



Office of the Provost

Program Planning Summary

To the South Carolina Commission on

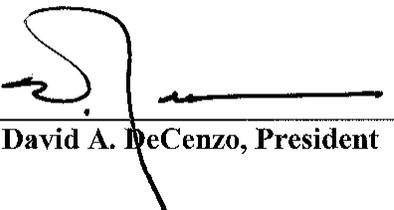
Higher Education

Ph.D.

In

Marine Science

August 15, 2012

for 

Dr. David A. DeCenzo, President

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College of Science

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PROGRAM PLANNING SUMMARY (August 15, 2012)

Institution:	Coastal Carolina University
Academic unit involved:	College of Science
Name of proposed program:	Doctorate in Marine Science (Coastal and Marine Systems Science)
Proposed date of implementation:	Fall 2013
CIP Code	40.0607
New program or modification:	New program
Number of credit hours:	60 (30 post-Masters)
STEM designation:	Yes
Delivery mode:	Traditional

JUSTIFICATION OF NEED FOR THE PROPOSED PROGRAM

Developing technical understanding of the coastal zone and applying that knowledge to coastal resource management is important to society. This is a consequence of pressure on natural resources brought about by the demographic shift of population to the coast and the importance of coasts to the overall economy. The coastal system is particularly challenging to manage. It exists at the interface of dynamic and interacting terrestrial, oceanic and atmospheric subsystems. The coastal system is studied through various academic disciplines (e.g., Marine Science, Atmospheric Science, Environmental Science/Engineering, and Biological Sciences) but with limited focus on the connections. Recently, the research approach (as indicated by the creation of new multidisciplinary funding programs, such as the NSF Margins and Frontiers in Earth System Science, and the NSF Coastal Science, Engineering and Education for Sustainability programs) is to adopt an integrated, multidisciplinary view. The proposed program in Coastal and Marine Systems Science (CMSS) applies an integrated systematic approach to the study of coasts. The program builds on Coastal Carolina University's (CCU) marine science focus, existing academic and research programs, and a long-term commitment toward integrated management of South Carolina's coastal system. Coastal communities, states and industries are faced with challenges requiring technical solutions that have historically been considered separately (e.g., beach erosion, energy production, storm water runoff, and coastal hypoxia). This proposed Ph.D. program at CCU will provide a unique foundation to help meet the increasing societal need for professionals trained to consider this complex system holistically and to provide science-based guidance to society and industry.

ANTICIPATED PROGRAM DEMAND AND PRODUCTIVITY

Due to its geographic location, degree offerings and facilities, CCU attracts large numbers of students who are interested in marine science. Students pursue their interests from various perspectives: science, policy, recreation, and business. The B.S. in Marine Science and the M.S. in Coastal Marine and Wetland Studies are two successful degrees currently offered at the institution. Both of these programs are highly productive with five-year average enrollments of 563 and 37 students, respectively. The proposed Ph.D. degree in Coastal and Marine Systems Science represents the logical next step in the development of CCU as a hub for training students to identify and characterize important physical processes in the coastal system. Such training is critical as coastal areas come under increasing stress due to human migration, as well as environmental factors such as sea level and climate change. We anticipate strong demand for the Ph.D. program based on the following factors. First, the program is academically broad but administratively narrow. It will be desirable to students interested in a broad range of coastal zone issues, but at the same time these students will function as a cohort with a high degree of interaction. Second, graduate students in this program will have ample opportunities to hone their communication and scientific skills as they interact with undergraduates, M.S. students in Coastal Marine and Wetland Studies, their Doctoral colleagues, and stakeholders working within the coastal zone of South Carolina. The program allows students to address issues involving the interactions among the ocean, atmosphere, terrestrial and freshwater subsystems of the coastal system. Lastly, the collaborations between CCU and a range of partners will result in a strong, diverse learning community, along with a complementary collection of academic and technical resources to support the study of coastal systems. Specifically, one of our partners, the Restoration Institute at Clemson University, is the administrative home of the (wind turbine) Drive Train Test Facility and the Intelligent River program. We have been working with Clemson, the Savannah River National Laboratory, Santee Cooper and others in exploring and characterizing offshore wind energy potential for the last 8-9 years. We are formally partnered with the Intelligent River

program – that aims to fully instrument an ecosystem in a broad spatially meaningful manner – and will generate the type of data sets envisioned for analysis by students and faculty in our proposed Ph.D. program. We conservatively predict an initial cohort of three (3 FTE) new students the first year, increasing to four in the second year and four-to-five in each subsequent year, with an estimated degree completion period of 4 years. From our discussions of this program internally and externally, we believe that, rather than developing traditional marine science directions, the priority need is in areas looking more at the full coastal system, working to connect science to management. This has been our strength and history; we've been very successful in these efforts, forming research partnerships locally, regionally, and nationally.

