

**WHALIN, JSU
DHS COASTAL RESILIENCE CENTER
EDUCATION PROJECT
FINAL / YEAR 3 REPORT**

Project Title: PhD in Engineering (Coastal and Computational Engineering) at an HBCU

Principal Investigator Name/Institution: Robert W. Whalin, Ph.D., P.E., D.CE, Professor of Civil Engineering and Education Director, Coastal Resilience Center of Excellence, Jackson State University (JSU)

Other Partners/Institutions: US Army Engineer Research and Development Center (ERDC), Vicksburg, MS and Texas A&M University at Galveston

Project Start and End Dates: Jan. 1, 2016- June 30, 2020

Short Project Description: The primary objective of this project is to establish the first PhD Engineering Degree at an HBCU (Jackson State University) with a concentration in Coastal and Computational Engineering focused on coastal natural disasters. This PhD Engineering concentration, (coupled with undergraduate and MS level Coastal Engineering programs completed during the Coastal Hazards Center) provides a continuum of advanced education engineering programs focused on coastal natural disasters. End user relationships with ERDC, Mississippi Department of Transportation (MDOT), Corps of Engineers Districts, Mississippi Emergency Management Agency (MEMA) and local emergency management agencies across the southeastern US are fostered and strengthened.

PROJECT NARRATIVE:

1. Introduction and project overview:

This project directly addresses the education need for graduate engineering programs focused on coastal natural disasters to provide engineers that can help mitigate the ever increasing cost of damages, especially those from tropical storms and hurricanes, that DHS is confronted with through FEMA missions. Almost no graduate coastal engineering programs are focused on coastal natural disasters and none are located at an HBCU where a large percentage of African American engineers matriculate. Jackson State University has an African American student body exceeding 80% which will directly support the DHS Strategic Plan Goal to Enhance the DHS Workforce, especially the Objective to increase Workforce Diversity and Priority Goal 3 to Enhance Resilience to Disasters. Leverage of federal assets is assured by the Education Partnership Agreement (authorized by Public Law) between the Engineer Research and Development Center and Jackson State University. The Agreement facilitates ERDC providing Adjunct Faculty, student internships and potential use of ERDC experimental and computational facilities for graduate research. An outstanding record of DHS End User involvement and transition of

graduates to end users has been established during the seven and one-half years of the Coastal Hazards Center of Excellence at Jackson State University and will continue to be strengthened throughout the five-year Coastal Resilience Center of Excellence program. Research staff and graduate students have direct participation in a CRC research project, summer research experiences (SUMREX) with CRC research partners and in highly relevant hurricane barrier projects nationwide (funded by others) including the Ike Dike concept for protecting Galveston Island and the greater Houston metropolitan area from devastating, albeit low probability, hurricane surges. Coastal Engineering programs nationwide have been on a decline for the past two decades and United States leadership in the coastal engineering profession has declined relative to other nations. This project will help ameliorate the trend while increasing the supply of minority coastal and computational graduate level engineers focused on the field of coastal natural disasters.

2. History:

The history of this project actually began on July 1, 2008 when DHS funded the Coastal Hazards Center of Excellence (Education) at Jackson State University with me (Dr. Robert W. Whalin) as PI and Director. One JSU CHC project had the objective of developing undergraduate and graduate coastal engineering courses and programs focused on coastal natural disasters. The CHC COE was quite successful including establishment of MS Engineering degree concentrations in Coastal and Computational Engineering focused on coastal natural disasters.

The CHC success provided a firm foundation, (including relations with end users in the greater Homeland Security Enterprise, HSE who employ graduates), for the current Coastal Resilience Center education project entitled, “PhD in Engineering (Coastal and Computational Engineering) at an HBCU” (Jackson State University). The MS Engineering, Coastal Engineering concentration graduates form a steady, albeit small, stream of potential PhD graduate students for the CRC PhD program.

