



STATE
UNIVERSITY
SYSTEM
of FLORIDA
Board of Governors

AGENDA
Academic and Student Affairs Committee
Traditions Hall, Gibbons Alumni Center
University of South Florida
Tampa, Florida
June 23, 2011
8:30 a.m. – 9:30 a.m.

1. **Call to Order** **Governor Ann Duncan**

2. **Committee Minutes from January 20, 2011** **Governor Duncan**

3. **Academic Items from the June 9, 2011 Conference Call** **Governor Duncan**
 - a. **Ph.D. in Materials Science and Engineering**
CIP 40.1001, Florida State University
 - b. **Ph.D. in Security Studies, CIP 45.0902**
University of Central Florida
 - c. **Public Notice of Intent to Amend Regulation 6.010**
Student Affairs Administration
 - d. **Public Notice of Intent to Amend Regulation 6.017**
Criteria for Awarding the Baccalaureate Degree

4. **CAVP Academic Coordination Project** **Governor Duncan**
Provost Ralph Wilcox,
University of South Florida

5. **Concluding Remarks and Adjournment** **Governor Duncan**

STATE UNIVERSITY SYSTEM OF FLORIDA
BOARD OF GOVERNORS
Academic and Student Affairs Committee
June 23, 2011

SUBJECT: Minutes from the January 20, 2011 Academic and Student Affairs
Committee Meeting

PROPOSED COMMITTEE ACTION

Consider the Minutes from the January 20, 2011 Academic and Student Affairs
Committee Meeting

AUTHORITY FOR BOARD OF GOVERNORS ACTION

Section 7(d), Art. IX, Florida Constitution

BACKGROUND INFORMATION

The Minutes from the January 20, 2011 meeting of the Academic and Student Affairs
Committee are provided for review and approval.

Supporting Documentation Included: Committee Minutes from January 20, 2011

Facilitators/Presenters: Governor Ann Duncan

**MINUTES
BOARD OF GOVERNORS
STATE UNIVERSITY SYSTEM OF FLORIDA
ACADEMIC AND STUDENT AFFAIRS COMMITTEE
CONFERENCE CENTER
UNIVERSITY OF WEST FLORIDA
PENSACOLA, FLORIDA
JANUARY 20, 2011**

Chairperson Ann Duncan convened the Board of Governors Academic and Student Affairs Committee meeting at 9:00 a.m., January 20, 2011, in the Conference Center on the University of West Florida campus. The following committee members were present: Gallop Franklin (co-chair), Patricia Frost, Dr. Stanley Marshall, Frank Martin, Gus Stavros, and Dr. Rick Yost. Commissioner Eric Smith was absent.

1. Minutes of Prior Meeting

Chair Duncan presented the minutes from the November 4, 2010 meeting. There were no changes to the minutes. Chair Duncan asked for a motion to approve the minutes as presented. The motion was seconded, and members of the Committee concurred.

2. Board Regulations

a) Public Notice of Intent to Amend Regulation 7.005, Residency for Tuition Purposes

Chair Duncan introduced Vikki Shirley to discuss Regulation 7.005 related to Residency for Tuition Programs. Ms. Shirley stated that the primary amendment to this regulation involves the process by which a student can seek reclassification of his or her status from out-of-state to in-state for tuition purposes. Based on reports issued by Office of Program Policy Analysis and Government Accountability (OPPAGA), the Legislature amended the residency statute to place a higher burden on students who were initially classified as non-residents to seek reclassification. The Law requires students to provide convincing documentation that supports permanent legal residency in Florida for a 12 month consecutive period prior to seeking reclassification. The amendment to revision 7.005 implements this new criterion by requiring students to provide a minimum of 3 documents that support their permanent residency status in Florida, and those documents are set forth in statute. The documents also must verify that the student has relinquished their residency status in the prior state.

Vikki Shirley also asked for authorization to publish the regulation as a rule in the Florida Administrative Weekly and to post the regulation as a proposed regulation on the Board's website.

Chair Duncan then posed a question regarding veterans and their residency status based on issues raised at the Veterans' Symposium. Richard Stevens addressed her question, explaining that although there is a reluctance to open the Residency Statute, the Florida Department of Veterans' Affairs has passed language that would give veterans at least a year after leaving the service to prove that they have not established residency elsewhere.

Chair Duncan asked for comments or questions. Seeing none, Chair Duncan requested a motion to approve the proposed Regulation. The motion was made and seconded, and the members of the Committee concurred.

b) Public Notice of Intent to Amend Regulation 8.011, New Academic Program Authorization

Chair Duncan introduced Richard Stevens to discuss Regulation 8.011 related to the Authorization of New Academic Degree Programs. Regulation 8.011 is being amended in part to conform to statutory changes from 2010 and in part to clarify policies regarding the approval process. Richard Stevens addressed the changes to Regulation 8.011, and Vikki Shirley provided an overview of Florida's partnership and commitments with the US Department of Education's Office for Civil Rights (OCR).

Chair Duncan requested input on the draft regulation from President Ammons and additional clarification from Mrs. Shirley regarding Florida's relationship with OCR, namely if all three educational sectors were held to the same OCR commitments. Mrs. Shirley clarified the OCR partnership was with the entire state of Florida. Chair Duncan requested a motion to approve the proposed Regulation. The motion was made and seconded, and the members of the Committee concurred.

3. Academic Programs

Chair Duncan introduced the following program at UF:

a) Ph.D. in Public Health, CIP 51.2201 (University of Florida)

Chair Duncan introduced Dr. Joseph Glover, Provost and Senior Vice President for Academic Affairs, from the University of Florida. Dr. Glover reviewed the new College of Public Health and introduced its Dean, Dr. Michael Perri to explain the academic aspects of the program. Dr. Perri outlined the public need, the workforce needs, and the research opportunities for the state of Florida.

Chair Duncan clarified budget estimates and noted the letters of support from USF, FIU, and FAMU. Chair Duncan asked if there were any comments or questions. Governor Martin sought clarification on workforce demands both within Florida and nationally. Dr. Cynthia Hughes-Harris, Provost and Vice President for Academic Affairs at FAMU, spoke on the overlap and the opportunity for collaboration among similar programs within the state university system.

Chair Duncan asked for a motion to approve the Ph.D. in Public Health at UF. The motion was seconded and the members of the Committee concurred.

b) Limited Access for BA/BS in Entrepreneurship (University of South Florida - St. Petersburg)

Governor Marshall asked for a motion to approve the Limited Access program. Chair Duncan clarified for the committee the motion is for the approval of Limited Access for the USF - St. Petersburg program since the campus is separately accredited. Chair Duncan asked if there were any comments or questions. Seeing none, the motion was seconded and the members of the Committee concurred.

4. System Coordination of Academic Programming

Chair Duncan introduced Dr. Ralph Wilcox, Executive Vice President and Provost at the University of South Florida. Dr. Wilcox noted the collaboration of the Ad Hoc Committee with Board of Governors staff and members of the Council of Academic Vice Presidents (CAVP) to analyze and report on degree productivity and collaboration. Dr. Wilcox described the thresholds utilized to determine degree productivity in the systematic annual review process. Programs that fall short of the threshold shall be placed in one of five categories: continuation, explore new collaborations in joint delivery, other corrective action, place in inactive status, or terminate the program. Chair Duncan commented on the importance of using the information in a positive manner.

5. Student Affairs Reports/Updates:

a) SUS Council for Student Affairs

Chair Duncan asked Dr. Ehasz to update the Committee on the activities of the SUS Council for Student Affairs. Dr. Ehasz stated the SUS Workgroup on Student Health Insurance Purchasing Consortium, under the leadership of Dr. Mike Rollo, VP for Student Affairs at FGCU, is in the process of refining quotes from two carriers, with an agreement implementation date is Fall 2011, and hope to have a full report of the results at the March 2012 meeting.

Dr. Ehasz noted the quick response of the SUS institutions in regard to recent social media events and the shooting in Arizona. Dr. Ehasz assured the members that the SUS campuses are prepared for such events and offered to present additional information to the committee upon request.

b) Florida Student Association (FSA)

Co-Chair Franklin updated the Committee on the FSA and reported on the January FSA meeting. Co-Chair Franklin discussed plans for FSA television commercials for the legislative session. Co-Chair Franklin noted the "Rally in Tally" will take place in Tallahassee on March 22 after meeting with key stakeholders in state government. The next FSA meeting will be at FCGU on January 29, 2011.

Co-Chair Franklin stated the FSA is currently looking at the need for additional student life facilities across the SUS. Co-Chair Franklin discussed the CITF and how the FSA is exploring ways to utilize it to create opportunities for student life facilities expansion.

6. Distance Learning Workshop Update

Chair Duncan discussed the upcoming March 2011 Distance Learning Workshop and the importance for full participation. Chair Duncan stated the workshop will include the formulation of common definitions for distance learning, overview of models currently used within the state, identifying best practices and strategies for quality assurance. Chair Duncan questioned the challenges and opportunities when formulating policy in regard to distance learning.

7. Adjournment

Chair Duncan thanked the Committee for their work and having no further business adjourned the meeting at 10:00 a.m.

STATE UNIVERSITY SYSTEM OF FLORIDA
BOARD OF GOVERNORS
Academic and Student Affairs Committee
June 23, 2011

SUBJECT: Ph.D. in Materials Science and Engineering (CIP 40.1001) at Florida State University

PROPOSED COMMITTEE ACTION

Consider approval of the Doctor of Philosophy (Ph.D.) in Materials Science and Engineering at Florida State University, CIP Code 40.1001.

AUTHORITY FOR BOARD OF GOVERNORS ACTION

Section 7(d), Art. IX, Florida Constitution
Board of Governors Regulation 8.011

BACKGROUND INFORMATION

Florida State University (FSU) is proposing to offer an interdisciplinary Doctor of Philosophy in Materials Science and Engineering (MS&E) degree program. This field involves the study of relationships among the processing, structure, properties, and performance of materials. The program will be administered by the Graduate School on behalf of nine departments and will require a minimum of 54 post-baccalaureate credits, including at least 27 credits of letter-graded courses and at least 24 credits of dissertation research. The nine affiliated departments that will support the program are Biological Science, Chemistry and Biochemistry, Physics, and Scientific Computing within the College of Arts and Sciences, as well as Chemical and Biomedical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Industrial and Manufacturing Engineering, and Mechanical Engineering within the FAMU/FSU College of Engineering. Although this will not be a joint FAMU/FSU program under the College of Engineering, FAMU faculty will have opportunities to participate in teaching and research related to the program.

The FSU Board of Trustees approved the program on March 14, 2011. If the proposal is approved by the Board of Governors, FSU will implement the program in Fall 2011.

Supporting Documentation Included: Staff Analysis

Facilitators/Presenters: FSU Representatives

**BOARD OF GOVERNORS
STATE UNIVERSITY SYSTEM OF FLORIDA
NEW DOCTORAL DEGREE PROPOSAL STAFF ANALYSIS**

Program: Ph.D. in Materials Science and Engineering **CIP Code:** 40.1001
Institution: Florida State University **Proposed Implementation Date:** Fall 2011
Staffed By: Lynda Page, Richard Stevens **Initial Review Date:** 04/29/11 **Last Update:** 05/16/11

Estimated Costs:

	Total	% & \$ Current Reallocated	% & \$ New Recurring	% & \$ New Non- Recurring	% & \$ C&G	Cost per FTE	SUS 09-10 Average Cost per FTE
Year 1	\$460,185	85% \$390,375	0% \$0	0% \$0	15% \$69,810	\$72,292	\$23,267 14 CIP
Year 5	\$2,785,415	39% \$1,078,807	0% \$0	0% \$0	61% \$1,706,608	\$27,876	\$27,711 40 CIP

Projected FTE and Headcount are:

	Student Headcount	Student FTE
First Year	6	5.4
Second Year	14	12.6
Third Year	23	20.7
Fourth Year	33	29.7
Fifth Year	43	38.7

On March 29, 2007, the Florida Board of Governors approved Regulation 8.011, which sets forth criteria for authorization and implementation of new doctoral programs by the Board of Governors, as well as criteria for authorization and implementation of bachelor's, master's, and specialist degrees by boards of trustees. The following staff analysis is an assessment of how well the university meets Board of Governors Accountability and Readiness criteria for implementation of this degree program.

Proposal Page Numbers:

INTRODUCTION		ACCOUNTABILITY		READINESS				
Program Description	System Analysis	Overall	Budget	Mission and Strength	Program Quality	Curriculum	Faculty	Resources
8	9	10	23	31	37	37	48	57

A. Program Description:

Florida State University is proposing to offer an interdisciplinary Doctor of Philosophy in Materials Science and Engineering (MS&E) degree program. This field involves the study of relationships among the processing, structure, properties, and performance of materials. The program will be administered by the Graduate School and will involve a minimum of 54 post-baccalaureate credits, including at least 27 credits of letter-graded courses and at least 24 credits of dissertation research. Utilizing faculty members spanning nine departments that are spread across two colleges, the University anticipates that the interdisciplinary approach will position students to work and conduct world-class research on materials. The nine affiliated departments are Biological Science, Chemistry and Biochemistry, Physics, and Scientific Computing within the College of Arts and Sciences, as well as Chemical and Biomedical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Industrial and Manufacturing Engineering, and Mechanical Engineering within the FAMU/FSU College of Engineering.

The program is designed so that students may complete both the course work and dissertation in five years. It includes check points of passing a written qualifying exam and the presentation and defending of a prospectus. Throughout the program, students will have the opportunity to participate in the interdisciplinary seminar series designed for students to obtain information on advances in materials research. The seminar series will involve presentations from visiting scientists and from MS&E faculty.

According to the proposal, the program will emphasize research and anticipates supporting research assistants through research grants. Current faculty have been very successful in obtaining outside research grants from federal and private agencies such as the National Science Foundation, Department of Defense agencies, NASA, National Institutes of Health, and others. This research focus should prepare graduates of the program for cutting-edge innovation as they move into the MS&E area as professionals.

B. System-Level Analysis and Evaluation in accordance with Board of Governors Regulation 8.011:

Florida State University believes that the proposed program addresses the four State University System Strategic Planning Goals, positioning its graduates to assist in the development of a "New Florida." MS&E is found within the science, technology, engineering, and mathematics (STEM) area of focus and will help to produce a high-skilled workforce in these critical areas. The program will also assist in meeting the FSU mission statement for "promoting excellence in graduate education and research and encouraging the dissemination and transfer of knowledge by providing broad access to institutional resources and services to the community and to the State." The proposed program falls within the STEM Area of Programmatic Strategic Emphasis as

adopted into the Board of Governors 2005-2013 Strategic Plan and updated in November 2008. It is also aligned with strategic guidance provided in the plan for the development of new doctoral programs in research with regard to being aligned with the University and System missions and being in a targeted discipline.

A strong argument of need is made for the program based upon economic development goals of the state. By building upon an active research-based faculty and resources already in place, the program will be able to assist in meeting the increased demand for materials scientists and will assist in bringing industry into the Northwest region. This region, one of the 10 included in the Enterprise Florida Roadmap, has an urgent need for high-tech companies and jobs.

The proposal further provides that the Bureau of Labor Statistics states in its *Occupational Outlook Handbook, 2010-11 Edition*, that "...the employment of materials scientists is projected to grow by 12 percent as manufacturers seek to improve the quality of their products by using new materials and manufacturing processes." The University points to key economic sectors in the state, such as aerospace, defense, marine, and space, found to employ materials scientists. It is reported that several faculty members working closely with colleagues in military research located in the panhandle have learned that defense labs have been directed to increase the number of Ph.D.-level researchers, including materials scientists. The implementation of the proposed program will address an employment need in the community while increasing the opportunity for students to seek a Ph.D. in the area. Having the support of the three universities currently offering a Ph.D. in Material Science (i.e., University of Florida, University of Central Florida, and Florida International University) and Florida A&M University, their partner in the joint FAMU-FSU College of Engineering, the University proposes a program that will meet the needs of their students and community.

The program duplicates existing doctoral level MS&E programs at the University of Florida, University of Central Florida, and Florida International University. Materials science programs are interdisciplinary by nature, typically relying on the research strengths of affiliated departments. The proposed FSU program would follow a different administrative model than others in the state by being housed within the Graduate School rather than within a single department, with leadership rotating among affiliated departments. This model is similar to the model that was used when FSU implemented its program in computational science within an interdisciplinary center.

The proposal makes a strong argument for implementing the degree based upon existing faculty and research resources already in place within other programs. However, it should be noted that four of the nine affiliated programs are relatively new, and three of the older programs have experienced low enrollment and degree

productivity in the past five years. The question that might be asked of FSU is whether the proposed MS&E program may weaken these programs by reallocating resources or strengthens these programs through gained efficiencies in faculty effort.

As illustrated in the following tables, enrollment in the State University System’s existing doctoral materials science and engineering programs has shown some decline over the past four years, and it would appear that implementation of the FIU program in 2007 may have had a marginal impact on enrollments at UF and UCF. However, degree production does not appear to have been significantly affected at existing programs when FIU implemented its program, but this may be a result of prior enrollees finishing their dissertations. Beginning on page 13, the proposal provides a comparison of the proposed program with existing programs, identifying gaps and overlap in areas of concentration. FSU has gathered letters of support for the proposed program from the universities with the three existing programs; copies of these letters can be found in Appendix C.

Materials Science and Engineering Doctoral Enrollments

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
FIU	0	0	0	0	0	0	2	2	9	22
UCF	13	16	21	38	39	36	42	35	37	29
UF	116	146	146	140	132	132	150	145	122	106
Total	129	162	167	178	171	168	194	182	168	157

SOURCE: Board of Governors Online Interactive Data Tool

Materials Science and Engineering Doctoral Degrees

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
FIU	0	0	0	0	0	0	0	0	3	1
UCF	1	6	3	3	1	6	5	6	8	7
UF	25	20	16	35	43	35	19	26	40	43
Total	26	26	19	38	44	41	24	32	51	51

SOURCE: Board of Governors Online Interactive Data Tool

C. Assessment of the University Review Process in accordance with Board of Governors Regulation 8.011:

Due to the system of stair-step accountability set in place by the Board of Governors in Regulation 8.011, it is now incumbent upon university boards of trustees to verify that all doctoral programs coming before the Board of Governors have met the requirements of the regulation. The following is an assessment of the university review process to ensure that all criteria set forth have been considered by the university prior to submission to the Board of Governors office.

ACCOUNTABILITY

Check 'yes' or 'no' box, and make comments beneath each criterion, as appropriate.

1. *Overall* – *The proposal is in the correct format, includes all necessary signatures, and contains complete and accurate tables for enrollment projections, faculty effort, and the proposed budget.*

YES NO

- The proposal has been approved by the university board of trustees and includes all required signatures.**

The FSU Board of Trustees approved the proposal at their meeting on March 4, 2011. A signature coversheet with all required signatures is provided.

- The university has provided a proposal written in the standard SUS format which addresses new academic program approval criteria outlined in Board of Governors Regulation 8.011.**

The proposal is written in the standard SUS format, addressing the required academic program approval criteria.

- The university has provided complete and accurate projected enrollment, faculty effort, and budget tables that are in alignment with each other.**

All tables are added correctly and correlate with each other.

- The university has included a statement in the proposal signed by the equity officer as to how this proposal will meet the goals of the university's equity accountability plan.**

The proposal notes that the program anticipates actively recruiting students from FAMU in science and mathematics, plus FAMU engineering students in the FAMU-FSU College of Engineering. It also specifies that faculty members will be encouraged to have minority students in the Research Experiences for Undergraduates summer internship programs at the National High Magnetic Field Laboratory at FSU to get first-hand research experiences on materials.

A letter of support is provided from Dr. Cynthia Hughes-Harris, FAMU Provost and Vice President for Academic Affairs; however, she does note that FAMU would not want the initiation of the FSU program to preclude FAMU from initiating its own future MS and Ph.D. program in Materials Science in niche areas that do not duplicate the FSU research efforts.

2. Budget – *The proposal presents a complete and realistic budget for the program consistent with university and Board of Governors policy, and shows that any redirection of funding will not have an unjustified negative impact on other needed programs.*

YES NO

The University Board of Trustees has approved the most recent budget for this proposal.

Budget tables were included in the proposal approved by the University Board of Trustees.

The university has reviewed the budget for the program to ensure that it is complete and reasonable, and the budget appears in alignment with expenditures by similar programs at other SUS institutions.

The projected cost per FTE is slightly higher than the State University System average for doctoral Engineering, totaling \$27,876 per student FTE in Year Five versus the \$27,711 SUS average for 2009-10. However, the System average is calculated at the two-digit CIP Code level across all universities and programs, so it cannot be considered anything more than a “ballpark” estimate for what a new program should cost.

In the event that resources within the institution are redirected to support the new program, the university has identified this redirection and determined that it will not have a negative impact on undergraduate education, or the university has provided a reasonable explanation for any impact of this redirection.

As an interdepartmentally administered program, the program will be supported by some reallocation of resources, but it is expected that graduate students in this program will also provide instructional and research resources back to the affiliate programs.

READINESS

Check ‘yes’ or ‘no’ box, and make comments beneath each criterion, as appropriate.

3. Program Quality – *The proposal provides evidence that the university planning activities have been sufficient and responses to any recommendations to program reviews or accreditation activities in the discipline pertinent to the proposed program have been addressed.*

YES NO

The university has followed a collaborative planning process for the proposed program in accordance with policies and procedures adopted by the University Board of Trustees.

The proposal provides a timeline that shows initial discussions about the possibility of establishing a Ph.D. program in MS&E beginning in 2006. The interdisciplinary Master of Science in Materials Science was developed first. Extensive interdepartmental planning has since taken place, especially after 2009. The process also included communication with other state university MS&E programs, along with consideration of the involvement of FAMU students.