ASSESSMENT OF EXTENT TO WHICH THE PROPOSED PROGRAM DUPLICATES EXISTING PROGRAMS IN THE STATE

Due to its unique focus and curricular structure, the proposed program does not duplicate any existing program in the state. The basic tenet of the Ph.D. program in Coastal and Marine Systems Science at CCU is that challenges and issues in the coastal zone must be studied and approached within the coupled earth, atmosphere and ocean system (i.e., a systems approach). A systems approach allows one to incorporate populations as integral components of the various subsystems. While traditional Ph.D. programs have stressed the importance of basic research in the training of future scientists, it is now clear that scientists of the future, and specifically scientists dealing with challenges in the coastal zone, must understand the intersection of various scientific disciplines, as well as understanding science policy and human systems. The Ph.D. program in CMSS will include basic curricular and research experiences as well as education directed at developing predictive capabilities for future coastal system responses to natural and human-induced drivers. The Ph.D. programs in Marine Science and Geological Sciences at USC have traditionally focused on some aspects of the coastal system. However, the Marine Science program at USC draws on several disciplines, including biology, and is most noted for its research accomplishments at the Baruch Marine Field Laboratory where scientists study a relatively pristine ecological system. Considering the quality and focus of the programs at USC, there is certainly the possibility of many synergies and areas of overlap building from our historical collaborations that have been strong for the past thirty years. USC has also established large programs housed in Geography, the School of Earth, Ocean and Environment, the Baruch Institute, Marine Science, Geology and others. In our planned program, we have focused on organizing a structure to focus on strategic areas needed in understanding the coastal zone. Given that we have historically worked effectively with a broad range of universities, agencies, and private and public sector interests, we plan to continue these associations. Our ability to partner with a diverse range of interests is a strength of the developing program.

RELATIONSHIP OF PROPOSED PROGRAM TO EXISTING PROGRAMS AT THE PROPOSING INSTITUTION

With the recognition that coastal resources are important to the region's economy, history and culture, CCU committed to studying coastal environments with the formation of the Center for Marine and Wetland Studies in 1988. The Center established a strong research capacity particularly within coastal geologic and applied geophysics, environmental quality/watershed planning, and coastal ocean/atmospheric observations and modeling. Coastal faculty and students from several academic programs (i.e., Marine Science, Physics, Archaeology, Computer Science and Biology) are facilitated through the Center and work cooperatively with Center staff. Recently, the Center has transitioned into a School within the College of Science. This is in recognition of the important role it will play in the development of the CMSS program as well as its historical success in gathering the resources necessary to support doctoral-level research activities (~\$8M in research funds in the past academic year).

In 2003, the University established a Master of Science degree in Coastal Marine and Wetland Studies, further formalizing the interdisciplinary focus on coastal environmental issues and science at the graduate level. The Coastal Marine and Wetland Studies program is supported by faculty from several different academic departments, principally Biology and Marine Science, as well as staff from the Center for Marine and Wetland Studies (now School).

RELATIONSHIP OF THE PROPOSED PROGRAM TO OTHER INSTITUTIONS VIA INTERINSTITUTIONAL COOPERATION

The proposed program will favorably complement some well-regarded programs at Clemson University and other universities and research centers. CCU presently maintains a cooperative MOU with Clemson University related to renewable energy development and water quality studies. There is also a Cooperative Dual-Degree engineering program between Clemson and CCU that could extend to applied science in managing or utilizing the coastal system. Other cooperative activities exist as part of:

1. Clemson University’s Restoration Institute, Strom Thurmond Institute and Carolina Clear programs.
2. USC’s Baruch Marine Field Laboratory related to marine biological and ecological studies within North Inlet and adjacent coastal waters for the study of hypoxia.
3. Department of Natural Resources Marine Resources Research Institute to better characterize and manage the state’s natural resources related to beach erosion and beach nourishment.
4. Savannah River National Laboratory - coastal wind resource observations and advanced coupled modeling of the ocean/atmosphere system oriented to renewable energy research.
5. U.S. Geologic Survey’s Coastal and Marine Geology program and Water Resources Division - geologic framework, coastal erosion, natural resource characterization.