During Year 2, Jackson State University experienced severe unanticipated fiscal challenges and leadership changes (President, Provost, and Vice Presidents all changed). Specifics are in the Year 2 Annual Report. The fiscal turbulence led to a decision to delay submittal of the new PhD Engineering (Coastal Engineering concentration) documentation until Year 3. We are gratified to report that this strategy succeeded and the PhD Engineering (Coastal Engineering concentration) was approved in April 2018. The project and milestones are back on the original schedule. The Education and Transition Activities and Milestones are summarized in the following sections.

3. Results:

The first three years of this five-year project have been highly productive. Year three proved to be a watershed year as the severe fiscal challenges impacting milestones in year two were overcome and all milestones through Year 3 have been met. No impact is envisioned for the

remaining Year 4 and Year 5 milestones. Table 1 documents courses that were enrolled in by Coastal Engineering concentration students.

A summary of coastal engineering related degrees awarded during the first 3 years follows. Five MS Engineering (Coastal Engineering concentration) degrees were awarded during the first three years of this Project. One PhD Engineering (Civil Engineering concentration) degree was awarded to a student who also completed all requirements for the recently approved PhD concentration in Coastal Engineering. These courses were electives in the students Civil Engineering concentration. This PhD degree was awarded in April 2018. Seven BS degrees were awarded to students who enrolled in the graduate Coastal Engineering concentration of the MS Engineering degree.

Ethnicity of Graduates	BS	MS	PhD
African American	3	3	0
Hispanic American	0	0	0
Asian American	2	1	1
Caucasian	2	1	0
Total Graduates	7	5	1

The most significant milestone during Year 3 was institutionalization of the PhD Engineering degree (Coastal Engineering concentration) which was approved in April 2018 by the Vice President of Academic Affairs and Provost. The concentration will appear in the JSU graduate catalog for Fall 2018. This is the final step in formal institutionalization of the Coastal Engineering concentration. The Computational Engineering concentration was approved and institutionalized in 2016 along with the PhD Engineering degree and its other concentrations (Civil, Environmental, Computer, and Electrical Engineering).

The following three pages contain the approved modifications (in red) to the JSU Graduate Catalog that describes the approved Coastal Engineering concentration of the Doctor of Philosophy (Ph.D.) in Engineering degree program.

joins theoretical analysis and physical experimentation as tools for discovering new knowledge.

Program Objectives

1. Develop computational systems for the solution of physical problems in engineering and science.
2. Develop algorithms and software required for the mathematical models of physical processes.
3. Visualize, analyze, and interpret computed results and other physical data.

Core Courses		Semester
Course	Title	Hours
CPE 503	Computational Methods	3
CPE 520	Advanced Engineering Analysis I	3
CPE 521	Advanced Engineering Analysis II	3
CPE 618	High Performance Computing	3
Elective Courses		
CPE 500	Software Engineering	3
CPE 505	Analysis of Algorithms	3
CPE 508	Operating Systems	3
CPE 512	Computer Architecture	3
CPE 515	Advanced Logic Design	3
CPE 530	VLSI Design	3
CPE 531	VLSI Testing and Design for Testability	3
CPE 532	Digital Integrated Circuit Design	3
CPE 533	Fault-Tolerant Computing Systems	3
CPE 541	Computer Networks	3
CPE 547	Modeling and Analysis of Computer and Communication Systems	3
CPE 552	Computer Vision	3
CPE 555	Control Systems	3
CPE 557	Robotics	3
CPE 560	Embedded Design with Microprocessors	3
CPE 601	Code Optimizations	3
CPE 610	Parallel Computing and Programming	3
CPE 611	Computer Arithmetic	3
CPE 630	Design Automation of VLSI Systems	3
CPE 640	Computer Security	3
CPE 641	Advanced Computer Networks	3
CPE 642	Computer Network Security	3
CPE 655	Advanced Control Systems	3
CPE 693	Advanced Topics in Engineering	1 to 4
CPE 695	Scientific Writing Seminar	1
CPE 696	Seminar	1
CPE 697	Internship	1-3
CPE 698	Independent Study	1-4
CPE 699	Dissertation Research	1-6

Doctor of Philosophy (Ph.D.) in Engineering Program Description

The Ph.D. in Engineering Program consists of 8 emphasis areas including Computer Engineering, Telecommunications Engineering, Electrical Engineering, Computational Engineering, Civil Engineering, Coastal Engineering, Environmental Engineering, and Geological Engineering.

