primarily be SC residents working full-time in SC industries, but may also include students located nationally and internationally, as well as US citizens on overseas deployment. This masters program will also be desirable to current undergraduate mechanical, electrical, and chemical engineering students who are interested in acquiring skills needed for employment in the aerospace industry. USC already has an Accelerated Masters Degree program, where students with a GPA of 3.5/4.0 and above may take up to three graduate courses while pursuing their undergraduate degrees. This allows students to get the MS/ME degree within a year of their baccalaureate degree. Engineers having a masters degree should be better prepared for the challenging and higher paying jobs in the aerospace industry, plus more attractive to the aerospace companies.

Once fully developed, an annual program student enrollment of about 15-20 for in-class instruction and about 30-35 through distance education is anticipated. Based on the data reported by American Society for Engineering Education, Table 1 lists the 2010 enrollments at selected US institutions offering Aerospace Engineering Programs. As previously noted, the data shows that no institution in South Carolina offers an Aerospace Engineering Degree program. The neighboring states of North Carolina and Georgia each have one institution with an Aerospace Degree Program. It is also worth noting that Wichita State University and University of Washington have aerospace master degree enrolment of 126 and 110 respectively. Both of these universities are located in states where Boeing has manufacturing facilities.

Table 1. Nationwide 2010 Student Enrollment in Aerospace Engineering

University	Degree	Full-time	Part-time	Region
The University of Alabama in Huntsville	M.S.E.	22	42	South
The University of Alabama	M.S.	11	31	South
Auburn University	M.S.,M.A.E.	14	20	South
University of Central Florida	M.S.A.E.	17	10	South
Embry Riddle Aeronautical University, Daytona Beach	M.S.	110	7	South

University of Florida	M.S., M.E.	42	0	South
Florida Institute of Technology	M.S.	25	18	South
Georgia Institute of Technology	M.S.	191	90	South
University of Maryland, College Park	M.S.	70	26	South
Mississippi State University	M.S.	15	4	South
Naval Postgraduate School	M.E.	0	0	South
North Carolina State University	M.S.	36	22	South
University of Oklahoma	M.S.	7	9	South
Old Dominion University	M.S., M.E.	3	16	South
University of Tennessee, Knoxville	M.S.	17	10	South
Texas A&M University	M.S.	67	7	South
The University of Texas at Arlington	M.S., M.E.	42	51	South
The University of Texas at Austin	M.S.	33	0	South
Virginia Polytechnic Institute and State University	M.S., M.E.	22	12	South
Washington University	M.S.	3	11	Midwest
West Virginia University	M.S.	16	1	South
Wichita State University	M.S.	39	71	Midwest

Employment Opportunities

The graduates of this program will have opportunities for high paying SC jobs, primarily with the expanding aerospace companies and suppliers to these industries. Although the program is being proposed with anticipated need for aerospace engineers arising from the SC expansion of its aerospace industry (e.g., Boeing and its secondary suppliers), graduates of this program will have job opportunities in the aerospace industry, NASA, government laboratories, consulting engineering firms, and in local, state and federal government

agencies - throughout the US as well as in foreign countries. According to US Bureau of Labor Statistics employment data[4], total employment in Aerospace Engineering is about 78,450 with an estimated mean wage of $ 99,000. It is significant to note that Washington and Kansas are the two states with highest concentration of Aerospace jobs with 2.4 and 2.09 jobs per thousand in aerospace engineering. Both of these states have significant presence of Boeing manufacturing facilities. Of the total 2720 aerospace engineering jobs in Kansas, Wichita, which is the home of Boeing manufacturing facility, alone has 2,590 aerospace engineering jobs. The data is consistent with the assumption that South Carolina is poised to see significant increase aerospace engineering jobs.

Program Relationship to Mission

The mission of this program and that of the University of South Carolina, as defined by the Commission, are similar. In particular, this program will result in producing aerospace engineers who will contribute directly to the economic development of the state. In addition to training fresh engineers, it will also provide opportunities for engineers with backgrounds in other fields of engineering to retool themselves in aerospace engineering. As this program will be available via distance education (APOGEE), it will be available to engineers employed full-time in all SC industries. Contributions from advanced engineering knowledge by these Aerospace Program graduates will help both the aerospace industry and other industries succeed in SC, resulting in direct economic development of South Carolina.

