New Program Proposal
Ph.D., Marine Science
Coastal Carolina University

Summary

Coastal Carolina University requests approval to offer a program leading to the Ph.D. degree in Marine Science to be implemented in Fall 2013. The proposed program is to be offered through traditional instruction on campus. The following chart outlines the stages for approval of the proposal. The full program proposal is attached.

Stages of Consideration	Date	Comments
Program Planning Summary received and posted for comment	8/15/2012	USC transmitted concerns about research opportunities for students and need for another Ph.D. in Marine Science
Program Planning Summary considered at ACAP	10/11/2012	ACAP members advised Coastal to enhance the description of collaborating faculty (especially those with experience in participating on dissertation committees) and resources to support the broad-based curriculum; development of mathematically-based content; and suggested development of cognates. Staff suggested that Coastal garner USC's support and provide additional information on collaboration between Coastal and Clemson. Further discussion among ACAP members and Coastal representatives were about employment prospects, fiscal support, equipment, existing resources, and enhancement of experiences of bachelor's and master's students with the addition of the new program.
Program Proposal Received	1/11/2013	
Comments and suggestions from CHE staff to the institution	2/10/2013	Staff requested refinements to the proposal: compare and contrast proposed program to USC's; address collaboration with USC; provide more information on need/justification; update sections on physical plant, equipment, costs, and accreditation. Staff transmitted primary concerns about cost and duplication of USC's program.
Revised Program Proposal received	2/15/2013	The revised proposal included additional information to justification and need sections, job opportunities, resources, entrance points, milestones, and assessments.
Program Proposal posted to ACAP members for review	2/28/2013	

Stages of Consideration	Date	Comments
ACAP Consideration	3/21/2013	ACAP members questioned Coastal representatives about the Clemson MOU, incremental development of resources, state investment in existing resources for the bachelor's and master's programs, SACS accreditation timeline, justification of duplication, viability of partnerships based on common interests vs. directive by CHE of unlikely sustainability; cost concerns and justification of reallocation of funds; long-term strategic implementation.
Program Proposal posted to CAAL members for review	4/16/2013	
Comments received from Commissioner Munns	4/24/2013	In response to feedback from Commissioner Munns, staff requested that institutions address issues, received responses, and distributed the information to CAAL. The issues concerned infusion of the first Ph.D. program into various aspects of the University; how the institution will grow, monitor, and assess the program; costs; and accreditation.
Responses provided to CAAL	5/1/2013	Responses addressed the items listed and are attached.
CAAL consideration	5/2/2013	CAAL and institution representatives further discussed the SACS accreditation timeline; faculty experience teaching, mentoring, and overseeing dissertations at the Ph.D. level; and whether USC had provided written confirmation that it does not object to the program. The Committee voted to recommend approval to CHE.

Recommendation

The Committee on Academic Affairs and Licensing commends favorably to the Commission approval of the program leading to the Ph.D. degree in Marine Science at Coastal Carolina University, to be implemented in Fall 2013, provided that no additional "unique cost" or other special state funding be required or requested.

Commissioner Munns' Questions and CHE/Institutional Responses:
Coastal Carolina University, Ph.D., Marine Science Program Proposal

Ph.D. Processes

1. ***I believe the Ph.D. degree will be new to coastal, therefore please discuss how you will infuse into the administration of the school the necessary capabilities, processes, procedures, and culture to obtain a successful Ph.D. program.***

As described in the proposal document that was sent to our regional accreditor, the Southern Association of Colleges and Schools (SACS), the new School of Coastal and Marine Systems Science houses the new doctoral program in Coastal and Marine Systems Sciences and the existing Burroughs and Chapin Center for Marine and Wetland Studies. The School's administrative unit is composed of:

Director, School of Coastal and Marine Systems Science (Dr. Paul T. Gayes)
Assistant Director, School of Coastal and Marine Systems Science (Dr. Richard Viso)
Administrative Specialist (Ms. Julie Quinn)
Grants/Business Manager (Mr. Jim Whitfield)

The Director and Assistant Director of the School of Coastal and Marine Systems Science/Center for Marine and Wetland Studies have primary supervisory responsibility for the operations and program of the School. The Director and Assistant Director serve as the communication line for School activities to the Dean of the College of Science and University Administration and key School committees. They serve as leads for the continued development, assessment and improvement of the program. The School maintains an administrative specialist to support the day-to-day administrative functions.

The School of Coastal and Marine Systems Science has developed around a well-established center with a long history of productive research. As a result, the new School possesses mature research support mechanisms for grant development and management, technical and operational support as well as a concentration of advanced instrumentation and computational hardware and software. Center/School faculty generated research grants have directly supported doctoral students and dissertation research for students enrolled in doctoral programs at other institutions in the past (e.g. Univ. of Delaware, USC, Dalhousie, NSCU, Ben-Gurion) as well as post-doctoral researchers housed within the Center. Center/School faculty have maintained active collaborative research programs with colleagues at well-established R1 institutions (e.g. Scripps Institution of Oceanography, Woods Hole Oceanographic, Clemson, USC, UGA, NCSU etc.) as well as at National Laboratories (e.g. SRNL, NASA-Jet Propulsion Laboratory, UCAR) and federal and state environmental and natural resources agencies (e.g. US Geological Survey, Office of Naval Research etc.).

New faculty lines assigned to the School are joining existing research faculty established in the Center. In addition, considerable capabilities, expertise and experience are resident within affiliated faculty from several departments in the College of Science that have long served as the core of the existing Master's Degree program in Coastal Marine and Wetland Studies. The existing master's degree program is being transitioned into the new School to facilitate coordination and optimize leveraging of faculty, technical and curricular resources between the master's and doctoral programs.

The School/Center has greatly benefited from formal and informal counsel from colleagues at well-established programs in the design and focus of the doctoral program. Many of these associations are long-lived and have proven valuable in the long term planning and development of the successful Center. The new School will be well positioned to continue to draw upon these resources in addition to standing University academic program and administrative planning and assessment structures as the new program comes on line and matures.

The School's Grants/Business Manager is based within the Center and is available to support faculty and students with grant pre- and post- research award functions. The Grants/Business Manager also serves as liaison between the School/Center staff and students and other key University offices such as Office of Research Services, Procurement, Human Resources, etc. Additional technical support staff (e.g. operations) housed within the Center for Marine and Wetland Studies are available to facilitate and support research and instructional functions involving School/Center advanced instrumentation and research vessels.

The primary administrative leadership of the School (and Doctoral program) are all scientists trained in the field. In addition, qualified faculty resident within the School will oversee the various administrative committees, assuring the development of an appropriate institutional culture.

Faculty Governance

The School of Coastal and Marine Systems Science Faculty will maintain a proportional representation in College and University faculty governance committees and functions as specified by College and University policy. Individual faculty members serving on College and University committees will be determined through nomination and election by the faculty of the School through the Doctoral Program Committee.

School Faculty Governance

The School will maintain a structure of faculty committees as needed to effectively develop and manage the academic, faculty and student functions and interests of the School in concert with the School's administrative leadership. Standing faculty committees of the School of Coastal and Marine Systems Science are outlined below.

Doctoral/Graduate Program Committee

The Doctoral/Graduate Program Committee is comprised of all core faculty of the School of Coastal Marine and Systems Science. This committee serves to provide guidance on the integrated function and management of faculty and academic issues within the School. This committee meets regularly with the Director to consider broad programmatic issues and assign tasks to appropriate standing committees of the faculty or Office of the Director.

The Doctoral Program Committee will also serve to:

- Make recommendations to the Director for admission of prospective candidates to the program
- Review transcripts of new students for applicability of previous class work for School core and specialized disciplinary course requirements.

- Periodically review and make recommendations for improvements in School infrastructure (physical, support, operational) and policy to better support School mission and functions.
- Be a primary vehicle for formal communication and discussion with the Director to foster better, informed and coordinated management and operation of the School.
- Provide a body for formal hearing of student concerns or possible formal appeals of School decisions or actions.
- Be the primary body for considering issues and concerns associated with joint and affiliated faculty of the School. The Doctoral Program Committee shall receive, review and recommend nominations and applications for affiliated and joint faculty associations with the School.
- Help gather and evaluate data appropriate to assess the efficacy of the program and provide recommendations to improve student success and program competitiveness.

Sub-committees may be established, as necessary, to allow directed analysis and development in key areas or functions within the School and recommendation to the Doctoral/Graduate Program Committee. These include:

Curriculum Committee

The Curriculum Committee shall consist of a minimum of three core School faculty and is charged with the following responsibilities:

- Receive and recommend approval or rejection of course proposals for new courses and curricular development within the School.
- Periodically review and assess the School's curriculum and recommend improvements or modification to better serve the mission of the doctoral program, School and University.
- Serve as a point of contact and discussion for potential joint or synergistic course development and offerings.

Comprehensive and Qualifying Examinations Committee

The Comprehensive and Qualifying Examinations Committee shall consist of a minimum of three core School faculty and is charged with the following responsibilities:

- Establish and refine, in concert with input from the Doctoral Program Committee, the procedures, format, content and administering of the School's Comprehensive Examination required of all doctoral students
- Establish and refine as necessary the format and procedures of Qualifying Examinations required for all doctoral students. A representative of the committee, or their designee not serving on a student's Advisory Committee, shall be appointed by the Director to serve as the chair of the Comprehensive and Qualifying Examinations Committee to ensure consistency of these examinations across the program are maintained and School objectives and mission are represented in these examinations

Faculty Promotion and Tenure Committee

The Faculty Promotion and Tenure Committee shall consist of a minimum of three tenured core School faculty and is charged with the following responsibilities:

- Annual review, mentorship and guidance of untenured School faculty. Provide formal feedback to the faculty members and recommendations to the Director on progress and potential of the untenured faculty members towards promotion and tenure.
- Periodic review of individual faculty and collective school productivity and effectiveness. Makes an annual report to the Doctoral Program Committee and Director and recommendation as necessary to ensure the productivity and effectiveness of the faculty and program are maintained.

School Seminar/Speaker Committee

School Seminar/Speaker Committee shall consist of a minimum of three core/affiliated School faculty and three students and is charged with the following responsibilities:

- Recommending a program of seminar topics and speakers to be invited for leading School seminars each semester. These should emphasize seminar speaker and topics that emphasize and highlight integrated, interdisciplinary, societally relevant coastal systems science and interests of faculty and students in the School, College, University and community.
- Coordinate speakers/topics for the Fall semester with the School public forums and systems science course.
- Facilitate enlisting external expertise and perspective to provide input on development and refinement of School/graduate program.

Additional committees may be established by the Director or Doctoral Program Committee to address specific needs and initiatives of the School.

Doctoral Faculty Mentors

All full time School of Coastal and Marine Systems Science faculty as well as jointly appointed and affiliated faculty approved by the Director and Dean of the College of Science may supervise doctoral students in the program.

Each student will establish a formal Advisory Committee to consist of five mentors able to provide guidance in the students chosen dissertation thematic area. This committee should include the student's major professor and professionals holding appropriate credentials and standing to help supervise doctoral research. The student's major professor and at least three of the Advisory Committee members must be SCMSS faculty in good standing and at least one, but no more than two, external professionals holding appropriate academic credentials and professional standing to contribute to guidance, mentorship and evaluation of doctoral research by the student.

<u>Interdisciplinary Program</u>

2. ***In addition to establishing a Ph.D. capability the proposal rightly says that this will be a different Ph.D., it will be interdisciplinary. Please describe how you will grow, monitor and assess this new capability.***

The School of Coastal and Marine Systems Science has developed around a well-established research center with a long history of productive interdisciplinary research and culture. This

also builds from the experience of the existing master's degree program that is already highly interdisciplinary in nature. The existing Center and Master's degree program presently engages broad scientific sub-disciplinary areas (marine science, biology, computer science, physics and chemistry) as well as policy and resource management expertise (environmental sociology, economic) in interdisciplinary research and applications. Considerable active collaborative research associations have been maintained by School/Center faculty with colleagues at other research institutions (e.g. Scripps Institution of Oceanography, Woods Hole Oceanographic, Clemson, USC, UGA, NCSU, ECU etc.) as well as at National Laboratories (e.g. SRNL, NASA-Jet Propulsion Laboratory, UCAR) and federal and state environmental and natural resources agencies (e.g. US Geological Survey, Office of Naval Research) further expands the array of expertise and sub disciplinary perspectives that School faculty and students can draw upon to consider complex interdisciplinary coastal systems.

The historical experience and continued participation of School faculty and students working with coastal communities, natural resource managers, agencies and industries greatly facilitates the interdisciplinary model and culture. Participation of School personnel in state and federal coastal resource management panels and task forces exemplified the interdisciplinary culture and functions needed to enlist the best science and understanding of complex natural systems to contribute to efforts at improving resource management, utilization and policy development. Continued hosting of associated meetings and workshops afford students considerable opportunity to experience the interdisciplinary practice. The School plans to continue to build on this history and actively pursue formal and informal opportunities for students to participate and contribute to discussion and contribute to collaborative efforts with external groups in real world applications.

Practically speaking, we expect input from such external groups interacting with our students will be highly beneficial data to monitor and assess aspects of the interdisciplinary goals. These experiences, however, are typically highly individualized by the particular issues or initiatives that are ongoing at any one time and will also likely result in individual students or small groups of students participating in different applications with different groups. Thus, we will seek input from our broader research teams and partners on the programmatic efforts to develop and build upon such experiences as well as input in the efficacy of individual student's participation. Initially, further development and assessment of this function will be tasked to the Graduate Program Coordinator. The Graduate program coordinator is a position that is being modified from the existing master's program to facilitate administration of the graduate programs and to expand and promote student experiences with our research partners.

Ultimately this question deals with how the assessment process will determine whether students have obtained the identified skills associated with this novel program. As an interdisciplinary program, it will build on the knowledge and experience of students from undergraduate programs in traditional core science disciplines (biology, geology, oceanography, environmental science, etc.) and/or graduate students in master's degrees in related areas, the goals of this program are to prepare highly-trained professionals who can function across a range of areas:

Goal 1: Understand complex systems at the Ocean-Atmosphere-Terrestrial interface from a variety of
scientific disciplines and across a range of temporal and spatial scales.

Goal 2: Design and conduct scientific research to enhance the knowledge base concerning coastal and
marine systems as well as for specific societally relevant environmental problems in the coastal zone.

Goal 3: Describe and characterize coastal systems using advanced coastal observing instrumentation, and conceptual and quantitative models, and incorporate new research results towards improving the prediction of future system behavior and response to natural and societal drivers.
Goal 4: Translate complex problems and solutions in language and methods understood by public policy decision-makers as well as the general public.
Goal 5: Develop core competence, experience and publication records to successfully compete for professional positions in industry, academia, and government.