Mission

To provide students with the necessary advanced knowledge, research skills, creativity, ethics, critical thinking, and problem solving to be able respond to engineering challenges and needs of our ever-changing world for professional competence and lifelong and inquiry-based learning.

Objectives

The primary educational objective of the Ph.D. in Engineering Program is to produce engineers with terminal degrees to meet the needs for highly educated engineers with advanced technical and research skills in the workforces. The specific objectives of the eight emphasis areas are as following:

Civil Engineering: to prepare students for continued professional and scholarly development consistent with their technical interests in civil engineering by conducting a major independent and original research study with critical thinking.

Coastal Engineering: to prepare students with advanced knowledge and skills in coastal engineering, (including coastal natural disasters) and produce graduates with competencies in advanced original research, education and professional practice in coastal engineering.

Environmental Engineering: to equip students with advanced knowledge and skills in the environmental engineering field and produce graduates with competencies in advanced original research, education, and professional practice in the area of environmental engineering.

Geological Engineering: to train students with advanced knowledge and scholarly development in geological engineering and produce graduates with competency in advanced original research in the area of geological engineering.

Computer Engineering: to equip students with advanced knowledge in computer engineering and produce graduates with competencies in advanced original research, education, and professional practice in computer engineering.

Telecommunications Engineering: to equip students with advanced knowledge in telecommunications engineering and produce graduates with competencies in advanced original research, education, and professional practice in telecommunications engineering.

Electrical Engineering: to equip students with

223

advanced knowledge in electrical engineering and produce graduates with competencies in advanced original research, education, and professional practice in electrical engineering.

Computational Engineering: to equip students with advanced knowledge in computational engineering and produce graduates with competencies in advanced original research, education, and professional practice in computational engineering.

Admission Requirements The applicants must meet all admission requirements set by the Division of Graduate Studies. In addition, the applicants must meet the following admission requirements.

1. A Bachelor of Science (B.S.) degree in civil engineering, environmental engineering, computer engineering, or electrical engineering or closely related engineering disciplines from accredited colleges and universities, or a Master of Science (M.S.) in related engineering field.
2. Applicants who do not have a B.S. or M.S. in an engineering field will be required to satisfy the articulation courses.
3. Minimum undergraduate grade point average (GPA) of 3.0 on a 4.0 scale and minimum graduate GPA of 3.50 on a 4.0 scale are required. In special cases, exceptional applicants with B.S. degrees in engineering will be considered. These applicants must have a minimum GPA of 3.5
4. Applicants with Minimum undergraduate grade point average (GPA) of 2.90 on a 4.0 scale and minimum graduate GPA of 3.250 on a 4.0 scale may be considered for conditional admission. These applicants must achieve a minimum graduate GPA of 3.50 during the first year of the Ph.D. Program to be eligible for consideration for regular admission.
5. International students must meet the English requirements as outlined by the Division of Graduate Studies.
6. Applicant must submit three letters of recommendation from professionals who are knowledgeable with applicant's credentials.
7. Applicant must submit a one-page statement on career goals and objectives, as well as research experience and interests.

Degree Requirements

The applicants must meet all degree requirements set by the Division of Graduate Studies. In addition, the applicants must meet the following degree requirements.

To obtain the Ph.D. in Engineering Degree, the students are required to complete a minimum of 72

credit hours beyond B.S. or 36 credit hours beyond M.S. degree. The program includes core courses, elective courses, and 24 hours of dissertation research. The adviser or the advising committee may recommend additional courses based on the students background and proposed research plan. Students have to maintain a graduate GPA of 3.0 or above to avoid academic probation.