- An external consultant has reviewed the proposal and supports the department's capability of successfully implementing this new program.**

Dr. John D. Wiley, Chancellor Emeritus of the University of Wisconsin-Madison, reviewed the university proposal in order to judge compliance with the Board of Governors' new degree criteria. He notes that the interdepartmental, inter-college model that is proposed has been successfully implemented at other institutions, including Wisconsin. Additionally, he notes that because of the quality and quantity of excellent materials science research at FSU, the approval and implementation of the proposal "would almost immediately vault FSU into the very top ranks of Materials Science and Engineering PhD programs nationally."

- The university has found the level of progress that the department has made in implementing the recommendations from program reviews or accreditation activities in the discipline pertinent to the proposed program to be satisfactory.**

The proposal responds as N/A to this section. This response may be due to the fact that the Master of Science in Material Science was newly approved in 2008 and will not come up for a Quality Enhancement Review until 2018 – 2019. However, as an interdisciplinary program, it would seem reasonable that there would be reviews associated with the affiliated departments.

- The university has analyzed the feasibility of providing all or a portion of the proposed program through distance learning.**

The university indicates that the MS&E courses will be delivered on campus using traditional delivery methods. The research lab nature of this program does not readily lend itself to coursework being provided via distance learning.

- If necessary, the university has made allowances for licensure and legislative approval to be obtained in a timely manner.**

Legislative approval is no longer necessary and would not have applied to this particular program.

4. Curriculum - The proposal provides evidence that the university has evaluated the proposed curriculum and found that it describes an appropriate and sequenced course of study, and that the university has evaluated the appropriateness of specialized accreditation for the program.

YES NO

- The university has reviewed the curriculum and found that the course of study presented is appropriate to meet specific learning outcomes and industry driven competencies discussed in the proposal.**

The University includes the specific learning outcomes for the program that tie back to student performance in core courses. It includes a detailed outline of degree program expectations along with a thorough description of the fundamental core courses of the program. Additionally, there are shorter descriptions of elective specialization courses included in the proposal.

The proposal notes that the program is a research-oriented degree program. The students will be supported on faculty members' research grants that add significant, cutting-edge research in areas important to the industry.

- The university anticipates seeking accreditation for the proposed program, or provides a reasonable explanation as to why accreditation is not being sought.**

The university notes that Materials Science and Engineering is accredited at the undergraduate level by the Accreditation Board for Engineering and Technology; however, there is no agency or society that accredits such programs at the M.S. and Ph.D. level.

5. Faculty – The proposal provides evidence that the university is prepared to ensure a critical mass of faculty will be available to initiate the program based on estimated enrollments, and that faculty in the aggregate have the necessary experience and research activity to sustain a doctoral program.

YES NO

- The university has reviewed the evidence provided and found that there is a critical mass of faculty available to initiate the program based on estimated enrollments.**

No new faculty will be hired in the establishment of the degree program. The workload for the program will be spread among 26 current faculty members found among 9 different departments.

- The university has reviewed the evidence provided and found that the faculty in aggregate has the necessary experience and research activity to sustain the program.**

The consultant notes that "...FSU already has a strong materials science and engineering faculty. They simply need authority to name the degree appropriately, in a way that is recognized by potential faculty, students, and recruiters." Many of the faculty members are already involved in teaching graduate level MS&E coursework through the master's program.

- The university has reviewed the evidence provided and found the academic unit(s) associated with this new degree to be productive in teaching, research, and service.**

The proposal provides evidence that the faculty members bring with them an extensive breadth of experience in publications, funded research, and direction of student research. Only seven of the 26 are noted as not having previously directed student research. All have experience with being published and actively pursue grants. The group totals more than 31 million dollars in externally-funded grants received 2005 through 2010.

- If appropriate, the university has committed to hiring additional faculty in later years, based on estimated enrollments.**

No new faculty will be hired through Year Five with the establishment of the proposed program. Faculty will, however, have an increased workload by that year. Funding for the faculty is based on reallocated funds and contracts and grants. The University notes that there will be no change in any department budget or the budgets of the College of Arts and Science or College of Engineering due to the reallocation.

6. Resources – The proposal provides evidence that the university has ensured the available library volumes and serials; classroom, teaching laboratory, research laboratory, office space, equipment, clinical and internship sites, fellowships, scholarships, and graduate assistantships will be sufficient to initiate the program, and that if applicable, funding has been secured to make more resources available as students proceed through the program.

YES NO

- The university has provided a signed statement from the Library Director verifying that the library volumes and serials available are sufficient to initiate the program.**

The University's extensive collection that already supports the nine departments involved with the proposed interdisciplinary program will be available to the MS&E

students. The University notes that an expansion of statewide electronic journal packages will be provide additional science journal content.

- The university has ensured that the physical space necessary for the proposed program, including classrooms, laboratories and office space, is sufficient to initiate the program.**

The Ph.D. program will be supported by current classroom and laboratory space spread throughout campus in buildings supporting the faculty from the nine different departments. Students will be provided with office space by their advisor's home department.

- The university has ensured that necessary equipment is available to initiate the program.**

The MS&E faculty members already have their own research equipment. FSU has previously invested in shared equipment for materials research. There is no need for additional specialized equipment.

- The university has ensured that fellowships, scholarships, and graduate assistantships are sufficient to initiate the program.**

The proposal notes that the institution will start with the provision of six full fellowships (\$20,000 each for the academic year) plus tuition waivers for first-year students. Already successful in obtaining outside research grants, MS&E will be actively seeking funds to support fellowships and research assistantships. Faculty members have a history of receiving outside research grants from a variety of federal and private agencies.

- If applicable, the university has ensured that the department has arranged a suitable number of clinical and internship sites.**

Although the program does not include clinical or internship experiences, it does include the opportunity for students to work with faculty members utilizing state-of-the-art resources while conducting cutting-edge research as identified by the scientific community.



11 APR 20 AM 11:07

MEMORANDUM

To: Vice Chancellor Dorothy Minear

From: Robert B. Bradley *RBB*

Re: New Degree Program - Ph. D. in Materials Science and Engineering

Date: April 5, 2011

At its March 4th, 2011 meeting, the Florida State University Board of Trustees authorized me to send this proposal for a new doctoral degree, the Ph. D. in Materials Science and Engineering, for Board of Governors review. I have enclosed a copy of the relevant Board of Trustees agenda item, notification of the Trustees' action, letters of support from other universities, the external reviewer's report, information regarding the external reviewer selection process, and a copy of the degree proposal.

Thank you for your assistance in this process; please let me know if you need additional information.

cc: President Eric Barron
Chairman Andy Haggard
Dr. Richard Stevens
Dean Anne Rowe
File Copy

enclosures

RBB/cd

Florida Board of Governors

Request to Offer a New Degree Program: Doctor of Philosophy in Materials Science and Engineering at Florida State University

<u>Florida State University</u> University Submitting Proposal	<u>Fall 2011</u> Proposed Implementation Date
<u>Graduate School</u> Name of College or School	<u>None</u> Department(s)
<u>Materials Science and Engineering</u> Academic Specialty or Field	<u>Doctor of Philosophy in Materials Science & Engineering (40.1001)</u> Complete Name of Degree (Include CIP code)

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

3-14-11
Date Approved by the University Board of Trustees

Eric B... 3-14-11
President Date

[Signature]
Signature of Chair, Board of Trustees

Robert B. Bradley 2-25-11
Vice President for Academic Affairs Date

Provide headcount (HC) and full-time equivalent (FTE) student estimates for Yrs 1 through 5. HC and FTE estimates should be identical to those in Table 1. Indicate program costs for Years 1 and 5 of implementation as shown in the appropriate columns in Table 2. Calculate an Educational and General (E&G) cost per FTE for Yrs 1 & 5 (Total E&G divided by FTE).

Implementation Timeframe	Projected Student Enrollment (From Table 1)	
	HC	FTE
Year 1	6	5.4
Year 2	14	12.6
Year 3	23	20.7
Year 4	33	29.7
Year 5	43	38.7

Projected Program Costs (From Table 2)		
Total E&G Funding	Contract & Grants Funding	E&G Cost per FTE
\$390,375	\$69,810	\$72,292
\$1,078,807	\$1,706,608	\$27,876

Rationale and Executive Summary

This is a proposal to create an interdisciplinary Doctor of Philosophy in Materials Science and Engineering (MS&E) program at the Florida State University that will be administered by the Graduate School. The MS&E program will begin with faculty members whose tenure homes span nine departments currently spread across two colleges. This Ph.D. program builds on the recently created interdisciplinary Master of Science in Materials Science program that started in 2008.

Materials science and engineering is a broad-reaching and interdisciplinary field, where gigabyte memory sticks, human joint replacements, lightweight and smart prostheses, touch screen cell phones, and the advanced composites (more than 50% by weight) in the new generation of commercial jet airliners are all or in part the results of MS&E. Materials science involves the relationships between the processing, structure, properties, and performance of materials. MS&E graduates develop or synthesize new materials and create new products or systems using existing materials. Fundamental to MS&E is the design and simulation of the properties of new and existing materials through advanced computational methods. There is an inter-weaving of basic and applied experiences that creates a unique skill set that allows graduates to successfully pursue the frontiers of MS&E research.

This program advances the State and Federal calls to increase competence in science, technology, engineering, and math (STEM) in upcoming generations, and to promote interdisciplinary approaches to solving fundamental problems in a global environment. FSU is situated in the "Northwest Region" in the I-10 transportation corridor, one of the 10 regions that comprise the Enterprise Florida Roadmap demographics¹. In this region, there are urgent needs and a strong push to create high-tech companies and jobs. MS&E can play a critical role in these. In addition, there are a number of federal research laboratories in the region including Eglin and Tyndall AFBs, the Naval Surface Warfare Center, and the Naval Air Station Pensacola that need new and well trained doctoral graduates to replace the retiring employees in the MS&E field. The program, through the many faculty, departments, centers, and facilities that will comprise its core, addresses many of the Roadmap priorities. Specifically, students will be exposed to or can contribute to university start-ups, advanced manufacturing, aviation and aerospace, energy, multidisciplinary research, STEM pipelines, alignment with industry, expansion of academic R&D, World Class Scholars, Centers of Excellence, development of universities as Best-in Class, Federal facilities, and the culture of commercialization.

FSU has made significant investments to create a materials-oriented environment that is ready to fully support an interdisciplinary MS&E Ph.D. program. These investments include state-of-the-art atomic resolution transmission electron microscopy (TEM) instruments and laboratories, high performance computing capabilities for modeling and

¹ *Enterprise Florida's Roadmap To Florida's Future, 2010-2015 Strategic Plan for Economic Development, eflorida.com/roadmap*

simulation, and establishing two materials-related Faculty Cluster Hires in (1) Growth, Processing and Characterization of Advanced Materials and in (2) the Integrative NanoSciences Institute. To date, these Clusters have recruited 8 new faculty members (4 in the Engineering and 4 in Arts and Sciences) with tenure homes in 5 different Departments. An additional 4 to 6 hires are planned in the future. Moreover, in the past few years, four new major institutes and centers have been created in one newly-renovated and three new buildings that were purpose made for these entities. These institutes and centers, all of which are connected with materials research, are: the Center for Applied Power Systems, the Applied Superconductivity Center, the High-Performance Materials Institute, and the Florida Center for Advanced Aero-Propulsion. The Department of Scientific Computing has materials science faculty who bridge theory with the real world through advanced computational techniques.

The core faculty members named in this proposal do materials research and actively participate in the new Master of Science program. They have successful, on-going research programs investigating materials, having brought in more than \$31M in materials-related contracts and grants since 2005.

Three universities in Florida offer Ph.D. degrees in MS&E: the University of Florida, the University of Central Florida, and Florida International University. As shown in the body of the proposal, the main research interests of the FSU MS&E faculty members are unique to FSU, and complementary to research areas in the three existing programs. Support letters for the program from these three schools, plus a support letter from FAMU, which is interested in programs that may potentially impact its engineering faculty members, are included as appendices.

Three important reasons to create this program are to be able to recruit students whose primary interest is to earn a Ph.D. in materials science and engineering, to educate these students in a broad, interdisciplinary environment, and to better leverage educational and research resources in multiple units across campus. At present, there is no Ph.D. degree *per se* in MS&E at FSU, and in particular, no departmental curriculum that provides a route to a core competence in MS&E. Although some departments have expanded their doctoral curricula to address materials related areas, there is a need to provide a broader educational experience for MS&E students at the inter-college level.

This interdisciplinary program, which will be administered by the Graduate School, is designed to avoid departmentalizing the program (Fig. 1). It will begin with faculty members with tenure homes in 9 departments across two colleges but is designed to easily incorporate faculty members from other departments and colleges. The initial faculty members come from Biological Science, Chemistry and Biochemistry, Physics, and Scientific Computing in the College of Arts and Sciences, plus Chemical and Biomedical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Industrial and Manufacturing Engineering, and Mechanical Engineering in the College of Engineering.

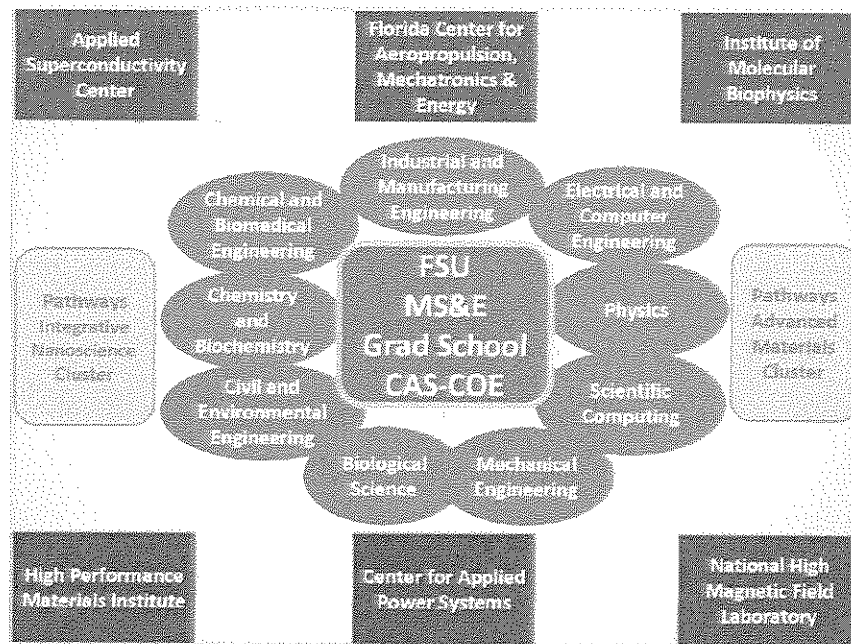


Fig. 1. Overview of the institutional structure of MS&E. The center crimson rectangle shows the Graduate School that will administer the program. The blue ovals are the academic departments in which MS&E faculty members have their tenure homes. The crimson rectangles along the edges are the centers, laboratories, and institutes. The gold rectangles are the Pathways Clusters.

In their first year, students will gain a firm basis in the fundamentals of MS&E through a series of complementary core courses taught by faculty members from different departments and through the weekly Interdisciplinary Seminar Series (ISS). In the ISS students will gain exposure to both FSU and external researchers working in the area of MS&E, they will learn presentation skills and present their own research in ISS, and outside speakers will be brought in to talk on business related topics such as entrepreneurship and how to bring research ideas to market. The ISS will also serve as a forum for MS&E faculty members who wish to recruit MS&E students.

Creating the MS&E Ph.D. program has many benefits. It will produce more engineers for the State; it will significantly contribute to research, economic development and job creation in the Panhandle area – in Feb. 2011 Bing Energy announced it will move from California to Tallahassee where it will manufacture commercial fuel cells using advanced technology developed and patented by faculty members in the MS&E Ph.D. program; it will help FSU gain ground on the AAU frontier; and it will better position FSU in the area of materials science and engineering in terms of federal research grants, particularly large-scale, interdisciplinary grants. It builds on the sizable investments FSU has already made in MS&E, it is composed of faculty members who are currently at FSU, it augments the existing M.S. program in materials science allowing students to pursue a Ph.D. in MS&E, it provides a means for FSU faculty members to recruit students who are primarily interested in studying MS&E, it provides a way to educate and train these students in a broad, interdisciplinary manner, it is relatively inexpensive to implement, and its graduates will benefit the State and the Nation.

TABLE OF CONTENTS

INTRODUCTION 8

I. Program Description and Relationship to System-Level Goals 8

A. Briefly describe within a few paragraphs the degree program under consideration, 8

B. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which goals the program will directly support and which goals the program will indirectly support. 9

INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY 10

II. Need and Demand 10

A. Need: Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level. 10

B. Demand: Describe data that support the assumption that students will enroll in the proposed program. 13

C. If similar programs (either private or public) exist in the state, identify the institution(s) and geographic location(s). 13

D. Use Table 1 (A for undergraduate and B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources. 20

E. Indicate what steps will be taken to achieve a diverse student body in this program, and identify any minority groups that will be favorably or unfavorably impacted. 22

III. Budget 23

A. Use Table 2 to display projected costs and associated funding sources for Year 1 and Year 5 of program operation. Use Table 3 to show how existing E&G funds will be shifted to support the new program in Year 1. 23

B. If other programs will be impacted by a reallocation of resources for the proposed program, identify the program and provide a justification for reallocating resources. 26

C. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside the proposed major). . 27

D. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental entities, etc.). 28

IV. Projected Benefit of the Program to the University, Local Community, and State 28

Use information from Table 1, Table 2, and the supporting narrative for “Need and Demand” to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. 28

V. Access and Articulation – Bachelor’s Degrees Only.....	31
INSTITUTIONAL READINESS	31
VI. Related Institutional Mission and Strength	31
A. Describe how the goals of the proposed program relate to the institutional mission statement as contained in the SUS Strategic Plan and the University Strategic Plan.	31
B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.	32
C. Provide a narrative of the planning process leading up to submission of this proposal.	35
VII. Program Quality Indicators - Reviews and Accreditation.....	37
Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit.....	37
VIII. Curriculum.....	37
A. Describe the specific expected student learning outcomes associated with the proposed program.	37
B. Describe the admission standards and graduation requirements for the program.	38
C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements.....	40
D. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.	44
E. Provide a one- or two-sentence description of each required or elective course.	44
F. For degree programs in the science and technology disciplines, discuss how industry-driven competencies were identified and incorporated into the curriculum and identify if any industry advisory council exists to provide input for curriculum development and student assessment.....	47
G. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program.....	48
H. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor’s or master’s programs associated with the proposed program.	48
I. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs).	48
IX. Faculty Participation.....	48
A. Use Table 4 to identify existing and anticipated ranked (not visiting or adjunct) faculty who will participate in the proposed program through Yr 5.	48

B. Use Table 2 to display the costs and associated funding resources for existing and anticipated ranked faculty (as identified in Table 4).	52
C. Provide the number of master's theses and/or doctoral dissertations directed, and the number and type of professional publications for each existing faculty member (do not include information for visiting or adjunct faculty).	52
D. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service.	57
X. Non-Faculty Resources	57
A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5.	57
B. Describe additional library resources that are needed to implement and/or sustain the program through Year 5.	59
C. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.	59
D. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5.	59
E. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.	60
F. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5.	60
G. Describe any additional special categories of resources needed to implement the program through Year 5.	60
H. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5.	61
I. Describe currently available sites for internship and practicum experiences, if appropriate to the program.	61
J. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list.	61
Appendix A –Abbreviations used in the body of the proposal	62
Appendix B - Partial list of equipment available for materials science research	63
Appendix C – Support letters	65
Appendix D – External review of the proposal by John Wiley	69

Proposal for a Doctor of Philosophy in Materials Science and Engineering at Florida State University

INTRODUCTION

Note: Appendix A is a list of abbreviations we use in the proposal.

I. Program Description and Relationship to System-Level Goals

- A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.**

We propose an interdisciplinary Doctor of Philosophy in Materials Science and Engineering (MS&E). The proposed Ph.D. program goals are to educate students in the broad field of materials science and engineering through an interdisciplinary approach where they are taught by faculty members with a variety of backgrounds from different departments and colleges. It will train students to conduct world-class research on materials and provide the students the opportunity to acquire professional written and oral communication skills.

The interdisciplinary MS&E program will be administered by the Graduate School to provide balanced access to, and investment in, the program throughout various colleges and departments. MS&E will begin with faculty members with tenure homes in nine departments (Biological Science, Chemical and Biomedical Engineering, Chemistry and Biochemistry, Civil and Environmental Engineering, Electrical and Computer Engineering, Industrial and Manufacturing Engineering, Mechanical Engineering, Physics, and Scientific Computing) spanning two colleges (Arts and Sciences, and Engineering). In the future MS&E can expand to include faculty members who do materials related research in other departments and colleges.

The MS&E Ph.D. program will require a minimum of 54 credit hours beyond the bachelor's degree.

The program will emphasize research in materials science and engineering. Materials science and engineering has an enormous impact on modern society. Discoveries and advances in materials are helping shape modern life. For instance, materials scientists at Intel convert silicon wafers into the integrated circuits that are the heart of all new consumer electronic devices; Boeing and Airbus's newest planes are lighter and more fuel efficient because they have replaced aluminum components that were designed by materials scientists decades ago, with new, lighter and stronger carbon-fiber composites; and the superconducting magnets that are crucial for MRI scanners were developed by materials scientists. Our MS&E graduates will be employed doing research and

development in the manufacturing industry, research in industrial and federal/national research laboratories, and teaching and research in academia. Some well-known companies in which materials scientists play key roles include 3M, Alcoa, Boeing, Cummins, DuPont, Exxon Mobil, General Dynamics, GE, General Motors, HP, IBM, Intel, Lockheed Martin, Motorola, and Xerox.