Student Learning Outcomes (SLOs)

After successfully completing the Doctoral degree requirements, students will be able to:

1. Critically evaluate evidence-based studies of coastal and marine systems (Goals 1, 3).
2. Design field, laboratory and/or computational experiments, data acquisition and analysis to advance scientific knowledge and applications in coastal and marine systems science
(Goals 2, 3).
3. Develop and test conceptual and/or mathematical models to simulate and predict complex coastal behavior (Goals 2, 3).
4. Analyze research data and evaluate its application to regional issues (Goals 2, 3, 4).
5. Incorporate knowledge of temporal and spatial variability of coastal systems into recommendations for management of coastal and marine systems (Goals 1, 2, 3, 4).
6. Apply scientific theories, intellectual skills and competencies, and management principles when making decisions related to utilization of human and physical resources in coastal and marine zone policies (Goals 2, 3, 4).
7. Effectively communicate technical information and scientific results to a range of constituencies in the private, public, and academic sectors (Goals 1, 4).
8. Apply a structured and scientific process when making and recommending policy decisions (Goals 1, 2, 3, 4).
9. Demonstrate a leadership role within the field of coastal and marine research, development, and management (Goals 1, 5).

Assessment of Learning Outcomes

Student learning outcomes will be assessed at three different stages of the program.

1. The Comprehensive Examination will be used to assess SLOs 1, 4, 5 and 6. Since the student will have completed the core courses, this assessment together with the oral component will help gauge the proficiency of the student and ability to continue in the program.
2. The Qualifying Dissertation Examination will be used to assess SLOs 2, 3, 7 and 8. An assessment instrument will be developed that includes the formal presentation in front of School faculty and students, informal feedback from the attending audience and evaluations from Advisory Committee members.
3. The formal dissertation and defense will be used to asses SLOs 7, 8 and 9. The Advisory Committee will use a rubric to assess student learning based on the student presentation, the quality of the dissertation and student understanding of various key topics during the defense.
4. To the extent possible, formal feedback from outside partners, agencies, communities that have opportunity to work with our students in direct applications such as research applications oriented to ongoing societal environmental issues as well as in workshops or

other formats. An initial effort to standardize this external input may be possible through the existing Board of Visitors of the Center for Marine and Wetland Studies. This Board is comprised of individuals that bring a broad cross-section of scientific/technical, technical institutional/agency as well as public/community experience and expertise in providing input on the development and planning undertaken by the center. The board has frequently interacted with students in the past and worked to help support student initiatives and involvement (e.g. Caudle Student Research Endowment Fund). We will be exploring this Board's potential for more formally participating in this important function as well as continuing to facilitate opportunities for students to interact with external professionals and contribute to discussion of issues facing society in our region at the next formal Board meeting scheduled for July-August 2013.

Cost

3. ***There will be new costs for faculty (3), facilities (several new or expanded buildings and a boat), and additional library and research resources.***

- ***Are the new buildings and renovations already CHE approved, and if not describe the plan.***

The new buildings and renovations refer to the recently completed Brittain Hall which was completed in January 2013, the second Annex to the science complex which received Phase II approval by CHE in January 2013 and the renovation of the Smith Science Center which was approved as a part of the Comprehensive Permanent Improvement Plan dated February 2013.

Direct funding of the cost of the vessel has already been received from the General Assembly. Boat operations will support Coastal's undergraduate and master's programs as well as the proposed Ph.D. program. Operating cost for new vessels are included as part of the overall university budget.

- ***Page 25: The cost table shows revenue growth with time in the tuition funding line, but it also says that the other funding will come from growth, presumably this growth is also increased tuition from an increase in students. Aren't these lines redundant (double counting)?***

The tuition funding is specific to the Ph.D. program and the Other Funding growth is from other sources such as undergraduate and graduate tuition excluding the Ph.D. program. The additional Other Funding is to show the offset from existing expenses currently belonging to other programs at CCU. The revenue sources are not being double counted.

- ***With your best estimate on cost over this five year period, what is your expectation for:***
    - ***Ph.D. tuition and Ph.D. tuition growth?***

At this time, Ph.D. tuition is proposed to be identical to the University's tuition for graduate study. Any changes to Ph.D. tuition will mirror any approved changes in overall graduate tuition during the five year period.

- ***Change to undergrad student tuition because of the increased cost of this program?***

Undergraduate tuition costs will not increase as a result of this program. As indicated above, some of the expenses are already included in the budget but will transition over to this program and the remainder will be covered through student body growth.

Accreditation

4. ***Please discuss the prognosis for accreditation (timeline and probability of success) and whether program approval should precede or follow accreditation.***

CHE program approval typically precedes accreditation approval. The comprehensive SACS document requesting a Level Change to provide Doctoral level-education has been submitted to SACS, received, and scheduled by SACS for the SACSCOC Board of Trustee to review at its meeting in June, 2013.This step will include SACS approval of the modified change to Coastal's Mission Statement – already approved by CHE. Coastal was strongly encouraged by our SACS Liaison to be optimistic about this level-change review. Once the review is determined to be positive, our next step is to begin admitting students to the Ph.D. program. The SACS process will then include a SACS visit to review program operations 6-9 months after the first student enters the program.

COASTAL CAROLINA UNIVERSITY
Conway, South Carolina

Proposal to
South Carolina Commission on Higher Education
To establish a
Ph.D. in Marine Science: Coastal and Marine Systems Science

January 14, 2013

Contact Person:
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CLASSIFICATION

Name of proposed program:	Doctoral Program in Marine Science: Coastal and Marine Systems Science
Academic Unit:	College of Science
Designation of Degree:	Ph.D. in Marine Science
Proposed date of Implementation:	Fall 2013
CIP Code:	40.0607
New or Modification:	New
Site:	Main Campus of Coastal Carolina University and collaborating facilities
Qualifies for Palmetto Fellows and LIFE Scholarship Awards:	No
Delivery mode:	Traditional

INSTITUTIONAL APPROVAL

List of all internal institutional bodies of which approval was required and the dates on which each such body approved the program.

Internal Institutional Body	Date of Required Approval
Graduate Committee, College of Science	12/6/2012
Graduate Council	1/16/2013
Faculty Senate	2/6/2013
Provost	2/14/2013
President	2/14/2013
Board of Trustees	6/7/2012

JUSTIFICATION

Purposes and objectives of the program

Developing technical understanding of the coastal zone and applying that knowledge to coastal resource management is essential for society. This need is a consequence of the pressure on both state and national resources brought about by population density along the coast (currently 53% of the United States population lives in coastal counties), as well as the importance of coasts to the world economy. The coastal zone is particularly challenging to manage, as it embodies the dynamic interface and complex interactions of terrestrial, oceanic and atmospheric subsystems. Typically, aspects of this system are the focus of a range of academic programs (e.g., marine science, atmospheric science, physical oceanography, environmental science/engineering, geological sciences, and biological sciences) but with a limited focus on the interdependencies among those fields. A recent shift in research approach (as indicated by the creation of new multidisciplinary funding programs, such as the NSF Margins, Frontiers in Earth System Science and Science, Engineering and Education for Sustainability programs) is to adopt an integrated, multidisciplinary view of such systems that are ever increasing in complexity. Subsequently, emergent systems' properties and problems are not readily predicted by separate analysis of individual subsystems, and an integrated approach is required for full

understanding. The proposed doctoral program in Coastal and Marine Systems Science is designed to approach the study of complex coastal ocean, earth, atmosphere, biosphere, and societal interactions and the associated management applications as a single integrated system. The program builds on Coastal Carolina University's (Coastal's) focus on coastal zone environments, existing academic and research programs, and a long-term commitment toward an integrated management of South Carolina's coastal systems. Furthermore, the proposed program is supported by strong complementary and synergistic partnerships with Clemson University, Savannah River National Laboratory and numerous other academic, governmental, and corporate institutions across the region and the entire country.

The increasing coincidence of environmental and economic interests related to sustainable and productive use of coastal natural resources (e.g., beaches, maritime recreation, marine renewable energy, real estate, fisheries and water quality) and adaptation to potential changes in this system will be important drivers for all coastal communities in the future. Coastal communities, states, and industries face an increasing array of challenges and costs requiring technical solutions that have historically been considered separately (e.g., beach erosion, storm protection, energy production, storm water runoff, and coastal hypoxia). There is great potential for the coordination of efforts. Efficiencies would be found in an integrated, multidisciplinary systems approach to regional coastal environmental management. This approach will provide a unique foundation to help meet increasing societal needs for professionals trained to consider this complex system holistically and to provide science-based guidance to society and industry.

Program goals

Building on the knowledge and experience of students from undergraduate programs in traditional core science disciplines (biology, geology, oceanography, environmental science, etc.) and/or graduate students in master's degrees in related areas, the goals of this program are to prepare highly-trained professionals who:

Goal 1: Understand complex systems at the Ocean-Atmosphere-Terrestrial interface from a variety of scientific disciplines and across a range of temporal and spatial scales;

Goal 2: Design and conduct scientific research to enhance the knowledge base concerning coastal and marine systems as well as for specific societally relevant environmental problems in the coastal zone;

Goal 3: Describe and characterize coastal systems using advanced coastal observing instrumentation, and conceptual and quantitative models, and incorporate new research results towards improving the prediction of future system behavior and response to natural and societal drivers;

Goal 4: Translate complex problems and solutions into language and methods understood by public policy decision-makers, as well as by the general public; and

Goal 5: Develop core competence, experience and publication records to successfully compete for professional positions in industry, academia, and government.

Student learning outcomes (SLOs)

After successfully completing the doctoral degree requirements, students will be able to:

1. Critically evaluate evidence-based studies of coastal and marine systems (Goals 1, 3).

2. Design field, laboratory and/or computational experiments, data acquisition and analysis to advance scientific knowledge and applications in coastal and marine systems science (Goals 2, 3).
3. Develop and test conceptual and/or mathematical models to simulate and predict complex coastal behavior (Goals 2, 3).
4. Analyze research data and evaluate its application to regional issues (Goals 2, 3, 4).
5. Incorporate knowledge of temporal and spatial variability of coastal systems into recommendations for management of coastal and marine systems (Goals 1, 2, 3, 4).
6. Apply scientific theories, intellectual skills and competencies, and management principles when making decisions related to utilization of human and physical resources in coastal and marine zone policies (Goals 2, 3, 4).
7. Effectively communicate technical information and scientific results to a range of constituencies in the private, public, and academic sectors (Goals 1, 4).
8. Apply a structured and scientific process when making and recommending policy decisions (Goals 1, 2, 3, 4).
9. Demonstrate a leadership role within the field of coastal and marine research, development, and management (Goals 1, 5).

Need for the program in the state

The South Carolina coastal zone is rapidly developing and will continue to be an important area of economic and population growth for the state. Much of this growth is supported by the state's coastal natural resources. Other coastal areas in the country and world are facing similar trends and needs for improved balance between maintaining coastal resources and expanding sustainable economic growth.

Coastal Carolina University's Office of Institutional Research, Assessment and Analysis compiled a survey (Appendix 1) of academic and industry representatives across the region regarding the need for highly trained scientists within the proposed program area. A consistent recommendation from this survey (response rate = 28%) was the need for a more systems-oriented approach to societally relevant coastal marine problems and a migration away from traditional marine science graduate education. The thematic areas and strengths of the proposed program were highlighted as growth areas needing expertise and leadership for developing new industries, such as in marine renewable energy. Developing industries and increasing needs for more efficient and effective management of natural coastal resources as economic drivers will require an integration of research: technical, policy, regulatory and economic, which will expand the need for expertise in interdisciplinary systems-based scientific realms. This was also a theme highlighted by an external reviewer's comments on the proposed program (Appendix 2). These areas are well aligned with Coastal's strengths and proposed program focus as well as with the cooperative relationships with Clemson University and the Savannah River National Lab, among others.

The need for improved coastal science as well as the connection of that science to public and private decision makers was highlighted by a recent letter from the Executive Director of South Carolina Sea Grant Consortium speaking to the need for this focus and program at Coastal (full letter attached in Appendix 3).

The design of the program was influenced by input from Dr. Edmund Estes of North Carolina State University, the external reviewer. Dr. Estes has a long history of administering graduate programs dealing with natural resources and environmental policy. He pointed out that Ph.D. level research, if structured well and communicated broadly, can positively influence

environmental policy. As such, the proposed doctoral program includes core classes in issues and applications. Further, the program evaluation includes tracking of interactions between graduate students and entities that eventually craft and enforce environmental policies. This applied aspect of the proposed doctoral program is unique and will position graduates for a diversity of jobs in the environmental field.

Centrality of the program to the mission of the institution

Act 213 (R. 243, H. 5051) of the 2012 South Carolina General Assembly, amended the *S.C. Code of Laws*, to allow four-year colleges and universities to offer a doctoral degree in marine science approved by the Commission on Higher Education. Subsequently the Coastal Carolina University Board of Trustees revised the mission statement of the University in 2012 and received approval of the new mission from the South Carolina Commission on Higher Education (SCCHE) on October 4, 2012.

Because the proposed Ph.D. program in Marine Science that initiated the mission statement change has not yet been approved by the Commission, the University will not use the revised mission statement until after SCCHE approves the program.

It states:

> "Coastal Carolina has ... become a regional comprehensive university with a tradition of a strong liberal arts core. Coastal Carolina seeks to develop students who are both knowledgeable in their chosen fields and prepared to be productive, responsible, healthy citizens with a global perspective. Coastal Carolina commits its resources to ... building baccalaureate and selective master's programs of national and/or regional significance in the arts and sciences, business, humanities, education and health and human services, ***and a Ph.D. program in Marine Science.*** Coastal Carolina fully embraces its leadership role as a regional center of economic and intellectual resources, lifelong learning, cultural and recreational opportunities and athletic programs."

The proposed doctoral program in Marine Science: Coastal and Marine Systems Science is a key element of this new mission. The program increases the scientific understanding of coastal and marine systems. Such knowledge is critical for sustaining coastal areas influenced by development, rapid population growth and storms.

Relationship of the proposed program to other related programs within the institution

With the recognition that coastal resources are important to the region's economy, history and culture, Coastal Carolina University operationalized its commitment to studying coastal environments with the formation of the Burroughs and Chapin Center for Marine and Wetland Studies (BCCMWS) in 1988. The Center has established a strong research capacity particularly within coastal geology and applied geophysics, environmental quality/watershed planning, and coastal ocean/atmospheric observations and modeling. University faculty and students from several academic programs (i.e., Marine Science, Physics, Archaeology, Computer Science and Biology) are assisted by the Center and work cooperatively with Center staff.