A comprehensive qualifying exam is given to the student after six months of the study beyond the M.S. degree, but no later than after 2 years of study. Academic advisor and engineering faculty in a student's area of research determine the coursework needed for a student to prepare for the comprehensive qualifying examination. The comprehensive qualifying examination includes a written part and oral exam. During the comprehensive qualifying examination, students must demonstrate a sufficient depth and breadth of knowledge in their major to pursue independent and original research. However, the student must consult with their advisor and/or the exam coordinator in the major area of study for the schedule and specific procedures. A signature form, verifying that a student has passed the comprehensive qualifying exam, must be signed by the student's advisor and returned to the departmental office. After passing the comprehensive qualifying exam, the students will be admitted to Ph.D. Candidacy. If a student fails to pass the comprehensive qualifying exam, he/she will be allowed to take it again between one and six months after the first attempt. If the student fails twice on this exam, he/she will be dropped from the PhD program.

When at least 80% of coursework is completed and the comprehensive qualifying exam is successfully passed, the students are able to take a preliminary exam administered by the advising committee and academic advisor. Students should take the preliminary exam within 3 years of residence beyond the MS degree and at least two semesters before their final dissertation defense. This exam is based upon an oral exam and a written proposal and a detailed plan to carry out the Ph.D. dissertation. Students must consult with their advisors for specific details of the requirements for the preliminary exam.

The defense of dissertation is the final exam of the Ph.D. program. An oral defense and a written Ph.D. dissertation demonstrating original and independent research and major contributions to an engineering field have to be approved by the advising committee before graduation. Recognizing the importance of high quality graduates, each graduate is expected to publish at least 2 papers based on the results of his/her research in high quality refereed engineering journals. A summary of minimum degree requirements is shown below. 224

Summary of Minimum Degree Requirements for Ph.D. in Engineering

Credit Hours

A minimum of 72 credit hours beyond B.S. or 36 credit hours beyond M.S. degree. Must complete 24 hours of dissertation research, the required core courses, and elective courses. The adviser or the advising committee may recommend additional courses based on the students background and the proposed research area.

Comprehensive Qualifying Exam

Successful completion of written and oral Comprehensive Qualifying Exam, given after six months of the study beyond the M.S. degree, but no later than after 2 years of study.

Preliminary Exam

Successful completion of the preliminary exam within 3 years of residence beyond the MS degree and at least two semesters before their final dissertation defense.

Final Dissertation and Defense

An oral defense and a written Ph.D. dissertation demonstrating original independent research and major contributions. Each graduate is expected to publish at least 2 papers based on the results of his/her research in high quality refereed engineering journals.

Program: PhD in Engineering

Emphasis Area: Coastal Engineering

Department: Civil and Environmental Engineering

Core Courses

1. Choose four from the following list (CIV 520 is mandatory) after consultation and approval of the student's advisor.

Course	Title	Semester Hours
CIV 520	Advanced Engineering Analysis I	3
CIV 538	Coastal Structures	3
CIV 539	Advanced Coastal Engineering Design	3
CIV 558	Sedimentation and River Engineering	3
CIV 631	Linear Theory of Ocean Waves	3
CIV 632	Tides and Long Waves	3
CIV 636	Spectral Wave Analysis	3
CIV 637	Advanced Design for Breakwater Rehabilitation	3

Elective Courses

Course	Title	Semester Hours
CIV 521	Advanced Engineering Analysis II	3
CIV 530	Advanced Pavement Analysis and Design	3
CIV 531	Traffic Engineering	3
CIV 532	Pavement Materials and Design	3
CIV 533	Evaluation, Maintenance, & Rehabilitation of Public Works Infrastructure	3

CIV 556	Groundwater Engineering	3
CIV 557	Computational Fluid Dynamics	3
CIV 558	Sedimentation and River Engineering	3
CIV 559	Environmental Hydraulics	3
CIV 562	Hazardous Waste Engineering	3
CIV 564	Surface Water	3
CIV 633	Airport Planning and Design	3
CIV 640	Finite Element Method	3
CIV 650	Small Watershed Hydrology	3
CIV 652	Hydraulic Engineering Design	3
CIV 659	Advanced Topics in Water Resources Engineering	1-4
CIV 670	Rock Mechanics	3
CIV 680	Unsaturated Soil Mechanics	3
CIV 695	Scientific Writing Seminar	3
CIV 696	Seminar	3
CIV 697	Internship	1-3
CIV 698	Independent Study	1-4
CIV 899	Dissertation Research	1-6

4. **Students:**

Demographics of students enrolled in the project courses are most accurately portrayed by analyzing students advised myself. I advise all graduate students enrolled in the Coastal Engineering concentration (MS or PhD) and serve on the Graduate Committee (MS or PhD) of several other students who enroll in core Coastal Engineering courses that I teach. The following table summarizes some of the demographics for sixteen graduate students that I either Advise or serve on their graduate committee.