CCU faculty and students routinely work cooperatively with colleagues at Clemson and USC at the Belle W. Baruch Foundation’s Hobcaw Barony in Georgetown, SC focusing on saltmarsh and forest systems, respectively. The proximity of CCU to the Hobcaw Barony and to Clemson’s Restoration Institute in Charleston offer opportunities for expanded cooperation and access, including graduate student engagement by Clemson and USC scientists based along the coast. CCU also maintains a coastal reserve at Waties Island that is more directly embedded within the heavily developed setting. A short drive from the CCU campus, Waties Island is located in North Myrtle Beach. Collectively, the pristine setting at Baruch and the more human-influenced settings at Waties Island and Myrtle Beach provide strong opportunities to cooperate and to pursue significant multidisciplinary research ventures. The proposed Ph.D. in Marine Science (Coastal and Marine Systems Science) will leverage previous cooperative research ventures with Clemson and others and will be developed as a broad system-based program. For students entering with a B.S. degree, this degree would begin with core and elective classes similar to those offered through the M.S. degree in Coastal Marine and Wetland Studies, followed by course work, doctoral seminars and colloquia, and culminating in a dissertation completed at CCU but with committee representation by faculty from Clemson and other research institutions. The approximate credit distribution will be as follows:

Curriculum

I.	<u>CMSS Core Courses</u>	9
	CMSS 605 Coastal and Marine Hydrodynamics(3)	
	CMSS 606 Coastal and Marine Geological Processes (3)	
	CMSS 607 Coastal and Marine Bio-Geochemistry (3)	
II.	<u>System Science Core</u>	12
	CMSS 608 Coastal / Marine System Science, Issues and Applications (2)	
	CMSS 609 Coastal / Marine System Science Seminar (1) Required for four semesters.	
	CMSS 610 Temporal and Spatial Analysis (3) or	
	CMSS 611 Modeling Coastal and Marine Systems (3)	
	CMSS 612 Coastal / Marine Management, Policy, and the Law (3)	
III.	<u>Specialized Courses</u>	21
	Graduate coursework approved from an earned master’s degree and/or required by a student’s CCU doctoral committee.	
V.	<u>Dissertation Research and/or Directed Study</u>	18
<u>TOTAL CREDITS REQUIRED</u>		<u>60</u>

TOTAL NEW COSTS ASSOCIATED WITH IMPLEMENTING THE PROPOSED PROGRAM

Coastal Carolina University continues to invest and develop resources and capabilities in the area of coastal science. CCU expects an annual budget for its doctoral program in excess of \$750,000. To date, these investments have generated significant returns in grant productivity while increasing instrumentation and research opportunities for undergraduate and graduate students. Likewise, the university will reallocate funds

to cover faculty, startup needs, facilities, and graduate assistantships required for the Ph.D. program in Marine Science (Coastal and Marine Systems Science).

Coastal Carolina University

Response to Commission on Higher Education Staff Comments on the Originally Submitted Program Planning Summary

Proposed Ph.D. in Marine Science (Coastal Marine and Systems Science)

October 1, 2012

A) Nature of the collaboration with institutions not mentioned in the initial Program Summary (USC, MUSC, etc)

CCU has faculty working with colleagues and programs at the College of Charleston and USC. Most of these collaborations focus on marine biology and ecology. Certainly much opportunity for continued and expanded formal and informal partnering is possible. Our focus to date has been on CCU's core areas of strength in coastal processes, applied geophysics and environmental chemistry. We have continuing collaborations with those areas that have the strongest connections – our intention is to expand these as we grow the program. We clearly see opportunities for further collaborations and believe that substantial leveraging and benefit can be found particularly with USC – which also has a field station remote from their main campus that is close to Coastal (the Baruch Lab). This could afford considerable mutual support for faculty and for all programs.

As the nature of the coastal system is complex and engages a very broad range of sub-disciplines, there is great benefit in leveraging the unique strengths and capabilities of diverse partners. It can be difficult for any one institution, regardless of size, to fully encompass the full range of issues with similar levels of expertise and capacity. Thus CCU will continue to work cooperatively with Clemson, USC, UGA, ECU and others to best address the needs of the scientific community and the coastal system.

B) Connection to activities at the Clemson University Restoration Institute and other partners:

Beyond the activities listed within its institutional mission of restoration and sustainability, the Restoration Institute at Clemson (CURI) has a research and development focus that includes the Drive Train Test Facility (DTTF) and the Intelligent River Program.