Center-generated research ($8.5M in active external research funding for 2011-2012) has established a significant array of instrumentation, expertise, and support that has greatly benefited existing undergraduate and master's degree programs. These resources have facilitated development of several formal undergraduate and graduate courses contributed by Center faculty to existing undergraduate and master's programs that would not be adequately supported or possible otherwise. In addition, there has been significant expansion of direct involvement and support of students (grant-generated salary support, research project involvement, and mentorship) and undergraduate departmental faculty (summer salary, joint proposals, and contribution to startup funding) that has enhanced and expanded capacities of existing departments. These synergies and benefits are expected to broaden with the development of the new Ph.D. program. In addition, the new program expansion provides a vehicle for enhanced cross-department coordination and leveraging of existing programs and collective resources. In preparation for the developing doctoral program, the Center has been restructured into the School of Coastal and Marine Systems Science (SCMSS). The School of Coastal and Marine Systems Science operates within the College of Science with the director reporting to the dean. The School will participate in the organization of the College with representation on the College Graduate Committee and with representation on the Faculty Senate. This structure is similar to what occurred when the health-related programs (as the School of Health, Kinesiology, and Sport Studies) moved from the College of Education to the College of Science in 2008.

In 2003, the University established a Master of Science degree in Coastal Marine and Wetland Studies (CMWS), 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 academic departments, principally Biology and Marine Science, as well as staff from the Center for Marine and Wetland Studies. The doctoral program affords significant additional benefits to the master's program as a similarly broad and interdisciplinary program. Participation of doctoral students as part of research teams that will frequently engage master's degree students provides a broader array of expertise and greater mass of research culture and activities. In addition, as has been the case for undergraduate programs, instrumentation and research infrastructure developed by research funding to the Center/School also considerably expands access to advanced instrumentation and software that would otherwise not be available within the master's program. Academic courses created for Ph.D. student needs will be widely accessible to these masters level graduate students.

Students in the Coastal Marine and Wetland Studies M.S. program are currently required to take 12 hours of graduate electives. This requirement is now met through graduate courses offered within Biology (BIOL), Marine Science (MSCI) and Coastal Marine and Wetland Studies (CMWS). The Ph.D. in Coastal Marine and Systems Science (CMSS) will provide expanded curricular options particularly for those students interested in systems science.

Interactions and relationships between the proposed program and those at other institutions

Due to its particular focus, curricular structure, and collaborative leveraging of resources and expertise, this program is distinct (not directly duplicative) yet very well placed to be compatible and synergistic with some programs specializing in other diverse fields across the state and region. The basic tenet of the Ph.D. Marine Science program in Coastal and Marine Systems Science is that challenges and issues in the coastal zone must be studied and approached within the coupled earth, atmosphere, and ocean system (i.e., an *integrated* systems approach). Human populations invariably interact with each of these systems, so the human element adds

an additional dimension. A systems approach allows one to incorporate populations (both human and "living marine resources") as integral components of the various subsystems. This focus on the complex interactions within the coastal zone was noted as "*an important need for our area and all coastal communities*" in written comments provided after the SCCHE ACAP review of the program summary in October 2012.

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 and near-shore marine zones, must understand the intersection of various scientific disciplines within science as well as policy and human systems. As such, the Ph.D. program in Coastal and Marine Systems Science includes core and advanced classes as well as education directed at developing predictive capabilities for future coastal system responses to natural and human-induced drivers. The only similar program in the state of South Carolina is the Marine Science Ph.D. at the University of South Carolina. This program is broadly based in biology, chemistry, earth science and geography and is staffed by faculty with joint appointments. The proposed Ph.D. at Coastal Carolina University also takes a broad educational approach to coastal systems but with a greater emphasis on physical processes and their interactions. This emphasis is a reflection of the faculty who designed and will deliver the curriculum.

The proposed Ph.D. program will favorably complement some well-regarded programs in the state, specifically the University of South Carolina and Clemson University. Coastal Carolina University presently maintains a cooperative Memorandum of Understanding with Clemson University (see Appendix 4a) building on eight years of leveraging respective strengths and initiatives related to renewable energy development and water quality studies. This partnership affords each institution access to specialized and synergistic capabilities concentrated in the respective institutions. For example, Coastal Carolina University has formally joined the Clemson University "Intelligent River" team working to instrument the length of the Savannah River system from the mountains to the sea. This Clemson University program is designed to provide real-time data related to the function of the river to facilitate science and management and a range of riverine science, resource management and technology initiatives at Clemson University. It leverages Coastal's marine and estuarine expertise and field operational capabilities. This partnership also provides a basis for greatly expanding and broadening future collaborative research initiatives and student opportunities. This effort emphasizes an integrated systems approach to a complex system, particularly in the interconnected link between the river, estuarine, and ultimately coastal and ocean environments. The Coastal-Clemson Cooperative affords an important opportunity to bridge a traditional divide between "environmental" natural sciences and engineering approaches to coastal problems, as well as leverages an academic focus that spans the broad range of issues that are critical for understanding the coastal zone. Work progresses to develop baseline observational and modeling capabilities to advance a potentially important developing industry in marine energy. Clemson University's new Drive Train Test Facility, located in Charleston, is the largest engineering test bed for wind turbine technology in the world. It is focused on testing developing technology and larger, more efficient wind turbines to support the developing offshore renewable energy industry worldwide. Offshore resources represent a particular economic potential for the state of South Carolina and surrounding region. Coastal Carolina University's focus is to improve the observation and modeling of wind resources in addition to simulation of conditions that ultimately comprise these yet untapped resources.

Coastal Carolina University is also working with the Savannah River National Laboratory (SRNL; see Memorandum of Understanding (MOU) in Appendix 4b) and others to greatly

advance the observation and modeling of the coastal boundary region where air-sea-land effects interact in a complex manner driving coastal weather, waves and currents. The CCU-SRNL cooperative is presently starting a collaborative Dept. of Energy project seeking to model and characterize potential hurricane wave forcing on the Southeast US continental shelf. This study is a basis for engineering partners to refine the design of offshore structures, which will help reduce the cost and uncertainty for developing industries.

Both of these examples illustrate the interdisciplinary, societal and economically relevant, systems-oriented focus of the proposed Ph.D. program as well as the strength of the collaborative model to continue developing important initiatives into the future. Access to collective expertise and specialized resources is greatly enhanced through such partnerships, as well as perspectives offered by outside speakers from industry, agencies, national laboratories and other professionals in the field students are seeking to enter.

There are several other cooperative activities between Coastal Carolina University faculty and students and regional universities and research centers aimed at better understanding coastal systems, including:

1. University of South Carolina's Baruch Marine Field Laboratory related to marine biological and ecological studies within the pristine environments at North Inlet, which recently expanded to adjacent coastal waters after leveraging the disciplinary focus and capabilities of each program (e.g. interdisciplinary study of anthropogenically-affected tidal creek biogeochemistry as well as coastal hypoxia events).
2. Department of Natural Resources, Marine Resources Research Institute where Coastal Carolina University's coastal geologic and applied marine geophysics group works to better characterize and manage the state's coastal natural resources related to beach erosion, beach nourishment, and sea floor habitat.
3. U.S. Geologic Survey's Coastal and Marine Geology Program and Water Resources Division related to geologic framework, coastal erosion, and natural resource characterizations.
4. US Army Corps of Engineers Charleston and Jacksonville Districts- engaged in cooperative studies of coastal erosion, regional sediment management and coastal water quality. BCCMWS is presently assisting the Corps with expedited studies associated with the upcoming Charleston Harbor deepening.
5. University of South Florida- The Center for Marine and Wetland Studies has established an MOU with the University of South Florida (see Appendix 4c) to facilitate cooperation between respective geophysical sea floor mapping capabilities. This cooperative has helped leverage respective instrumentation, staff and student opportunities for faculty and students of both institutions in mutually supportive studies and other initiatives.
6. University of Georgia (UGA) and its Long-Term Ecological Research site at Sapelo Island, Georgia. Coastal faculty members are currently co-principal investigators with 20+ other researchers from UGA and institutions across the southeast to investigate the long-term behavior of a coastal barrier island. This collaboration provides student opportunities with other regional academics.

Coastal Carolina University faculty and students routinely work cooperatively with colleagues at the University of South Carolina at the Belle W. Baruch Foundation's Hobcaw Barony in Georgetown, SC and Clemson University focusing on forest systems and saltmarsh, respectively. The proximity of Coastal Carolina University to the Hobcaw Barony and to Clemson University's

Restoration Institute in Charleston offer opportunities for expanded cooperation and access, including graduate student engagement by University of South Carolina and Clemson University scientists based along the coast. Coastal Carolina University also maintains a coastal reserve at Waties Island that is more directly embedded within the heavily developed South Carolina coast. A short drive from the Coastal Carolina University 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, especially those involving human sustainability management issues.

This degree will require: 1) successfully completing a suite of required core courses to set the framework of the expanse across coastal marine sciences and systems approaches, 2) advanced and specialized courses developed within the School of Coastal and Marine Systems Science as well as 600-level or above (graduate student only) currently offered in BIOL, MSCI and CMWS, 3) doctoral seminars and colloquia, and 4) a dissertation completed at Coastal.

ENROLLMENT

Admissions

Students may apply to the Ph.D. program in Marine Science: Coastal and Marine System Science through Coastal Carolina University's Office of Graduate Studies (http://www.coastal.edu/graduate/index.html).

In general, students are encouraged to apply to the doctoral program for a planned start in the fall semester. The main application deadline for the program is January 15. The SCMSS Program Committee will evaluate applications and notify applicants of acceptance or rejection by March 1 for matriculation starting in the following fall semester.

Students may be considered for beginning graduate work on an alternate schedule, typically spring semester, at the discretion and recommendation of the SCMSS Admission Committee and Director. Students proposing to enter the program on an alternate schedule or with need for any other special consideration affecting matriculation should contact the Office of the Director of the School prior to submitting an application.

All students applying to the doctoral program in Coastal and Marine System Science are encouraged to contact individual faculty members with related research programs about their research interests and strongly consider visiting the School either individually or at scheduled open houses offered by the school.

The School of Coastal and Marine System Science will only admit a finite number of doctoral students annually on a competitive basis. Students are expected to have identified a faculty research advisor/mentor to be admitted to the doctoral program and include a recommendation by a SCMSS faculty member agreeing to serve as the student's research mentor with their application.

Qualifications for Admission to the Doctoral Program.

All applicants to the doctoral program in Marine Science: Coastal and Marine System Science must meet the requirements for graduate admission to Coastal Carolina University and the School of Coastal and Marine System Science.

This includes:

- Successful completion of a master's or bachelor's degree from a regionally accredited institution
    - A minimum GPA of 3.0 or higher (on a 4.0 scale) documented by official transcripts for all collegiate course work.
    - Final transcripts for bachelor's and master's degrees (if applicable) are required to be received before formally beginning the program.
    - Successful completion of at least two semesters of college level calculus, physics and chemistry and advanced coursework in scientific disciplines related to the student's proposed research area.
- Copies of official scores on the Graduate Record Examination (GRE)
    - SCMSS requires a minimum of 300 combined verbal and quantitative scores on the GRE taken after August 1, 2011 and within 3 years of application.
- Three letters of recommendation outlining the applicant's past work and preparation and potential for successful completion of doctoral studies.
- Applicants who are not native English speakers must demonstrate proficiency in English.
    - This may be demonstrated by a minimum of 550 on TOEFL (paper-version) 220 on TOEFL (computer-version) or 80 on TOEFL IB (internet-version) exams.
- Identify a faculty research mentor.

Students Entering the Doctoral Program Holding a Master's Degree

Applicants entering the doctoral program with a master's degree from a regionally accredited institution may be awarded variable credit hours for graduate work completed prior to admission to this program (see required elements of the curriculum below). The SCMSS Committee will review the application materials submitted by each applicant to determine what graduate course credit will be approved as applicable to the doctoral program's coursework requirements.

Students found with deficiencies in prior courses or other preparatory work for doctoral studies may be accepted on a provisional basis. Provisionally accepted students will be assigned specific courses or work to be appropriately prepared for the program. Upon completion of the specified preparatory work the student will be fully admitted to the program. Any graduate coursework completed applicable to the program course requirements while in professional status will be applied to program requirements.

Students applying to, or already enrolled, in Coastal Carolina University's Coastal Marine and Wetland Science program with interests in the doctoral program should discuss their interest in the doctoral program with potential research mentors. Students are expected to first complete their master's degree Coastal Marine and Wetland Science and be directly admitted to the doctoral program through regular admissions process.

Highly qualified CMWS students may apply to the SCMSS Doctoral Program Committee to by-pass the master's degree and progress directly into the doctoral program. To do so students should:

a. Formally apply, in writing, to the SCMSS Doctoral Program Committee for consideration of the transition in status.
b. Have successfully completed the CMWS core curriculum requirements.
c. Provide a written recommendation by a SCMSS faculty research mentor outlining the student's work completed to date and potential for transition to doctoral work.

d. Provide a professional curriculum vita highlighting professional accomplishments, documented achievements relevant to proposed doctoral work, and outline of the proposed dissertation research.
e. Provide recommendations by the CMWS coordinator and CMWS thesis committee supporting the transition.
f. Successfully complete the SCMSS Comprehensive Exam.

Students Entering the Doctoral Program holding a Bachelor's Degree

Highly qualified applicants entering the doctoral program from a regionally accredited undergraduate program may be provisionally accepted into the doctoral program through the general admission outlined above.

Students should include a written recommendation by a SCMSS faculty member agreeing to serve as their research mentor with their application. As part of the admission process, the student identified SCMSS faculty research mentor and SCMSS Program Committee will review the student's application and determine if there are any deficiencies in prior courses or other preparatory work for doctoral studies. If deficiencies are identified the SCMSS Program Committee may assign specific courses or work to be appropriately prepared for the program. Upon completion of any specified preparatory work and successful completion of the School Comprehensive Examination, the student may petition to be fully admitted to the doctoral program. Any graduate coursework completed applicable to the program course requirements while in professional status will be applied to doctoral program requirements.

Doctoral Program Milestones

1. The student selects a SCMSS faculty member as their major professor and research mentor as part of the admission process. The student and major professor identify an Advisory Committee as soon as possible after being admitted to the program. The Advisory Committee is to be composed of:
    a. five members with at least three from the SCMSS faculty.
    b. at least one external member holding appropriate credentials and experience to help advise on doctoral level research.

    The Advisory Committee must be approved by the Doctoral Program Committee and Director of the School by the end of the first term in residence.
2. The completion of 60 credit hours of instruction beyond the bachelor's degree to include:
    a. 21 hours of the doctoral program core curriculum
    b. 18 hours of specialized graduate courses specified by the student's Advisory Committee
    c. 21 hours of Dissertation Research and Directed Study with a maximum of up to 6 hours of directed study.
3. The completion of the school Comprehensive Examination normally at the completion of the doctoral program core curriculum coursework.
    a. The Outcome of the Comprehensive Examination is Pass or Fail. Students receiving a failing score on the comprehensive exam may elect to retake the exam or a portion of the exam one time within a 6 month period.
    b. Failure to pass more than one section of the examination is considered a failure of the entire exam. Students not passing the comprehensive exam may apply to the Master's Degree program in Coastal Marine and Wetland Sciences.
4. The student advances to candidacy with the following requirements:

a. Completion of all program core curriculum courses and a minimum grade point average of 3.0 for all core and specialized graduate coursework at the time of application to candidacy.
b. Successful completion of the school Comprehensive Examination.
c. Successful passing of the school Qualifying Exam and approval of a dissertation proposal by the Advisory Committee
d. Recommendation for advancement to candidacy by the student's Advisory Committee, Doctoral Program Committee, Director of the School of Coastal and Marine System Science and Dean of the College of Science.