Coastal Engineering Concentration Graduate Students (16)

	Full-Time	Part-Time	Intermittent	Total	MS	PhD
African American	3	4	-	7	5	2
Asian/Indian	5	-	-	5	1	4
Hispanic	-	-	-	-	-	-
Caucasian	2	1	1	4	2	2
Total	10	5	1	16	8	8

A substantial number of our graduate students are non-traditional students. A number work at full-time jobs in the greater metropolitan area and several have families. Our engineering graduate programs seek to accommodate the non-traditional student by teaching almost all graduate courses in the evening for 3 hours one day a week, Monday thru Thursday; usually starting at 5:30pm.

The following table provides the ethnicity of graduates in the Coastal Engineering concentration during Years 1, 2, and 3.

MS Engineering Graduates (6)

	Number of Graduates	Work in HSE	In PhD Program	Other
African American	3	3	1 (Part time)	-
Asian/Indian	2	-	2	-
Hispanic	-	-	-	-
Caucasian	1	-	1 (Intermittent)	1
Total	6	3	4	1

PhD Engineering Graduates (2)

	Number of Graduates	Work in HSE	Work in Academia	Work Outside HSE
African American	-	-	-	-
Asian/Indian	1	-	1	-
Hispanic	-	-	-	-
Caucasian	-	-	-	-
Total	1	0	1	0

5. Institutionalization:

This project was formally institutionalized during Year 3 as previously described. It is a formal PhD Engineering degree concentration in the graduate catalog and has equal status with all other PhD degree programs and concentrations at JSU. Graduate students can apply for academic support on an equal footing with any other major. A steady, albeit small continuous supply of potential graduate students exists from ERDC and Vicksburg District Corp of Engineers employees. The PI plans to remain at JSU for the foreseeable future and will continue to prepare research proposals, mentor students and nurture the programs. It is reasonable to assume departing or retiring faculty (including the PI) will be replaced with comparable talented faculty. The degree concentration has a comfortable home in the Civil and Environmental Engineering Department and is envisioned to remain there. The Education Partnership Agreement between ERDC and JSU has been in existence for over two decades and is fully expected to remain in effect. There is a robust set of leveraged research and education programs by the PI and such a set of programs should continue.

6. Interactions with research projects:

Research project interactions have been continuous and sustained with CRC research projects as well as externally funded research projects as summarized in Table 2A. During the summer of 2016 (June 1- Aug. 10), Mr. Xuesheng Qian, a PhD Engineering student, spent the summer as a JSU CRC SUMREX student at the University of Texas working with Dr. Clint Dawson and his team performing ADCIRC hurricane surge modeling research of Gulf of Mexico hurricanes. Early in 2018, we had Mr. Qian scheduled to have a 2018 SUMREX research experience at Oregon State University. Unfortunately, those plans did not materialize when Mr. Qian became Dr. Qian on April 28, 2018 completing his PhD research and dissertation defense earlier than envisioned. Dr. Qian is starting a career in an academic research position.

Ms. Sabrina Welch was a JSU SUMREX student during the summer of 2017 working with Dr. Stephen Medeiros and his teaching assistant at the University of Central Florida (May 21 to June 10) and with Dr. Scott Hagen and his research team at LSU (June 11 to June 30) in the ADCIRC modeling SUMREX program they started in 2016. Ms. Welch was joined by another graduate student from University of Puerto Rico, Mayaguez in this excellent UCF/LSU SUMREX program. Ms. Welch attended the ADCIRC Boot Camp and Users Group meeting held in Boston, MA (May 1 to May 5, 2017) and had the opportunity to meet Dr. Leuttich, CRC PI and Dr. Chris Massey, ERDC and other key researchers and graduate students using the ADCIRC modeling system.