We have worked, along with CURI, the Savannah River National Laboratory, Santee Cooper and others, in exploring and characterizing offshore wind energy potential for the last 8-9 years. CURI's interests in engineering and testing at the DTTF would be supported by environmental studies, as well as the focus on coastal observations and modeling that would be a key component of our program. Recent Department of Energy funded work has involved the characterization of storm waves impacting the design of offshore wind platforms – combining both engineering and coastal science. Activities within the

CCU doctoral program - specifically expertise in coastal hydrodynamics, and air-sea interactions – can provide important simulations for testing at DTTF. Present programs with several participants (Savannah River National Laboratory, NREL (National Renewable Energy Lab), MMI – a private sector engineering firm, and the Netherlands Maritime Research Institute) involve the study of wave forces that need to be considered in the design of off-shore wind structures.

The Clemson Intelligent River Program is an NSF-funded initiative focused on developing technology for gathering data across the entire Savannah River system. Clemson enlisted CCU for its marine expertise and operational capabilities with sensor deployment in challenging ocean settings. Combining the Clemson river and freshwater focus, with CCU's ocean/coastal atmospheric capacities, is part of our interest in utilizing specific expertise to best address complex interactions within, and affecting, the coastal zone.

These efforts will form a foundation for additional contacts and opportunities for others – particularly in coastal zone areas. This would include capabilities at USC-Columbia and USC-Baruch, as well as SECORRA (Southeast Coastal Ocean Observation Regional Authority – where CCU is already a member institution). CCU is continuing to partner with North Carolina State University, Rutgers University, the University of Delaware, the University of Utah, the University of Kentucky and other public and private interests in the national MesoUS program – a nation-wide collaboration on regional atmospheric observations – feeding information to the National Weather Service.

Another example of our partnerships is the SC Coastal Erosion Study, a five-year research program in concert with the US Geological Survey (USGS)-Coastal and Marine Geology Program. CCU was the lead SC institution and instrumental in the collaboration with the USGS in the Grand Strand region. The thematic focus and emphasis of the SC Coastal Erosion Study followed a scientific approach similar to other cooperative efforts that CCU has established with the USGS in other regions. The Coastal Erosion Study enlisted and provided funding to researchers at USC and College of Charleston. Such initiatives are mutually supportive and illustrate the importance of the system approach and the value in engaging capabilities not resident at any one institution.

The South Carolina Office of Ocean and Resource Management (OCRM) has been the lead agency on a NOAA grant exploring the environmental pressures on the coast that may be anticipated over the next fifty years. CCU was invited to lend its expertise in coastal ocean and beach erosion studies to join the overall team comprised of OCRM (policy), USC (Social Vulnerability and Salt Marsh Ecosystems) and Clemson (Resource Economics) to this interdisciplinary effort. Rather than be seen as a competition among these respective programs and institutions, this collaboration is a good example of how diverse and specialized resources can help address complex scientific, policy and economic issues in the coastal zone. In essence, all institutions benefited from the effort as did the science and policy recommendations made for the state. This type of broad agency- and university-wide collaboration is the framework within which CCU works. We anticipate that our doctoral program will be characterized by a similar collaborative approach.

C) Program demand

From our discussions of this program, we believe that the priority need is in looking at the full coastal system, addressing societally relevant problems, and working to connect science to management, rather than just traditional marine science directions. This has been the strength and history of the Center for Marine and Wetland Studies at CCU. Recent reorganization of the Center as a School formalizes and expands this focus.

It is worth noting that many programs outside of the state are moving into this area, expanding beyond traditional marine science (e.g. School of Coastal System Science at TAMU-CC) along with an increasing

integration of ocean and atmosphere (e.g. SoMAS – Stony Brook, etc.). The professional society, ABSPA, has indicated a need for more students in coastal geo/process/engineering areas. We further note that in spite of the economic down turn, inquiries for CCU students in this area remain strong with specific companies stepping up recruitment.

In addition, expanding opportunities exist within the private sector in areas such as hurricane surge modeling – allowing better risk/cost scheduling – as well as public safety and planning. Similarly, areas of projections of future coastal impact, either hypoxia or sea level change, have applications in consulting companies tied to FEMA, DOE, the Military, and the natural resource and extraction industries.

D) Impact on enrollment of the existing USC Ph.D. program

We do not expect much impact. USC is very well established, and CCU faculty have participated in the existing graduate program by serving on USC dissertation committees. In addition, at least one recent USC Ph.D. student was supported by a grant provided to a Coastal faculty member. Considering our proximity to Baruch, and the distance from Columbia, access and interaction with the proposed doctoral program can be an asset and potentially support USC faculty/students at Georgetown. While the focus with Clemson is developing formally, informal interactions with USC have been on-going for decades. Overall, our focus areas are largely complementary with USC at Baruch – more geophysical, process, and issues of watershed quality – and not competitive.