5. The student will present a seminar to the school on their dissertation work (defined in 3a c above) and defend the dissertation in examination by the student's major professor and Advisory Committee.
6. The student will submit documentation that all degree requirements (coursework, examinations and dissertation defense and dissertation/publications).

Projected student enrollment

Coastal Carolina University plans to admit up to four students each fall semester beginning in 2013. The set target retention rate is 75% for each entering class of full-time students. Table 2 presents data for projected total and estimated new headcount for the period 2013 – 2018.

Table 1 – Projected Total Enrollment

	Fall Semester		Spring Semester		Summer Semester	
Year	Total Headcount (1)	Credit Hours (2)	Total Headcount	Credit Hours (2)	Total Headcount	Credit Hours
2013-2014	4	36	4	36	4	36
2014-2015	7	54	7	54	7	54
2015-2016	9	68	9	68	9	68
2016-2017	9	66	9	66	9	66
2017-2018	9	64	9	64	9	64

<u>CURRICULUM</u>

A minimum of 60 credits is required to complete the doctorate degree. The courses are grouped into three categories ranging from graduate core courses to dissertation research. The core of the curriculum is intended to provide a comprehensive foundation across the sub-disciplinary areas of the marine sciences (Atmospheric, Physical, Chemical, Geological and Biological) to facilitate a systems approach to the coastal marine environment and preparation for comprehensive exams. Specialized coursework, directed study, and research courses identified by the Dissertation Committee are required to support student research and professional objectives. Students may receive credits for an earned master's degree in an area related to the doctoral program.

The curriculum for the Ph.D. in Marine Science: Coastal and Marine Systems Science (60 credit hours)

I.	Coastal and Marine Systems Science Core Courses	21*
	CMSS 605 Coastal and Marine Hydrodynamics (3) **	
	CMSS 606 Coastal and Marine Geological Processes (3)	
	CMSS 607 Coastal and Marine Bio-Geochemistry (3)	
	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)	
	CMWS 603 Coastal and Wetland Policy and Management (3)	
II.	Specialized Courses	18*
	Graduate coursework approved from an earned master's degree and/or required by a student's Coastal doctoral committee.	
III.	Dissertation Research and/or Directed Study	21
TOTAL CREDITS REQUIRED		60

* With the approval of the School's graduate director a student's Dissertation Committee may specify other coursework to satisfy the core or specialized course requirements to suit a student's particular needs and the objectives of the curriculum.
** All CMSS courses are new offerings.

Comprehensive and qualifying examinations

Comprehensive Exam: Students are required to pass the School Comprehensive Exam to be taken within a year of completion of the core curriculum courses. The exam will consist of written and oral components. In the written exam, students will respond to four questions established by the School Comprehensive Exam Committee to assess the broad range of sub-disciplinary knowledge required to address complex coastal systems and the ability to identify and explain the linkages between sub-disciplinary concepts and processes. The School Comprehensive Exam Committee will schedule a follow-up oral examination with each student based on the responses of the written exam and allow for further examination of sub-disciplinary knowledge not emphasized in the written exam. Following the oral examination, the Committee will identify one of the three following outcomes: pass, fail, or retake the exam within three months. Students must pass the comprehensive exam to continue in the doctoral program.

Qualifying Exam: Students are required to present and defend their dissertation research plan. This examination of the student's dissertation research plan and specific technical background required to complete the proposed research must be completed before the sixth full semester in residence to advance to candidacy in the doctoral program. The dissertation proposal will be constructed as a formal research proposal addressing the objective and need for the proposed research, command of the existing literature and foundation of the proposed research, specific testable hypotheses or research questions, an experimental design and work plan to address the questions, as well as description of proposed analyses and the broader implications of the research results. The proposal is reviewed by the Dissertation Committee, which will schedule a formal presentation and defense of the work by the student. The presentation will be open to all School faculty and students. Following the public presentation, the Committee will meet with the student for an oral examination of the proposal and presentation. The oral exam will assess the student's research plan and preparation for the proposed research. The Committee will also identify any deficiencies in the proposal and assign one of three outcomes: pass and approval of the final proposal/work plan; provisional pass and require a resubmission of an improved

proposal and work plan and re-exam within three months; or failure. Upon passing the qualifying exam, the student may proceed with the dissertation research.

Dissertation: Students will submit the results of his/her doctoral research as a formal dissertation and/or series of publications. The Dissertation Committee will schedule a formal public presentation of the work by the student to be followed by an oral examination (defense) of the work by the Dissertation Committee. Upon passing the defense, the student will submit the completed dissertation as specified by the School of Coastal and Marine Systems Science and University guidelines.

Technical requirements

Both Coastal Carolina University (Conway) and Clemson University (Clemson, Georgetown, Charleston) support distance-learning systems (Blackboard, Moodle) suitable for use as necessary for cooperatively offered specialized courses.

Assessment of student learning outcomes

The student learning outcomes presented on page 3 will be assessed at three different stages of the program.

1. The comprehensive exam will be used to assess SLOs 1, 4, 5 and 6. Since the student will have completed the core courses, this assessment together with the oral component will help gauge the proficiency of the student and ability to continue in the program.
2. The qualifying exam will be used to assess SLOs 2, 3, 7 and 8. An assessment instrument will be developed that includes the formal presentation in front of school faculty and students, informal feedback from the attending audience and evaluations from graduate committee members.
3. The formal dissertation and defense will be used to assess SLOs 7, 8 and 9. The Dissertation Committee will use a rubric to assess student learning based on the student presentation, the quality of the dissertation and student understanding of various key topics during the defense.

Metrics for the program evaluation plan

1. Based on recruitment projections (four per year) and subsequent retention, a projected target graduation rate of three to four students per year after the start-up period of five years is anticipated.
2. Expectations include diverse tracks for post-graduate employment with some taking traditional academic (post-doctoral) tracks and others working in industry, government agencies, and the private sector. Coupled with efforts to build and expand professional networks for students and potential for significant changes in the academic, public and private sectors in the near future, these patterns will take some time to be established. Regardless, post-graduation employment patterns will be tracked and measured against peer and aspirant institutions and available regional and national patterns. The target is to exceed the regional means in the first ten years (two full cohorts) and national means after twelve years.
3. The program will monitor collaborations/student engagement with external agencies, participation in professional conferences and workshops, and submissions of proposals/publications.

4. Tracking graduation success and initial post-graduation employment patterns of recent graduates will take place as is currently occurring in the Center for Marine and Wetland Studies. See Appendix 7.

COURSE DESCRIPTIONS

Coastal and Marine Systems Science Core Courses

CMWS 603 Coastal and Wetland Policy and Management. (3) An examination of the relationships between economics, environmental policy, environmental ethics, and environmental law. Environmental laws, federal, state and local permitting agencies and their regulations that apply to the coastal zone and wetlands will be examined using locally focused case studies. Consideration is given to gathering and presenting scientific information needed for policy decisions. The interactions and competing pressures between economic interests that impact wetlands will be contrasted with a commitment to ethical treatment and responsible management of wetlands and coastal ecological systems.
CMSS 605 Coastal and Marine Hydrodynamics. (3) Overview of the properties and dynamics of the coastal ocean/atmospheric coastal system. Emphasis is on the physical drivers of circulation and mixing within the ocean, atmosphere and coastal water bodies across a wide range of temporal and spatial scales. Includes introduction to solute and particulate transport and dispersal in coastal systems.
CMSS 606 Coastal and Marine Geological Processes. (3) Overview of the geological framework and processes shaping the world's ocean basins and coastal bodies of waters. Emphasis is on the characterization of sedimentary habitats, coastal morphology and drivers and records of change in coastal systems across a wide range of temporal and spatial scales.
CMSS 607 Coastal and Marine Bio-Geochemistry. (3) This course examines interactions of macro- and micro-nutrient cycling in the coastal environment. Chemical budgets considering sources (atmosphere, land, sediments) and sinks (ocean, biology, sediments, and atmosphere) are investigated and how those parameters are affected by natural and man-made processes.
CMSS 608 Coastal / Marine Systems Science, Issues and Applications. (2) (Coreq: CMSS 609). An integration of the sub-disciplinary contributions to understanding and predicting behavior of coastal marine systems. Theoretical and applied coastal marine systems science applications are illustrated through case studies and analyzing viable solutions to coastal environmental issues challenging society.
CMSS 609 Coastal/Marine Systems Science Seminar. (1) An application of the sub-disciplinary contributions to understanding and predicting behavior of coastal marine systems. Current literature, seminar speakers and organizing a public forum on a topical issue facing society illustrate theoretical, applied and practical coastal system issues.
CMSS 610 Spatial and Temporal Analysis. (3) This course covers theory and application of various analysis methods to coastal observational data. Practical implementation of the methods as applied to coastal processes occurring at different spatial and temporal scales is emphasized through use of advanced data analysis software.
CMSS 611 Modeling Coastal and Marine Systems. (3) Principles of mathematical modeling of coastal and marine systems. Emphasis is on numerical theories, setting boundary conditions and parameterizations, simulation, and analysis. The course involves the applications of commonly employed ocean, atmosphere, and marine model systems to the coastal regions.
CMSS 612 Coastal/Marine Management, Policy, and the Law. (3) Overview of coastal and marine management strategies, regulatory framework and jurisdictions, policies

and the law. Emphasis is on environmental issues of coastal states, communities, and economies.

Dissertation research and directed study courses

CMSS 787 Special Topics or Directed Study. (1-6) Topics designed in specialty areas of coastal marine systems science.
CMSS 799 Dissertation Research. (1-9) Research conducted leading toward the preparation, acceptance and defense of a thesis.

Coastal and Marine Systems Science Specialized courses

Examples of existing graduate courses acceptable for this concentration. See Appendix 5.

FACULTY

Rank and qualifications of each faculty member who will be involved in the program are presented in Table 2.

Table 2 – Faculty Qualifications for the Coastal and Marine Systems Science Program

School of Coastal and Marine Systems Science Faculty			
Staff by Rank	Highest Degree Earned	Field of Study	Teaching in Field
Professor	Ph.D.	Coastal Oceanography	Yes
Professor	Ph.D.	Oceanography	Yes
Post-Doctoral	Ph.D.	Geophysical Fluid Dynamics	Yes
Assistant Professor	Ph.D.	Oceanography	Yes
Assistant Professor	Ph.D.	Oceanography	Yes
New Hire Fall 2013 Associate Professor	Ph.D.	Coastal and Marine Systems Science	Yes
New Hire Fall 2014 Assistant Professor	Ph.D.	Coastal and Marine Systems Science	Yes
New Hire Fall 2014 Assistant Professor	Ph.D.	Coastal and Marine Systems Science	Yes

Affiliated Faculty (serving on graduate committees as needed)			
Staff by Rank	Highest Degree Earned	Field of Study	Teaching in Field
Lecturer	Ph.D.	Mechanical Engineering	Yes
Lecturer	Ph.D.	Marine and Atmospheric Chemistry	Yes
Lecturer	Ph.D.	Coastal Oceanography	Yes
Professor	Ph.D.	Atmospheric Sciences	Yes
Assistant Professor	Ph.D.	Geosciences	Yes
Assistant Professor	Ph.D.	Physical Oceanography	Yes
Lecturer	Ph.D.	Coastal and Marine Systems Science	Yes
Research Scientist	Ph.D.	Earth and Atmospheric Sciences	Yes

Coastal has recently established the School of Coastal and Marine Systems Science (SCMSS), which is comprised of an existing research center, the Center for Marine and Wetland Studies, and the developing doctoral program in Marine Science: Coastal and Marine Systems Science. Housed within the College of Science, the school engages both formal joint appointments and more informal affiliations with faculty expertise in several existing departments.

Coastal has committed three new faculty positions to the SCMSS and developing doctoral program. The first position will be filled for Fall 2013 and the other two new faculty members are scheduled to start Fall 2014. The school is also presently searching to fill a vacant 3-year term Research Scientist position to support key research areas and working groups and help transition to the doctoral program framework.

The three new faculty positions, as well as other existing positions within the school, are structured as research-oriented positions with commensurate graduate-focused teaching, and mentoring obligations. Individuals are being sought who are well aligned with the core focus areas of the program, who can augment or enhance existing strengths in the School and broader College of Science and collaborating programs, and who can work across disciplines and will develop a sustainable research program. The University has committed to provide for at least one of the new positions to be brought in at the Associate Professor level in order to expedite the initial startup period of the doctoral program. School of Coastal and Marine Systems Science faculty provide a range of support to existing master's and undergraduate programs in terms of cross-listed and direct course instruction leveraging specialized resources and expertise of the School/Center, as well as informal support such as supervision of undergraduate and graduate research assistants. In FY 2011-12, center faculty provided direct grant-generated support to 35 undergraduate students in three different undergraduate departments. School and affiliated faculty participate in the Coastal Marine and Wetland Studies graduate program and, collectively, have supervised 20 postdocs, 35 doctoral students and have served on 14 doctoral committees at other universities.

Institutional plan for faculty development as it relates specifically to the proposed program

Coastal Carolina University promotes professional development and growth through an ongoing process involving all faculty. The Office of the Provost and Senior Vice-President for Academic Affairs oversees travel, reassigned time, small grants, and community service opportunities. Grants made available through the Office of the Provost include the following: Professional Activities Travel Mini-Grants, Academic Enhancement Grants, Assessment Mini-Grants, and Proposal-Writing Grants. Support for faculty travel for presentation at professional conferences is available from the College of Science. Scholarly activities are also supported through the Office of the Vice-President for Research, providing pre-award and post-award support services for faculty seeking external funding.

The Center for Marine and Wetland Studies and new School of Coastal and Marine Systems Science maintain operational, technical and grant management staff to help support faculty and student research. In addition, the Center has historically contributed to faculty development through support of instrumentation acquisition, undergraduate and graduate student support, and conference travel.

Institution's definition of full-time equivalents

A full-time equivalent (1 FTE) at Coastal Carolina University for undergraduate faculty is defined as seven courses during the academic year. Within the doctoral program housed in the School of Coastal and Marine Systems Science, faculty teaching loads are four courses during the academic year and higher scholarly expectations relative to the undergraduate faculty.

Table 3 presents data for the first five years of the program, the number (headcount) and full-time equivalent (FTE) of faculty, staff, and administrators to be employed for the program. The institutional definition of FTE for this program is 12 credit hours.

