The Citadel

School of Engineering

PROGRAM PLANNING SUMMARY

Bachelor of Science Degree

in

Mechanical Engineering

Submitted to the South Carolina Commission on Higher Education
August 1, 2012

John Rosa, LTG
President
The Citadel

Program contact: Dr. Ron Welch
Dean of Engineering
843-953-6588
ronald.welch@citadel.edu

University Contact: Dr. Sam Hines
Provost
The Citadel
shines1@citadel.edu
843-953-5007

Program Planning Summary

Classification:

Program Title : Mechanical Engineering

Academic Unit: School of Engineering

Designation: : Bachelors of Science in Mechanical Engineering (BSME), 4-year program

136 credit hours including military science and physical education requirements

Proposed date of implementation: Aug 2013

CIP code from the current USDOE's Classification of Instructional Programs:
14.1901

Identification of Program as New or Modification: New

Site: On-site four-year day degree program as well as two-year evening degree completion program located at the Low Country Graduate Center for transfer students. Both traditional delivery.

Program qualifies for supplemental Palmetto Fellows Scholarship and LIFE Scholarship awards: Yes __X__ No:

Justification:

The Bachelors of Science in Mechanical Engineering is intended to meet the expressed needs of South Carolina industries. Nationally, Mechanical Engineering is broken out as a separate category by the Department of Labor which shows growth in hiring of mechanical engineers from 212,000 in 2002 to 320,000 in 2011, and includes a 6% growth from 2010. Additionally it shows that Mechanical Engineers are the second most hired group of engineers after civil and before electrical engineers.

The engineering related job market in the Charleston area has exploded in recent years, including drastic increase in the need for Mechanical Engineers. Two large employers in the area, Boeing and SPAWAR Systems Center Atlantic, require literally thousands of engineers. Other large employers include automotive, manufacturing, medical device manufacturers, power generation, and processing. The Bachelors of Science in Mechanical Engineering is being developed at the request of a number of these South Carolina companies, particularly those based in Charleston. The desire to hire local talent and educate an existing workforce drives the need for a local undergraduate Mechanical Engineering program to complement the available civil and electrical engineering programs. A recent survey of mechanical engineering job postings found positions in health care, aviation, defense applications, power systems, telecommunications, automotive, manufacturing, testing, data centers, and many others. This

diversity means that employment as a mechanical engineer is more robust than other more narrowly focused engineering specialties.

The need for mechanical engineers will continue to grow and currently the US is not producing enough as we are seeing an increase in manufacturing and design returning to the US, to include the greater Charleston area. Engineering problem solving is in increased demand and mechanical engineers are a necessary and diverse core engineering skill set that are primarily focused on manufacturing processes and professional services. In this manner they bridge the gap between civil engineering needs and electrical engineering needs. Products will become increasingly complex with increased demand for sustainability that can only be answered through use of innovative processes that consider the human condition while being produced in less time.

The Bachelors of Science in Mechanical Engineering is an interdisciplinary degree. It includes electives that could be taken from Civil and Electrical Engineering as well as Chemistry, Biology, and Physics which are available at The Citadel. The overlap into Psychology should not be overlooked as the research into the human condition associated with products and manufacturing processes are explored.

Anticipated program demand:

The number of students taking evening engineering courses at The Citadel has increased dramatically in the last few years. For example, the electrical engineering numbers have more than doubled from 15 electrical engineering students to 38 students. Trident Technical College has an average of 10-15 students completing the Associates of Science in Mechanical Engineering each year. The arrival of Boeing and their survey of employee educational needs estimate nearly 1000 employees needing undergraduate degree completion, many in mechanical engineering. Many current civil and electrical engineering cadets (estimate 15) have expressed a desire to take mechanical engineering, but the over-arching desire to attend the Citadel over shadows the desire to study mechanical engineering and forces them to study civil or electrical engineering. Additionally, there are a number of potential cadets (estimated 10-15 per year) who decide to attend either VMI or Norwich which do have mechanical engineering programs.