E) Student pipeline

In general we strongly encourage CCU undergrads to broaden their experiences by pursuing advanced degrees elsewhere. It is conceivable, however, that some within the existing Master's program may benefit from continuing at CCU. We are encouraged by the prospects for cooperation with Clemson and others where undergraduates remain within state by virtue of partnerships, benefiting from areas of specific strength and emphasis. At present our partnerships with the University of Georgia, East Carolina University, the University of South Florida, and Stony Brook University have facilitated the transition of Coastal undergraduates into those graduate programs. Through active partnering, promoted by the CCU doctoral program, we expect this will continue to provide for reciprocal opportunities for students from those institutions.

F) Nature of the USC program – possibilities for cooperation; not competition

The University of South Carolina has a large and well-respected Marine Science program. There certainly are many synergies and areas of overlap, along with historical collaborations. USC has also established large programs housed in Geography, the School of Earth Ocean and Environment, the Baruch Institute, Marine Science, Geology and others. While Coastal is not a large university with an extensive range of graduate programs, we are very good in our specific area of focus. Rather than numerous and extensive programs we have focused our efforts and organized into a structure specific to our mission. As a consequence we have recently re-organized the Center into a School and will concentrate on strategic areas of need related to understanding the coastal zone. Within USC's program a great many Coastal faculty are listed as research associates etc., providing access to unique resources (Baruch Foundation property and facilities of USC and Clemson) as well as broader scientific expertise. We hope to continue and expand that interaction with the advent of the doctoral program.

G) Connection with the Hollings Marine Lab (HML)

In the past, HML researcher Geoff Scott, Director of NOAA's Center for Coastal Environmental Health and Biomolecular Research, and the Acting Director of the Hollings Marine Laboratory, has interacted with several CCU faculty. He has invited CCU to participate on a joint proposal in the past, and serves on various advisory committees with CCU faculty and staff. CCU's Center/School staff recently met with the HML director, who has scheduled visits to Coastal Carolina University in the immediate future to explore better cooperation. This is particularly important, as financial pressures at HML and other institutions have made it cost effective to collaborate with a range of partners.

H) Connection with other federal labs

Coastal Carolina University has a 2012 MOU with the Savannah River National Lab, as well as MOUs with the US Army Corps of Engineers (USACE)-Charleston, and is presently expanding cooperatives with USACE-Jacksonville. The US Geological Survey-WRD regional office is housed in the Center/School, and we have had cooperatives with NPS and USGS Coastal and Marine. CCU is continuing two phases of a coastal erosion study and continues to work with the USGS in New York. Furthermore, three students are presently on the USGS Woods Hole staff while continuing to work with the program at CCU. Finally, several SC agencies (growing from our connections with NOAA) connect with a range of federal activities (MesoUS/Sea Grant). One of our strengths, and a strength of the proposed doctoral program, could be considered our engagement with other agencies (USGS, SNRL, USACE etc.)

I) Other master's programs in the state – connection to CCU and its programs

CCU already actively collaborates with many state institutions and certainly CCU undergrads have gone on to graduate programs in South Carolina. Those associations, largely driven by faculty/research groups actively working together, will certainly be looked upon as a possible draw and service to students at these other institutions. For example, fishery oriented research, concentrated in Charleston, is greatly amplified by SC DNR-MRRI, and NOAA labs. Similarly, we partner with DNR for geophysical research.

J) Existing MOU's

We have a strong ongoing MOU (2012) with Clemson University. In contrast, while there is no formal MOU with USC-Baruch, many CCU faculty are listed as Research Associates for the Baruch Institute and routinely work on research projects at North Inlet in cooperation with USC and Clemson. Baruch's focus is primarily bio-geochemistry and traditional marine biology/ecology. Thus these programs are viewed as complementary.

K) Nature of the Doctoral collaboration

The emphasis on a Focused Collaborative Doctorate (FCD) – and the use of the term – subsided with a change in legislation allowing for an independent doctoral program. However, functionally our view of the value of collaboration does not change very much. While we propose a free-standing doctoral program at CCU, we very much intend to expand our collaborative focus in strategic and mutually beneficial areas: coastal system/IR, renewable energy, watershed planning and water quality. The MOU with Clemson specifically identifies: “Academic programming such as student exchange, research, internships, practical training, distance learning, continuing education, cooperative education and service training”. The SRNL research oriented cooperative specifically identifies: “Facilitating SRNL staff access and engagement with CCU's developing PhD program”