Table 3 – Faculty, Staff, and Administrators Employed for the Ph.D. in Marine Science: Coastal and Marine Systems Science Program

	New		Existing		Total	
Year	Headcount	FTE	Headcount	FTE	Headcount	FTE
Administration						
2013-2014	0	0	2	1	2	1
2014-2015	0	0	2	1	2	1
2015-2016	0	0	2	1	2	1
2016-2017	0	0	2	1	2	1
2017-2018	0	0	2	1	2	1
Faculty						
2013-2014	1	1	5	2.5	6	3.5
2014-2015	2	2	6	3.5	8	5.5
2015-2016	0	0	8	5	8	5
2016-2017	0	0	8	5	8	5
2017-2018	0	0	8	5	8	5
Staff						
2013-2014	0	0	1	0.5	1	0.5
2014-2015	0	0	1	0.5	1	0.5
2015-2016	0	0	1	0.5	1	0.5
2016-2017	0	0	1	0.5	1	0.5
2017-2018	0	0	1	0.5	1	0.5

PHYSICAL PLANT

The Burroughs and Chapin Center for Marine and Wetland Studies (BCCMWS) building will be the main facility supporting the new School of Coastal and Marine Systems Science and the doctoral program in Coastal and Marine Systems Science. The BCCMWS contains 25,000 square feet of office, classroom and research labs. The Center's 1,400 square-foot Environmental Quality Laboratory, containing 100 linear feet of lab bench, is located in the Coastal Science Center directly across the street from the BCCMWS.

In addition, the BCCMWS building has an associated warehouse space that supports large instrumentation storage, small boats, machine shop (fabrication/repair), core repository, and approximately 10,000 square feet of warehouse space.

Affiliated faculty housed within a number of other College of Science undergraduate departments (e.g. Marine Science, Physics, and Mathematics) maintain office, teaching and some limited research space in the Coastal Science Center and Smith Science Center. Coastal is presently completing a 40,000 square-foot expansion of the Smith Science Center and has plans for renovation of the original Science Center and an additional 65,000 square-foot expansion in 2014 that will support the Marine Science and other undergraduate programs. Three academic departments will be transitioning to new buildings on campus starting in January 2013. This will provide for additional office and existing research lab space in the Coastal Science Center/BCCMWS complex in the future.

Additional facilities of note

Coastal Carolina University maintains an 1,100-acre parcel of undeveloped land including barrier island, marsh, tidal creek and inlet, upland, lake and wetland sub environments at Waties Island (30 minutes from campus). This is used to support undergraduate and graduate courses and research. A 1,200 square-foot cottage provides Coastal faculty and students a base of operations for activities at Waties Island including overnight capacity for up to ten people.

In addition, Coastal maintains a cooperative agreement with Clemson University (Appendix 4a) that provides access to Clemson facilities at Hobcaw Barony in Georgetown as well as the Clemson University Restoration Institute in Charleston. Many Coastal faculty and staff are active at the Georgetown facilities operated by the University of South Carolina and Clemson University, working independently or in concert with Clemson University or University of South Carolina staff.

Equipment

The Center for Marine and Wetland Studies faculty have acquired research instrumentation, software and computation hardware over the last few years through grants and contracts with a cumulative value of $3.5 million (listed in Appendix 6.) In addition, the University is acquiring a new $1M research vessel to fully support all the existing instrumentation, academic research, and education programs. The research vessel purchase was awarded to the vendor on February 12, 2013. Funding was provided by the state through the capital reserve fund. The award of funding was to purchase the much needed vessel in order to replace an aging vessel and provide a better solution for the instrumentation. While the vessel will be used by the Ph.D. program, its purchase was to support the existing research needs of the current Marine Science programs.

No new state resources are required for establishing or supporting this program. As has been true to date, the program will continue to develop new capacities as needed through grant and generated support.

Library resources

The Kimbel Library at Coastal Carolina University is an academic library with holdings of over 250,000 items in all formats. The library currently subscribes to over 23,000 periodicals: magazines, newspapers, scholarly journals, and proceedings in print and online formats. The library provides access to its holdings and approximately 140 online citation, abstracting, full-text and reference resources via the World Wide Web at (http://www.coastal.edu/library). Library instruction sessions are available to all academic departments covering general library usage as well as project or course-specific sessions for upper-level research oriented courses. Coastal Carolina University fully supports and participates in PASCAL (Partnership Among South Carolina Academic Libraries). This consortium is particularly valuable to the Ph.D. program as students will have access to relatively expensive and specialized monographs in the area of marine science. Further, the consortium also currently offers access to Springer e-books as well as to *Scienc*e and *Nature*.

Institutional comparison

A quantitative comparison of Kimbel Library's holdings in four salient subject areas relevant to marine science was conducted using the current edition of the Association of College and Research Libraries *Standards for College Libraries*. Three institutions offering a doctoral program in marine sciences were identified using National Center of Education Statistics, limited by FTE and programs offered. Three schools with an FTE comparable to that of Coastal Carolina University and that offer both an M.S and Ph.D. in the marine sciences are shown in Table 4. Headcounts (vs. FTE) for combined enrollment of master's and Ph.D. programs were used as these figures were available for all institutions. The Coastal Marine and Wetland Sciences program had 36 degree-seeking students enrolled in Spring 2012 and anticipate four students for the first year of the doctoral program.

Table 4 - Institutions

Institution	Program	Period Covered	Headcount - M.S. & Ph.D.
University of North Carolina-Wilmington	Marine Biology, Ph.D.	Spring 2012	48
College of William & Mary	Marine Science, Ph.D.	Fall 2011	96
University of Maine	Oceanography, Ph.D.	Fall 2011	71

The library catalogs of these schools were examined to determine the number of cataloged titles (library holdings) in four subject areas of marine science. Examination of holdings is not meant to be comprehensive, but the subjects examined are common to all four programs and are sufficiently focused to indicate support of this specific area of the physical sciences.

Table 5 – Institutional Holdings

Call Number Range	Subject	Coastal Carolina University	College of William & Mary	University of North Carolina -	University of Maine - Orono
GB 450 - 460	Coasts	63	368	170	199
GC	Oceanography	476	5,964	2,079	2,020
QC 851 - 999	Meteorology	461	854	423	1494
QH 541.5.C65	Coastal Ecology	22	87	34	54
Total Holdings		1,022	7,273	2,706	3,767
Students		40	96	48	71
Holdings/Student		26	76	56	53

Kimbel Library has supported the existing graduate program since its inception; however, the number of Kimbel Library's monographic holdings is substantially smaller in comparison to the other institutions with established doctoral programs. The average number of titles per student in these subject areas is 62 titles/student. Kimbel Library will need to add 1,475 titles during the initial years of the new program to approximate the current holdings of the comparison universities in these subject areas alone.

When limited to four common subject areas, Kimbel Library owns an average of 26% of the core titles in the common subject areas.

Table 6 - Coastal Core Titles, Common Subject Areas

Call Number Range	Subject Heading	Owned	Not Owned	% Core Owned
GB 450 - 460	Coasts	3	4	42.9%
GC	Oceanography/ Marine Sciences	23	35	39.7%
QC 851 - 999	Atmosphere/Meteorology/ Climatology	33	126	20.8%
QH 541.5.C65	Coastal Ecology	0	2	0.0%
Total		**59**	**167**	**26.1%**

While percentage of core holdings in the four common subjects are fairly high, core title holdings are lacking in the subject areas of Temporal and Spatial Analysis (QA, Mathematics), Regional Economics and Coastal Zone Management (HT, Communities), Maritime Law and Environmental Law (K, Law), Engineering (TA, TC), and Environmental Technology (TD).

Periodicals

Online access to periodicals is provided via aggregator databases, publisher packages, open access titles, and direct online subscriptions. Kimbel Library's journal subscriptions were examined in *Ulrich's Serials Analysis System*, which compares total periodical holdings with a recommended core list of periodicals for libraries using general subject headings. Kimbel Library provides access to at least 700 journal subscriptions relevant to marine science, most (96%) of which are considered "core" titles in the discipline and over half (61%) of which have an ISI impact factor, a measure of citation frequency. Overall, Kimbel Library subscribes to one-third of all "core" titles in these subject areas.

Table 7 - Serials Subscriptions and Core Serials Holdings

Ulrich's Subject	Kimbel Library Subscribed	ISI Impact Factor	% Impact Factor	Kimbel Library Core Subscribed	% Core Subscribed	Core Titles, Not Subscribed	Kimbel Library Subscribed as % of Core
Earth Sciences	126	66	52%	119	94%	239	35.20%
Geology	220	130	59%	216	98%	657	25.20%
Geophysics	94	73	78%	90	96%	175	35.47%
Hydrology	40	26	65%	39	98%	68	37.38%
Oceanography	127	70	55%	123	97%	209	38.25%
Meteorology	95	62	65%	88	93%	162	38.00%
Total	**702**	**427**	**61%**	**675**	**96%**	**1,510**	**32.13%**

Quantitative estimate of acquisitions needed

Kimbel Library owns over 3,000 titles to support marine science studies; of these, 17.2% overall are considered "core" titles for an academic collection; 77% of these are considered to be for a faculty audience and more appropriate for a doctoral program than for undergraduates. Core titles not owned in all subject areas total 648. Actual cost of these core titles is $60,500; addition of 77% of these titles to the collection is $46,500 or $9,300 in the first five years of the program.

The library would need to more than double its monographic holdings in the four primary subject areas to have a collection quantitatively comparable to those of three institutions that offer doctoral programs in marine sciences. Kimbel Library's major book vendor reports that the 2012 average cost of a book in the four common subject areas is $117. The addition of 1,475 titles to the collection would require $171,000 at 2012 prices, or $34,200 over the first five years of the program. As the library cannot and should not attempt to acquire a retrospective collection on par with the comparison universities, these figures are provided for information only. However, we plan to realize cost savings on monographs through use of PASCAL.

Journal subscriptions are an ongoing cost. The average cost of general science journals in 2012 is $1,449, with an average annual increase of 7%. The Library's budget would need to be increased to cover long-term subscriptions of any new journal titles added. Selection of journal titles should closely conform to titles indexed in sources available to Coastal students.

ACCREDITATION

Coastal Carolina University is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) to award baccalaureate and master's degrees. Approval for awarding a doctoral degree is pending. Funds have been allocated for the SACS substantive change visit as indicated in Table 8 - Estimated New Costs and Funding Sources.

ESTIMATED COST

Table 8 presents the associated staffing and operations costs and new funding sources required for the program. No "unique cost" or other special state appropriations will be required or requested.

Table 8 – Estimated New Costs and Funding Sources

Estimated New Costs by Year						
Category	2013	2014	2015	2016	2017	Totals
Staffing						
Faculty Salaries	$ -	$ 76,800	$ 234,400	$ 235,000	$ 239,700	$ 785,900
Student Research Assistantships	$ -	$ 80,000	$ 140,000	$ 200,000	$ 240,000	$ 660,000
Student Travel (conferences)	$ -	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 40,000
Professional Travel (CCU)	$ -	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 40,000
Seminar/Visiting Scientists	$ -	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 80,000
SACS Accreditation Visit		$ -	$ 7,500			
Operations						
Supplies admin/classes	$ 15,000	$ 15,000	$ 20,000	$ 20,000	$ 20,000	$ 90,000
Library Acquisitions	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 75,000
Totals	$ 30,000	$ 226,800	$ 456,900	$ 510,000	$ 554,700	$ 1,770,900
Sources of New Financing by Year						
Category	2013	2014	2015	2016	2017	Totals
Tuition Funding	$ 56,534	$ 86,849	$ 112,021	$ 111,382	$ 110,659	$ 477,445
Other Funding (Specify) *		$ 139,951	$ 344,879	$ 398,618	$ 444,041	$ 1,327,489
Totals	$ 56,534	$ 226,800	$ 456,900	$ 510,000	$ 554,700	$ 1,804,934

* The Other Funding for the program is made up through existing expenses already incurred by the University and through the growth in enrollment. Coastal Carolina University has experienced 83% growth over the past ten years and expects to continue growing at a rate of 2-3% per year going forward. The funds necessary for the doctoral program will become part of the regular budget. The funds required for FY2014 have already been included in the planning process for the upcoming budget.

It is appropriate to note that several key resources such as vessel operations, software/instrument repair, visiting professional travel and library acquisitions will also substantially benefit and enhance the existing master's degree and several undergraduate degree programs that otherwise would not have access to many specialized capacities and instrumentation generated and operated by the Center, School and new program.

Appendix 1

Needs Assessment Survey
Ph.D. Program in Marine Science

N=21 (1 respondent gave no rankings, only comments)
Survey sent to 74 potential respondents
Updated 2/11/2013

Average Ranking for:			
All Questions	"Action" Questions	"Training" Questions	"Characterizing" Questions
4.7	5.3	4.9	4.2

On a scale from Low (1) to High (6), please rate the need for each action below:	Ave. Rank	6		5		4		3		2		1		nr
		#	%	#	%	#	%	#	%	#	%	#	%	#
Improving scientific understanding of our coastal resources and systems to achieve better management.	5.7	15	75.0%	4	20.0%	1	5.0%	0	0.0%	0	0.0%	0	0.0%	1
Improving communication and confidence of the public in scientific results related to coastal resources.	5.2	10	50.0%	4	20.0%	5	25.0%	1	5.0%	0	0.0%	0	0.0%	1
Increasing existing levels of human expertise and knowledge related to coastal resources.	5.5	12	60.0%	6	30.0%	1	5.0%	1	5.0%	0	0.0%	0	0.0%	1
Expanding graduate education related to coastal systems.	4.9	6	30.0%	7	35.0%	5	25.0%	2	10.0%	0	0.0%	0	0.0%	1

On a scale from Low (1) to High (6), please rate the importance of training future scientists in the areas below:	Ave. Rank	6		5		4		3		2		1		nr
		#	%	#	%	#	%	#	%	#	%	#	%	#
Systems-level, interdisciplinary approaches to coastal marine science.	5.5	11	55.0%	7	35.0%	2	10.0%	0	0.0%	0	0.0%	0	0.0%	1
Predicting trends of coastal marine environments.	5.1	8	40.0%	6	30.0%	5	25.0%	1	5.0%	0	0.0%	0	0.0%	1
Spatial and temporal analysis of environmental data.	4.9	5	25.0%	10	50.0%	3	15.0%	1	5.0%	1	5.0%	0	0.0%	1
Atmospheric drivers of coastal systems.	4.3	2	10.0%	9	45.0%	4	20.0%	4	20.0%	0	0.0%	1	5.0%	1
Groundwater influences in coastal systems.	4.6	2	10.0%	11	55.0%	4	20.0%	3	15.0%	0	0.0%	0	0.0%	1
Coupling physical, chemical and biological models.	5.0	4	20.0%	12	60.0%	4	20.0%	0	0.0%	0	0.0%	0	0.0%	1
Communicating science to natural resource, environmental and economic managers.	4.8	7	35.0%	5	25.0%	6	30.0%	1	5.0%	1	5.0%	0	0.0%	1
Identifying natural, social and cultural drivers of coastal environmental change.	4.8	6	30.0%	7	35.0%	5	25.0%	1	5.0%	1	5.0%	0	0.0%	1
Ocean instrumentation and observation.	4.9	6	30.0%	7	35.0%	6	30.0%	1	5.0%	0	0.0%	0	0.0%	1

On a scale from Low (1) to High (6), please rate the relative need for characterizing the following coastal resources:	Ave. Rank	6		5		4		3		2		1		nr
		#	%	#	%	#	%	#	%	#	%	#	%	#
Fishery habitat and fisheries	5.1	8	40.0%	6	30.0%	5	25.0%	1	5.0%	0	0.0%	0	0.0%	1
Recreational beaches	3.7	2	10.0%	6	30.0%	2	10.0%	4	20.0%	6	30.0%	0	0.0%	1
Wind and hydrokinetic renewable energy	4.7	6	30.0%	5	25.0%	6	30.0%	2	10.0%	1	5.0%	0	0.0%	1
Continental shelf oil and gas	3.8	2	10.0%	2	10.0%	8	40.0%	6	30.0%	2	10.0%	0	0.0%	1
Scenic vistas	3.3	1	5.0%	6	30.0%	1	5.0%	5	25.0%	3	15.0%	4	20.0%	1
Biodiversity	4.7	4	20.0%	8	40.0%	6	30.0%	1	5.0%	1	5.0%	0	0.0%	1

Appendix 2

External Reviewer Report

North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina

Department of Agricultural and Resource Economics
Campus Box 8109
Raleigh, North Carolina 27695-8109

NC STATE UNIVERSITY

Dr. Edmund A. Estes,
919.515.2607
919.515.6268 (fax)

November 12, 2012

Dr. Robert Sheehan, Senior Vice President and Provost
Coastal Carolina University
P.O. Box 261954
Conway, SC 29528-6054

Dear Dr. Sheehan:

At the request of Dr. Paul Gayes, Director of the Center for Marine and Wetland Studies, I am writing to share with you my professional assessment and serve as an external consultant concerning Coastal Carolina University's intent to establish a Ph.D. program in Marine Science. I am an enthusiastic supporter of the decision to establish a Ph.D. program in Marine Science and this letter details specific reasons why I support this action. Initially, however, I wanted to provide you with some background information about my training, experience, and employment so that you will have some perspective about how I formed my views.