Relationship of the Proposed Program to Other Institutional Programs

The expertise of the current faculty in the USC College of Engineering and Computing (CEC) will partially meet the research and teaching needs of the proposed program. The CEC has nationally and internationally recognized expertise in a number of critical aerospace structures and materials research areas, such as composite materials (material-level chemistry, mechanics, structural analysis, and manufacturing), structural analysis and fracture mechanics, advanced joining science for metals, surface chemistry, coating science, electrochemistry, structural health monitoring, condition based maintenance, sensing and detection of structural damage, structural diagnosis and prognosis, future fuels and power sources, and electric power modeling and analysis. Hiring of three additional faculty members will form a critical mass to sustain research and education in aerospace engineering.

The proposed program will complement the existing graduate programs of the College of Engineering and Computing by making additional graduate courses available to the full-time graduate students as well as those enrolled in the distance education program. For this MS/ME program in Aerospace Engineering, several of the existing courses in Civil and Environmental Engineering, Mechanical Engineering, Electrical Engineering, and Computer Science and Engineering will partially meet the core course requirements. Eight additional classes will be developed for the proposed program. The new classes will be comprised of

[4] US Bureau of labor Statistics, Occupational Employment and Wages, May 2011, 17-2011 Aerospace Engineers (last modified on May 17, 2011), http://www.bls.gov/oes/current/oes172011.htm

two classes in each of four focus areas (each focus area having an introductory class at the 500-level and an advanced class at the 700-level). The four focus areas are: Aerospace Structures, Materials for Aerospace Applications, Aerospace/Aeronautical Controls, and Advanced Aerospace Manufacturing.

The College of Engineering and Computing's APOGEE (A Program of Graduate Engineering Education) is one of the longest-running distance education programs in the nation. APOGEE has been successfully offering distance-education graduate programs in all five engineering departments for four decades. This planned program in aerospace engineering will be an excellent addition to the existing engineering curricula by providing additional course options to both on-campus and distance education graduate students. The distance education students may, at the discretion of the instructor, be required to have on campus appearances for up to three Saturday classes.

Relationship of the Proposed Program to Existing Programs in SC

Other institutions in SC may offer a few of the aerospace-related courses, but no other institution in South Carolina offers an MS or ME in Aerospace or Aeronautical Engineering. Therefore, the proposed program does not duplicate existing programs in the state.

The graduate program in aerospace engineering will create opportunities for collaborative research initiatives with Clemson, The Citadel, and SC State University. The proposed Aerospace Engineering program is multi-disciplinary in nature, and therefore will be an ideal venue for multi-university initiatives where each of the universities complements the others. For example, Clemson's International Center for Automotive Research (ICAR) will provide collaborative opportunities related to product design, manufacturing and risk assessment studies. Discussions regarding collaborative opportunities will be held with other universities in the state, as well.

Enrollment

Admission Criteria

The admission criteria will generally conform to those currently required by the USC Graduate School. In general, an applicant must have a baccalaureate degree or its equivalent in engineering, computer science, or a related field from an accredited institution. Admission will be based on the applicant's GRE score, letter of recommendation, GPA and quality of the applicant's prior education.

Projected Total Enrollment

For the credit hours listed in Table 2, it is assumed that the full-time student will be enrolled in a minimum of six hours during the fall and spring semesters and during the summer, and that the part-time students will take three credit hours during each semester and the summer. The department accepts new students in both Fall and Spring semesters, this is reflected on projected student enrolment increase in spring. Projected enrolment is based on comparable enrolment in peer institutions and on the enrolment of similar programs in the college. It is

anticipated that enrolment in the program will be all new students and not transfers. Table 3 shows projected headcounts for new students.

Table 2. Headcount and Credit Hours

Year	Fall				Spring				Summer			
	Headcount		Credit Hours		Headcount		Credit Hours		Headcount		Credit Hours	
	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT
2012-2013	8	4	24	24	12	8	36	48	12	8	36	48
2013-2014	18	9	54	54	20	10	60	60	20	10	60	60
2014-2015	24	12	72	72	28	15	84	90	28	15	84	90
2015-2016	35	20	105	120	35	20	105	120	35	20	105	120
2016-2017	40	20	120	120	40	20	120	120	40	20	120	120

Table 3. New Enrolment and Credit Hours

Year	Fall				Spring				Summer			
	Headcount		Credit Hours		Headcount		Credit Hours		Headcount		Credit Hours	
	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT
2012-2013	8	4	24	24	12	8	36	48	12	8	36	48
2013-2014	18	9	54	54	20	10	60	60	20	10	60	60
2014-2015	24	12	72	72	28	15	84	90	28	15	84	90
2015-2016	35	20	105	120	35	20	105	120	35	20	105	120
2016-2017	40	20	120	120	40	20	120	120	40	20	120	120