The Program Directorship will rotate on a regular basis. The Director, chosen from the participating faculty members in the MS&E program, approved by the deans of participating colleges, and appointed by the Dean of the Graduate School, will oversee the program with input from an executive committee. This committee, called the Governing Executive Committee, will be formed with representation from all participating colleges/departments in which MS&E faculty members have tenure homes. Any faculty member at FSU who does research in materials science can apply to be an MS&E faculty member and advise MS&E Ph.D. students. FAMU faculty members with an appointment in the FAMU-FSU College of Engineering and who do materials research will be eligible to be a member of MS&E and co-advise MS&E Ph.D. students.

B. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which goals the program will directly support and which goals the program will indirectly support.

(See the SUS Strategic Plan at <http://www.flbog.org/StrategicResources/>)

MS&E directly addresses several of the SUS Strategic Planning Goals, including:

- I.A.4 Access to and production of degrees – emerging technologies doctoral degrees;
- I.B.3.a Meeting statewide professional and workforce needs – Economic development;
- I.C. Building world-class academic programs and research capacity;
- I.D. Meeting community needs and fulfilling unique institutional responsibilities.

As the Board of Governors notes in its *“New Florida” Initiative* in January 2010, Florida’s future depends on developing a knowledge and innovation economy that is built on high-technology, high-wage jobs in the fields of science, technology, engineering and mathematics (or “STEM”). Building this new economy requires new talent, so we need to increase the percentage of Floridians who have advanced degrees in these critical fields. In the *2010-2015 Roadmap* developed by Enterprise Florida¹, it is stressed that the key to Florida’s future economic growth is to expand and transform foundational industry clusters (e.g., Advanced Manufacturing, Marine and Space), expand existing industry clusters (e.g., Aviation and Aerospace, Clean Energy and Life Science) and develop new clusters (e.g., Nanotechnology). MS&E plays a key role, as it is related to almost all of these fields critical to Florida’s economic growth. A new Ph.D. program in MS&E will help the State achieve its goals by producing more, high-skilled workforce in these critical fields.

FSU has made considerable recent investments hiring first-rate faculty members, acquiring research equipment, supporting research infrastructure, and building laboratories and new buildings to support research in materials science. With these resources, the new Ph.D. program will directly address SUS Goals by attracting students who will be educated in the STEM field of materials science and engineering and carry out world-class research in an interdisciplinary environment.

The new MS&E Ph.D. program will also directly address the FSU mission and goals defined in the University's mission statement (2005) for promoting excellence in graduate education and research and encouraging the dissemination and transfer of knowledge by providing broad access to institutional resources and services to the community and to the State. It will provide new opportunities for graduate education and research in the area of MS&E and offer technology transfer opportunities to industry in the State.

INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY

II. Need and Demand

A. Need: Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level.

Reference national, state, and/or local plans or reports that support the need for this program and requests for the proposed program which have emanated from a perceived need by agencies or industries in your service area. Cite any specific need for research and service that the program would fulfill.

The first materials science and engineering programs were created in the early 1960s, but the discipline is much older than that, having deep, broad roots in metallurgy and ceramics. Materials science and engineering has been a multi-disciplinary field since its inception, having merged metallurgy and ceramics, and included parts of other disciplines such as solid-state physics and polymers, and has incubated new fields such as nanotechnology. It bridges condensed matter physics, chemistry, the engineering disciplines, and most recently biology, and nanoscience and nanotechnology. Materials science experimental, computational, and theoretical research forms an important vehicle to create new materials and improve existing materials that underpin the development of new technologies in medicine, energy, transportation, electronics, communications, information, building, construction, homeland security and national defense. All major federal funding agencies, including the National Science Foundation, Department of Energy, Department of Defense, and National Institutes of Health, support large research programs in materials science and engineering. In the 2010 *U.S. News and World Report* rankings of America's Best Graduate Schools², 7 of the top 10 graduate programs in materials science and engineering are at state universities like FSU. Materials research and engineering are strong components at many AAU member universities.

² <http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-engineering-schools/material-engineering>

There is an increasing demand for materials scientists by high-technology industries including manufacturing, automotive, aerospace, catalysis, electronics, construction, medical science, and metal and mineral extraction. The Bureau of Labor Statistics states that "...the employment of materials scientists is projected to grow by 12 percent as manufacturers seek to improve the quality of their products by using new materials and manufacturing processes"³. Growth is expected to be particularly strong for materials scientists and engineers working on nanomaterials and biomaterials. Also, according to the Aerospace Industries Association, there will be a need for more people in the aerospace industries, including materials scientists, as baby boomers retire and the industry creates more advanced designs with greater capabilities and higher efficiencies.

Several faculty members in our recently created (Fall 2008) interdisciplinary Master of Science in Materials Science work closely with colleagues at the military research laboratories in the Panhandle. These faculty members have recently learned that these defense labs have been directed to increase the number of Ph.D. level researchers in the labs, including materials scientists.

Florida has strong national presence in key economic sectors such as aerospace, defense, marine and space. Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics – top aerospace/defense companies in the U.S. – all have substantial operations in Florida, and all employ materials scientists. New materials are key to advances in these industries, such as the carbon-fiber composites being used in military aircraft and the latest commercial Boeing and Air Bus planes.

Other large companies in Florida, such as Siemens Westinghouse Power Corp., employ materials scientists who improve the efficiency of power systems by incorporating new, higher-performance materials in advanced systems designs.

Enterprise Florida cites data from the Food and Drug Administration that "Florida has one of the country's largest medical device sectors, ranking 2nd in the U.S. for the number of FDA-registered medical device establishments." There are over 20,000 people in Florida who work in this sector. Advanced materials are critical to this industry sector⁴.

There are also many small companies in Florida that depend on advanced materials and employ Ph.D. materials scientists, including Quantachrome, Applicote, Semiconductor Diagnostics, Inc., nScript, Inc., and Fractal Systems, Inc.

In Feb. 2011 Bing Energy, a high-tech company that manufactures commercial fuel cells to generate electricity, announced it will move from California to Tallahassee. A key component of their fuel cells competitive advantage comes from a new electrode material that was developed and patented by FSU faculty members in the MS&E program. Bing

³ Bureau of Labor Statistics - *Occupational Outlook Handbook, 2010-11 Edition*

⁴ eFlorida - http://www.eflorida.com/Life_Sciences.aspx?id=220

Energy cited being close to the faculty members where the technology was developed as one of the reasons they decided to move their operations to Tallahassee.

The federal science and engineering (S&E) workforce is shrinking. For example, the Department of Defense S&E workforce declined from 45,000 to 28,000 in the decade between 1990 and 2000 and more will soon retire, many of them in areas related to materials science and engineering⁵. This is evidenced by the recent increasing recruitment effort for FSU doctoral graduates from some federal research laboratories. A unique feature of the proposed MS&E doctoral degree program is to address this critical issue by complementing existing work and needs of the federal research labs in the Florida panhandle (Tyndall and Eglin AFBs, the Naval Air Station Pensacola, and the Naval Surface Warfare Center) and beyond. Emphasis will be placed on DoD areas of current and future needs including advanced structural materials, nanomaterials, energy materials, multifunctional materials, and multiscale materials. Our goal is to enhance our nation's global leadership position in MS&E by training current and future federal employees (uniformed and civilian) to be world class leaders in areas of critical national needs, matching the core competencies available within the MS&E program at FSU. The students working at the federal labs will work on innovative research funded through the labs as their dissertation work. The new MS&E program will provide the flexibility in core course delivery to accommodate the targeted students' rigorous work environments.

On the national level, well-known companies in which materials scientists and engineers play key roles include 3M, Alcoa, Boeing, Cummins, DuPont, Exxon Mobil, General Dynamics, GE, General Motors, HP, IBM, Intel, Lockheed Martin, Motorola, and Xerox. The graduates from MS&E can also work in research and development in academia, national labs and industrial labs.

The increasing budget and scales of federal agencies' SBIR/STTR programs in MS&E fields have created and will continue to generate higher demand for the doctoral graduates in these fields. Recently, more and more doctoral graduates work for high-tech small businesses, with many of them taking leadership roles in those companies working on SBIR/STTR projects. The new Ph.D. program will help enhance the graduates' capabilities of running SBIR/STTR programs with the proposed interdisciplinary training programs, research experience with federal funded projects, and entrepreneurship/commercialization education/practice.

Recent placements of our own students indicate that the job-market for graduates in MS&E will be strong. Over the past few years, graduating Ph.D. students who worked with MS&E faculty members have been employed at Air Force Research Laboratory, Boeing, Lexar, GE, Fermi National Accelerator Lab, Intel, and Sandia National Laboratory to name a few. These examples show that advanced materials play a central role in many advanced, new technologies, and MS&E graduates will be readily employed.

5 "Envisioning A 21st Century Science and Engineering Workforce for the United States: Tasks for University, Industry, and Government." *The National Academies Press, 2003*

Creating the MS&E program will also enhance FSU's ability to increase federal research funding, graduate student recruitment, and Ph.D. production. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially. This is seen for example in the DoD MURI program, the NSF Division of Materials Research Centers programs, including the MRSECs, NSECs, CEMRIs and most recently MIRTs. The interdisciplinary MS&E Ph.D. program at FSU will help build strong bridges between MS&E faculty across campus and it will help make FSU more competitive for these interdisciplinary grants.

B. Demand: Describe data that support the assumption that students will enroll in the proposed program.

Include descriptions of surveys or other communications with prospective students.

According to a recent NSF Graduate Enrollment Survey⁶, from 2001 to 2007, the growth of graduate student enrollment in the materials engineering field grew 13.6%. This indicates materials science and engineering is a steadily growing field so we can confidently expect students to apply to MS&E. In addition, several students who inquired about the new FSU Master of Science in Materials Science program were interested in whether FSU had a Ph.D. program. Those interested in earning a Ph.D. in materials science and engineering applied to other schools. One student who was admitted to the Master of Science in Materials Science program chose chemical and biomedical engineering over the masters program in materials science because she could earn a Ph.D. in chemical engineering but not in materials science. A growing number of the current students in our new Master of Science in Materials Science Program have told their advisors they plan to continue on for a Ph.D. and would like to be able to earn their Ph.D. in MS&E at FSU. This adds an important imperative to the timing of this proposal.

Faculty members at FSU who do materials science research regularly receive inquiries from students asking about pursuing a Ph.D. in materials science and engineering under their guidance. In recent years, many students have either not applied to or have left FSU due to the lack of MS&E related programs that satisfy their interests and professional aspirations.

C. If similar programs (either private or public) exist in the state, identify the institution(s) and geographic location(s).

Summarize the outcome(s) of any communication with such programs with regard to the potential impact on their enrollment and opportunities for possible collaboration (instruction and research). Provide data that support the need for an additional program.

There are three materials science and engineering Ph.D. programs in Florida: at Florida International University (FIU), the University of Central Florida (UCF), and the University of Florida (UF). UF and FIU are single-department programs in which all of

⁶ National Science Foundation: Graduate Students and Post doctorates in Science and Engineering: Fall 2007 <http://www.nsf.gov/statistics/nsf10307/pdf/nsf10307.pdf>

the faculty members in the Ph.D. program come from a single department, the students take their courses within that department but may take elective courses outside the department, and the students are mainly taught by faculty from that department. UCF is centered in a single department but has faculty members associated with it from other departments. These models work well for the existing programs. The research areas in these three programs are multi-disciplinary covering a wide range of topics in MS&E.

The proposed FSU program follows a different model. It will initially be made up of faculty members with tenure homes in nine different departments across two colleges and is administered by the Graduate School, but can expand in the future to include faculty members in other FSU departments and colleges. It could also include faculty members from another university, such as FAMU, if they establish a Ph.D. degree in MS&E. Collaborative arrangements could be made for efficient use of resources if FAMU were to initiate such a degree. Students will have their academic home in the Graduate School; they will take a set of required core courses and elective specialization courses to give them both breadth and depth in MS&E. These courses will be taught by faculty members from multiple departments in Arts and Sciences and in Engineering; they will meet weekly for their entire time as graduate students in a new Interdisciplinary Seminar Series; and they will meet regularly with their research committee, composed of faculty members from across campus. The rationale for this model at FSU is to build a strong, new Ph.D. program using the components that already exist at FSU. These components are: faculty members who are already doing materials research and participating in the interdisciplinary Master of Science in Materials Science program (created in fall 2008); diverse, strong scientific and educational expertise from faculty members in nine different departments who will instruct and train MS&E students; extensive investment FSU has already made hiring new faculty, purchasing research equipment, creating research laboratories, and building new buildings for materials research. In short, all the components for the MS&E Ph.D. program already exist at FSU. This proposal brings them together in an effective, cost efficient new program.

The new Ph.D. program in Materials Science and Engineering at FSU will have minimal research overlap with the three existing MS&E Ph.D. programs at UF, UCF and FIU. We have surveyed the research areas in each of these three programs from their websites and talked with each of the three programs. We had a retreat at UF between FSU and UF MS&E faculty members in December 2010 where we presented this proposal to UF faculty members, discussed research areas in the two programs, and sought areas for collaboration. The UF faculty members had a positive reaction to this proposed MS&E program at FSU. The faculty members determined that there are unique, strong research programs at FSU that do not overlap or compete with UF's research programs; rather, the two programs are complementary. With the MS&E program at FSU, UF and FSU can write joint proposals to federal funding agencies for major, multi-university grants.

Appendix C contains support letters from FIU, UCF, and UF for this MS&E Ph.D. program. Support for the FSU program was discussed internally up to the provost level at each of these schools. We also have a support letter from FAMU. We asked FAMU to review the program, even though it does not have a Ph.D. program in MS&E, because we

wanted the FAMU administration to be able to have the opportunity to review the program and evaluate potential impact on engineering faculty members with FAMU lines in the joint FAMU-FSU College of Engineering.

The UF Ph.D. program is in the Department of Materials Science and Engineering. It is the largest and highest nationally-ranked program in Florida. It is broad in scope having faculty members who do processing and characterization of materials and as well as advanced computational studies to understand, model, and predict properties of materials. Table II.C.1 lists the research areas in MS&E at UF and FSU. Although it is natural that there is some overlap in research areas between two large MS&E programs, the top portion of the table shows those areas where FSU has developed strong research thrusts that are not major research areas at UF. Likewise, the UF MS&E program is particularly strong in biomaterials, which is an area FSU has chosen not to emphasize over the past few years so as not to duplicate the UF program.

TABLE II.C.1

Summary of MS&E research activities at FSU and UF. This table is not meant to be a full and comprehensive comparison.

Research Areas	Description of FSU MS&E activities	Related UF MS&E activities
----- Research areas at FSU with little overlap at UF -----		
Fundamental theory: bulk and low dimensional materials	Fundamental understanding of interactions in materials, including effects of disorder, dimensionality, temperature, and magnetic field.; Dobrosaljevic, Rikvold, Vafek	No apparent program
Superconducting devices, quantum computing elements	Superconducting devices, and quantum computing elements; Chiorescu	No apparent program
Fundamental magnetism	Molecular magnetism, magnetic and hybrid materials; Chiorescu, Latturmer, Shatruk	No apparent program
Nanocomposites	Carbon nanotube based functional materials, fundamental research, processing and testing of nanocomposite materials.; Alamo, Liang, Liu, Wang, Zhang	Durability of epoxies for infrastructure applications; nanoparticle-metal matrix composites; E. Douglas, M. Manuel
Applied Superconductivity	Fundamental and applied research on technologically important and emerging superconducting materials. Materials for next generation high-field magnets; Hellstrom, Larbaestier	High Temperature Superconducting Thin Films and Devices; D. Norton (now Assoc. Dean for Res. and Grad. Prog.)
Chemical Vapor Deposition for Nanostructured Materials	Unique methods to use CVD to produce carbon nanotube forests and directed synthesis of nanowires on microelectromechanical (MEMS)-type platforms; O. Englander, M. Zhang	CVD on VII-V - Nitrides; C. Abernathy (now Dean of UF COE)
Thin film structures	Oxide thin films produced by molecular beam epitaxy (MBE) and pulsed laser deposition (PLD) for sensors, devices, and low dimensional novel materials properties; Chiorescu, Warusawithana, Zheng	Oxide and semiconductor films growth ; C. Abernathy, D. Norton (both are now UF COE administrators), S. Pearton
Materials characterization under novel and extreme conditions	Broad spectrum of characterization techniques for materials characterization and testing; Brooks, Chiorescu, Hellstrom, Larbaestier, Liang, Siegrist	Advanced diffraction tools for electroactive ceramics; J. Jones, K. Jones
----- Research areas at both FSU and UF -----		
Polymer Science and Engineering	Experimental and computational aspects of polymers including: rheology, crystallization, morphology, structure-properties relations, and polymer-nanostructure composites; Alamo, Collier, Shanbhag, Liu	General efforts in polymer science, biopolymers, etc.; C. Batich, A. Brennan, E. Douglas, K. Powers
Materials chemistry and energy related-materials.	Materials synthesis for energy harvesting, storage, and fuel cell applications. Various growth techniques for new materials.; Latturmer, Shatruk, Siegrist, Strouse	Complex alloys, thin film photonics, electroactive ceramics, ferroelectrics. F. Ebrahimi, P. Holloway, K. Jones, J. Jones, J. Nino, S. Pearton, R. Singh
Modeling, Simulation, Computation of materials.	Modeling and simulation of macro and nanoscale structures, semiconductor devices, magnetic materials, and biomaterials.; Andrei, El-Azab, Liang, Oates, Rikvold, Sobanjo	Molecular dynamics studies; S. Sinnott, S. Phillpot
----- Research areas at UF with little overlap at FSU -----		
Biomaterials	Bio-lithographic and self organized bio-structures, functional applications of cellulose, electronic properties of natural and functionalized silks; Brooks, Lenhart	Major departmental effort in biomaterials, biomimetrics, and biomedical areas by 11 UF-MS&E Faculty
Ceramics, metals, minerals	Small research effort at FSU	Major departmental effort involving 6 faculty members

TABLE II.C.2

Summary of MS&E research activities at FSU and UCF. This table is not meant to be a full and comprehensive comparison.

Research Areas	Description of Unique FSU MS&E activities	Related UCF MS&E activities
----- Research areas at FSU with little overlap at UCF -----		
Applied Superconductivity	Fundamental and applied research on technologically important and emerging superconducting materials. Materials for next generation high-field magnets; Hellstrom, Larbalestier	No research effort
Superconducting devices, quantum computing elements	Superconducting devices, and quantum computing elements; Chiorescu	No research effort
Chemical Vapor Deposition for Nanostructured Materials	Unique methods to use CVD to produce carbon nanotube forests and directed synthesis of nanowires on microelectromechanical (MEMS) platforms; Englander, Zhang	No research effort
Fundamental magnetism	Molecular magnetism, magnetic and hybrid materials; Chiorescu, Lattner, Shatruk	No research effort
----- Research areas at both FSU and UCF -----		
Nanocomposites	Carbon nanotube based functional materials, fundamental research, processing and testing of nanocomposite materials.; Alamo, Liang, Liu, Wang, Zhang	Carbon nanotube-based functional materials, e.g., conductive polymer/nanotube composites & 2-D circuits; fundamental research, processing & testing nanocomposite materials; An, Guo, Zhai
Fundamental theory: bulk and low dimensional materials	Fundamental understanding of interactions in materials, including effects of disorder, dimensionality, temperature, and magnetic field.; Dobrosaljevic, Rikvold, Vafek	Mesoscale models of thermal transport; atomic & electronic structure at solid/liquid interfaces; Schelling
Materials characterization under novel and extreme conditions	Broad spectrum of characterization techniques for materials characterization and testing; Brooks, Chiorescu, Hellstrom, Larbalestier, Liang, Siegrist	Broad spectrum of materials characterization and testing techniques, including neutron and x-ray studies at load and temperature; coatings for extreme environments; Sohn, Vaidyanathan
Thin film structures	Oxide thin films produced by molecular beam epitaxy (MBE) and pulsed laser deposition (PLD) for sensors, devices, and low dimensional novel materials properties; Chiorescu, Warusawithana, Zheng	Thin film solar cells and magnetic materials; IR bolometers; MEMS; Heinrich, Dhere, Coffey, Chow
Polymer Science and Engineering	Experimental and computational aspects of polymers including: rheology, crystallization, morphology, structure-properties relations, and polymer-nanostructure composites; Alamo, Collier, Shanbhag, Liu	Polymer research for functionalization of microfluidic system; soft lithography; liquid crystal imaging; soft materials; Zhai, Fang, Hun, Hickman
Materials chemistry and energy related-materials.	Materials synthesis for energy harvesting, storage, and fuel cell applications. Various growth techniques for new materials.; Lattner, Shatruk, Siegrist, Strouse	Solar cells; renewable energy; PEM & solid oxide fuel cells; batteries; Dhere, Heinrich, Fenton, Orlovskaya, Coffey
Modeling, Simulation, Computation of materials.	Modeling and simulation of macro and nanoscale structures, semiconductor devices, magnetic materials, and biomaterials.; Andrei, El-Azab, Liang, Oates, Rikvold, Sobanjo	Multiscale modeling; molecular dynamics; Schelling, Chen, Gou, Vaidyanathan
Biomaterials	Bio-lithographic and self organized bio-structures, functional applications of cellulose, electronic properties of natural and functionalized silks; Brooks, Lenhart	BioMEMS; microfluidic devices; biomaterials for drug screening; Cho, Hickman, Fang, Chen, Seal
----- Research areas at UCF with little overlap at FSU -----		
Optics and optical materials	Small program at FSU	Major program effort in optics and electro-optics; 5 faculty members
Nanoparticle and nanostructured materials	Small program at FSU	Synthesis and property studies of nanocomposite and nanostructured materials; 5 faculty members
Ceramic materials	Small program at FSU	Fabrication and characterization of ceramics; An, Orlovskaya
Diffusion, interactions, and reactions	Small program at FSU	Diffusion in bulk and grain boundaries; 4 faculty members
Nonequilibrium materials	Small program at FSU	Mechanical alloying; non-equilibrium materials; Suryanarayana, Heinrich

Table II.C.2 analyzes research at UCF and FSU. Again the table shows there is some research overlap between these two programs. The top of the table indicates the FSU research areas that are particularly strong at FSU and the bottom of the table shows the strong research areas at UCF. Faculty members in the UCF program have strong ties with the Center for Research and Education in Optics and Lasers (CREOL), the Florida Solar Energy Center (FSEC), and the NanoScience Technology Center (NSTC).