For 32 years I was employed by North Carolina State University in Raleigh as a tenure-track faculty member, coming through the academic ranks after an initial appointment as an untenured Assistant Professor in 1979 to a tenured Full Professor by 1990 in the Department of Agricultural and Resource Economics (ARE) within the College of Agricultural and Life Sciences (CALS). In 2004, administrative duties were added to my job when I was asked to serve as Associate Department Head and Departmental Extension Leader. As Associate Department Head, my responsibilities included oversight of activities performed by the ARE's Undergraduate Teaching Coordinator, management of activities conducted by the Director of the Economics Graduate Program (ARE and the Department of Economics at NCSU jointly administer the graduate economics Master's and Ph.D. degree programs), and had budget authority for activities conducted by the Director of the Center for Resource and Environmental Policy (CEnREP). While the undergraduate teaching coordinator, graduate program Director, and CEnREP Director managed day-to-day activities for their respective groups, I provided overall leadership and policy advice as Associate Head. In addition, administrative responsibilities included mentoring junior faculty as well as providing overall policy guidance for all research and extension faculty. It should be noted, of course, that overall responsibility for all faculty resided ultimately with the ARE Department Head and CALS Deans but routine administrative decisions were made by me as Associate Head. Finally, I conducted a horticultural research and extension program throughout the state of North Carolina, published peer-reviewed articles, and received approximately $1,500,000 in grant funds, including approximately $500,000 in research funds received as part of the Tristate Research Project involving investigators from North Carolina State University, Clemson University, and the University of Georgia.

As a tenured Full Professor in the ARE department, I was asked to serve on numerous graduate student committees both as a committee member and as a graduate student's dissertation advisor. In 1979 I was appointed to serve as an associate graduate faculty member and in 1985 I was granted full-membership status in the NCSU graduate faculty. As a graduate school faculty member I served as Graduate School representative on numerous qualifying and final Ph.D. exams across a variety of disciplines at NCSU (when asked by the NCSU Graduate School). Somewhat uniquely, the graduate program within my department (ARE) was jointly operated by ARE and the Department of Economics (in the College of Management). Master's and Ph.D. degrees in economics were awarded to graduate students in the program that allowed a wide variety of specialty concentration areas ranging from production economics, international trade, and agricultural marketing to a mix of environmental topics such as property rights issues, natural resource policy, statistics, and econometrics. In recent years, the joint program typically had an enrollment of approximately 110 degree-seeking graduate students, with degree intentions split about equally between Master's and Ph.D. students. Usually graduate students are admitted to the Master's degree program initially but then advance to the Ph.D. degree track after successful completion of written and oral comprehensive exams. On average about 6 to 8 Ph.D. students receive degrees annually, with a majority of dissertations focused on environmental economic issues.

It is my strong belief that CCU and the Center are forward-thinking in their effort to initiate a Ph.D. degree program in order to extend their research depth in marine science. In my mind marine science is an interdisciplinary, composite physical science that allows for a spectrum of student interests and concentrations. This scientific flexibility is attractive to superior quality graduate students while also allowing maintenance of scientific rigor at its highest level. I realize that science-based Ph.D. programs such as in marine science are expensive to operate because of the breadth of topics investigated and the expensive research labs and equipment needed for both students and faculty. A Ph.D. program will require additional grantsmanship efforts by Marine Science faculty so it is important that faculty intensify outside fund and grant applications if the Ph.D. degree program is to expand. In addition, the new Ph.D. program likely will slow down efforts to move students quickly through the system in a timely manner. It is incumbent on faculty, especially major professors to monitor graduate student progress toward degree completion. Finally, added Ph.D. program costs are subject to second-guessing by undergraduate students (and their parents) who want state funded universities to reduce undergraduate tuition and fees instead of subsidizing graduate study in selected science areas. However, the need for high-level research in environmental and marine sciences remains strong while the demand for marine scientists is expected to expand in the short and long term as socially conscious individuals express greater interest in combining technical science skills with environmental awareness. At NCSU, a majority of our departmental graduate students are interested in either biological or environmental science as their field of interest for advanced research. Recent press attention to topics such as off-shore drilling, fracking, wetland destruction, environmental devastation, and storm surge topics (along the east coast associated with Hurricane Sandy) will reinvigorate student interest in graduate science study, especially in fields related to environmental topics such as coastal erosion. Multidisciplinary research approaches utilized by marine scientists seem attractive to students because they combine technical science skills with prescriptive policy implications. As coastal issues and topics continue to attract coastal resident interest in the future, then community leaders, coastal residents, and taxpayers will demand

additional science-based information to implement policy. Local institutions such as Coastal Carolina University can offer policy recommendations based on Ph.D. level research conducted by local faculty and students. Useful results will strengthen existing linkages among CCU faculty, local community leaders, and South Carolina policy makers while also instilling pride in undergraduate students as they discover that people find CCU research both meaningful and useful.

As the Marine Science Ph.D. program evolves after its establishment, the number of topics and issues investigated will expand and diversify. Expansion offers a number of advantages to other distinct but related science disciplines such as coastal life research, coastal geology investigations, marine chemistry, and environmental economic studies. Of course, coastal and/or marine sciences are related to their ancestral scientific home, that is, biology, geology, chemistry, or economic behavioral sciences. Interrelationship among Ph.D. students in related sciences would be strengthened in all science fields as faculty at CCU gain from mutual interest research at the highest academic level. Funding competition between departmental faculty at CCU as well as competitive concerns with other institutions (Clemson, USC) could drive budget resentment over the initiation of a Ph.D. program by CCU but over time mutual commonalties and cooperation will dominate competitive funding rivalries such that the scientific community, students, the local coastal community, and other South Carolina universities will gain and recognize the marine science Ph.D. program as complementing rather than duplicating an existing Ph.D. research program.

Over time, I believe firmly that the impact of the establishment of a Ph.D. program in Marine Science at CCU will have a very positive impact for all citizens of South Carolina, for many coastal communities located from the Outer Banks of North Carolina coast to the lower Georgia coast, and for CCU students and other South Carolina university undergraduates. From the mid-1980s through the mid-1990s I was a co-principal investigator of a research project funded by a special bill that provided federal funds to the Strom Thurmond Institute (South Carolina) to examine vegetable production in the Carolina's and Georgia. The Tristate Research Project united horticultural science investigators and economists from Clemson University, the University of Georgia, and North Carolina State University to examine the feasibility of coordinating and planting in a specific sequence a variety of small fruits and vegetables. Through coordinated tristate researchers it was demonstrated that sequential crop planting and harvesting would benefit tristate producers since commercial buyers would view the region as a single supply source. This multidisciplinary and multistate approach resulted in economic gain for a set of producers by expanding the mix and timing of crops grown the region. I have extensive experience cooperating with Clemson University faculty and Clemson researchers have a long and distinguished tradition of examining an array of land grant topics. However, Clemson University has experienced serious cuts in federal and state funding and reorganized many of its colleges, schools and departments in recent years. Budget reductions have required all state-supported South Carolina universities to do more with fewer resources and budget constraints have limited student and faculty research funding opportunities. Clemson University investigators have tended to focus on broad environmental and resource research topics rather than examine more narrowly focused science topics such as biological and marine science. Alternatively, CCU faculty have examined marine and wetland topics in greater depth by focusing on coastal issues and establishment of the Center for Marine and Wetland Studies. This

specialization would continue with the establishment of a Ph.D. program in marine science. It is my observation that there is little research overlap between the offering of a Ph.D. program in marine science and the physical science research conducted by other South Carolina universities such as Clemson University. As the Ph.D. research topics in marine science evolve over time I expect to see distinct, timelier, and regionally more important conducted by CCU faculty compared with the broader service, environmentally sensitive science examined by Clemson or USC faculty. Graduate students will then choose CCU or other South Carolina universities offering a Ph.D. degree based on topic preference and funding opportunities rather than other reasons. It is my view that other South Carolina universities will have a comparative advantage in examination of general land and water use policy issues, conducting broad analysis of controversial environmental topics, investigation of resource conservation topics, and offer a scientific assessment of wildlife management issues while CCU will have a comparative advantage in marine science and coastal management topics. Thus, establishment of a Ph.D. program in marine science at CCU complements rather than competes with existing state-sponsored Ph.D. programs on-going in South Carolina, particularly within the cross-disciplinary research area of marine science.

Finally, personal conversations with Dr. Paul Gayes, Director of the Center for Marine and Wetland Studies and with Dr. Leonard Pietrafesa, CMWS Research Scholar, indicate enthusiastic support for establishment of a Ph.D. program in Marine Science at CCU. My review of the course offerings and faculty credentials suggest that highly qualified Center faculty work at CCU and they have the capacity to require that students complete rigorous research requirements in order to receive their Ph.D. degree from CCU. Over time, I expect that Ph.D. degrees awarded by CCU will grow in prestige and stature as graduates become better known in the marine science field.

In conclusion, I endorse strongly and enthusiastically the establishment of a Ph.D. degree offering in marine science at Coastal Carolina University. This program will benefit a number of groups including coastal community citizens, current and future students, faculty, and CCU alumni as graduates make people aware of the usefulness of science-based research findings. If you have questions about my comments, or need clarification about statements made in this letter, feel free to contact me via email, snail mail, or phone (919-815-3704 personal cell).

Best regards,

Edmund A Estes

Edmund A. Estes
Associate Head and Professor Emeritus
College of Agricultural and Life Sciences
North Carolina State University
Campus Box 8109
Raleigh, NC 27695-8109

CC: Dr. Paul Gayes (ptgayes@coastal.edu)

Appendix 3

Letter of Need from Director of SC Sea Grant Consortium

Coastal Science Serving South Carolina

Sea Grant
S.C. Sea Grant Consortium

287 meeting street
charleston, sc 29401

p. 843.953.2078
f. 843.953.2080
www.scseagrant.org

Member Institutions

The Citadel

Clemson University

Coastal Carolina University

College of Charleston

Medical University of South Carolina

S.C. Department of Natural Resources

S.C. State University

University of South Carolina

Chairman
Dr. David A. DeCenzo
President,
Coastal Carolina University

Executive Director
M. Richard DeVoe

Enhancing practical use and conservation of South Carolina's coastal and marine resources that foster a sustainable economy and environment.

October 31, 2012

Dr. David A. DeCenzo
President
Coastal Carolina University
P.O. Box 261954
Conway, SC 29528

Dear Dr. DeCenzo:

I am writing to express my solid support for the establishment of a Ph.D. in Marine Science program at Coastal Carolina University (CCU), to be developed in cooperation with and in strong alignment with the well-established capabilities at Clemson University, the Savannah River National Laboratory, and others.

We at the Consortium are excited about the possible opportunities for graduate student learning and training that such an integrated program of study will afford. With a focus on the interdisciplinary training of Ph.D. students in the biological, geological, oceanographic, and environmental sciences, and a goal of producing graduates that can be readily infused into ocean-related positions with government, industry, and academia, CCU will be able to begin to fill a void that has existed in South Carolina and the Southeast region for many years.

I am particularly pleased with the approach CCU has taken in that it intends to accept only a handful of students each year into the program. This modest approach will ensure that the students receive the attention and directed training they will need to be successful, while not placing too much pressure on CCU and its partners to create, develop, and support a large graduate infrastructure that may not now be feasible.

It is necessary to point out that the proposed Ph.D. program will be focused on connections among the oceanic, atmospheric, and terrestrial features of our coastal environment. These features must be studied in tandem in order to gain the knowledge that will be necessary to support business and industry growth in traditional and alternative offshore energy development, commercial and recreational fisheries production, and the recreation and tourism sectors.

Coastal Carolina University, through the Center for Marine and Wetland Studies, continues to be a leader in South Carolina in conducting geophysical and seafloor mapping studies that are critically important for identifying sand resources for nourishment projects, assisting with management of the state's offshore ocean disposal sites, mapping critically important fisheries habitat areas, monitoring shoreline migration patterns and identifying erosional hot-spots, and supporting research and monitoring efforts to examine the potential for offshore wind energy development, among other efforts. These real-world activities will provide the foundation for a Ph.D. program that is not just academically robust, but also will produce students who will be extremely well-suited to immediately secure employment. This is truly "jobs creation."

In addition, the potential for developing partnerships with state and federal agencies and business and industry through fellowships and traineeships will be greatly enhanced through the Ph.D. program.

In summary, the establishment of a Ph.D. program to complement and enhance CCU's marine sciences capabilities through training and workforce development will be a significant addition to the state's growing arsenal of graduate programs in the coastal and ocean arena, will complement the capacities found in other institutions throughout the state and region, and will enhance our abilities to leverage and compete for research and monitoring funds in support of coastal and ocean resource management in the future.

I am in full support of this exciting program. Please let me know what the Consortium can do to bring this opportunity to fruition, and to contribute to its success once it is in place.