Program of Study for the Masters Program in Aerospace Engineering: Proposed Curriculum

Required Courses

All M.S. and M.E. candidates in Aerospace Engineering will be required to take the five (5) core courses listed below:

EMCH 508 – Finite Element Analysis in Mechanical Engineering

EMCH 577 – Aerospace Structures I

EMCH 744 – Aerodynamics & Flight Mechanics

EMCH 585 (modified) - Introduction to Composite Materials

EMCH 721 – Aeroelasticity

Elective Aerospace Courses

All students in Aerospace Engineering must take a minimum of two (2) courses from the following courses:

EMCH 743 – Aircraft and Rocket Propulsion

EMCH 777 – Aerospace Structures II

EMCH 522 – Design For Manufacturability & Assembly

EMCH 544 – Compressible Flows

EMCH 516 – Control Theory in Mechanical Engineering

EMCH 532 – Intermediate Dynamics

EMCH 571 – Mechanical Behavior of Materials

ENGR 701 – Methods of Engineering Analysis

ENGR 707 – Continuum Mechanics

ECHE 721 – Advanced Heat Flow Analysis

EMCH 751- Advanced Heat Transfer

EMCH 741 – Viscous and Turbulent Flows

EMCH 794 – Thermodynamics

EMCH 785 – Design of Composite Materials for Aerospace Structures

EMCH 881 -- Fatigue of Materials

Other Elective Courses

All remaining work must be taken from an approved list of courses which currently includes all engineering courses numbered 500 or above and math courses numbered 700 or above. Business courses numbered 500 or above may be taken with advance approval by the advisor

and the Graduate Studies Committee. Other courses will be added to the list as approved by the faculty.

Catalog description of new courses (all approved as of November 2011):

EMCH 577 AEROSPACE STRUCTURES I (3) Static analysis of structural elements with applications in a variety of fields. Topics include, but not limited to, elasticity theory, simple beam theory, boundary value problems, structural stability, and finite element analysis.

EMCH 744 AERODYNAMICS and FLIGHT MECHANICS (3) Aerodynamic analysis of wings and bodies in aircraft, fundamentals of potential flows, thin airfoil theory, finite wing theory, and laminar and turbulent boundary layers.

EMCH 585- INTRODUCTION TO COMPOSITE MATERIALS (3) **(Prereq: EMCH 327, 371, MATH 242).** Introduction to fiber reinforced polymer (FRP) composite materials, Manufacturing methods and processes. Micro-Mechanics and properties of orthotropic laminated and woven composites. Analysis of composite structures (Mechanics and Synergistic environmental effects). Structure/property relationships. Characterization of modern composite materials. Design considerations.

EMCH 721 – AEROELASTICITY (3) (Prereq.: Instructor permission). Study the principles and applications of aircraft aeroelasticity with emphasis on aircraft structural dynamics, vibrations, unsteady aerodynamics, and interaction thereof.

EMCH 743 AIRCRAFT AND ROCKET PROPULSION (3) (Prereq: EMCH 577 AERODYNAMICS or EMCH 544 COMPRESSIBLE FLOWS) Introduction to 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 and solid propellant rockets.

EMCH 777 AEROSPACE STRUCTURES II (3) (Prereq. Instructor permission) Principles and applications of aerospace structures with emphasis on the construction and analysis of thin-wall monocoque and semi-monocoque wings and fuselages

EMCH 785 – DESIGN OF COMPOSITE MATERIALS FOR AEROSPACE STRUCTURES (3) (Prereq. Instructor permission) Property and performance requirements for aerospace structures. Laminated plate theories, Analysis of mechanical, hygrothermal, and electrical loading, Design for stiffness at the lamina, laminate, and structural level (materials and analysis). Design for strength at the lamina, laminate, and structural level (materials and analysis). Design for durability, damage tolerance, and life at the lamina, laminate, and structural level (materials and analysis). Advanced topics such as multi-functionality and multi-physics analysis.

Additional Program of Study Requirements

Course and Program Grades

Courses not satisfying the requirements for a graduate degree are:

1. Any course with a grade of D+, D or F.
2. More than 12 credits with grade of C+ or below (the 4-C Rule).

3. Any course taken on a non-letter grade basis (except thesis).
4. More than 12 semester hours of credits from a previous graduate degree program.

The student must maintain a **minimum grade point average of 3.0** in:

1. All courses taken as part of the official degree program.
2. All courses numbered 700 or above.
3. All courses taken for graduate credit, including those not included in the official degree program.
4. Pass/Fail – A "fail" grade counts toward the 4-C rule.