The FIU Ph.D. program, which is relatively new, is smaller (6 faculty members at present) than the other two existing Ph.D. programs and the proposed FSU program (26 faculty members). The research specializations of the individual FIU faculty members are in ceramics, memory alloys, fuel cells, thermodynamics, MEMS, high-density information storage, carbon nanotube-based devices and technology, nano electromechanical systems (NEMS), nanoparticle synthesis and characterization, bio/nanomaterials for drug delivery, modeling, and characterization.

Referring back to Tables II.C.1 and II.C.2 we see that the strong FSU research areas in the top of section of each table are not duplicated in the UF or UCF MS&E research programs. The unique research areas at FSU, which are complementary to research areas at UF and UCF are: nanocomposites; fundamental theory of bulk and low-dimensional materials, applied superconductivity, superconducting devices and quantum computing elements; chemical vapor deposition for nanostructured materials; and materials characterization under novel and extreme conditions.

Supporting the FSU research areas described in the Table in Section II.C are several strong research centers at FSU with which MS&E faculty members are associated. These include the National High Magnetic Field Laboratory (NHMFL), the Applied Superconductivity Center (ASC), the recently formed Analysis and Fabrication Facility in Physics under the direction of Condensed Matter and Materials Physics (CMMP), the Center for Advanced Power Systems (CAPS), the High-Performance Materials Institute (HPMI), the Florida Center for Aeropropulsion, Mechatronics and Energy (AME), and the Institute of Molecular Biophysics (IMB). These Centers and Institutes, which are all unique to FSU, actively support materials research at FSU. In addition to the facilities provided by these Centers and Institutes, several recent academic and organizational changes have defined the central role of materials at FSU and have provided a natural slate of classroom courses to educate Ph.D. students. For example, the Department of Chemistry and Biochemistry has recently established a degree in Materials Chemistry. The Department of Physics recently formed the Condensed Matter and Materials Physics group. The recently-formed Department of Computational Sciences offers a degree track in Computational Materials Science.

Over half (14) of the MS&E faculty members listed in the proposal are associated with FSU's National High Magnetic Field Laboratory (NHMFL). They do basic and applied research on magnetic materials or on materials that require the very high magnetic fields or specialized magnetic characterization capabilities available at NHMFL. The NSF-funded NHMFL is the only high-magnetic field laboratory in the US and is only one of a handful in the world. The NHMFL has branch laboratories at UF and Los Alamos

National Laboratory (LANL). The facilities at UF are the Microkelvin Laboratory in the Physics Dept. and the outside users program in the Advanced Magnetic Resonance Imaging and Spectroscopy within the McKnight Brain Institute. FSU does not have capabilities that duplicate these UF facilities. LANL has the Pulsed Field Laboratory, which is not duplicated at FSU.

The Applied Superconductivity Center is a world leader studying superconducting materials that are used to generate very high magnetic fields, to produce and transmit electricity, and to build high-power electric motors. Before moving to FSU from the University of Wisconsin-Madison in 2006, Larbalestier and Lee had developed the materials processing used to make the Nb(Ti) superconductors at the heart of commercial, medical MRI systems.

Several of the faculty members are associated with the High-Performance Materials Institute (HPMI). It is an international leader in composite materials, particularly nanocomposites made with carbon nanotubes. The research is to understand, develop, and commercialize new multifunctional materials technologies using carbon nanotubes. HPMI works closely with industrial and DOD research laboratories.

One may be wondering why FSU wants to offer a Ph.D. in materials science and engineering if its faculty members are already doing research in materials science. The answer is simple – students. Potential Ph.D. students interested in materials science recognize that to get a well-rounded education in materials science and engineering requires an educational infrastructure in materials science and engineering, such as this MS&E program. At present, without an MS&E Ph.D. program, we cannot effectively recruit, train, and certify students whose primary interest is in materials science and engineering. Currently FSU students doing Ph.D. research on materials cannot follow a Ph.D. curriculum that emphasizes materials science and engineering. Instead they have to follow the Ph.D. curriculum of their home department. These students do not, and cannot, get the broad educational background in materials science and engineering within the curricular confines of these traditional departments needed to develop a steady stream of high-quality, MS&E Ph.D. graduates from FSU. As discussed below, more than half of the students in the current Master of Science in Materials Science program have expressed strong interest in continuing with Ph.D. studies in MS&E at FSU if the new program can be created soon. Without the MS&E Ph.D. program, these students plan to go elsewhere to pursue their Ph.D. studies.

- D. Use Table 1 (A for undergraduate and B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources.**

Generally undergraduate FTE will be calculated as 40 credit hours per year and graduate FTE will be calculated as 32 credit hours per year. Describe the rationale underlying enrollment projections. If, initially, students within the institution are expected to change majors to enroll in the proposed program, describe the shifts from disciplines that will likely occur.

The enrollment estimates in Table 1B are based on the enrollment history and past experience from the participating departments, as well as national statistics for MS&E compiled by the National Science Foundation⁷. As soon as the MS&E Ph.D. program is implemented, we expect students will continue on from the Master of Science in Materials Science program and a few will transfer from other graduate programs at FSU. Undergraduates presently in science or engineering departments at FSU can pursue an interdisciplinary Ph.D. program in MS&E at FSU.

⁷ http://www.nsf.gov/statistics/nsf10309/content.cfm?pub_id=3996&id=8

TABLE 1B
PROJECTED HEAD COUNT FROM POTENTIAL SOURCES
 (Graduate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1		Year 2		Year 3		Year 4		Year 5	
	HC	FTE	HC	FTE	HC	FTE	HC	FTE	HC	FTE
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	0	0	0	0	0	0	0	0	0	0
Students who transfer from other graduate programs within the university**	1	0.9	2	1.8	2	1.8	2	1.8	2	1.8
Individuals who have recently graduated from preceding degree programs at this university	2	1.8	4	3.6	6	5.4	8	7.2	10	9
Individuals who graduated from preceding degree programs at other Florida public universities	0	0	1	0.9	3	2.7	5	4.5	7	6.3
Individuals who graduated from preceding degree programs at non-public Florida institutions	0	0	0	0	0	0	0	0	0	0
Additional in-state residents***	0	0	0	0	0	0	0	0	0	0
Additional out-of-state residents***	0	0	0	0	1	0.9	2	1.8	3	2.7
Additional foreign residents***	3	2.7	7	6.3	11	9.9	16	14.4	21	18.9
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
Totals	6	5.4	14	12.6	23	20.7	33	29.7	43	38.7

* List projected yearly cumulative ENROLLMENTS instead of admissions

** If numbers appear in this category, they should go DOWN in later years.

*** Do not include individuals counted in any PRIOR category in a given COLUMN.

E. Indicate what steps will be taken to achieve a diverse student body in this program, and identify any minority groups that will be favorably or unfavorably impacted.

The university's Equal Opportunity Officer should read this section and then sign and date in the area below.

The MS&E faculty members will strive for diversity within MS&E by actively recruiting students from the historically-black Florida A&M University (FAMU) with undergraduate degrees in chemistry, physics, and mathematics, plus FAMU engineering students in the FAMU-FSU College of Engineering. In addition, MS&E faculty members will be encouraged to have minority students in the REU summer program work in their laboratory to get first-hand research experience on materials. REU is the Research Experience for Undergraduates program funded by the National Science Foundation and is run through the National High Magnetic Field Laboratory (NHMFL) at FSU. Admission to this program is coordinated with the NHMFL offices of the Center for Integrated Research and Diversity to select a diverse cross section of REU students following NSF Diversity Guidelines. This hands-on summer research experience is an excellent tool for recruiting minority students for graduate school.

In the FAMU-FSU College of Engineering, about 24% of the undergraduates are from FAMU, an HBCU, and over 35% of the FSU students are minority or women students. MS&E includes faculty members in all departments in the College of Engineering. These faculty members can use their class-room interaction with FAMU and FSU students to recruit minority students into MS&E.

The NHMFL has a diversity program that targets minority students for research assistant positions in the lab. Since many of the MS&E faculty members are associated with the NHMFL, MS&E will encourage its faculty members to work with the NHMFL to recruit minority students.

In addition, the association of FSU with FAMU through the joint College of Engineering provides opportunities for collaborative research between FSU and FAMU faculty members. Further, FAMU students will be able to take materials classes at FSU.



Equal Opportunity Officer

6/9/11

Date

III. Budget

- A. Use Table 2 to display projected costs and associated funding sources for Year 1 and Year 5 of program operation. Use Table 3 to show how existing Education & General funds will be shifted to support the new program in Year 1.**

In narrative form, summarize the contents of both tables, identifying the source of both current and new resources to be devoted to the proposed program. (Data for Year 1 and Year 5 reflect snapshots in time rather than cumulative costs.)

**TABLE 2
PROJECTED COSTS AND FUNDING SOURCES**

Instruction & Research Costs (non-cumulative)	Year 1					Year 5					
	Funding Source					Funding Source					
	Reallocated Base* (E&G)	Enrollment Growth (E&G)	Other New Recurring (E&G)	New Non-Recurring (E&G)	Contracts & Grants (C&G)	Subtotal E&G and C&G	Continuing Base** (E&G)	New Enrollment Growth (E&G)	Other*** (E&G)	Contracts & Grants (C&G)	Subtotal E&G and C&G
Faculty Salaries and Benefits	103,555	0	0	0	0	\$103,555	334,985	0	0	0	\$334,985
A & P Salaries and Benefits	0	0	0	0	0	\$0	0	0	0	0	\$0
USPS Salaries and Benefits	19,200	0	0	0	0	\$19,200	19,776	0	0	0	\$19,776
Other Personnel Services	0	0	0	0	0	\$0	0	0	0	0	\$0
Assistantships & Fellowships	250,370	0	0	0	69,810	\$320,180	706,278	0	0	1,706,608	\$2,412,886
Library	0	0	0	0	0	\$0	0	0	0	0	\$0
Expenses	17,250	0	0	0	0	\$17,250	17,768	0	0	0	\$17,768
Operating Capital Outlay	0	0	0	0	0	\$0	0	0	0	0	\$0
Special Categories	0	0	0	0	0	\$0	0	0	0	0	\$0
Total Costs	\$390,375	\$0	\$0	\$0	\$69,810	\$460,185	\$1,078,807	\$0	\$0	\$1,706,608	\$2,785,415

*Identify reallocation sources in Table 3.

**Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "other new recurring") from Years 1-4 that continue into Year 5.

***Identify if non-recurring.

Faculty and Staff Summary

Total Positions (person-years)	Year 1	Year 5
Faculty	0.578	1.967
A & P	0.000	0.000
USPS	0.500	0.500

Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	\$390,375	\$1,078,807
Annual Student FTE	5.4	38.7
E&G Cost per FTE	\$72,292	\$27,876

**TABLE 3
ANTICIPATED REALLOCATION OF EDUCATION & GENERAL FUNDS**

Program and/or E&G account from which current funds will be reallocated during Year I	Base before reallocation	Amount to be reallocated	Base after reallocation
058000-110 - Provost Instruction and Research	11,602,554	-295,497	11,307,057
113000-110 - Dean of Graduate School	790,320	295,497	1,085,817
Academic year faculty member salaries & fringe benefits given below - faculty will continue to be paid from their existing department			
074000-110 - Biological Science	6,214,495	-4,186	6,210,309
075000-110 - Chemistry & Biochemistry	5,117,185	-8,342	5,108,843
084000-110 - Physics	4,687,587	-14,285	4,673,302
137000-110 - Scientific Computing	1,934,985	-7,141	1,927,844
212000-110 - College of Engineering	5,285,258	-60,924	5,224,334
Totals	\$35,632,384	-\$94,878	\$35,537,506

Tables 2 and 3 present information on the projected costs and existing funds, respectively. It is important to note that reallocation of faculty salaries and benefits does not change the budgets for the College of Arts and Sciences or the College of Engineering, or any departments in these colleges, since the faculty members will remain entirely in their home department and be paid by their home department.

Six full fellowships per year will be provided for first-year students through the Graduate School. These fellowships will include in-state tuition waivers for all six fellowships and out-of-state tuition waivers for 3 of the fellowships. Out-of-state tuition waivers for 2 additional first-year students will be available each year. Beginning the summer after their first academic year, the students will be supported on research grants that will pay the stipend and in-state tuition waiver. Out-of-state tuition waivers for up to 50% of the students in MS&E through graduation will be offered.

A half time office staff assistant will be provided for MS&E, as well as funds for supplies for the MS&E office, funds to recruit students, and for travel for four outside speakers per year for the Interdisciplinary Seminar Series, which is described below in Section VIII.C. The Director of MS&E will be provided with a half month of summer salary.

No new faculty members will be hired for the MS&E program. All faculty members associated with MS&E have a tenure home in a specific department, so their costs are reallocations of existing funds within their home department. The expenses associated with the faculty members are for teaching courses, being the major advisor for MS&E students in their research groups, and for committee work in MS&E.

Most of the courses that form the basis of this program already exist and have the capacity to accommodate the MS&E students. The courses are typically open to any FSU student as well as FAMU student. The exercise of sharing the distribution of students by program amply documents this with no real impact on the availability of courses.

By the end of the summer of their first academic year, each incoming student who has received fellowship support will find a research advisor who will support the student on C&G funds from that point through graduation. Students who enter without a fellowship will be supported on faculty members' C&G funds from the time they enter MS&E.

B. If other programs will be impacted by a reallocation of resources for the proposed program, identify the program and provide a justification for reallocating resources.

Specifically address the potential negative impacts that implementation of the proposed program will have on related undergraduate programs (i.e., shift in faculty effort, reallocation of instructional resources, reduced enrollment rates, greater use of adjunct faculty and teaching assistants). Explain what steps will be taken to mitigate any such impacts. Also, discuss the potential positive impacts that the proposed program might have on related undergraduate programs (i.e., increased undergraduate research

opportunities, improved quality of instruction associated with cutting-edge research, improved labs and library resources).

Overall, we expect there will be little negative impact on existing programs by creating MS&E. The curriculum, save for the new Interdisciplinary Seminar Series, is built around existing courses across campus. Several of the core courses that will be used for the MS&E Ph.D. program were developed for the recently created Master of Science in Materials Science program. The new Interdisciplinary Seminar Series will be cross-listed in all the departments with participating MS&E faculty members. It will be team taught by MS&E faculty as part of their teaching assignment.

A strong positive impact from the MS&E Ph.D. program is providing a mechanism for faculty members doing materials research to recruit students who want to earn a Ph.D. in the field of materials science and engineering. Currently there are untenured MS&E faculty members who are building research programs and need graduate students that have a keen, primary interest in MS&E. There are also newly-hired senior faculty members who also need students interested in MS&E. Because there is no materials science Ph.D. program, these faculty members currently can only recruit Ph.D. students through their home departments. Students who want to pursue MS&E are not inclined to enroll in these traditional departments, where many of them earned their BS degree.

In addition the existence of the MS&E program will provide a richer experience for FAMU students who are enrolled in engineering or disciplines related to the MS&E degree by having more students to interact with and by their being able to enroll in the MS&E Interdisciplinary Seminar Series (see Section VIII). The MS&E program will also provide new opportunities for potential collaborations between FSU and FAMU faculty members that may benefit FAMU students.

C. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside of the proposed major).

We expect MS&E will have minimal impact on related programs and departments. MS&E students will attend existing courses. The curriculum is built almost entirely around existing courses, with about 43% of the courses being in Arts and Sciences. We anticipate a steady-state matriculation of about 10 students per academic year. These students will all take the required fundamental core courses (see Section VIII for a list of all courses) together, which will add roughly 10 students per core course per year. There is currently room for the 10 additional MS&E students in all of these core courses. Each of the MS&E students will also take an elective core course plus elective specialization courses chosen from the roughly 30 courses that are offered. Thus there will be just a few MS&E students in the elective courses each year. There is room for the MS&E students in these courses. The MS&E courses that MS&E students will take make up a small fraction of the total number of courses that are taught in each department and college. Students will need to meet all prerequisite requirements for the classes they take.

- D. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental entities, etc.). Describe the external resources that appear to be available to support the proposed program.**

External support for the Program will come in two forms. First is fellowship support for graduate students. In addition to the availability of the six university fellowships provided through the Graduate School for first-year students, the MS&E faculty members will write proposals for grants to support graduate students to the Department of Education Graduate Assistance in Areas of National Need (GAANN), Florida-Georgia Alliance for Minority Participation (FGAMP) Graduate Fellowships, NASA Graduate Student Researchers Program (GSRP), and NSF Integrative Graduate Education and Research Traineeship (IGERT). We will also work with individual students to apply for fellowships from organizations such as the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM), NSF - Graduate Student Fellowships, the Ford Foundation Diversity Fellowships, Sloan Foundation Graduate Fellowships, and the Bill and Melinda Gates Foundation.

The second type of support is for Research Assistantships paid from faculty member's research grants. MS&E faculty members are very successful in obtaining outside research grants (more than \$31M since 2005, see the table in Section IX.C) to federal and private agencies such as the National Science Foundation, Department of Defense agencies, NASA, National Institutes of Health, Department of Energy, Petroleum Institute. These winning proposals are for top-quality, cutting-edge research as identified by the scientific community in the peer review process used to evaluate proposals.

IV. Projected Benefit of the Program to the University, Local Community, and State

Use information from Table 1, Table 2, and the supporting narrative for "Need and Demand" to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. The projected benefits can be both quantitative and qualitative in nature, but there needs to be a clear distinction made between the two in the narrative.

In this section, we first provide the Benefits of the Program, and then the Benchmarks we will use to gauge its success.

Benefits of the Program

Students, the University, the local community, the State, and the Nation will benefit from the program:

- It will provide a means to recruit students interested in studying MS&E and create a way to educate and train these students in a broad, interdisciplinary manner.

- It will augment the existing M.S. program in materials science allowing students to pursue a Ph.D. in MS&E.
- It will build on the sizable investments in faculty members and research infrastructure FSU has already made in MS&E.
- It will be relatively inexpensive to implement.
- It will help FSU as a whole in gaining ground on the AAU frontier.
- It will better position FSU in the area of materials science and engineering in terms of federal research grants, particularly large-scale, interdisciplinary grants.
- It will address one of the three areas of critical education need for the State: producing more engineers.
- It will significantly contribute to research, economic development and job creation in the Panhandle area.
- It will add to the Nation's technical capability by the additional research it will attract and enable, and the highly trained researchers who will graduate from the program.

Specifically the MS&E program is right on target with promoting Florida's future. Quoting from the Enterprise Florida's Roadmap to Florida's Future¹, "The Florida High Tech Corridor Council is a state best practice model with potential applicability for other regions and state transportation corridors." Florida State University is situated in the "Northwest Region" as one of the 10 Regions that comprise the Enterprise Florida Roadmap Demographics. FSU must step to the plate to provide leadership in this Region to fulfill many of the action items recommended in the Enterprise Florida Roadmap. A strong Ph.D. program in MS&E is an essential component in FSU's role in Florida's future. Priority areas listed in the Roadmap to which MS&E will respond include:

- Advanced Manufacturing – through MS&E faculty members and students being associated with High-Performance Materials Institute and Industrial and Manufacturing Engineering.
- Aviation and Aerospace – through MS&E faculty members and students being part of the Florida Center for Advanced Aeronautics and Propulsion.
- Clean Energy - by MS&E faculty members and students being exposed to seminars given by the Institute for Energy Systems, Economics and Sustainability.
- Multi-disciplinary research – by MS&E faculty members participating in interdisciplinary research efforts as seen in the existing Master of Science in Materials Science program and this new proposed Ph.D. program, and by FSU having initiated cluster hires that span several departments.
- Development of universities as "Best-in Class" – by MS&E faculty helping guide ongoing investments in research for FSU to achieve its goal of being best in class.
- Alignment with industry clusters for economic growth – by MS&E faculty members and students being associated with the High-Performance Materials Institute.
- STEM pipeline – by creating a new Ph.D. program that will graduate MS&E students with backgrounds in science and engineering. MS&E is particularly

important because the development of new materials underlies many advances in technology. It will actively recruit diversity students and women who are FSU and FAMU undergrads and mentor them through graduation.

- Expansion of academic R&D – by MS&E faculty members pursuing major research centers from NSF, DOE, DoD, and NIH in the area of materials science.
- World Class Scholars – by FSU having hired Larbalestier and Hellstrom from the University of Wisconsin-Madison.
- Centers of Excellence – by MS&E faculty members having won competitions creating the Center of Excellence in Advanced Materials within Industrial and Manufacturing Engineering and the High-Performance Materials Institute.
- Federal Facilities – by MS&E faculty members and students associating with the National High Magnetic Field Laboratory and guiding its renewal process.
- Culture of commercialization – by having students exposed to business ideas and concepts, through the Interdisciplinary Seminar Series that all of the MS&E students will take each semester. Students will be able to take Technology Entrepreneurship, and Commercialization as an elective specialization course to broaden their understanding of how to commercialize their ideas. Also, students can participate in existing and planned entrepreneurship programs at FSU such as ChemPreneur program offered by the Department of Chemistry and Biochemistry and the College of Business. With the unique entrepreneurship/commercialization training, this new Ph.D. program should generate significant impact on economic development and create jobs in Florida.
- Regional Innovation Networks – by MS&E faculty members working with the Tallahassee Economic Development Council to bring new businesses to the Florida Panhandle region.
- Retention of talent – one of the biggest problems faced in the Panhandle is the loss of recently trained graduates to other major centers of industry, academics, and technology, most of which are outside Florida, and in some cases, even outside the US. In coordination with the FSU Office of Technology Transfer, the College of Business, programs such as SBIR and STTR, existing University-Industry connections, and emerging entrepreneurial efforts sponsored by the FSU Office of Research, the new Ph.D. program will provide an effective mechanism to encourage our brightest talent to consider growing their businesses and careers locally after graduation.