Sincerely,

M. Richard DeVoe
Executive Director

Appendix 4a

Memorandum of Understanding Between
Coastal Carolina University and Clemson University

CLEMSON
UNIVERSITY

Office of the Vice President
Economic Development
John W. Kelly, Ph.D.

Clemson University
130 Lehotsky Hall
Clemson, SC
29634-0101

P 864-656-3642
F 864-656-3608
jkelly@clemson.edu

August 6, 2012

Dr. Paul Gayes, Director
Burroughs & Chapin Center for Marine and Wetland Studies
Coastal Carolina University
P.O. Box 261954
Conway, SC 29528-6054

Dear Paul,

I'm enclosing the ORIGINAL Clemson University-Coastal Carolina University Memorandum of Understanding for signature by Coastal Carolina administrators. We apologize for the delay in getting a signed version of this to you. Please review and if you have no concerns, have the appropriate persons at CCU sign and let's finalize so we can move on to coursework!

Once CCU signatures are attached, make a copy of the MOU for your files, and *return the original to me at my Clemson Office.*

Thanks so much, and we look forward to taking our collaboration to the next level!

Sincerely,

John W. Kelly

John Kelly /sme

CLEMSON UNIVERSITY

COASTAL CAROLINA UNIVERSITY

Memorandum of Understanding

Between

CLEMSON UNIVERSITY
Clemson, South Carolina
United States of America

And

COASTAL CAROLINA UNIVERSITY
Conway, South Carolina
United States of America

Clemson University in Clemson, South Carolina and Coastal Carolina University, Conway, South Carolina wishing to further relations between our two institutions in education, research, economic development, service, and other related activities, do hereby commit to mutual and reciprocal cooperation to achieve our shared goals.

Areas of cooperation may include any program of study, research, workforce development and service offered by either institution which is felt to be desirable and feasible for the development and strengthening of our cooperative relations. Development of an agreement concerning any specific program will be contingent on mutual consent, availability of funds, and approval of each institution. Such programs may include:

1. Academic programming such as student exchange, research, internships, practical training, distance learning, continuing education, cooperative education and service learning.
2. Exchanges for research, training or teaching.
3. Collaborative research projects, workshops or conferences.
4. Exchanges of other institutional professional's or information.
5. Collaboration on economic development that benefits our institutions and the state of South Carolina.

Supplemental agreements governing all areas of cooperation under this Memorandum of Understanding shall be negotiated and decided separately and shall come into effect upon the signature of the authorized institutional representative.

This Memorandum of Understanding represents the parties' interest in and commitment to collaboration for the next year. The MOU may be revisited annually to confirm that it still represents the mutual goals of each institution.

On Behalf of Clemson University:
[redacted]

Dr. Gerald Sonnenfeld, VP, Research
[redacted]

Dr. John Kelly, VP, Economic Development

Date: July 31, 2012

On Behalf of Coastal Carolina University:
[redacted]

President

Date: 8/13/2012

- Addendum -

Coastal Carolina and Clemson University have a successful history of collaboration evidenced by:

Projects and Research:

The Palmetto Wind Project – Supporting Partners in Buoy and Sodar Studies
Coastal Carolina University's interests and focus on coastal/ocean/atmosphere boundary observation and modeling and environmental studies has complimented Clemson's engineering focus in renewable energy production, distribution and technology contributing strongly to the overall state initiative to develop coastal renewable marine resources. This collaboration has been on-going since 2007.

The partnership has also fostered strong partnerships with other cooperating institutions including: The Savannah River National Laboratory, US DOE National Renewable Energy Laboratory, The SC Energy Office and Santee Cooper. This project holds much promise for further economic development for South Carolina in renewable energy.

Clemson University and Coastal Carolina University intend to discuss possible collaboration in these mutually agreed academic and research areas.

North Myrtle Beach Offshore Wind Farm Development
Intelligent River Remote Sensor Technology for the Coastal Savannah River Basin
Coastal Mapping
Economic Development Modeling for Wind Energy

The above-mentioned initiatives are an extension of the Palmetto Wind and other past cooperatives focused on:

1) Advancing the development and enhancement of marine renewable energy technology and industry
2) Building on novel and innovative observation, telemetry, assimilation, modeling reporting and natural resource management applications management of complex natural systems.

Be that, Clemson University and the Coastal Carolina University are committed to supporting economic development through education, research and workforce development, in order to keep the best and the brightest of our students in South Carolina. Clemson University may share faculty and laboratory resources at its Baruch Institute for Coastal Ecology and Forest Science in Georgetown, SC and at its Restoration Institute in North Charleston, SC when collaborating on agreed upon projects, with terms to be negotiated in the appropriate supplemental agreements.

Appendix 4b

Memorandum of Understanding Between
Coastal Carolina University and Savannah River National Laboratory

SRNL-MOU-2012-00003

MEMORANDUM OF UNDERSTANDING

BETWEEN

SAVANANNAH RIVER NUCLEAR SOLUTIONS, LLC
As Managing and Operating Contractor For
SAVANNAH RIVER NATIONAL LABORATORY

AND

COASTAL CAROLINA UNIVERSITY

CONCERNING

Offshore Wind Tower

This Memorandum of Understanding (MOU) is between Savannah River Nuclear Solutions, LLC (SRNS) as Managing and Operating Contractor for the U.S. Department of Energy's (US DOE) Savannah River National Laboratory (SRNL) under Contract No. DE-AC09-08SR22470, and Coastal Carolina University (CCU). CCU and SRNS may individually be referred to as a "Party" or collectively as the "Parties".

Purpose

CCU and SRNS desire to strengthen their research and development capabilities and explore opportunities for collaboration. Coastal Carolina University's Center for Marine and Wetland Studies is the focal point of basic and applied research in coastal systems for the university. It has partnered with SRNL staff and others productively over the last several years particularly in areas related to coastal ocean and atmospheric boundary observations,/modeling and other initiatives oriented to assessment and development of renewable marine energy resources in the southeast. (CCU desires to grow its relationship with SRNL to advance it's mission of research and education in these areas). SRNL is the applied research and development laboratory for the US DOE's Office of Environmental Management. Both Parties are known for their innovative, practical applications of strategies and technologies designed to address major issues affecting national and international environmental issues. In view of these common interests and objectives, the Parties desire to foster scientific and technical collaboration in areas of mutual interest by:

- cooperating on mutually beneficial science and technology initiatives, including participation in scientific joint workshops or similar meetings
- leveraging our respective capabilities, expertise and resources for the advancement of science and technology particularly in areas such as wind energy, coastal boundary observations and modeling
- facilitating SRNL staff access and engagement with CCU's developing Ph.D. Program
- Authoring joint publications and presentations

As these efforts develop and grow, the formation of alliances between the Parties, and their affiliated institutions will be evaluated to more broadly support important initiatives in the principal focus areas mentioned above. The Parties will negotiate separate written agreements containing mutually agreeable terms and conditions when collaborative opportunities are identified which will address, among other items, the specific object of cooperation, funding, and protection and allocation of any intellectual property shared or developed.

Areas of Cooperation

CCU and SRNS intend to participate jointly in proposal and research efforts that will mutually benefit the Parties. Collaboration will be encouraged on technical tasks that can assist CCU and SRNS in carrying out their respective missions. Proposals submitted to funding agencies for collaborative research projects should emphasize the complementary strengths of CCU and SRNS, including the leveraging of existing resources, expertise of technical staff and collective program management skills. The Parties will execute a formal agreement prior to initiating any cooperative research efforts.

Initial efforts will center on specific initiatives in the areas below:

- Coastal and marine boundary layer mechanics
- New and merging techniques for remote sensing of the spatial and temporal distribution of wind
- Geology, hydrogeology, geophysics, and geochemistry of coastal and marine environments
- Numerical techniques for analysis of met-ocean system

Under this MOU, the Parties intend to notify each other of projects on which they can collaborate and provide each with the necessary information and support reasonably requested by the other Party to facilitate the purposes of the MOU.

Terms

The Parties agree that the following terms shall govern this MOU:

1. This MOU shall be effective upon signature by both Parties and shall remain in effect for a period of five (5) years, unless superseded by a more comprehensive agreement or terminated by the Parties. Either Party may terminate this MOU upon sixty (60) days written notice to the other party. In the event of termination, all on-going joint activities not completed as of the termination date may continue to their completion under the terms of this MOU unless specified otherwise by the Parties.

2. Each Party acknowledges that they are entering into this MOU in a spirit of cooperation. The Parties intend to pursue the goals and purposes of this MOU in good faith, subject to its terms and conditions.

3. The Parties agree that any work to be undertaken pursuant to this MOU will be the subject of additional specific agreements that are consistent with the terms and conditions of SRNS's contract with US DOE and CCU's operating directives. The exchange of information will also be in accordance with the information protection requirements set forth in SRNS's contract with US DOE and CCU's operating directives. The Parties acknowledge neither can undertake activities which are inconsistent with their individual contractual obligations.

4. The Parties acknowledge that during the course of this MOU they may wish to exchange information of a proprietary nature. The Parties agree that any such exchange of proprietary information shall be made under a separate written Non-Disclosure Agreement specific to the subject matter being discussed. [*No classified information is permitted to be exchanged under this MOU or a subsequent Non-Disclosure Agreement.*]

5. No work or funds are committed under this MOU. Any commitment of work or funds shall be made under a separate agreement following the contracting requirements of each Party.

6. Each Party shall bear all costs, risks and liabilities which may incur arising out of its obligations and efforts under this MOU. However, neither Party is obligated to undertake any activity hereunder.

7. In the event one Party publishes an article or report related to specific collaborative work, credit or co-authorship will be provided to all Parties. Each Party will be provided copies of proposed publications by the other Party at least thirty (30) days prior to submission for publication for review and comment. A Party may elect to not have their authorship credited.

8. Any news releases, public announcements, advertisements or publicity to be released by either Party concerning this MOU, or any proposal or agreement resulting from this MOU shall be subject to prior written approval by the other Party.

9. The Parties agree to conduct activities contemplated by this MOU in accordance with applicable laws and regulations to which it is subject, including export control laws. Each Party acknowledges that it is responsible for its own compliance with all U.S. export laws and regulations. Neither Party will knowingly export, directly or indirectly, any export controlled hardware, software, or technical data in the performance of this MOU without an appropriate review and license, if necessary.

10. It is understood and agreed that this MOU is entered into by SRNS; however, this MOU may be transferred from SRNS to US DOE or a US DOE designee without prior approval from CCU. SRNS will notify CCU as soon as practicable if a transfer of MOU authority from SRNS to another party is imminent.

11. Conflicts or issues that may arise which cannot be resolved between CCU and SRNL personnel should be raised to the necessary level of management to obtain resolution. An

effort shall be made by all participants to resolve conflicts with a spirit of cooperation at the working level.

12. Unless otherwise specified, this MOU embodies the entire understanding between the two Parties and any prior representation or agreement is superseded. Any modifications to this MOU must be in writing and signed by all Parties.

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized representatives.

COASTAL CAROLINA UNIVERSITY

[redacted]

David A. DeCenzo 6/25/2012
President

Date:

SAVANNAH RIVER NUCLEAR SOLUTIONS, LLC

[redacted]

John W. Temple
Director, Contracts

Date: 6/27/2012

Appendix 4c

Memorandum of Understanding Between
Coastal Carolina University and The University of South Florida

COOPERATIVE AGREEMENT
BETWEEN
Coastal Carolina University
AND
The University of South Florida, Board of Trustees, a public body corporate

This Cooperative Agreement (hereinafter known as Agreement) made and entered into this 1st day of October 2011, by and between the Coastal Carolina University (hereinafter known as CCU), and the University of South Florida. Board of Trustees, a public body corporate (hereinafter known as USF).

ARTICLE I – BACKGROUND AND OBJECTIVES

WHEREAS, CCU and USF are both public institutions of higher education located in coastal settings with educational and research missions including specialized interests and capabilities in marine geophysics; and

WHEREAS, CCU Burroughs and Chapin Center for Marine and Wetland Studies and USF College of Marine Science have individual/faculty/ labs/programs that have assembled and possess similar/identical marine geophysical instrumentation and technical expertise and have periodically partnered on projects of mutual interest and benefit, particularly where pooling expertise and instrumentation has been advantageous and cost effective; and

WHEREAS, through such cooperative efforts have been able to expand student access and participation in research cruises gaining valuable professional experience and training; and

WHEREAS, CCU and USF programs maintain professional grant supported staff/expertise associated with similar instrumentation and programs that may appropriately support cooperative projects, on a sub-contractual basis, where the partner institution serves as the lead or principal investigator; and

WHEREAS, CCU and USF programs and students may benefit significantly from such continued partnering and cooperative efforts:

NOW, therefore, the CCU and USF mutually agree to enter into this Agreement to facilitate such continued cooperation and mutual support.

ARTICLE II – STATEMENT OF WORK

A. The purpose of this Cooperative Agreement between Coastal Carolina University and the University of South Florida is to facilitate the coordination and cooperation of specialized technical groups in each institution including:

1. Promoting access of students to opportunities and space available on respective research fieldwork and subsequent data-processing/analysis and student research projects;
2. Facilitating mutually beneficial technical and instrumentation support reflecting the operation of identical specialized instrumentation and expertise which may support:
    a. Directly pooling technical resources on large cooperative projects expanding spatial coverage of key geophysical datasets then might be feasible individually,
    b. providing preferred internal cost structures for staff and instrumentation costs that may be engaged in cooperative studies and budgeted in cooperative grant proposals and studies, and
    c. synergistic efforts in maintaining and supporting key advanced instrumentation in respective labs seeking economy of scale in maintaining spare parts, staff training and related capabilities.
3. Facilitating individual subcontractual agreements for specific projects where one or the other institution may be the lead for a specific grant or study and subcontract the other for specific synergistic services including instrumentation, student and staff travel and student and staff salary and associated costs.

D. Both agencies agree to the following Terms of Reference:

ARTICLE III – TERM OF AGREEMENT

This agreement shall become effective on the date herein below last written and shall continue for a period not to exceed 5 years (except by amendment as agreed to by the parties).

ARTICLE IV – KEY OFFICIALS

A. USF Coordinator: Dr. David Naar, University of South Florida, College of Marine Science, 140 7th Ave. South, St. Petersburg FL, 33701-5016. Telephone 727 553 1637

B. CCU Coordinator: Dr. Paul Gayes, Coastal Carolina University, P.O. Box 261954, Conway, S.C. 29422-2559. Telephone: (843) 349-4015

ARTICLE V – SUBCONTRACTUAL AGREEMENTS

Subcontractual agreements for specific services associated with cooperative projects may be established by a specific scope of work and budget allowing transfer of funds from

respective institutions from research grants and contracts. Invoicing for subcontractual services will document the specific services and costs and be submitted as required by the contracting institution on a per project or quarterly basis or as established by the original funding agency with the lead institution.