Dr. Gavin Smith, CRC Director gave a seminar at Tougaloo College on April 7, 2017 at which a number of JSU CRC professors, staff and graduate students attended. All coastal engineering staff, graduate students and professors were invited.

One of most unusual research experiences for our education project students was the opportunity for them to compete for a summer research experience led by the Texas A&M University at Galveston. Dr. Sam Brody is the PI for the TAMUG five year NSF PIRE (Partnership for International Research and Education) Flood Risk Reduction project. A group of PIRE partner students (TAMUG, TAMU, Rice and JSU) compete for approximately 15 slots to plan and undergo research experiences in The Netherlands with students from the international partner Delft Technical University. We had three JSU students participate in Summer 2016, one in Summer 2017 and one in Summer 2018. The first two years' research projects are published in Publication 6. h below. I am the JSU PI for the PIRE subcontract from TAMUG. Our JSU students have done an outstanding job. They spend 14-16 days in The Netherlands collecting data, interviewing practicing engineers, professors and viewing coastal projects in The Netherlands. My students are enrolled in a 3-hour Independent Study course during the summer and complete their research, prepare a report and prepare a poster presentation. Mr. Bruce Ebersole, our CRC Senior Research staff member, is one of the mentors that make the trip to The Netherlands and oversee the students research.



Several CRC and ERDC researchers have given seminars attended by our JSU graduate students and professors. Those included Dr. Casey Dietrich, North Carolina State University; Dr. Gavin Smith, University of North Carolina; Dr. Jeff Melby, ERDC and Noble and Associates; and Dr. Chris Massey, ERDC.

In summary, students in this Education Project have benefitted from research project interactions at University of Texas, University of Central Florida, Louisiana State University, University of North Florida, and University of North Carolina, Texas A&M University at Galveston, Texas A&M, Rice University and Delft Technical University.

7. **Publications:**

The first seven publications below are authored or co-authored by one or more of the CRC staff at JSU and the last publication is edited by TAMUG faculty and staff and Technical University Delft staff featuring research papers by the first two PIRE student cohorts. Four of the papers are authored by CRC JSU graduate Coastal Engineering concentration students.

- a. Whalin, Robert, W., “HBCU Engineering Faculty and Graduates: Implications for Race, Retention and Graduation Linkages”, NAAAS & Affiliates 2016 National Conference, Baton, Rouge, LA, February 2016.
- b. Whalin, Robert, W.; Pagan-Trinidad, Ismael; Villanueva, Evelyn; and Pittman, David, W., “A Quarter Century of Resounding Success for a University/Federal Laboratory Partnership”, ASEE 123rd Annual Conference and Exposition, New Orleans, LA, June 26, 2016.
- c. Whalin RW, Brody SD, and Merrell WJ. The Galveston Bay Region as an International Test Bed for Flood Risk Reduction, 8th Texas Hurricane Conference, University of Houston, Houston, TX, August 5, 2016.
- d. Ebersole B, Richardson TW, and Whalin RW. Modeling Coastal Storms: Past, Present and Future, 8th Texas Hurricane Conference, University of Houston, Houston, TX, August 5, 2016.
- e. Whalin RW. HBCU Engineering Faculty and Graduates: Implications for Race, Retention and Graduation Linkages, NAAAS & Affiliates 2016 National Conference Proceedings, Baton Rouge, LA, published Oct. 2016.
- f. Whalin RW, Pang Q, Latham J, Lowe LN. Assessment of a Summer Bridge Program: Seven Years and Counting, 2017 ASEE National Conference Proceedings, Columbus, OH, June 24-28, 2017.
- g. Ebersole, Bruce; Richardson, Thomas; and Whalin, Robert, W., "Surge Suppression Achieved by Different Coastal Spine (Ike Dike) Alignments", 9th Texas Hurricane Conference, University of Houston, August 4, 2017, Houston, TX.
- h. “NSF-PIRE, Coastal Flood Risk Reduction Program, Authentic Learning and Transformative Education”, Volume 1-2015-2017; Edited by Baukje “Bee” Kothius, Yoonjeong Lee and Samuel Brody, March 2018.