Benchmarks

Specific targets and benchmarks for MS&E within the first 5 years are the following:

- Enroll 10 new students per year by year 5.
- Improve the quality of the students entering the program as shown by increasing the average GRE score of admitted students over 5 years by 50 points (based on the current 1600 point scale and using the first year enrollees as the baseline)
- Have active participation from all MS&E faculty members as shown by faculty members (1) supporting MS&E students from their research grants, (2)

participating in MS&E functions such as attending faculty meetings, serving on supervisory committees, and participating in the qualifier exam, (3) teaching and speaking at the Interdisciplinary Seminar Series, (4) teaching core and elective specialization courses, and (5) helping recruit new students.

- MS&E faculty members obtaining multi-investigator center funding from federal agencies for funding in materials science.
- MS&E faculty members obtaining block grants to support and train graduate students, such as the NSF-IGERT and the Dept. of Education GAANN. An IGERT will be submitted in year 2 of the program.
- Implement graduate training programs with major Department of Energy labs such as the “shared graduate student training concept” now under discussion between Oak Ridge National Laboratory and Florida State University.
- Attract students who work with faculty members across campus in rough proportion to faculty member participation in each college by the end of year 4.

FSU Review of the program

In the seventh year after MS&E is implemented and every 7 years thereafter, MS&E will be reviewed as part of the Quality Enhancement Review, as well as by a committee made up of members of the FSU Graduate Policy Committee. Continuation of MS&E will be contingent on recommendations stemming from these reviews and provided to the office of Academic Affairs.

V. Access and Articulation – Bachelor’s Degrees Only

Not applicable.

INSTITUTIONAL READINESS

VI. Related Institutional Mission and Strength

- A. Describe how the goals of the proposed program relate to the institutional mission statement as contained in the SUS Strategic Plan and the University Strategic Plan.**

The goals of MS&E address the State of Florida’s needs and embody the Mission of Florida State University to “...preserve, expand, and disseminate knowledge in the sciences, technology...”⁸.

Within the SUS Strategic Plan, FSU’s distinctive institutional mission⁹ is as a “...graduate research university that puts research into action for the benefit of our students and society.” It recognizes that the “...notable research faculty provide a range of

⁸ http://president.fsu.edu/plan/strategicPlan_Nov2009.pdf

⁹ http://www.flbog.org/about/_doc/strategicplan/StrategicPlan_05-13.pdf

interdisciplinary offers that transcend the traditional disciplines, including ... Materials Science...”. And it notes that FSU “...provides world class opportunities for graduate ... students to: ...work with faculty to forge new relationships among professions, including ... the physical sciences and engineering...”.

Florida has a strong national presence in key economic sectors including aerospace, defense, marine and space, and a growing presence in the medical device industry. These industries are dependent on materials science and engineering. Florida’s current leadership in some of these economic sectors is slipping. Companies in Florida as well as other states are facing unprecedented challenges and are aggressively developing their own capabilities. In addition, Florida is behind many states in some key emerging economic sectors such as nanotechnologies. Florida has recognized the need to foster engineering education and research. Recently, Florida identified engineering as one of the areas where critical education needs exist (education and nursing are the other two areas). To bolster the economy, Florida needs an increasing number of well-trained engineers in emerging fields, including materials science and engineering. The MS&E Ph.D. program will produce the graduates in this emerging field to meet the demand.

In keeping with its mission of excellent graduate education and its role as a comprehensive graduate-research university, FSU inaugurated the Pathway of Excellence Initiative in 2006, which leverages the University's unique strengths with significant new investments in research and graduate education through academic clusters, new facilities and new graduate programs. Recognizing the importance of materials education and research, FSU funded two cluster hiring initiatives in Advanced Materials and in Integrative NanoSciences. Establishing the MS&E Ph.D. program is a major component in this cluster program.

B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.

MS&E is an essential element to a number of existing and growing institutional strengths in materials research at FSU. Over the past 5 years, FSU and the State of Florida have made significant investments in materials research and education; the MS&E Ph.D. program is an integral component of the success of these initiatives. New and existing programs include:

- Applied Superconductivity Center (ASC). FSU invested ~\$4M to recruit and relocate ASC from the University of Wisconsin-Madison to FSU. This included two tenured faculty members (Larbalestier, a member of the National Academy of Engineering, and Hellstrom) and a number of senior Scholar/Scientist researchers. Both of the faculty members were in the Department of Materials Science and Engineering and in the interdisciplinary Materials Science Program at the University of Wisconsin-Madison and thus bring important experience and insight to develop and run MS&E. They also bring with them a longstanding track record in graduate education in materials science and engineering.

The State of Florida selected Larbalestier and Hellstrom as 21st Century Scholars representing a significant investment in materials research and education at FSU. Only 16 faculty members were selected as 21st Century Scholars.

- Cluster Hiring Initiative in Growth, Processing and Characterization of Advanced Materials. This FSU initiative includes six new faculty lines over several years and represents a \$5.7M FSU commitment to materials research and education. The promise of establishing an MS&E Ph.D. program was an element to recruit world-class faculty to fill these new positions and is needed to recruit graduate students to work with them. The Cluster faculty will play a significant role in MS&E. The Cluster has hired four of the six faculty members:). Englander (ME), T. Siegrist (CBE), M. Warusawithana (Physics), and M. Zhang (IME). All of these new faculty members will benefit from having access to MS&E students.
- Cluster Hiring Initiative in the Integrative NanoScience Institute (INSI), which is building a program in the emerging area of bio-nanoscience. The program is at the interface of materials science, device engineering, synthetic chemistry, and molecular biology, blending “hard” (metals and semiconductors) and “soft” (organic and biological) materials: the science, engineering and art of tailoring and harnessing biomolecular function in nano-fabricated settings. Research is on fundamental nanoscale phenomena and processes that will be required for successful integration of hard and soft materials, and for putting such hybrid materials to practical use. Representing a broad area of bio-related devices and materials, hires to date include J. Guan (Chemical and Biomedical Engineering), Sourav Saha (Chemistry and Biochemistry) H. Mattoussi (Chemistry and Biochemistry). INSI hired S. Lenhart (Biological Science) who will benefit from having access to MS&E students due to the diverse needs of the bio-materials program he is developing.
- Related Clusters. Pathways Clusters that can provide potential synergistic relationships to the MS&E program include Clusters in Neuroscience, Biological Sciences, and Psychology.
- High-Performance Materials Institute. HPMI is a NSF Industry/University Cooperative Research Center, in partnership with the Ohio State University and the University of Wisconsin-Madison. HPMI is recognized nationally and internationally as a leader in developing cost-effective, high-performance composite materials and systems. The HPMI has a close working relationship with researchers and practitioners in local and national industries and laboratories. Currently, HPMI is focused on investigating high-performance and multifunctional nanotube-based nanocomposites. HPMI recently moved into a new Materials Research Building (2009) that was purpose built for their research on advanced composite materials.

- National High Magnetic Field Laboratory (NHMFL). The NHMFL grant is one of the biggest contracts from the NSF Division of Materials Research to a university. 14 of the faculty members involved with MS&E are associated with the NHMFL and have their graduate students work within the NHMFL using its unique magnetic capabilities to synthesize and characterize materials, carrying out theoretical and computational studies on materials, and developing new materials for high-field magnets. After MS&E is implemented, many of the graduate students who work on these projects will be in MS&E where they can get a stronger education in materials science and engineering.
- Chemistry and Biochemistry. Most of the instrumentation area in the new 168,000 sq ft chemistry building is dedicated to materials characterization, including: NMR, X-ray, XRF, mass spec, laser spectroscopy, atomic force microscopy, EPR, optical spectroscopy. The Department of Chemistry and Biochemistry has recently created a specialization area in Materials Chemistry, which offers courses and research work for students related to various aspects of the chemistry of materials. Faculty members in the materials chemistry specialization area will participate in MS&E.
- College of Engineering. All five departments in the College of Engineering are actively involved in materials research. Civil and Environmental Engineering has research in composite materials reinforced with natural fibers; an energy materials group is emerging in Electrical and Computer Engineering; Industrial and Manufacturing Engineering's High Performance Materials Institute (HPMI) is a world leader in carbon nanotube composites; and Mechanical Engineering has more materials-focused faculty and activities than any other department.
- Physics. The Department of Physics has a long history of excellent research in the areas of materials. Five faculty members are associated with MS&E. They actively pursue research projects in magnetic materials, semi-conducting materials, and nanoscience/nanotechnology.
- Scientific Computing. Scientific computing is a new department, having been established in 2008. It has a Ph.D. program with a specialization in Computational Materials Science. Being able to recruit students with a background in materials science and engineering will benefit scientific computing faculty members who do computational studies on materials.
- The Institute of Molecular Biophysics (IMB) is associated with *the Graduate Program in Molecular Biophysics* (MOB). This interdisciplinary research institute brings together biologists, chemists, mathematicians, physicists, and engineers. The structural biology and computational biophysics faculty are a sub group of MOB faculty members who reside in IMB.

- The Interdisciplinary Program in Neuroscience promotes interdisciplinary research into neural processes. It includes faculty members from biological sciences, biomedical sciences, mathematics, and psychology. Neurosciences is included because in discussions with its director, the breadth of neuroscience research includes interesting problems that MS&E students and faculty might be interested in such as biomaterials or bioengineering methods to study implanted electrode arrays.

C. Provide a narrative of the planning process leading up to submission of this proposal.

Include a chronology (table) of activities, listing both university personnel directly involved and external individuals who participated in planning. Provide a timetable of events necessary for the implementation of the proposed program. Planning Process

The idea for an interdisciplinary MS&E Ph.D. program originated in the discussions to create an interdisciplinary program in Materials Science. These discussions were begun in 2006 and culminated in the creation of the interdisciplinary Master of Science in Materials Science program. This was approved in 2008; the first student matriculated in 2008 and the first student graduated in 2010. The plan was to establish the M.S. degree first then follow it with the Ph.D. program. Informal planning for the Ph.D. degree started as soon as the Master of Science degree was created and the materials science faculty members began to meet about the M.S. program. The first formal discussions with the FSU administration about the Ph.D. program occurred in late 2009. The Proposal to Explore was written and approved in spring 2010. The Proposal to Implement has been written over the summer and fall of 2010.

Date	Participants	Planning Activity
Nov. 19, 09	Kirby Kemper, Nancy Marcus, Jennifer Buchanan, Ben Wang, Chuck Zhang, Jim Brooks, and Eric Hellstrom	Discussed strategy and for creating interdisciplinary Ph.D. program in MS&E based on the newly created interdisciplinary Master of Science in Materials Science.
Jan. 7, 10	Larry Abele, Kirby Kemper, Nancy Marcus, Joe Travis, Marty Chen, Chuck Zhang, Jim Brooks, and Eric Hellstrom	Discussed plans to create Ph.D. program with FSU upper administration.
Jan. 20, 10	Faculty from participating departments	Discuss plans to create Ph.D. program based on the M.S. Program in Materials Science
Jan. and Feb. 10	Jim Brooks, Eric Hellstrom, and Chuck Zhang	Drafted Proposal to Explore and got approval from 9 dept. chairs and two deans
Feb. 22, 10	Marty Chen, Bruce Locke, Eric Hellstrom plus FSU Graduate Planning Committee	Presented Proposal to Explore to GPC. It was approved.
Mar. 15, 10	Nancy Marcus and Eric Hellstrom	Discussed broad issues about funding the program and how to make sure the Ph.D. program was truly interdisciplinary
Apr. 23, 10	Faculty from participating departments	Discussed curriculum issues.
July 9, 10	Nancy Marcus and Eric Hellstrom	Discussed specific issues for funding graduate students in year 1 and beyond
July and Aug. 10	Nancy Marcus and several department chairs	Discuss issues that individual departments have with funding graduate students.
June – Sept. 10	Jim Brooks, Eric Hellstrom, Chuck Zhang	Draft the Proposal to Implement
Sept. 13, 10	Nancy Marcus and MS&E faculty	Discuss the interdisciplinary nature of MS&E and funding options
Sept. 21, 10	MS&E faculty	Discuss core curriculum
Oct. 20, 10	Nancy Marcus, Kirby Kemper, Jim Brooks, Eric Hellstrom, Chuck Zhang	Discuss administrative structure of MS&E
Dec. 14, 10	6 FSU faculty members met with 10 UF faculty members	Retreat at UF to discuss this proposal, review research areas, and look for possible areas to collaborate
Dec. 2011 and Jan. 2010	Hellstrom, UCF and FIU MS&E directors	Discussed research strengths and unique programs at UF and FSU, and potential collaborations
Jan. 3, 11	Deans, Dept. Chairs, Jim Brooks, and Eric Hellstrom	Discuss important issues for the proposal to satisfy wide range of academic stakeholders
Jan. 24. 2011	FSU Graduate Planning Committee	Proposal approved by FSU Graduate Planning Committee
Mar. 4, 2011	FSU Board of Trustees	Approved by FSU Board of Trustees

Events Leading to Implementation

Date	Implementation Activity
June 2011	Draft MOU between participating departments, colleges, and the Grad School. This will be based on the MOU for MS Program in Materials Science.
Aug. 2011	Approve MOU by participating departments, colleges, and the Grad School
Aug. 2011	Create administrative codes for the program within FSU. These codes already exist for the MS Program in Materials Science, so the protocol for doing this is known.
Fall 2011	Start MS&E Ph.D. program with students who have earned an MS degree in FSU's Master of Science in Materials Science. Already have students from the MS Program in Materials Science who will be on hold waiting for the Ph.D. program to start.

VII. Program Quality Indicators - Reviews and Accreditation

Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit.

List all recommendations and summarize the institution's progress in implementing the recommendations.

N/A

VIII. Curriculum

A. Describe the specific expected student learning outcomes associated with the proposed program.

If a bachelor's degree program, include a web link to the Academic Learning Compact or include the document itself as an appendix.

The specific learning outcomes are:

(1) Ability to demonstrate a thorough knowledge of materials science and engineering:

Students graduating with a Ph.D. in materials science and engineering must demonstrate an understanding of a range of topics in materials science and engineering and must also demonstrate the ability to carry out meaningful, independent research.

Assessment Plan: This learning outcome will be assessed by the student performance in the core courses with a written exam, an oral presentation of the research topic with an oral examination (prospectus) of the elective specialization courses and the final oral defense of the dissertation. The evaluation will be based on the following measurements: (1) at least 75% of all students in MS&E will pass the written qualifying exam covering the core courses; (2) at least 80% of the students who pass the qualifying exam will pass their oral

prospectus; and (3) at least 80% of the students who pass their prospectus will pass their dissertation defense.

(2) Ability to Communicate in a Professional Setting: Students graduating with a Ph.D. in MS&E will be able to demonstrate technical communication skills at an appropriate level.

Assessment Plan: This learning outcome will be assessed by the student performance by participation in the ISS (Interdisciplinary Seminar Series), in the dissertation defense, publications, and oral presentations. The evaluation will be based on the following measurements: (1) at least 80% of the students in the program will pass their prospectus exam; (2) at least 80% of the students who pass their prospectus exam will pass their dissertation defense; (3) at least 80% of the students who pass their prospectus exam will complete a paper and submit it to a journal or a technical conference before graduating; and (4) at least 80% of the students will have given an oral presentation of their research in a public forum other than their dissertation defense.

B. Describe the admission standards and graduation requirements for the program.

MS&E will follow FSU's admission standards and adds some additional requirements. These are:

FSU requirements

- An earned bachelor's degree from a regionally accredited U.S. institution, or a comparable degree from an international institution, with a minimum 3.0 (on a 4.0 scale) grade point average (GPA) in all work attempted while registered as an upper-division undergraduate student working towards a bachelor's degree; or
- A graduate degree from a regionally accredited U.S. institution, or a comparable degree from an international institution;
- Test scores from a nationally standardized graduate admission test which is acceptable for the program to which the applicant is applying.
- International students whose first language is not English are required to take the TOEFL exam and to have a minimum score of 80 on the Internet-based examination.
- Three (3) letters of recommendation

MS&E specific requirements

- Undergraduate or graduate degree in a STEM field.
- Have a minimum combined score of 1100 on the verbal and quantitative GRE exam.
- A statement of professional goals
- The student's application materials will be reviewed by an MS&E admissions committee composed of faculty members from participating departments.

Admissions process

Students will apply to the MS&E program through the FSU Graduate School Admissions Portal. Each applicant will be evaluated by the admissions committee, which will be made up of MS&E faculty members with tenure homes covering all the departments across campus. This committee will decide whether to admit each student and will also evaluate each student for one of the first-year fellowships.

Graduation Criteria for the Ph.D. in MS&E

All students must pass all of the required coursework (27 credit hours of graded course work) with a minimum 3.0 GPA. In addition to meeting the university requirement to maintain an overall GPA of 3.0 or above, MS&E students need to achieve a grade of "B" or better in each core course. Students not achieving a "B" must either retake the course or take another core course in a different topic area that will be selected by MS&E in consultation with the instructor of the core course in which the student did not achieve at least a "B."

All MS&E students must take a written qualifying exam. This will be based on the required core courses.

All MS&E student must write, present, and defend a prospectus on their proposed research. As part of the oral prospectus presentation and defense, the research committee will evaluate the student's mastery of the breadth of materials science based on oral questions covering the topics in the student's elective specialization courses.

A dissertation is required, which must be an original work and will serve in part to demonstrate the student's ability to carry out research. On completion, the dissertation will be defended orally in front of the dissertation committee.

Dissertation Advisor and Supervisory Committee

The student will choose a major professor (dissertation advisor) from the MS&E faculty by the end of his/her second semester. The Ph.D. supervisory committee consists of a minimum of five faculty members with Ph.D. directive status. The major professor is the chair of the supervisory committee and must be an MS&E faculty member. The student and the major professor will select the supervisory committee. A maximum of 2 members of the supervisory committee can be from the advisor's department, a maximum of 3 can be from the advisor's college, and the committee must have members from at least 3 different departments. In addition at least 4 of the 5 committee members must be from MS&E. Additional members may be appointed to the committee if deemed desirable by the major professor. The supervisory committee must be selected by the end of the semester in which the student passes the Ph.D. qualifying exam covering the core courses.

FSU faculty members who participate in the MS&E Ph.D. program must be approved for graduate faculty status in MS&E. The university representative on the committee will be a faculty member who does not have graduate faculty status in MS&E.

After passing the qualifying exam, and following existing Graduate School policy, the student will submit a summary of his/her research results and plans for ongoing research in August of each year and will discuss this in a meeting with all of his/her supervisory committee in September of each year. The committee will write a short evaluation of the student's progress. This evaluation procedure is done yearly until the student graduates.

Ph.D. Qualifying Examination

The Ph.D. qualifying exam will be a written examination based on the content of the four core courses completed by the candidate. It will be taken after the first year. Students have two chances to pass the qualifying exam.

Preliminary Examination and Prospectus

After passing the Ph.D. qualifying exam and finishing all the elective specialization courses, the student will prepare a prospectus. This is a written document that includes preliminary research results and a plan and timeline to complete the research. The student will submit the written prospectus to his/her supervisory committee and will also present the prospectus orally. During the oral prospectus presentation, the student will have oral questions from the supervisory committee based on the student's elective specialization courses to gauge the student's understanding of the breadth and depth of materials science. This oral examination and presentation of the prospectus will constitute the preliminary examination.

Ph.D. Dissertation Defense

Upon satisfactorily completing the preliminary examination and prospectus, the student will finish his/her research and then prepare a written document for his/her dissertation and defend the dissertation orally.

- C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements.
Identify the total numbers of semester credit hours for the degree.**

Students entering the program with a B.S. degree (or equivalent) will be required to take a minimum of 54 credits including at least 27 credits of letter-graded courses and at least 24 credits of dissertation research. Students will also take the Interdisciplinary Seminar Series (0 credits) the entire time they are in MS&E. The letter-graded credits are described below.

27 credits (minimum) of letter-graded courses

- 4 core courses (minimum 12 credits).
 - Fundamental Core Courses: - Three required
 - Elective Core Courses: - One required
- 5 elective, specialization courses (minimum 15 credits)

24 credits (minimum) of dissertation research

Fundamental Core Courses – All three courses are required.

Survey of materials. – This topic includes an introduction to advanced materials, biomaterials, nanomaterials, and/or topics in materials chemistry, and is covered in several existing courses in mechanical engineering in chemistry and biochemistry, and in biological science. Incoming MS&E students will have a wide variety of backgrounds. The survey course provides fundamental understanding about materials these students need for the other MS&E courses. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, and Mechanical Engineering.

- *Topics in Materials Chemistry I:* Introduction to materials chemistry, focusing on the structure, properties, and functions of metals and alloys, glasses and ceramics, semiconductors and nanomaterials. This course is intended for graduate students involved in materials research (CHM 5715)

Thermodynamics and kinetics. – This topic concerns the fundamental properties of thermodynamics, and the kinetics of the transformation of materials. Existing courses in chemical and biomedical engineering cover these topics. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, Industrial Engineering, Mechanical Engineering, and Physics.

- *Materials Thermodynamics and Kinetics:* The course offers students the foundation of thermodynamics and kinetics applied to materials research (ECH 5934)
-

Solid state science for materials scientists/engineers. - This topic covers the essential areas of structural, thermal, electronic, and magnetic properties of materials, including superconducting, magnetic, semiconducting, and ferroelectric materials of strong current technological interest. The essential theoretical background for materials properties will be provided in the course. This topic area can be taught by faculty members in Chemical Engineering, Electrical Engineering, and Physics.