Publication Requirement for M.S. Students

An educational objective for M.S. students is that they have the ability to communicate their research results through oral presentations and written publications. Consistent with this objective, an M.S. student is required to submit, based on research performed while at USC, at least one conference paper (or abstract with presentation) or one journal paper prior to graduation.

Master's Thesis

A thesis is required of all students seeking the M.S. degree. The student's academic advisor must approve the subject of the thesis. The Graduate School will furnish general thesis regulations upon request. Any student who wishes to use University facilities or to confer with the faculty on thesis work must be officially enrolled for thesis credit.

Thesis Committee

A student's M.S. Thesis Committee consists of the student's advisor and the second reader of the student's thesis.

Thesis Presentation and Defense

The thesis presentation is to be open to all members of the University community and guests. During the Fall and Spring semesters, the presentation and defense are to be conducted during normal business hours and on a day that faculty are expected to be on campus. The Graduate Director must approve the date and time of presentations given during the summer sessions.

Comprehensive Examination

A comprehensive examination covering the major field of study is required of all candidates for the M.S. degree, which is conducted immediately following the thesis defense. The student's thesis committee administers this exam.

For the M.E. degree, a student passes the comprehensive exam by demonstrating competence in a written exam.

Faculty

As previously mentioned, the USC College of Engineering and Computing (CEC) already has faculty with expertise in several areas related to aerospace engineering. The expertise of the current CEC faculty in materials, thermo-fluids, structural health monitoring, and future fuels will partially meet the instructional needs of the proposed aerospace engineering

program. Additionally, the Provost has approved the hiring of 3 faculty members as a cluster in safety-critical systems, with a focus on aerospace applications. Table 4 below shows the list of current faculty members responsible for teaching in the proposed aerospace program.

Table 4. Rank and Academic Qualifications of Faculty for the Proposed Program

Rank	Highest Degree Earned	Field of Study	Teaching in Field
Professor #1	Ph.D.	Mechanical Engineering	Yes
Professor #2	Ph.D.	Mechanical Engineering	Yes
Professor #3	Ph.D.	Mechanical Engineering	Yes
Asst. Professor #4	Ph.D.	Mechanical Engineering	Yes
Asst. Professor #5	Ph.D.	Mechanical Engineering	Yes
Asst. Professor #6	Ph.D.	Mechanical Engineering	No[1]
Asst. Professor #7	Ph.D.	Electrical Engineering	No[1]
Professor #8	Ph.D.	Computer Science and Engineering	No[1]

[1]These positions are already approved by the provost

Proposed Changes in Assignment for Current Faculty

The proposed program is similar to other programs and courses in the college of engineering and computing. Therefore, no changes in the assignments of current faculty are anticipated.

Institutional Plan for Faculty Development

A viable graduate-level program at a major research university must include both teaching and research components. Research creates new knowledge in the field and teaching disseminates this knowledge to the greater community. Faculty engaged in the aerospace engineering program will be expected to devote a significant part of their workload to research in their areas of expertise. Any new faculty hired will be mentored by the senior faculty to aid in new faculty career development.

The aerospace engineering field is rapidly evolving and returning to national prominence. To keep current, faculty members in the Aerospace Engineering program will be expected to attend conferences and symposia where the latest research is being discussed.

Institutional Definition of Full-time Equivalents (FTE)

One FTE is equivalent to a teaching load of 100 undergraduates, 48 Master's or 18 doctoral graduate students in a 3-hour class. Table 5 below presents the projected overall program headcount and FTE of faculty, administrators and staff for this program. One new faculty member for each the first three years will be recruited with a total of three new faculty.

Table 5: Overall Program Headcount and FTE of Faculty, Administrators and Staff

UNIT ADMINISTRATION/FACULTY/STAFF SUPPORT						
Year	**New**		**Existing**		**Total**	
	Headcount	FTE	Headcount	FTE	Headcount	FTE
Administration						
2012 – 13	0	0	1	0.25	1	0.25
2013 – 14	0	0	1	0.25	1	0.25
2014 – 15	0	0	1	0.25	1	0.25
2015 – 16	0	0	1	0.25	1	0.25
2016 – 17	0	0	1	0.25	1	0.25
Faculty						
2012 – 13	1	1.0	5	1.0	6	2.0
2013 – 14	1	1.0	6	2.0	7	3.0
2014 – 15	1	1.0	7	3.0	8	4.0
2015 – 16	0	0	8	4.0	8	4.0
2016 – 17	0	0	8	4.0	8	4.0
Staff						
2012 – 13	0	0	4	0.5	4	0.5
2013 – 14	0	0	4	0.5	4	0.5
2014 – 15	0	0	4	0.5	4	0.5
2015 – 16	0	0	4	0.5	4	0.5
2016 – 17	0	0	4	0.5	4	0.5

Physical Plant and Equipment

No additional physical space will be needed for the proposed program.