8. **Lessons Learned:** If starting this project again under the same conditions, I would do nothing different. It has evolved exactly as planned and the severe unexpected university fiscal challenge was solved with, what turned out to be, a winning strategy. Regardless of whether this was good fortune or astute foresight, the end result could not have been better. All activities and milestones are now on the original schedule for Years 4 and 5. In summary, I would make no change in the project.

9. Tables:

Table 1: Documenting CRC Education Project Courses and Enrollments

Courses Developed and Taught by Jackson State University under Project PhD in Engineering (Coastal Engineering and Computational Engineering concentration) at an HBCU						
Course		Developed (D), Revised (R), and/or Taught (T), by Project Year				
Number	Title	1	2	3	4	5
CIV631	Linear Theory of Ocean Waves	T	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		C	C	-		
Enrollment		6	5	-		
CIV637	Advanced Design for Breakwater Rehabilitation	T	-	T		
Offering: Elective (E), Concentration (C), Minor (M)		C	-	C		
Enrollment		3	-	7		
CIV642	Prestressed Concrete Design	T	-	-		
Offering: Elective (E), Concentration (C), Minor (M)		E	-	-		
Enrollment		4	-	-		
CIV698	Independent Study (4 separate courses)	T/R (4 courses)	T/R (4 courses)	T/R (3 courses)		
Offering: Elective (E), Concentration (C), Minor (M)		C	C	C		
Enrollment		1 each	1 each	1 each		
CIV538 Spring 17	Coastal Structures	-	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		-	C	-		
Enrollment		-	6	-		
CIV636 Fall 16	Spectral Wave Analysis	-	T	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	C	C		

Enrollment		-	5	5		
CIV539 Fall 16	Advanced Coastal Engineering Design	-	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		-	C	-		
Enrollment		-	6	-		
CIV520	Advanced Engineering Analysis	-	T	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	C	C		
Enrollment		-	9	4		
CIV535	Pavement Design	-	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		-	E	-		
Enrollment		-	8	-		
CIV542	Advanced Design of Concrete Structures	-	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		-	E	-		
Enrollment		-	9	-		
CIV544	Advanced Design of Steel Structures	-	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		-	E	-		
Enrollment		-	8	-		
CIV544	Advanced Design of Hydraulic Structures	-	T	-		
Offering: Elective (E), Concentration (C), Minor (M)		-	E	-		
Enrollment		-	9	-		
CIV632	Tides and Long Waves	-	-	1		
Offering: Elective (E), Concentration (C), Minor (M)		-	-	C		
Enrollment		-	-	10		
CIV550	Engineering Hydrology	-	-	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	-	E		
Enrollment		-	-	10		
CIV661	Biological Processes in Wastewater Engineering	-	-	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	-	E		
Enrollment		-	-	9		

CIV561	Chemistry for Environmental Engineering	-	-	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	-	E		
Enrollment		-	-	6		
CIV567	Environmental Remediation	-	-	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	-	E		
Enrollment		-	-	7		
CIV675	Earth Dams and Slopes	-	-	T		
Offering: Elective (E), Concentration (C), Minor (M)		-	-	E		
Enrollment		-	-	9		
Total (Years 1-3)		17	69	70		

Table 2: Documenting External Funding and Leveraged Support Jan. 1, 2016 – July 1, 2018

2A: External Funding (Years 1-3)			
<u>Title</u>	<u>PI</u>	<u>Total Amount</u>	<u>Source</u>
Coastal Flood Risk Reduction	Whalin	\$219,000	Texas A&M University at Galveston (Prime for NSF PIRE Grant)
Storm Surge Modeling for Comprehensive Barrier Protection, Galveston Bay and Vicinity	Whalin	\$101,775	Texas A&M University at Galveston
Maritime Transportation Research and Education Center (MarTREC)	Whalin (since Aug. 2018, Co-PI prior)	\$370,000	University of Arkansas (Prime for DoT University Transportation Center)
Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE)	Whalin (since Aug. 2018, Co-PI prior)	\$225,000	University of Florida (Prime for DoT Regional University Transportation Center)
Evaluation of Ike Dike Hurricane Protection	Whalin	\$26,050	Bay Area Coastal Protection Alliance
2B: Leveraged Support (Years 1-3)			
<u>Description</u>			<u>Estimated Total Value</u>