Projected Total Enrollment						
Year	Fall		Spring		Summer	
	Headcount Day Evening	Credit hours	Headcount Day Evening	Credit Hours	Headcount	Credit Hours
2013-2014	10; 20	440	10; 20	430	15	135
2014-2015	27; 43	1027	27; 43	1022	30	270
2015-2016	48; 50	1480	48; 50	1494	35	315
2016-2017	89; 55	2248	89; 55	2289	37	333
2017-2018	134; 59	3028	134; 59	3150	40	360

Estimated New Enrollment						
Year	Fall		Spring		Summer	
	Headcount Evening	Credit hours	Headcount Evening	Credit Hours	Headcount	Credit Hours
2013-2014	20	260	20	240	16	96
2014-2015	43	325	43	1032	20	180
2015-2016	50	628	50	1200	25	225
2016-2017	55	690	55	1320	26	234
2017-2018	59	740	59	1416	27	243

Assumptions for the tables:

A) New students will enter the program in the fall semester;
B) There will be some attrition between academic years;

Program duplication:

There are no Bachelors of Science in Mechanical Engineering programs in the Low Country of South Carolina. There are BSME programs at Clemson University and The University of South Carolina, but no opportunity for local students in the heavily populated area of Charleston to attend a Mechanical Engineering program without leaving the area as well as no opportunity for local employees to complete their education in Mechanical Engineering. Trident Technical College has an Associate's of Science degree in Mechanical Engineering as well as Associate's degrees in Civil and Electrical Engineering. Many students in the Civil and Mechanical Engineering Associate programs at Trident Technical College matriculate into The Citadel's evening undergraduate Civil and Electrical Engineering programs. A number of the lower level courses that are required within a Mechanical Engineering program exist within the foundational courses in Civil and Electrical Engineering.

Data in 2011 on engineering students in select engineering programs at The Citadel, University of South Carolina, and Clemson University:

Total Undergraduate Students for Select Engineering Programs	**Total In Engineering**	**Civil**	**Electrical**	**Mechanical**
The Citadel	289	188	101	none
The University of South Carolina	1051	159	100	210
Clemson University	1849	605	386	785
Undergraduate Degrees Awarded				
The Citadel	83	52	31	None
The University of South Carolina	235	45	31	64
Clemson University	721	154	82	142

Other institutions:

Trident Technical College has an Associates of Science in Mechanical Engineering with many students taking their courses in the evening. The Citadel already has a Trident Technical College partnership with 2+2 articulation agreements for the Civil and Electrical Engineering degrees A full time evening undergraduate Mechanical Engineering program in the Charleston area will assist students from across the state and nation to continue taking Mechanical Engineering courses while completing a CO-OP with local companies. This will not only increase student skills while working, but increase the ability of timely graduation for more engineering students who choose to do a CO-OP in the Charleston area.

Cost:

The funding for the program will be through evening tuition, foundation support and space reallocation. The expected evening student enrollments in each course will generate the tuition revenue to cover the cost of faculty salary after the initial year of each hire such that after year five the program will have sufficient evening tuition revenue to cover the faculty cost. The College will support start-up of the program during the first five years to include equipment and office furniture and computers.

ESTIMATED COSTS BY YEAR					
CATEGORY	1ST	2ND	3RD	4TH	5TH
Program Administration					
Faculty Salaries	170k	310k	465k	535k	535k
Graduate Assistants	8k	8k	16k	16k	16k
Clerical/Support Personnel	25k	25k	25k	25k	25k
Supplies and Materials	10k	20k	20k	20k	20k
Library Resources	10k	5k	3k	2k	2k
Equipment	300k	100k	100k	100k	
Facilities					
Other (Identify)					

Proposed Curriculum:

The proposal calls for the curriculum to have five main focus areas to meet the needs of the local industry in South Carolina (See Attachment A – Draft Curriculum):

- Manufacturing
- Materials
- Mechatronics
- Power
- Aeronautics
- Other (thru course work in other programs such as Biomechanical, HVAC, Systems, Management, etc.