- Presently, this course is entitled *Materials and Measurement*. It was created by Physics and is being taught as one of the MS core courses. For the Ph.D. program, the emphasis of the syllabus will be more focused on the underlying physics of materials. Measurements will be treated in a separate course in the Characterization of Materials elective. (PHY 6937)

Elective Core courses - Students select one course from the following list

Survey of synthesis and processing. - This topic address the synthesis of materials in bulk, thin film, amorphous, single crystals; morphologies and their transformation into structures for measurement; applications in technology and commercialization. Existing courses in industrial engineering and chemical engineering cover these topics, and new courses in physics and mechanical engineering will be considered as the program develops. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, Industrial Engineering, Mechanical Engineering, and Physics.

- *Synthesis and Processing of Advanced Materials:* This course provides a basic understanding and up-to-date knowledge on the material structures and design, synthesis methods, and processing technologies of various advanced materials. A broad range of materials from inorganic ceramics and metal oxides to organic soft matters is covered with emphasis on processing/structure/property/function relationship of a number of advanced materials mainly for structural, electrical and electronic, and optical applications. (EIN 5930)

Computational methods for materials. - This topic is central to the theory, modeling, computation, and understanding of materials formation and materials properties. This topic area can be taught by faculty members in Chemical Engineering, Mechanical Engineering, Physics, and Scientific Computing.

- *Molecular Dynamics: Algorithms and Applications:* This course provides a comprehensive introduction to molecular dynamics simulation algorithms and their corresponding applications in molecular science.(ISC 5225)
- *Multiscale Modeling of Materials:* This course covers mathematical and algorithmic basis for atomic scale, mesoscale and continuum scale modeling approaches in material sciences. Emphasis is on the atomic-to-continuum connection, statistical approaches and homogenization problems in continuum modeling of heterogeneous materials. (ISC 5229)

Characterization of materials. - This topic covers materials measurement, including optical, physical, electronic, magnetic, resonant, and scattering methods, and microstructural probes. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, Mechanical Engineering, and Physics.

- *Characterization of Materials I:* Characterization of solid state materials by optical and electron microscopy, X-ray, electron, and neutron diffraction methods, and transport and magnetic measurements. The course covers fundamental principles and practical aspects of measurements used in materials research. (CHM 5716)
- *Characterization of Materials II:* Polymer and small molecule characterization using NMR and other physical and spectroscopic techniques. The class is

comprised of lectures and a practical component performed at an instrument germane to the specific section of the course. (CHM 5717)

Interdisciplinary Seminar Series - taken every semester the student is in MS&E (0 credits)

- This seminar-type course will be offered by MS&E faculty to provide students with an opportunity to obtain information on advances in materials research through presentations from visiting scientists and from MS&E faculty. Students will learn and practice presentation skills in this seminar. In addition to technical topics, this seminar series will also have talks on business related topics to help prepare the students to take leadership roles as they move from the university setting to industry and society. The ISS will serve as a forum for MS&E faculty members who wish to recruit MS&E students, and hence some seminar periods will be set aside to allow multiple faculty members to make short presentations advertising their research programs. This new, interdisciplinary course will be cross-listed by all departments with MS&E faculty members.

This core curriculum is built on existing courses at FSU, which are available to FAMU students. Topic areas and course content will be regularly reviewed. Changes in the selection of courses that meet the core-course requirements will be made when necessary to insure the MS&E program is responsive to the changing needs of the students, the particular talents and interests of the faculty members, and changes in the field.

D. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.

Suggested course sequence a student entering MS&E will take. The sequence also shows when other actions, such as selecting an advisor and taking required exams need to be done.

Semester - 1	Semester - 2
2 Required Core courses 1 Elective Specialization course ISS graduate seminar	1 Required Core course 1 Elective Core course 1 Elective Specialization course ISS graduate seminar <i>Choose research advisor by end of semester</i>
Semester - 3	Semester - 4
2 Elective Specialization courses ISS graduate seminar Research <i>Take Ph.D. preliminary exam during semester</i>	1 Elective Specialization course Research ISS graduate seminar
Semester - 5	Semester - 6
ISS graduate seminar Research <i>Prepare and defend prospectus</i>	ISS graduate seminar Research
Semester - 7	Semester - 8
ISS graduate seminar Research	ISS graduate seminar Research
Semester - 9	Semester - 10
ISS graduate seminar Research	ISS graduate seminar Research <i>Defend Ph.D. dissertation</i>

E. Provide a one- or two-sentence description of each required or elective course.

The required and elective core courses plus the Interdisciplinary Seminar Series were described above in Section VIII.C. The elective specialization courses are briefly described below. Elective courses may be added or removed by the Curriculum Committee.

- *Technology Entrepreneurship and Commercialization.* This course provides students with a hands-on educational experience proposing and analyzing technology-based ideas for development as a product and introducing the product into the market. (Currently offered as a directed independent study (DIS) course through each student's home department.)
- *Composite Materials Engineering.* This course offers students fundamental knowledge of constitutional materials, interface, fabrication and basic mechanical behaviors of composite materials. (EMA 5182)

- *Advanced Composite Engineering Topics*. A survey course on advanced composite topics, including fabrication process modeling and simulation, high temperature resins and composites, fiber preform and liquid composite molding (LCM), electrical and EMI shielding properties of composite materials. (EIN 5930)
- *Introduction to Micro- and Nanoscale Science and Engineering*. Introduction to nanoscale materials processing and properties, quantum mechanics of nanoscale materials, statistical mechanics and thermodynamics of finite systems, self-assembly and morphological growth in nanoscale systems, pattern formation at the nanoscale, and nanoscale mechanics. (EML 5930).
- *Experimental Methods in Nanoscale Science and Engineering*. Introduction experimental methods used to fabricate nanoscale materials. Course includes lab section fabricating nanoscale systems. (EML 5930).
- *Introduction to Advanced Materials*: The course provides the fundamentals of the science and practical uses of materials. (EML 5930)
- *Topics in Materials Chemistry II*: Introduction to materials chemistry, focusing on the structure, properties, and functions of polymers, organic and soft materials, and bio-inspired materials. This course is intended for graduate students involved in materials research. (CHM 5718)
- *Survey of Physical Chemistry*. An intense survey of physical chemistry covering the areas of thermodynamics, statistical mechanics, quantum mechanics, and chemical kinetics. The course emphasizes the application of mathematical methods in treating physical quantities. (CHM 5530).
- *Physical Methods*. This course offers description and applications of physical methods of molecular characterization. (CHM 5681).
- *Physical and Chemical Kinetics*. Comprehensive reaction kinetics and dynamics, phenomenological rate laws, mechanisms, diffusion-control and activation-controlled reactions and experimental and numerical techniques for kinetic studies. (CHM 5440).
- *Polymer Science and Engineering*. The course offers graduates fundamental concepts and structure-property relationships of polymeric materials. (ECH 5828)
- *Biomaterials and Biopolymers*. The course offers graduates an introduction to naturally occurring and synthetic biomaterials and biopolymers. Their structure, synthetic paths, properties and uses will be covered. (BME 5105)
- *Colloidal Engineering*. This course offers graduates thorough understanding of the primary forces acting between particles, colloidal stability, methods of characterizing particles and suspension mechanics. (ECH 5934)
- *Polymer Processing*. This course offers graduates a basic understanding of the major techniques used for processing thermoplastics, thermosets and polymeric solutions. (ECH 5937)
- *Polymer Characterization I & II*. This course describes synthesis and chemical mechanisms of polymerization reactions (Part I) and the theoretical basis of major methods of characterization of polymers in solution and the solid state (Part II).

Included are spectroscopic methods, molecular mass determination, surface studies and mechanical properties. (CHM 5454).

- *Chemical and Physical Characterization of Biopolymers.* Course covers biopolymer types and conformations; solution properties of biopolymers; macromolecular equilibria; hydrodynamic behavior; determination of size and shape; biopolymer separations; introduction to biological spectroscopy. (BCH 5745).
- *Polymeric Materials Manufacturing and Processing.* Introduction to fundamentals of polymeric materials processing including polymerization and rheology, and manufacturing processes including extrusion, injection molding and liquid composite molding. (EIN 5930)
- *Applied Superconductivity.* This course offers students an introduction to superconductivity, superconducting materials, and the technology challenges related to their processing and application. (EML 5072)
- *Electronic Materials and Devices.* A survey course on advanced conductive and semiconductor materials. (ECE 5930)
- *Materials for Energy Systems.* Introduction to several classes of Materials that are used in systems that produce, store or transfer energy. It concentrates on three main areas in which energy is transformed to useful sources: solar to chemical energy by photocatalysis, nuclear to electric energy by controlled nuclear reactions, and chemical to electrical energy in solid oxide fuel cells. (EML 5930)
- *Condensed Matter Physics I.* Crystal structure phonons, electron in metals, semiconductors, magnetism, ferroelectrics, and liquid crystals. (PHZ 5491)
- *Condensed Matter Physics II.* Elementary excitations in solids, the many-body problem, quantum fluids and superconductivity, magnetism, dielectrics, collective effects in fluids. (PHZ 5492)
- *Techniques in Experimental Physics.* The course is designed for students to become acquainted with modern techniques in experimental physics, learn lab skills, and understand the limiting factors of an experiment and how the results can be improved by using an optimal design. Modern trends in nanoscience and quantum experimental physics will be emphasized in this course. (PHY 5846C)
- *Electrochemistry.* Instrumentation and techniques in electrochemistry, including such topics as electrode processes, potentiometry, voltammetry, and coulometry. (CHM 5153).
- *Electrochemical Engineering.* This course offers graduates basic principles of electrochemical properties of materials and major and specialty applications. (ECH 5937)
- *Multiscale Modeling of Materials.* Prerequisites: basic knowledge of atomic structure of materials, mechanics, and graduate level knowledge in engineering mathematics and/or mathematical physics. This course emphasizes the use of mathematical and computational techniques to solve problems of materials structure and properties. The computational algorithms used in each of these areas will also be emphasized. Concrete examples will be used to explain the basic ideas, and the students will pursue projects in which they apply the concepts discussed in the lectures. (ISC 5935)

- *Applied Computational Science I.* This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of course work and lab work provides the proper blend of theory and practice with problems culled from the applied sciences. Topics include numerical solutions to ODEs and PDEs, data handling, interpolation and approximation, and visualization. (ISC 5315)
- *Applied Computational Science II.* This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of course work and lab work provides the proper blend of theory and practice with problems culled from the applied sciences. Topics include mesh generation, stochastic methods, basic parallel algorithms and programming, numerical optimization, and nonlinear solvers. (ISC 5316)
- *Theory of Elasticity.* The course offers upper division undergraduate and entry-level graduate foundation of advanced mechanics of materials. (EGM 5653)
- *Continuum Mechanics.* This course offers student fundamentals of continuum mechanics. (EML 5611)
- *Engineering Data Analysis.* Analysis of experimental and observational data from engineering systems. Focus on empirical model building using observational data for characterization, estimation, inference and prediction. (ESI 5417)
- *Applied Optimization.* The course offers student fundamental of Heuristic Optimization and its applications in engineering design, production and materials research. (ESI 5408)
- *Mechanical Metallurgy.* This course offers students fundamentals of metallurgy. (EMA 5226)
- *Physical and Chemical Kinetics.* Comprehensive reaction kinetics and dynamics, phenomenological rate laws, mechanisms, diffusion-control and activation-controlled reactions and experimental and numerical techniques for kinetic studies. (CHM 5440)

F. For degree programs in the science and technology disciplines, discuss how industry-driven competencies were identified and incorporated into the curriculum and identify if any industry advisory council exists to provide input for curriculum development and student assessment.

The Ph.D. in MS&E is a research-oriented degree. The graduate students will be supported on faculty members' research grants, which are typically funded by a federal agency or industry. The federal grants are won in competitive grant procedure where the MS&E faculty member writes a winning proposal that addresses a significant research question in a cutting edge research area. Industry funds significant, cutting-edge research in areas that are important to the industry. Thus the MS&E students will do research on topics the scientific and technical community believes are important, relevant, and timely.

- G. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program. Will the university seek accreditation for the program if it is available? If not, why? Provide a brief timeline for seeking accreditation, if appropriate.**

N/A

- H. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor's or master's programs associated with the proposed program. Are the programs accredited? If not, why?**

Materials Science and Engineering is accredited at the undergraduate level by ABET (Accreditation Board for Engineering and Technology). There is no agency or society that accredits the M.S. degree in Materials Science and Engineering.

- I. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs). If the proposed delivery system will require specialized services or greater than normal financial support, include projected costs in Table 2. Provide a narrative describing the feasibility of delivering the proposed program through collaboration with other universities, both public and private. Cite specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.**

The MS&E courses will be delivered on campus using traditional delivery methods.

IX. Faculty Participation

- A. Use Table 4 to identify existing and anticipated ranked (not visiting or adjunct) faculty who will participate in the proposed program through Year 5. Include (a) faculty code associated with the source of funding for the position; (b) name; (c) highest degree held; (d) academic discipline or specialization; (e) contract status (tenure, tenure-earning, or multi-year annual [MYA]); (f) contract length in months; and (g) percent of annual effort that will be directed toward the proposed program (instruction, advising, supervising internships and practica, and supervising thesis or dissertation hours).**

TABLE 4 (page 1 of 3)
ANTICIPATED FACULTY PARTICIPATION

Faculty Code	Person and department	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prog. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prog. Year 5	PY Year 5
A	Alamo, Rufina; PhD Chemical and Biomedical Eng.	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Andrei, Petru; PhD Electrical and Computer Eng.	Assoc. Prof.	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Brooks, James; PhD Physics	Professor	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Chiorescu, Irinel; PhD Physics	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Collier, John; PhD Chemical and Biomedical Eng.	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	El-Azab, Anter; PhD Scientific Computing	Professor	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Englander, Ongi; PhD Mechanical Engineering	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Hellstrom, Eric; PhD Mechanical Engineering	Professor	Tenure	Fall 2011	9	0.75	9.00%	0.068	9	0.75	15.00%	0.113
A	Larbolestier, David PhD Mechanical Engineering	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Lattner, Susan; PhD Chemistry and Biochemistry	Assoc. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Lenhart, Steve; PhD Biological Sciences	Asst. Prof.	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Liang, Richard PhD Industrial and Manufact. Eng.	Professor	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083

TABLE 4 (page 2 of 3)
ANTICIPATED FACULTY PARTICIPATION

Faculty Code	Person and department	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prog. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prog. Year 5	PY Year 5
A	Liu, Tao (Ted); PhD Industrial and Manufact. Eng.	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Oates, William; PhD Mechanical Engineering	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Rikvold, Per Arne; PhD Physics	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Shanbhag, Sachin; PhD Scientific Computing	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Shatruk, Mykhailo; PhD Chemistry and Biochemistry	Asst. Prof.	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Siegrist, Theo; PhD Chemical and Biomed. Eng.	Professor	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Sobanjo, John; PhD Civil and Environmental Eng.	Assoc. Prof.	Tenure	Fall 2011	9	0.75	4.50%	0.034	9	0.75	11.00%	0.083
A	Strouse, Geoffrey; PhD Chemistry and Biological	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Vafek, Oskar; PhD Physics	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Wang, Hsu-Pin (Ben); PhD Industrial and Manufact. Eng.	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Warusawithana, Maitri; PhD Physics	Asst. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Zhang, Chun (Chucky); PhD Industrial and Manufact. Eng.	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Zhang, Mei; PhD Industrial and Manufact. Eng.	Assoc. Prof.	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070
A	Zheng, Jianping (Jim); PhD Electrical and Computer Eng.	Professor	Tenure	Fall 2011	9	0.75	1.91%	0.014	9	0.75	9.28%	0.070

**TABLE 4 (page 3 of 3)
ANTICIPATED FACULTY PARTICIPATION**

Faculty Code	Source of Funding	PY Workload by Budget Classification	
		Year 1	Year 5
A	Existing faculty on a regular line		1.967
B	New faculty to be hired on a vacant line	0.578	0.000
C	New faculty to be hired on a new line	0.000	0.000
D	Existing faculty hired on contracts/grants	0.000	0.000
E	New faculty to be hired on contracts/grants	0.000	0.000
Overall Totals for		Year 1	Year 5
		0.578	1.967

- B. Use Table 2 to display the costs and associated funding resources for existing and anticipated ranked faculty (as identified in Table 4). Costs for visiting and adjunct faculty should be included in the category of Other Personnel Services (OPS). Provide a narrative summarizing projected costs and funding sources.**

In Year 1, the total reallocated E&G funds for faculty salaries and benefits will be \$103,555 with \$94,878 being reallocated within department accounts in Arts and Sciences and within department accounts in the College of Engineering and \$8677 from the Provost Instruction and Research Account. It will increase to \$334,985 in Year 5 due mainly to faculty members having more MS&E students in their research groups. There will be no change in any department budget or the budgets of the College of Arts and Science or College of Engineering's due to these reallocations.

In Year 1 there are also \$286,820 in reallocated E&G funds from the Provost Instruction and Research account for a half time OPS position, first year fellowships, student tuition waivers, and expenses.

No new faculty members will be hired explicitly for MS&E. MS&E faculty members will teach courses with MS&E students, will participate in running the interdisciplinary program, and will pay for and supervise MS&E students' research.

- C. Provide the number of master's theses and/or doctoral dissertations directed, and the number and type of professional publications for each existing faculty member (do not include information for visiting or adjunct faculty).**

The following table summarizes the graduate degree and research productivity for the faculty members who will participate in MS&E. It also contains research information used in Section IX.D.

TABLE IX.C. - M.S. and Ph.D. students, publications, and external research funding (page 1 of 4)

This table shows the number of M.S. and Ph.D. students directed and the publication record of MS&E faculty members (career totals). The information on research activities from 2005 through 2010 is used in Section IX.D. Note: contracts and grants awarded after June 2010 are not included in the table. The footnotes at the end of the table describe how the data in the column "Total \$ From Grants" were determined.

Faculty Member (Dept.)	M.S. Theses		Ph.D. Dissertations		Professional Publications (in referred journals) ¹				Externally-funded research activities – 2005 through 2010 ^{1,2}		
					Referred Journal Arts.	Proceedings	Book Chpts.	Books	No. of research contracts and grants Total (PI, CoPI)	Total \$ from grants	Entities that funded the research
Rufina Alamo (CBE)	8	4	165	15					6 (3,3)	\$1,150,000	NSF, Exxon Chemical Co, Engelhard Corp.
Petru Andrei (ECE)	0	2	25	4					4 (2,2)	\$371,208	NSF
James Brooks (Phy)	0	6	53	2	1				4 (4,0)	\$488,417	NSF
Irinel Chiorescu (Phy)	0	2	24	5	0				3 (3,0)	\$526,000	Arrived in 2005: NSF, Univ. of New Orleans, Sloan Foundation
John Collier (CBE)	59	18	64	52	18	0			9 (7,2)	\$1,485,968	NSF, U.S. Army Res. Off, SunGrant, Bush Brothers, EPA, Brown-Forman, USDA, DOE
Anter El-Azab (SC)	3	1	50	30	1	1			16 (16,0)	\$977,038	U.S. Dept. of Energy, Univ. of Florida, Battelle Energy Alliance, LLC, Universal Technology Corporation, U.S. Army Research Office, Oak Ridge Associated Universities, Lawrence Livermore Nat'l Security, LLC, UT-Battelle, LLC
Ongi Englander (ME)			5	6					2 (1,1)	\$39,975	Arrived in 2007: NSF, Proctor & Gamble
Eric Hellstrom (ME)	6	8	120	20	3				4 (1,3)	\$573,119	Moved to FSU in 2007: Fermi National Lab., U. S. Department of Energy, NSF

TABLE IX.C. - M.S. and Ph.D. students, publications, and external research funding (page 2 of 4)

Faculty Member (Dept.)	Externally-funded research activities – 2005 through 2010 ^{1,2}				Professional Publications (in referred journals) ¹				No. of research contracts and grants Total (PI, CoPI)	Total \$ from grants	Entities that funded the research
	M.S. Theses	Ph.D. Dissertations	Referred Journal Arts.	Proceedings	Book Chpts.	Books					
David Larbalestier (ME)	15	33	350	~75	2	0	21 (11,10)	\$4,006,685	Moved to FSU in 2006: NSF, U.S. Department of Energy, Air Force Research Lab., Alameda Applied Sciences Corporation, Fermi National Accelerator Lab., Consiglio Nazionale Delle Ricerche (CNR), Superpower, Inc., University of Wisconsin, New Energy and Industrial Development, American Superconductor, ITER (Int'l Fusion Energy Org), Univ. of Florida, UT-Battelle, LLC		
Susan Laffturner (Chem)	0	5	15	0	0	0	4 (4,0)	\$470,082	NSF, American Chemical Society, Oak Ridge National Lab.		
Steve Lenhert (BS)	1	0	20	7	2	0	2 (1,1)	\$1,315,000	Arrived in 2009: Funding was at KIT in Germany before he came to FSU		
Richard Liang (IME)	21	9	40	42	3		20 (11,9)	\$3,640,924	Lockheed Martin, Northrop Grumman Corporation, Transformational Technologies, Inc., National Composite Center, Spirit Aerosystems, Inc., General Dynamics Corporation, Universal Technology Corporation, U.S. Department of the Army, Air Force Office of Scientific Research, ATK Launch Systems, Inc., HX5, LLC, U.S. Army Research Lab., Georgia Aerospace Systems		
Tao Liu (IME)			21	9			3 (3,0)	\$316,016	Arrived in 2007: NEI Corporation (NASA), Universal Technology Corporation (Air Force Research Lab), Georgia Institute of Technology (DARPA)		
Billy Oates (ME)	1	1	11	10	8		6 (3,3)	\$625,000	Arrived in 2006: Space and Naval Warfare Systems Center, Procter & Gamble, U.S. Army Research Office, Spectral Energies, LLC		