High Performance Computer Time	\$39,000
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Table 3: Performance Metrics: WHALIN

Metric	Year 1 (1/1/16 – 6/30/16)	Year 2 (7/1/16 – 6/30/17)	Year 3 (7/1/17- 6/30/18)
HS-related internships (number)	5	4	3
Undergraduates provided tuition/fee support (number)	1	0	0
Undergraduate students provided stipends (number)	0	0	0
Graduate students provided tuition/fee support (number)	4	7	10
Graduate students provided stipends (number)	2	6	6
Undergraduates who received HS-related degrees (number)	2	3	3
Graduate students who received HS-related degrees (number)	0	4	4
Certificates awarded (number)	0	0	0
Graduates who obtained HS-related employment (number)	1	2	3
Lectures/presentations/seminars at Center partners (number)	1	1	1
DHS MSI Summer Research Teams hosted (number)	0	0	0
Journal articles submitted (number)	2	0	0
Journal articles published (number)	2	4	0
Conference presentations made (number)	2	4	3
Other presentations, interviews, etc. (number)	5	3	5
Trademarks/copyrights filed (number)	0	0	0
Requests for assistance/advice from DHS agencies (number)	0	4	2
Requests for assistance/advice from other agencies or governments	0	3	2
Total milestones for reporting period (number)	3	4	3
Accomplished fully (number)	2	3	3
Accomplished partially (number)	1	0	0
Not accomplished (number)	0	1	0

10. Year 3 Education Activity and Milestone Achievement:

All activities and milestones were completed 100% as scheduled. Two MS Engineering (Coastal Engineering Concentration) degrees were awarded and both are working in the greater Homeland Security Enterprise; one in Corps of Engineers and one in industry. Qualifying exam has been discussed with one student and scheduled for Fall semester 2018 and two other students are considering an appropriate time.

Education Activities and Milestones

Reporting Period 7/1/17 – 6/30/18			
Education Activities	Proposed Completion Date	% Complete	Explanation of why activity/milestone was not reached
1. Recruit PhD students in Coastal Engineering concentration	Continuous	100%	
2. Teach courses in PhD Coastal Engineering concentration and oversee dissertation research	6/30/18	100%	
3. Seek research funds from outside sources	Continuous	100%	
4. Continuous to teach BS/MS/PhD Coastal Engineering courses	6/30/18	100%	
Education Milestones			
1. Continue to graduate students in BS/MS Coastal Engineering courses	5/30/18	100%	
2. Schedule first PhD qualifying exam for a student	6/30/18	100%	

11. Year 3 Transition Activity and Milestone Achievement:

Three BS Year 3 graduates were recruited for the MS Engineering (Coastal Engineering concentration) graduate program for Fall 2018, the start of Year 4. In addition there were two MS students continuing their MS degree requirements in Fall 2018. At the end of Year 3, there were four students enrolled in the PhD Engineering (Coastal Engineering concentration). Two students graduated with MS Engineering degrees (one in Dec. 2017 and one in April 2018) and both are working in the greater HSE (one in the Corps of Engineers and one in private industry)

Transition Activities and Milestones: Final Status as of 2018

Reporting Period 7/1/2017 – 6/30/2018			
Transition Activity	Proposed Completion Date	% Complete	Explanation of why activity/milestone was not reached
1. Continued enrollment of students in BS/MS programs	6/30/18	100%	
2. Enrollment of students in approved PhD concentration	6/30/18	100%	
Transition Milestone			
1. Graduation of BS/MS students and employment in the greater HS enterprise or, continued graduate school enrollment	6/30/18	100%	