ARTICLE VI – PROPERTY MANAGEMENT/DISPOSITION

In the event of extended sharing or basing of components of similar instrumentation at partners facilities, each institution will retain ownership of its original inventory and any individual additional components acquired through grants and program funds. While in residence at a partner institution, the record of the inventory will be maintained and provided to the home institution as needed for their individual reporting requirements and procedures. Provision will be made to provide access to or proof of location of respective institution inventory as requested.

ARTICLE VII – REPORTS/RECORDS– TERMINATION

A. Either party may terminate this Agreement by providing sixty (60) days written notice to the other. At the time of termination respective inventory that may be based in other partner's facilities will be compiled and returned to the institution of record.

B. This Agreement may be amended through written approval by all parties involved.

THIS COOPERATIVE AGREEEMNT IS BEING ENTERED INTO PURSUANT TO THE DOD GRANT AND AGREEMENT REGULATIONS, DoD 3210.6-R.

Coastal Carolina University

[redacted]

Edgar L. Dyer, Exec VP/COO

Date 10/17/2011

University of South Florida,
Board of Trustees, a public body corporate

[redacted]

Date 10/6/11

APPROVED AS TO
FORM AND LEGALITY
[redacted]
HENRY W. LAMBERTSEN
ATTORNEY USF

Appendix 5

Existing Graduate Courses Supporting the Programs

CMWS 601 Coastal Marine and Wetland Processes. (3) A comprehensive overview through lectures and field observations of the inter-relations between geological, physical, biological and chemical processes affecting wetlands and coastal zone ecosystems. Emphasis is placed on understanding the relations between processes and features within the terrestrial, estuarine and near shore coastal environments. F

CMWS 602 Coastal Marine and Wetland Ecology. (3) Relations between organisms and their environments in wetland and coastal zone ecosystems. Interconnectedness, energy flows and food webs will be presented in lectures, laboratories and field experiences in coastal wetland environments, estuaries and coastal marine habitats. F

CMWS 603 Coastal and Wetland Policy and Management. (3) An examination of the relationships between economics, environmental policy, environmental ethics, and environmental law. Environmental laws, federal, state and local permitting agencies and their regulations that apply to the coastal zone and wetlands will be examined using locally focused case studies. Consideration is given to gathering and presenting scientific information needed for policy decisions. The interactions and competing pressures between economic interests that impact wetlands will be contrasted with a commitment to ethical treatment and responsible management of wetlands and coastal ecological systems. S.

CMWS 610 Applied Experimental Designs and Analysis. (3) (Prereq: Graduate status and STAT 201 or equivalent) A comprehensive course covering topics in observational and manipulative experimental design (e.g., sample size determination, power of the test) and surveying the variety of available statistical techniques and analyses (e.g., MANOVA, PCA, Loglinear models, Bayesian statistics). F

CMWS 611 Marine Environmental Modeling and Data Analysis. (3) (Prereq: MATH 260 and one advanced statistics course). Study to enable students to collect and analyze meaningful data in marine and wetland environments, leading to the prediction of (and the power to change) environmental trends. Topics include aspects of sampling and resampling methods, simulation techniques, basic design of experimental techniques, fundamentals of time series analysis, modeling with difference and differential equations and linear and nonlinear dynamics that pertain to marine and wetland studies. S

CMWS 612 Advanced Geographic Information Systems. (3) The use of Geographic Information Systems in the study and management of coastal and marine systems at an advanced level. Topics covered include project design, data management and analysis, exploration of surfaces and statistical modeling, and interpretation of aerial photograph and remotely sensed data. S

CMWS 613 Standard Methods of Seawater, Tissue and Sediment Analysis. (3) (Prereq: MSCI 305 or consent of instructor) An introduction to the practices and techniques of marine analyses. Topics include measurement of nutrients, organic matter, bacteria and trace metals. Students will be introduced to the use of standard marine analytical equipment including atomic absorption spectrophotometer, gas chromatograph-mass spectrometer, ion chromatograph, TOC/TIC analyzer, and CHNS elemental analyzer. S

CMWS 614 Applied Geophysical Field Methods. (3) A field course to provide the student with an understanding of data collection in the field. Detailed study of pertinent data collection techniques for understanding the geology and physical processes in the coastal region to include side-scan sonar, seismic and ground penetrating radar techniques, as well as integral ground truthing techniques. Integration of digital data collection techniques using computer software, hardware, and networking techniques will be covered. F

CMWS 630 Aquatic Physiological Ecology. (3) Physiological and biochemical mechanisms of adaptation to aquatic environments. Topics include principles of physiological measurement, bioenergetics, and the effects of temperature, salinity, oxygen, light, turbidity, pressure and nutrients. The class will include lectures, discussions, and demonstrations. F

CMWS 641 Environmental Ecotoxicology. (3) (Prereq: MSCI 305 or consent of instructor) Introduction to the field of environmental ecotoxicology. Topics include chemical principles of bioaccumulation and degradation, organic and inorganic toxicants, modeling approaches to understanding and predicting the fate of pollutants in the marine environment. S

CMWS 642 Applications of Isotope Geochemistry. (3) (Prereq: MSCI 304 and 305 or consent of instructor) An introduction to the manifold uses of stable and radioactive isotopes in elucidating biologic and inorganic reaction pathways and past environmental conditions in marine and terrestrial systems. Topics include paleotemperature, paleosalinity, estuarine mixing, as well as biological pathways and global biogeochemical cycles. S

CMWS 650 Climate Change and Evolution of Coastal Environments. (3) Study emphasizing short and long-term coastal and estuarine changes throughout the late Quaternary, specifically with respect to decadal, centennial, millennial, and longer time scales. Quaternary geomorphologies and long and short-term climate changes are studied and placed into a global context of various spatial and temporal changes, induced change, and the factors involved in change. S

CMWS 670 Watershed Science and Management. (3) An interdisciplinary survey of watershed science, covering essentials of hydrology, geology, biogeochemistry, ecosystem structure and function, watershed modeling, and ecological economics. Current trends in watershed management are covered from the perspective of the USEPA's Watershed Approach which relies on development and implementation of watershed management plans. Other tools for watershed protection will be addressed, such as the Clean Water Act, storm water best management practices, Better Site Design, habitat conservation, and public outreach strategies. S

CMWS 675 Wetland Regulation and Delineation. (3) (Prereq: permission of instructor) Study of legal definitions and regulations relevant to wetlands and the methods used to delineate wetlands. Lectures are augmented with practical field experience identifying various indicators of hydrology, soils, and vegetation in riparian, estuarine, and pocosin wetlands. S

Appendix 6

Existing Specialized Equipment / Instrumentation

Computational Platforms

The CCU infrastructure has two supercomputing clusters (funded through an NSF MRI grants) housed in the Coastal Science Center. These Scientific Linux clusters have a combined total of 672 central processing cores and an aggregate memory exceeding 1 terabyte (TB). These clusters are connected to a centralized main server with 30 TB of data capacity for users.

Access to SRNL academic platform: CCU maintains a cooperative agreement with the Savannah River National Laboratory. SRNL is in the process of allowing external access to High Performance Computing (HPC) resources for collaboration with universities and other laboratories. This Redhat Linux-MOAB HPC system has 1500 cores, 35 TB memory and 200 TB disk storage. Resources allocated to specific projects will be evaluated on a case-by-case basis.

Individual focus areas maintain specialized workstations appropriate for data acquisition, processing functions and applications (i.e. geophysical, hydrodynamic, visualization etc.)

Research Instrumentation

An extensive array of advanced research instrumentation has been acquired, primarily through external research grants, over the last several years. These include:

Marine Geophysical Instruments:
Kongsberg EM 3002d Duel Head Multibeam Sonar, Klien 3000 Side Scanning Sonar, Edgetech 512i CHIRP Sub-bottom profiler, AGI Marine Electrical Resistivity system (SGD), Geometrics Cesium Vapor Marine Magnetometer, Mini Sounder Single Frequency Transducer (2), TSS Heave Pitch Roll Sensor, Water Sound Velocity probe, Clark Ground Penetrating Radar, Ceilometers (6), Survey grade Real Time Kinematic GPS Receivers (5)

Marine Geophysical Software:
Kingdom Suite - Seismic Reflection Analysis and Interpretation, SonarPro, Caris Hips and Sips, XSONAR, Fledermaus, ArcGIS, Mathematica, Matlab, IDL, Envi, Seismic Unix, SIOseis, Earth Imager 2D/3D, Hypack

Hydrodynamic Instruments:
ADV (Acoustic Doppler Velocimeter), LISST (Laser In-Situ Scattering and Transmissometer), Acoustic Backscatter Sensor- Aquascat 1000, Imagenex 881A Sector Scanning Sonar, Windsonic
Triton SODAR Atmospheric Profiler, Underwater Camera system, Rooftop Time Averaged Beach Cam Video (4), Six (6) Met/Ocean Instrumentation buoy systems outfitted with

wave/current (ADCP), Water quality (Seabirds, sondes), meteorological sensors, GPS and Iridium

satellite telemetry, Bottom mount instrument quad pods (2), S-4 Electromagnetic Current Meters (5), RDI Workhorse Acoustic Doppler Current and Wave Profiles (in addition to met/ocean buoy systems above) (3), Mid-water column instrumentation floats (30).

Groundwater Discharge Measurement Facility

Durridge Rad7 radon detectors (10), 2-channel Radium Delayed Coincidence Counters (2) , Solinst Level Logger CTD probes (5), Onset HOBO Water Level Loggers (8), AGI Marine Electrical Resistivity system (also listed under geophysical instrumentation)

Sediment Lab

Laser particle size analyzer, CT scanner, mechanical sieves.

Miscellaneous Field Gear

Shipboard Electric Vibracore System, YSI 6600 Water Quality Sondes (10), Handheld YSI water quality sonde, YSI Pro-ODO Handheld dissolved oxygen meter, Hach Portable turbidimeter, Ponar Sediment Grab, Shipek Grab, Marine video/still camera sled system, SONY DSC-R1 Aerial Camera System CTD, Marsh system (1), 10 m Dutch Auger Coring System

Vessels / Vehicles

48 foot ($1.1M) Research Vessel Spring 2013. Outfitted with A-frame (4000lb capacity), forward hydraulic multibeam sonar mount.
Small work boats: 24 foot Privateer workboat, 18 foot RHIB survey boat, 18 Foot Carolina Skiff workboat, 15 Foot Boston Whaler workboat, 13 foot jet drive zodiac, 32 foot pontoon boat (IR)
4-Wheel Drive Trucks (3)
ATVs (3)

Environmental Quality Lab

The EQL maintains three long term water quality/weather stations at regional ocean piers (http://www.ysieconet.com/public/WebUI/Default.aspx?hidCustomerID=131)

The laboratory areas include over 100 linear feet of bench space, five fume hoods, and controlled temperature equipment (e.g., refrigerators, freezers, incubators, water baths). Laboratory facilities are temperature and humidity controlled. Laboratory facilities include sufficient bench-top area for processing samples; storage spaces for chemicals, reagents, glassware, and portable equipment; and floor space for stationary equipment. Additional areas in the science building are utilized for sterilizing materials in an autoclave and housing a water purification system (i.e., reverse osmosis).

Laboratory Equipment: Analytical balances, Atomic absorption spectrophotometers, Autoclave, Bench top conductivity meter, Bench top turbidity meters, BOD Incubator, Building water reverse osmosis purifier, Centrifuge, CHNS Analyzer, Circulating water chiller, Dessicators, Drying ovens, muffle furnace, Electrobalance, Fiber-Optic colorimeters, Flame AA, Fluorometer, Freeze drier, Fume hoods, GC-MS with purge and trap, Graphite furnace AA, Hach Spectrophotometers, Incubators, Inductive salinometer, Ion chromatograph, Laboratory water deionizers, Laminar flow hood, Lyophilizers and sonicators, Main water distiller, Microscope, Microwave digestor, solvent extractor, Nitrate reduction columns, Packed column GC, pH/ISE meters, Portable hand-held meters (conductivity, colorimetery, DO, pH, temperature, turbidity), Quanti-Tray sealers, Refrigerators / freezers, Shatterbox, Sonicator, Total Organic Carbon (TOC) Analyzer, Turbovap, UV Lamp, Vacuum pumps, Waterbaths, YSI 5100 DO meters (for BOD work)
Sampling Equipment: GPS, Hach Kits which include: conductivity, colorimetery, DO, pH, temperature, and turbidity meters, Hydrolab Scout H2O multi-parameter water quality meters, Plankton nets, Refractometers, Remote closing water bottles (General Oceanics 1.2 L, 4 L, and 20 L), Secchi disks, Sediment grab sampler, Sediment gravity corer, Small boats and motors, SonTek Flow Tracker, Submersible pump, Subsurface remote-closing sterile water sampler

Machine Shop

Milling Machine, drill press, band saw, stock metal saw, welding (stick/heliarc), plasma cutter, metal sheet cutter, pipe bender, radial arm saw, miscellaneous hand tools (metal and wood)

Technical Staff

Marine Operations Staff / Boat Captain (2)
Grants/Fiscal Manager (1)
GIS-Database Manager (1)
Grant Temporary Data Processing and Marine Operations Staff (2)

Appendix 7

Center for Marine and Wetland Studies
Alumni Tracking

Students mentored in the Center for Marine and Wetland Studies have gone on to graduate study in the following schools:

Boston University
Clemson University
Coastal Carolina University
Duke University
East Carolina University
Florida Institute of Technology
Florida State University
George Mason University
James Cook University
Johns Hopkins University
Louisiana State University
North Carolina State University
NOVA Southeast University
Old Dominion University
Pennsylvania State University
Scripps Institution of Oceanography
Stanford University
State University of New York at Stony Brook
Texas A&M University
University of Alabama
University of Florida
University of Georgia
University of Hawaii
University of Illinois Urbana-Champaign
University of Maine
University of Maryland
University of New Hampshire
University of Rhode Island
University of South Carolina
University of South Florida
University of Southern Mississippi
Virginia Institute of Marine Sciences

Students mentored in the Center for Marine and Wetland Studies have gone on to employment in the following professional organizations, institutions, and corporations:

Alaska Observers, Inc.
Alpine Ocean Seismic Survey, Inc.
Center for Watershed Protection
Coastal Carolina University
Delaware Sea Grant
Dewberry
EA Engineering, Science, and Technology, Inc.
Environmental Compliance Laboratory
Environmental Science Corporation
Florida Department of Environmental Protection
Florida Institute of Technology
Joseph W. Jones Ecological Research Center
Luna Innovations
Marine Geophysical Solutions
Maryland Department of Natural Resources
National Oceanic and Atmospheric Administration
Smithsonian Environmental Research Center
South Carolina Department of Health and Environmental Control
South Carolina Department of Natural Resources
Spectrum Environmental Associates, Inc.
Texas A&M University
The EarthWorks Group, Inc.
The PBS&J Corporation
U.S. Army Corps of Engineers Field Research Facility
U.S. Army Corps of Engineers Research and Development Center
U.S. Bureau of Land Management
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Forest Service
U.S. Geological Survey-Woods Hole
University of Hawaii Sea Grant
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