TABLE IX.C. - M.S. and Ph.D. students, publications, and external research funding (page 3 of 4)

Faculty Member (Dept.)	M.S. Theses	Ph.D. Dissertations	Professional Publications (in referred journals) ¹				No. of research contracts and grants Total (PI, CoPI)	Total \$ from grants	Entities that funded the research
			Referred Journal Arts.	Proceedings	Book Chpts.	Books			
Per Arne Rikvold (Phy)	0	3	37	13	2	0	\$517,000	NSF, IESES	
Sachin Shanbhag (SC)	0	0	29	1			\$218,000	Arrived in 2006: NSF, Dept. of Energy, Petroleum Research Fund	
Mike Shatruk (Chem)	0	0	26	26	1	0	\$304,667	Arrived in 2007: NSF	
Theo Siegrist (CBE)	0	0	197	26	1			Arrived in 2009	
John Sobanjo (CEE)	6	1	7	3	0	0	\$705,000	Federal Highway Administration, Florida Dept. of Transportation	
Geoff Strouse (Chem)	4	17	126	20	1	0	\$1,076,259	Northern Nanotech, National Institute of Biomedical Imaging, Univ. of California Santa Barbara, National Center for Research Resources, National Institute of General, NSF, ONR	
Oskar Vafek (Phy)	0	0	23	0	0	0	\$84,000	Arrived in 2006; NSF	
Ben Wang (IME)	40	18	186	151	15	8	\$7,268,454	Lockheed Martin, Georgia Aerospace Systems, Ohio State University Research, NSF, Florida Board of Governors, U.S. Army Research Lab, Simula, Inc., Boeing Company, 2Phase Technologies, Spirit Aerosystems, Inc., Siemens Westinghouse Power Corporation, TA Instruments, Air Force Office of Scientific Research, Office of Naval Research, Air Force Research Lab, ATK Launch Systems Inc., General Dynamics Corporation, Sikorsky Aircraft Corporation, Transformational Technologies Inc., Northrop Grumman Corporation	
Maitri Warusavithana (Phy)			17	3	0	0		Arrived in 2009	

TABLE IX.C. - M.S. and Ph.D. students, publications, and external research funding (page 4 of 4)

Faculty Member (Dept.)	Professionals Publications (in referred journals) ¹				Ph.D. Dissertations	M.S. Theses	Externally-funded research activities – 2005 through 2010 ^{1,2}		
	Referred Journal Arts,	Proceedings	Book Chpts.	Books			No. of research contracts and grants Total (PI, CoPI)	Total \$ from grants	Entities that funded the research
Chuck Zhang (IME)	9	111	8		9	13	23 (12, 11)	\$3,827,159	NSF, Universal Technology Corporation, Federal Highway Administration, Univ. of Florida, Transformational Technologies, Inc., Lockheed Martin, Ohio State University Research, ATK Launch Systems, Inc., General Dynamics Corporation, Office of Naval Research, Sikorsky Aircraft Corporation, Georgia Aerospace Systems, U.S. Army Research Laboratory, Spirit Aerosystems, Inc., National Composite Center, Air Force Office of Scientific Research
Mei Zhang (IME)	0	24	1	0	0	0	2 (1,1)	\$99,000	Arrived in 2007: NSF, Air Force Research Lab
Jim Zheng (ECE)	6	92	1	0	6	10	9 (8,1)	\$989,513	NSF, Ionova Technologies, Inc., Savannah River Nuclear Solutions, LLC, General Technical Services, Battelle Energy Alliance, LLC, BAE Systems, Bing Energy, Inc.
Total Research \$								\$31,074,484	

¹ Career total for numbers of M.S. and Ph.D. students and publications.

² The total dollar figures were calculated so as not to double count any dollars. The total amount is conservative as some people show smaller amounts than would ordinarily be accredited to them.

The algorithm that was used to calculate the funding is as follows.

- a. Each contract and grant that spanned years before or after 2005 – 2010 was prorated to count only the fraction of money for 2005 – 2010.
 - b. The amount of money in each contract and grant in 2005-2010 was divided by the number of co-PIs on the grant. For multi-investigator awards, each co-PI was credited with an equal amount of money. If one of the PIs on the award was not an MS&E faculty member, the \$ for that PI were not counted in the table. This leads to a conservative calculation of the total research money brought in for research on materials.
 - c. This table was started during summer 2010, so only contracts awarded by June 30, 2010 have been counted. Funds awarded in the second half of 2010 were not counted. This also leads to a conservative calculation of the total research money for materials.
- ³ Some of the MS&E faculty members receive funding from the \$26M per year from NSF that funds the NHMFL. None of this funding is counted in the table. This also leads to a conservative calculation of the total research money brought in for research on materials.

D. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service.

Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, as well as qualitative indicators of excellence.

MS&E is a Ph.D. program with a strong emphasis on research. It is composed of faculty members with tenure homes in 9 different departments. Each of the nine departments in which MS&E faculty members have their tenure homes has been productive in teaching, research, and service. However, since this Ph.D. program is administered by the Graduate School, instead of giving statistics for each of these departments, we have taken the pertinent portion of this question to be about the external research funding awarded. This is the strongest indicator of the ability of the faculty members to support the MS&E Ph.D. program. The table for Section IX.C includes additional information listing a summary of the contracts and grants the MS&E faculty members have won over the past 5 years (2005-2010). As described in the footnotes for this table, the total amount listed on the table is conservative and does not double-count any of the funds.

Conservatively, the total research funding brought in by the MS&E faculty members over the past 5 years is more than \$31M. This shows that the faculty members have productive research programs. Creating MS&E will increase the research productivity since some of the faculty members on this list are relatively new hires at FSU, including 6 NSF CAREER awardees (Chiorescu, Lattner, Oates Shanbhag, Shatruck, and Vafek) and a DARPA Young Faculty Award recipient (Oates), who all do materials science research. They are just starting their research programs and having MS&E will help them strengthen their research portfolios and output by being able to recruit students whose primary interest is studying materials science and engineering. Englander, Lenhart, and Warusawithana have submitted full proposals in fall, 2010 for Career Award to the Department of Energy.

X. Non-Faculty Resources

A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5.

Provide the total number of volumes and serials available in this discipline and related fields. List major journals that are available to the university's students. Include a signed statement from the Library Director that this subsection and subsection B have been reviewed and approved for all doctoral level proposals.

Students enrolled in the Ph.D. MS&E program will have access to all library resources owned or licensed by FSU. Resources related to MS&E are in the following areas: materials, materials science and engineering, physics, chemistry, mechanical engineering, industrial engineering, chemical engineering, nanoscience and nanotechnology engineering as well as bio-materials and computational science. These resources include

4,010 print books, 422 print journal titles, journal back files in print and micro forms, 4,785 eBooks, and 3,726 ejournals. Thirteen electronic databases give students access to over 6,000,000 summaries of journal articles, technical reports, and conference papers and proceedings dating from 1970 to this present time as well as more than 10,000 web site abstracts, and 80 full-text searchable handbooks, patents and standards. Excellent science databases, including Web of Science, Engineering Information Village, IEEE Explore, ACM Digital Library and SciFinder Scholar are available by remote access on the students' computers, or can be accessed at the libraries. Students and faculty members are included in the FSU IP Address Ranges for all electronic resources, and with their FSU computer account or FSU ID cards, they can access these resources through EZProxy or the Proxy Service. In addition, interlibrary loan is available through the FSU Libraries' website via the ILLiad interlibrary loan management system. For research support, students and faculty have access to chat virtual reference systems and face-to-face assistance from professional librarians and support staff located at the College of Engineering or on the main campus.

Engineering books, electronic resources, databases and journal holdings may be accessed on the FSU Libraries' website at <http://www.lib.fsu.edu/>. This website address gives access to resources and services available to all graduate students in the program.

FSU University Libraries, as a member of the Association of Research Libraries (ARL), is among the top academic research libraries in the nation. The libraries' holding report to ARL in 2007-2008 lists 2,844,624 volumes, 62,093 current periodicals and serials subscriptions, 300,000+ e-books, 450+ databases, and 9,109,694 in microforms. The electronic journals are available instantly via password-protected EZ-Proxy service. Article-specific linking capabilities, along with the cooperative borrowing arrangement, bring the world's literature to students or faculty members at their desktop or notebook computers.

In 2010, addition and expansion of statewide electronic journal packages are planned and the University Libraries at FSU will be a beneficiary of receiving access to additional science journal content. The new electronic packages cover all disciplines. Statewide electronic journal packages include Wiley-Blackwell, Nature, Sage and Taylor & Francis, Elsevier, Springer, Cambridge, Oxford, Univ. of Chicago, and bePress. In summary, the library volumes and serials resources are sufficient to meet the requirements of course instruction and research for the proposed program.

- B. Describe additional library resources that are needed to implement and/or sustain the program through Year 5.
Include projected costs of additional library resources in Table 3.**

No additional library resources are needed to implement and sustain MS&E through Y-5.


Library Director

06-08-11
Date

- C. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.**

The MS&E program uses existing courses that are currently taught in classrooms equipped with computers, LCD projectors, and overhead projectors. The courses will be taught in the buildings where they are normally taught, which may be on the College of Engineering campus or on the FSU main campus in the biology, chemistry, physics, and scientific computing buildings. Students can ride the FSU shuttle bus to commute between COE and the main campus.

The courses with associated labs sections already have the laboratory space and equipment they need. MS&E students will have access to these laboratories when they register for the courses.

Research laboratories belonging to the individual MS&E faculty members will be available for their students' research. In addition, through the Pathways program, FSU Centers and Laboratories (see Section VI.B for a list of Centers), and the Office of the Vice-President for Research, an inter-college initiative is underway to provide a network of shared facilities for student and faculty research.

Students in MS&E will be provided with office space by their advisor's home department.

- D. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5.
Include any projected Instruction and Research (I&R) costs of additional space in Table 2. Do not include costs for new construction because that information should be provided in response to X (d) below.**

Due to the relatively small size of MS&E student body and the availability of classrooms and laboratories in participating departments, MS&E does not require additional space to implement and maintain MS&E through Year 5.

E. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.

Since the curriculum is based on already existing courses, any specialized equipment needed for course instruction is already in place and no additional, new equipment is needed for instructional purposes.

In addition, no new equipment for research is needed. Over the past few years, FSU has invested heavily in equipment for research on materials. As an example we describe FSU's support of electron microscopes, which are central to research in materials science and engineering. FSU has purchased a state-of-the-art scanning electron microscope with a focused ion beam that allows one to cut into a sample where one wants to study the microstructure below the surface of the sample. FSU's latest investment is a new scanning transmission electron microscope (TEM) that can resolve individual columns of atoms. This microscope, a JEOL ARM200F, which has the highest resolution in its class, is the first of its kind in Florida and is only the second such TEM in the US.

There is an enormous amount of equipment at FSU available for MS&E students to use for their research. Since it is a very long list, we have included only a partial list of some of the larger pieces of equipment in Appendix B, which is in research centers (see Section VI.B) and also distributed over many individual faculty members' research laboratories. It will be available to MS&E students on an as-needed basis.

Further, through the Pathways program, FSU Centers and Laboratories, and the Office of the Vice-President for Research, an inter-college initiative is underway to provide a network of shared facilities for student and faculty research.

F. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5. Include projected costs of additional equipment in Table 2.

Because faculty members in MS&E have their own research equipment and because of FSU's extensive investment in shared equipment for materials research, no additional specialized equipment is needed to implement and sustain MS&E through Year 5.

G. Describe any additional special categories of resources needed to implement the program through Year 5 (access to proprietary research facilities, specialized services, extended travel, etc.). Include projected costs of special resources in Table 2.

No special categories of resources are needed to implement MS&E through Year 5.

- H. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5. Include the projected costs in Table 2.**

The Graduate School will provide 6 full fellowships (\$20,000 each for the academic year) plus in-state tuition waivers and up to three out-of-state tuition waivers for first year students.

It is expected that, as an ongoing policy of MS&E, the MS&E faculty members will actively seek "training grant" funds to support the new students. These include proposals to the Department of Education Graduate Assistance in Areas of National Need (GAANN), NASA Graduate Student Researchers Program (GSRP), and NSF Integrative Graduate Education and Research Traineeship (IGERT).

- I. Describe currently available sites for internship and practicum experiences, if appropriate to the program. Describe plans to seek additional sites in Years 1 through 5.**

N/A

- J. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Table 2 includes only Instruction and Research (I&R) costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs in particular would necessitate increased costs in non-I&R activities.**

N/A

Appendix A – Abbreviations used in the body of the proposal

Initials	Full Name		
MS&E	MS&E refers to the proposed program in materials science and engineering. Its use includes faculty members, departments, colleges, facilities, funding, and students associated with the new program.		
Initials	Full Name	Initials	Full Name
AAU	Association of American Universities	IGERT	NSF - Integrative Graduate Education and Research Traineeship
ASC	Applied Superconductivity Center	IMB	Institute of Molecular Biophysics
BOG	(Florida) Board of Governors	IME	Industrial and Manufacturing Engineering
BS	Biological Science (in CAS)	INSI	Integrative NanoScience Institute
CAPS	Center for Advanced Power Sources	ME	Mechanical Engineering
CAS	College of Arts and Sciences at FSU	MIRT	NSF – Materials Interdisciplinary Research Teams
CBE	Chemical and Biomedical Engineering	MRSEC	NSF – Materials Research Science and Engineering Center
CEE	Civil and Environmental Engineering	NEMS	Nano-Electromechanical Systems
CEMRI	NSF - Centers of Excellence for Materials Research and Innovation	NHMFL	National High Magnetic Field Laboratory
Chem	Chemistry and Biochemistry (in CAS)	NIH	National Institutes of Health
COE	College of Engineering at FSU	NSEC	NSF – Nanoscale Science and Engineering Centers
DoD	Department of Defense	NSF	National Science Foundation
ECE	Electrical and Computing Engineering	Phys	Physics (in CAS)
FCAAP	Florida Center for Advanced Aeronautics and Propulsion	SBIR	Small Business Innovation Research
FGAMP	Florida-Georgia Alliance for Minority Participation	SC	Scientific Computing (in CAS)
FIU	Florida International University	STEM	Science, Technology, Engineering and Mathematics
FSU	Florida State University	STTR	Small Business Technology Transfer
GAANN	Department of Education - Graduate Assistance in Areas of National Need	SUS	(Florida) State University System
GSRP	NASA - Graduate Student Researchers Program	UCF	University of Central Florida
HPMI	High-Performance Materials Institute	UF	University of Florida

Appendix B - Partial list of equipment available for materials science research

Microscopes SEM and TEM

- Zeiss 1540EsB Field emission scanning electron microscope
- ElectroScan E3
- FEI CM300 FEG (TEM)
- FEI Nova 400
- JEOL-2011
- JEM-ARM200F

Optical Microscopy

- Zeiss LSM 510 laser scanning confocal microscope
- Titan Krios (cryo TEM); currently being installed
- Nikon Eclipse Ti inverted fluorescence microscope
- Leica DMLP polarizing microscope with fluorescence source, digital imaging and thermal stage
- Olympus Scanning laser confocal microscope
- Magneto optical imaging microscope facility
- Standard polarized and dark field light microscopes
- Low Temperature laser Scanning Microscope (LTLSM)

Magnet Systems

- Quantum design 16 T PPMS
- Quantum design 9 T PPMS
- Quantum design 5.5 T SQUID magnetometer MPMS
- Oxford 14 T dedicated VSM
- Oxford 14/16T general purpose 2 inch magnet with VTI set up for nV transport
- Oxford 15/17T general purpose 2 inch magnet set up for high current testing with 2000 A battery supply
- 1 T transverse access electromagnet
- SQUID (AC/DC) (Quantum Design MPMS 7T)

- Magneto-circular dichroism (7/8 T; RT to 2.1K)
- Quantum Design 5T MPMS SQUID magnetometer
- Lakeshore Cryotronics 7300 series vibrating sample magnetometer (VSM) with high and low temperature attachments

NMR, EPR

- 500 MHz solid state NMR
- 500 MHz wide bore imaging NMR spectrometer
- 500 MHz solid state NMR spectrometer
- Fully outfitted condensed matter NMR instrumentation to 17 T and 0.3 K
- EPR (Bruker); X-band, Q-band

X-ray Diffraction

- Powder diffractometer (Rigaku dMax Ultima 3, Mercury COD)
- Single crystal diffractometer (Bruker AXS Apex II)
- Siemens D500 powder diffractometer
- Siemens D500 powder diffract. w/ high/low/near ambient heads
- Powder X-ray w/ 10 K stage
- Rotating anode X-ray
- Single Xtal X-ray

Thermal Analysis

- DTA/TGA (Differential thermal analysis/Thermal gravimetric analysis) with mass spectrometry
- Perkin Elmer Diamond differential scanning calorimetry (DSC)
- Thermomechanical Analyzer (TA Instruments TMA 2940)

DNA Analysis

- FSU-NimbleGen microarray facility
- Applied Biosystems 3130xl genetic analyzer (DNA sequencer)
- 7500 ABI real-time OCR (gene expression analysis)

Spectrometers

- X-ray fluorescence (Oxford ED 2000)
- PHI 5100 X-ray photoelectron spectroscopy (XPS)
- Mossbauer spectrometer with magnet and cryostat
- Biorad IR spectrometer
- Infrared absorption FT-IR (Perkin Elmer Spectrum)
- Raman (Horiba JY LabRam HR800), microscope
- Absorption (Perkin Elmer Lambda 950)
- Photoluminescence/Lifetime TCSPC (JY Fluoromax 4)
- FTIR spectrometer
- Dynamic light scattering
- IXRF energy dispersive X-ray spectroscopy (EDS)
- Gaertner single wavelength (HeNe) ellipsometer (non-scanning)

Scanning Probe Microscopes

- AFM (Asylum MFP-3D)
- Environmental AFM
- Digital Instruments Dimension 3000 scanning probe microscope (SPM)
- Omicron UHV scanning probe microscope (SPM), LEED and Auger electron spectroscopy (AES)

Lithography

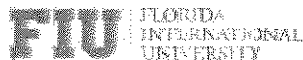
- Tencor Alpha-step 200 scanning profilometer
- Photolithography (including spinner, hot-plate/oven, mask aligner)
- Electron-beam lithography (JEOL 840 SEM with Raith Elphy Quantum)
- Reactive ion etcher (Southbay Technology 2000)
- Westbond ultrasonic wire bonder
- Thermal evaporators (Edwards and home-built)
- AJA UHV Sputtering system (five 2" magnetron sources, 2 DC and 2 RF power supplies, two gases)

Facilities for computation and modeling

Shared-High Performance Computing (HPC) facility: The HPC has 12 login nodes, 526 compute nodes (2688 cores), 156 TB usable storage, and Infiniband and IP communication fabrics. The system is divided into general access and owner-based components. General access consists of 812 cores and the owner-based part consists of 1876 cores. Physics owns 152 cores (11.3 TB) and the PI's group has full access.

Scientific Visualization: The general access laboratory for scientific visualization hosts five high-end visualization workstations each equipped with NVIDIA GPU video cards that are compatible with the CUDA SDK. One workstation has software and emitters for 3D visualization. All workstations have access to over 15 TB of storage. It has a high-resolution stereographic projection system to support multidisciplinary scientific visualization.

Appendix C – Support letters



February 21, 2011

Dean Nancy Marcus
Graduate School
Westcott Hall
Florida State University
Tallahassee, FL 32306

Dear Dean Marcus:

At the recommendation of the Materials Science and Engineering group and the Chair of the Department of Mechanical and Materials Engineering, I am pleased to support your PhD program in Material Science and Engineering.

Researchers at Florida International University and Florida State University have discussed the Florida State University proposal for a PhD in Materials Science. From these discussions, they determined there is little overlap between the materials science research areas here at FIU and at FSU. A topic they discussed was equipment and infrastructure and the possibility for cooperative use of the specialized equipment at the two universities. For instance, FIU has an electron microprobe analyzer that is useful for materials science research, which they do not have at FSU. Likewise, FSU has just purchased a new state-of-the-art transmission electron microscope for materials science research that can be used by FIU researchers.

We do not anticipate that a new PhD program in Materials Science and Engineering at FSU will negatively impact the MS&E program at FIU. Materials Science and Engineering is an important area for Florida and the nation, and the new PhD program will help satisfy the need for more people in this area.

For the above reasons, I endorse your PhD program in Materials Science and Engineering.

Sincerely,

A handwritten signature in black ink, appearing to read "Amir Mirmiran", is written over a light blue horizontal line.

Amir Mirmiran, PhD, PE, FASCE, FACH
Professor and Dean
College of Engineering and Computing

CC: Douglas Wirtzke, Provost and Executive Vice President

GEORGE LY THE DEAN
College of Engineering and Computing

10555 W. Flagler Street, EC 2100 Miami, FL 33174 • Tel: 305-487-2522 • Fax: 305-548-1410 • www.fiu.edu

Florida International University is an Equal Opportunity Institution. For more information, contact the Office of Institutional Effectiveness and Compliance at 305-487-2522.



March 1, 2011

Dean Nancy Marcus
Graduate School
Florida State University
Westcott Hall
Tallahassee, FL 32306

Dear Dean Marcus,

This letter is to support the PhD program in Material Science and Engineering (MS&E) that is being proposed by Florida State University. There have been discussions between UCF faculty in MS&E and FSU about the proposal and the research thrusts in each of the programs. While there is necessarily overlap in the course offerings of both programs, the research areas at FSU including fundamental magnetism, applied superconductivity, superconducting devices, and chemical vapor deposition methods for nanostructured materials are real strengths at FSU that would be enhanced by a doctoral program in MS&E.