Supporting Resources

Present facilities will suffice during the first two years. However, as enrollment increases, a larger room with teleconferencing facilities will be needed for the delivery of courses via distance education, Table 6 shows expense associated with teleconferencing facilities. A

onetime expense of $50,000 is budgeted for this during the third year of the program. The tuition revenue generated (Table 7), will be sufficient to cover this budgeted amount.

Equipment

Other than teleconferencing facilities for distance education, no specialized equipment or facilities will be needed for the proposed program.

Laboratory

No new teaching laboratory space will be needed for the proposed program. The proposed new courses are all lecture courses. It can be mentioned that some of the existing research facilities are already used for research related to aerospace engineering. Additional laboratory space for research related to aerospace engineering program has been allotted in the new Horizon building, where composite fabrication, characterization, and sensor development work will be performed (approximately 40,000 square feet).

Library Resources

The Thomas Cooper Library currently has 19,764 books and subscribes to more than 5,750 periodicals in engineering and related fields, of which at least 169 are in aerospace/mechanical engineering. Electronic subscriptions to many journals and other resources are available through inter-library loans, and are also available to distance education students around the state through the PASCAL partnership.

The university's total budget for the purchase of new books and periodicals totals $6.02 million. The College of Engineering and Computing's allocated amount for periodical subscriptions is $228,504 and $10,800 for books.

Assessment of Current Holdings

The current library holdings are more than adequate for research and teaching for the proposed program.

Estimate of Acquisitions Needed Annually

The current BS, Masters, and PhD degree programs in Mechanical Engineering are supported by an allocation of about $8,000 from the current library budget. An additional $2,500 annually, will be requested to add several periodicals explicitly devoted to aerospace engineering

Accreditation

USC will not seek to have the Masters programs in Aerospace Engineering accredited by the Accreditation Board for Engineering and Technology (ABET).

The program will come under the University of South Carolina's institutional accreditation by the Southern Association of Colleges and Schools (SACS).

Estimated Costs

The program will be housed in the Mechanical Engineering Department, thereby incurring no additional staff and management costs. To the best of our estimation, no significant additional costs will be associated with implementing the proposed program beyond the cost of the 3 faculty hires. Estimated tuition revenue generated will be more than enough to offset the cost for faculty hires, as such no additional funding will be requested from the state. Table 6 shows the projected cost, with Table 7 showing the sources for funding these costs.

Table 6. Costs to the Institution

Estimated Costs By Year						
Category	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
Program Administration	0	0	0	0	0	0
Faculty Salaries	80,000	160,000	240,000	240,000	240,000	960,000
Graduate Assistants	0	0	0	0	0	0
Clerical/Support Personnel	0	0	0	0	0	0
Supplies & Materials	5,000	5,000	5,000	5,000	5,000	25,000
Library Resources	2,500	2,500	2,500	2,500	2,500	12,500
Equipment	0	0	0	0	0	0
Facilities	0	0	50,000	0	0	50,000
Other/Operating	0	0	0	0	0	0
Totals by Year	87,500	167,500	297,500	247,500	247,500	**1,047,500**

Table 7. Sources of Funding

Sources of Funding						
Source	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
Estimated Revenue Generated from Tuition	112,680	184,440	259,860	354,375	381,600	1,292,955
Other State Funding	0	0	0	0	0	0
Reallocation of Existing Resources	0	0	0	0	0	0
Totals by Year	112,680	184,440	259,860	354,375	381,600	**1,292,955**

The revenue from tuition is estimated at $455 per credit hour based on the credit hours shown under the projected enrollment and an APOGEE / Executive Program fee of $150 per credit hour. All tuition goes to the University's general fund; allocation back to the College of Engineering and Computing is determined by the annual strategic planning / budgeting process.

Approvals

College of Engineering & Computing: May 2, 2011; final approval of curriculum Nov. 22, 2011
CHE Advisory Committee on Academic Programs: July 14, 2011
University of South Carolina Graduate Council: October 24, 2011
University of South Carolina Board of Trustees: December 13, 2011