The discussions also included ways in which UCF and FSU can collaborate in the future. One thing that was discussed was the possibility of setting up an annual meeting of the directors of Florida's Materials Science and Engineering programs to learn what the different programs are doing and look for areas to collaborate.

We expect that this new PhD program in MS&E will not negatively impact our successful graduate student recruitment. We also think that FSU will be successful in recruiting graduate students in the areas of their unique research thrusts.

Sincerely,

Suhada Jayasuriya, Ph.D., P.E.
Distinguished Professor and Chair
Department of Mechanical, Materials and Aerospace Engineering
University of Central Florida
Orlando, FL 32816-2450
Phone: (407) 823-5792
Email: suhadajayasuriya@ucf.edu

College of Engineering and Computer Science
P.O. Box 162450 • Orlando, FL 32816-2450 • 407-823-2416 • Fax: 407-823-0208

An Equal Opportunity and Affirmative Action Institution



Office of the Provost
and Senior Vice President

235 Tigert Hall
PO Box 113175
Gainesville FL 32611-0175
817-392-1404 Tel
817-392-1735 Fax

March 16, 2011

Dr. Robert Bradley, Interim Provost
Florida State University
212 Westcott Bldg.
Tallahassee, FL 32306-1310

Dear Bob:

I apologize for this last-minute letter and its perfunctory nature, but this matter came to my attention only yesterday. (It would be helpful to have a uniform understanding in the SUS that these matters need to run through Provost offices for official response.)

Based on my understanding of discussions that have taken place between the relevant chairs and deans of engineering, UF has no objection to FSU's proposal to establish a Doctor of Philosophy degree in Materials Science and Engineering.

Regards,

Joseph Glover
Provost

cc: Cammy Abernathy
Dottie Mincea
Richard Stevens

The Foundation for The Gator Nation
An Equal Opportunity Institution



Florida Agricultural and Mechanical University

TALLAHASSEE, FLORIDA 32307-2200

Established 1887

PHONE: (904) 999-2276
FAX: (904) 991-2551

DEBRA J. HUGHES HARRIS, PhD
VICE PRESIDENT FOR ACADEMIC AFFAIRS

March 1, 2011

Dr. Robert Bradley
Interim Provost
Florida State University
212 Westcott
Tallahassee, FL 32306

Dear Dr. Bradley:

Thank you for sharing with me a copy of Florida State University's (FSU) proposal for a PhD in Materials Science. Former Dean Chen and Dr. Eric Hellstrom have discussed the proposal with me.

Florida A&M University (FAMU) is supportive of this proposal to establish an interdisciplinary PhD program administered by the Graduate School at FSU. The proposed degree appears to provide opportunities to students in a field that is important to the State of Florida, and to have the potential for cooperation between our two institutions that would be mutually beneficial. FAMU faculty in the joint College of Engineering may participate, as appropriate, provided that their responsibilities pertaining to FAMU are not adversely affected. We do not want the initiation of this program by FSU to preclude FAMU from initiating its own MS and PhD degree programs in Materials Science in the future in niche areas that are not duplicative of FSU's research efforts. We would appreciate FSU's expression of support of FAMU, should we seek to implement MS and PhD degrees in Materials Science in the future, and your offer to collaborate on such an endeavor, thus making efficient use of the resources at the two universities.

Sincerely,

Cynthia Hughes Harris, PhD
Provost and Vice President for Academic Affairs

Cc Dr. John Collier, Interim Dean FAMU-FSU College of Engineering
Dr. Eric Hellstrom

FAMU IS AN EQUAL OPPORTUNITY/EQUAL ACCESS UNIVERSITY

Appendix D – External review of the proposal by John Wiley



WISCONSIN INSTITUTES FOR
DISCOVERY

WISCONSIN INSTITUTE FOR RESEARCH
WISCONSIN INSTITUTE FOR DISCOVERY

Dr. Eric Hellstrom
2031 East Paul Dirac Drive
Tallahassee FL, 32310

February 5, 2011

Dear Dr. Hellstrom,

Enclosed is my review of the proposal for establishing a PhD program in Materials Science and Engineering at Florida State University. As you will see, I found it to be an excellent proposal in all respects. If you, or the Florida Board of Governors, have any further questions or requests for clarification, please don't hesitate to contact me.

Sincerely,

John D. Wiley, Interim Director
Wisconsin Institute for Discovery
and
Chancellor Emeritus
University of Wisconsin-Madison

Wisconsin Institute for Discovery

University of Wisconsin-Madison

302 Lathrop Hall 1150 University Avenue Madison, WI 53706-1304
Phone: 608.765.8414 Fax: 608.262.4881

**EXTERNAL REVIEW OF A PROPOSAL BY FLORIDA STATE
UNIVERSITY FOR THE ESTABLISHMENT OF A PHD PROGRAM IN
MATERIALS SCIENCE AND ENGINEERING**

John D. Wiley, Chancellor Emeritus
University of Wisconsin – Madison
February 2, 2011

I have reviewed the proposal entitled "Request to offer a new Degree Program: Doctor of Philosophy in Materials Science and Engineering at Florida State University". This review was conducted to judge compliance with the Florida Board of Governors New Degree Criteria.

This is an extremely well-conceived, timely, and well-written proposal that addresses all of the Board of Governors' criteria, and includes both qualitative and quantitative documentation that the proposal does, indeed, meet all those criteria. The inter-departmental, inter-college model being proposed has been successfully implemented at other institutions (including Wisconsin). Indeed, several of the FSU faculty have already helped to build or have participated in Materials Science PhD programs of this sort at other institutions before joining FSU. The proposal to house this program in the FSU Graduate School (as opposed to within one of the participating Colleges) is a wise one that bodes well for successful implementation.

Because of the quality and quantity of excellent materials science research at FSU, approval and implementation of this proposal would almost immediately vault FSU into the very top ranks of Materials Science and Engineering PhD programs nationally. I could argue that they are already there, but the PhDs they are awarding carry the names of the academic departments of the faculty advisors: Physics, Electrical Engineering, Chemistry, etc - not Materials Science and Engineering, even when the research is clearly materials science and engineering.

Please allow me to digress and offer some background context. Doctor of Philosophy degrees are unique among academic credentials: They are research degrees, as opposed to degrees awarded for successfully completing rigid curricula of coursework. After some relatively flexible set of graduate-level courses and some comprehensive evaluations and

examinations, PhD candidates undertake the sole essential work required for the awarding of a PhD: They conduct an original piece of research, under the approval and guidance of a thesis advisor and a thesis committee of experienced faculty, and then publish their findings. In effect, PhD candidates must answer some previously unanswered question or solve some previously unsolved problem, thereby adding significantly to the store of human knowledge, as judged by the faculty committee and the peer reviewers of their publications. In this sense, every PhD that has ever been awarded is unique. They could all be given different names: "PhD in German History from 1881-1895" or PhD in Elliptic Differential Equations." Instead, we traditionally group similar PhDs under (usually departmental) umbrella names such as PhD in History or PhD in Mathematics. What the FSU faculty are asking is that you approve moving appropriate PhDs from under the departmental umbrellas and label them more accurately and appropriately as PhDs in Materials Science and Engineering. This is more a matter of packaging and marketing than a matter of establishing an entirely new program from scratch.

In contrast, adding a new, strictly curricular degree (a baccalaureate, masters, or professional degree) generally requires significant new investments in new space, new equipment, and a whole new set of faculty. Adding a Dentistry program, or a College of Engineering, or even a department of Anthropology where one did not previously exist requires new investments in the millions or tens of millions of dollars. That's not what is being requested here, and it explains the very modest cost of the proposed new PhD in Materials Science and Engineering.

Another criterion the Board of Governors is rightly concerned about is wasteful duplication: "Are we being asked to devote new state resources to a program that already exists elsewhere?" Again, PhD programs are different, making this question almost irrelevant. FSU already has a strong materials science and engineering faculty. They simply need authority to name the degree appropriately, in a way that is recognized by potential faculty, students, and recruiters. These points are addressed in Section II.B of the proposal.

Having said that, I must also say that the FSU faculty did an exceptionally good job of surveying the other Materials Science degree

programs in Florida (UF, UCF, and FIU) and consulting with their colleagues at these institutions. FSU has unique strengths in areas of materials science not as strongly represented elsewhere, so the fit is more complementary than competitive or redundant. This should not be a controversial or contentious change at all.

I believe this is an excellent proposal that can be easily and comfortably approved by the Board of Governors. To be sure there is no uncertainty, though, I will list the Florida Board of Governors Criteria separately and address each one briefly and individually:

(a) INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY

1. THE PROGRAM IS CONSISTENT WITH INSTITUTIONAL AND BOG STATE UNIVERSITY SYSTEM STRATEGIC PLAN

Yes. This case is made strongly in sections I and II of the proposal. If anything, I believe the demand projections (for Materials Science and Engineering PhDs in Florida's mix of high-tech industry) are conservative.

2. DEMONSTRATE NEED FOR PROGRAM GRADUATES, RESEARCH, OR SERVICE

Yes. Same answer as in (1), above.

3. FINANCIAL PLANNING AND RESOURCES ARE SUFFICIENT FOR IMPLEMENTATION

Yes. The faculty lines already exist, and normal turnover will provide for replacement and possible augmentation as the relevant fields evolve. The Graduate School has allocated fellowships for this program, as well as modest (but appropriate) funds for administration and oversight. The FSU materials science faculty already have a superb complement of instruments that would be the envy of most any materials science program in the country. No other campus or Florida institutions will be seriously impacted by the reallocations implied here.

**4. PROJECTED BENEFIT OF THE PROGRAM TO THE UNIVERSITY,
LOCAL COMMUNITY, AND STATE**

Yes. The benefits to FSU, the community, and the state (indeed, the nation) are thoroughly and convincingly presented in Section IV of the proposal.

**5. ACCESS AND ARTICULATION ARE MAINTAINED FOR ALL
PROGRAMS**

Yes. Sections a, b, and c of this criterion are tailored for baccalaureate programs, and are largely irrelevant, here. Section II.D of the proposal outlines the strong track record and future plans FSU faculty have for continuing to assure access and diversity.

(b) INSTITUTIONAL READINESS

**1. INDICATION OF ABILITY TO IMPLEMENT A HIGH QUALITY
PROGRAM**

Yes. There is no doubt, whatsoever, that FSU has a high-quality Materials Science and Engineering program already, and is poised to take it to a new level of excellence.

**2. CURRICULUM IS APPROPRIATE FOR THE DISCIPLINE AND
PROGRAM LEVEL**

Yes. FSU already offers an impressive array of graduate-level courses that can fill any holes in the undergraduate preparation of new graduate students and prepare all students for their comprehensive examinations prior to commencing dissertation research.

3. SUFFICIENT QUALIFIED FACULTY ARE AVAILABLE

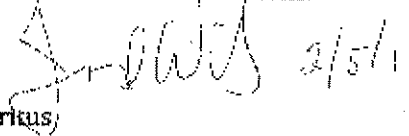
Yes. The existing faculty, based on their records of accomplishment, range from very promising (for the relatively new faculty) to internationally recognized leaders in Materials Science and Engineering. The flexible, collaborative, inter-departmental structure being proposed for this degree program assures that the program will always be able to recruit new faculty from the participating departments, and to change the mix of faculty expertise as the field evolves. The very existence of a Materials Science and Engineering PhD program will undoubtedly help those participating departments in attracting new faculty and graduate students to FSU, so everyone "wins."

4. SUFFICIENT INSTITUTIONAL RESOURCES ARE AVAILABLE

Yes. As noted previously, this proposal requests and requires no new resources, aside from some modest reallocations already approved by the Graduate School. All other resources needed to implement a strong Materials Science and Engineering PhD program already exist and are already being used to produce Materials Science and Engineering PhD graduates under different labels.

After completing this report and re-reading it, I had the nagging feeling that I should have been able to find some areas of concern or some things to suggest for improvement. So I re-read the proposal again. I find no such things to criticize or suggest. It is a superb proposal, and I recommend approval with no reservations.

John D. Wiley
Chancellor Emeritus
University of Wisconsin-Madison



STATE UNIVERSITY SYSTEM OF FLORIDA
BOARD OF GOVERNORS
Academic and Student Affairs Committee
June 23, 2011

SUBJECT: Ph.D. in Security Studies (CIP 45.0902) at University of Central Florida

PROPOSED COMMITTEE ACTION

Consider approval of the Doctor of Philosophy (Ph.D.) in Security Studies at the University of Central Florida, CIP Code 45.0902.

AUTHORITY FOR BOARD OF GOVERNORS ACTION

Section 7(d), Art. IX, Florida Constitution
Board of Governors Regulation 8.011

BACKGROUND INFORMATION

The University of Central Florida (UCF) is proposing to offer a Ph.D. degree program in Security Studies. Serving the state's need for analysts and security specialists for international corporations, military, and ports, it will "produce specialists capable of analyzing and communicating security issues to policy makers, the general public and the government." The program's advisory board is comprised of representatives from Siemens Energy, Inc., Georgetown University, the National Defense University, George Washington University, and the U.S. Naval War College. Documentation confirms that external consultants and security industry leaders are supportive of the program. The proposed program will require 62 hours of course work beyond the master's, including dissertation. Estimated enrollment will stabilize at 20 students, primarily full-time. Communication with FIU, FSU, UF, USF, University of Miami, and Nova Southeastern has confirmed the lack of overlap with their Political Science programs.

The proposal provides evidence that start-up costs will be covered by the College of Sciences and the Department of Political Science and paid from new undergraduate growth money. The College of Graduate Studies will hire one senior and two junior faculty members with expertise in security studies, and fund Graduate Teaching Assistants positions. Faculty will be expected to help generate external funding for this program.

The UCF Board of Trustees approved the program on March 17, 2011. If the proposal is approved by the Board of Governors, UCF will implement the program in Fall 2013.

Supporting Documentation Included: Staff Analysis

Facilitators/Presenters: UCF Representatives

**BOARD OF GOVERNORS
STATE UNIVERSITY SYSTEM OF FLORIDA
NEW DOCTORAL DEGREE PROPOSAL STAFF ANALYSIS**

Program: Ph.D. in Security Studies

CIP Code: 45.0902

(university proposed 45.1001 is Political Science)

Institution: University of Central Florida

Proposed Implementation Date: Fall 2013

Staffed By: Marion Merzer

Initial Review Date: 5/11/11 **Last Update:**

Estimated Costs:

	Total	% & \$ Current Reallocated	% & \$ New Recurring	% & \$ New Non- Recurring	% & \$ C&G	Cost per FTE	SUS 09-10 Average Cost per FTE
Year 1	\$329,265	45.29% \$149,111	54.71% \$180,154	0% \$0	0% \$0	\$110,910	\$27,193 45 CIP
Year 5	\$552,083	25.22% \$139,254	74.78% \$412,829	0% \$0	0% \$0	\$46,662	

Projected FTE and Headcount are:

	Student Headcount	Student FTE
First Year	5	2.97
Second Year	10	6.88
Third Year	15	9.69
Fourth Year	17	10.44
Fifth Year	20	11.83

On March 29, 2007, the Florida Board of Governors approved Regulation 8.011, which sets forth criteria for authorization and implementation of new doctoral programs by the Board of Governors, as well as criteria for authorization and implementation of bachelor's, master's and specialist degrees by boards of trustees. The following staff analysis is an assessment of how well the university meets Board of Governors Accountability and Readiness criteria for implementation of this degree program.

Proposal Page Numbers:

INTRODUCTION		ACCOUNTABILITY		READINESS				
Program Description	System Analysis	Overall	Budget	Mission and Strength	Program Quality	Curriculum	Faculty	Resources
2	5	9	22	33	39	42	59	73

A. Program Description:

The University of Central Florida (UCF) is proposing to offer a Ph.D. degree program in Security Studies. This program will serve the state's need for analysts and security specialists for international corporations, military, and ports. According to the proposal, the goal of the program is to "produce specialists capable of analyzing and communicating security issues to policy makers, the general public and the government." Future employment of program graduates will be available in the military, government, international corporations, and security agencies.

The proposal lists the program's advisory board as comprised of representatives from Siemens Energy, Inc., Georgetown University, the National Defense University, George Washington University, and the U.S. Naval War College.

Students admitted to the program will be predominantly from master's degree programs in Political Science, International Studies, or other related fields. The proposed program will require 62 hours of course work beyond the master's, including dissertation, a modern language proficiency requirement, and two 1-credit courses in professional development. Coursework will emphasize issues and theories of security studies and advanced research methods. It is expected that students earning the Ph.D. will be highly qualified to work in an academic career or for government or private or non-profit organizations.

B. System-Level Analysis and Evaluation in Accordance with Board of Governors Regulation 8.011:

The UCF proposal makes the argument that, since the terrorist attacks of September 11, 2001, national security is now one of the primary concerns of U.S. policy. Developing experts in the field of national security in an international context is a priority. Despite this priority, the proposal lists only three other programs in this field offered nationally (Tufts, Georgetown, and George Washington University), and no graduate program in this field exists at any institution of higher education in Florida. The Federal Government has acknowledged a need for more formal educational programs to prepare future employees in this area of national security. The consultants' report, included in the proposal, concluded that there is a need for this type of program, as jobs in this field have increased dramatically since 9/11. It is up to higher education institutions to take up this role. Few of the currently available Ph.D. programs in Political Science focus on Security Studies, "especially one as in this proposal that emphasizes this specific focus and career track by design." (See Appendix I.1.) Authors of the proposal contend that the UCF Ph.D. program is situated perfectly to take up the challenge.

In 2002, the Center for Homeland Defense and Security (CHDS) was created by several federal agencies, including the Naval Post-Graduate School. Believing that gaps existed in traditional training programs, they envisioned the need for an "evidence-based homeland security leadership development educational curriculum" to develop state, local, and federal leadership for defeating terrorism. CHDS purports that graduate programs focus on analysis, synthesis, and evaluation, teaching graduate students to think critically. These skills are needed so leaders in homeland security can "successfully prepare for the unknown." The proposed UCF Ph. D. program in Security Studies aims to produce highly qualified graduates in the field of Security Studies with the knowledge and training to make them competitive for employment in this field.

The proposed doctoral program would fall into one of the State University System Board of Governors Strategic Plan's Areas of Programmatic Strategic Emphasis. In 2008, The Board of Governors of the State University System of Florida established goals related to meeting statewide professional and workforce needs. Homeland Security and Defense was listed, among others, as an area of interest by key Florida economic and workforce councils. The Board recognized the importance of developing more programs with an international focus, in which graduates and research emphasize globalization. Professionals working in these areas are typically graduates of master's and doctoral programs. The UCF Ph.D. in Security Studies meets this goal.

The proposed program is also consistent with the institutional mission of providing excellent graduate programs and partnerships with the community. The proposal explains that the program meets the following institutional goals of UCF:

- Goal #1: Offer the best undergraduate education available in Florida.
- Goal #2: Achieve international prominence in key programs of graduate study and research.
- Goal #3: Provide international focus to our curricula and research programs.
- Goal #4: Become more inclusive and diverse.
- Goal #5: Be America's leading partnership university.

According to the proposal and its supporting documentation, employment trends at the state, national, and international level show that there is a need for students with doctoral-level training in international security for work in governmental, non-governmental, military, corporate, and academic occupational environments. Florida alone is home to seven Navy and Marine bases, six Air Force bases, 11 Coast Guard bases, and two strategic military commands. UCF proposes that, with Florida's military installations, diverse populations, proximity to Central America, and large coastline, there will be employment opportunities for students with the Ph.D. in Security Studies. A staff review of www.usajobs.gov in April, 2011, shows that there are presently 149 job openings on military bases in Florida described as "security specialist."

The U.S. Bureau of Labor Statistics, 2010-2011 Edition of the Occupational Outlook Handbook (OOH), projects a faster-than-average growth (increases of 14 to 19 percent) for employment of political scientists. The Handbook states that, "job opportunities should be best for jobseekers with a master's or Ph.D. degree in a social science and with strong quantitative skills." The students graduating from the UCF program will be prepared to meet these qualifications. According to the OOH, the median annual wages for a political scientist in 2008 were \$104,130.

The Occupational Outlook Handbook also projects that government employment between 2008 and 2018 will increase by 7 percent, and that candidates with a master's or Ph.D. degree will have the best employment prospects. According to the OOH, in 2008 there were 4,100 jobs held by political scientists, and 63 percent worked for the Federal Government.

According to employment website, www.wherethejobsare.org, the Department of Homeland Security is projected to hire over 65,000 positions over the next 3 years. A recent staff review of the website www.USAJOBS.gov shows more than 900 available positions in the Department of Homeland Security nationwide.

Letters of support from Siemens, the CIA, and the Naval War College all express the opinion that a high demand exists for such a program and suggest the numerous employment opportunities that are available for the graduates with a Ph. D. (See Appendix I.2-I.6.) As reported, many security organizations and agencies, both government and private, are locating themselves outside of Washington, D.C., and can be found in many different parts of the country, including Florida.

Addressing the issue of student demand, the proposal provides evidence of a high degree of local demand for the program. First, a survey of students enrolled in topical undergraduate courses showed 85% of the students interested in applying for the proposed program (page 14). Additionally, a focus group conducted with graduate students in a Master's in Political Science program showed high interest (page 14). However, the argument that existing programs in Political Science are admitting more students than they actually enroll does not in and of itself support broader demand for the proposed degree program. There is no clear evidence provided that the students who chose not to enroll in existing programs would have enrolled in a more specialized program such as Security Studies.

Addressing concern over potential program duplication, the UCF proposal states that there are no other Ph. D. programs specifically focusing on Security Studies, in the State of Florida. There are Ph.D. programs in political science or international studies at FIU, FSU, UF, USF, University of Miami, and Nova Southeastern. (See Table II.2.) Letters of support from FIU, FSU, UF, and USF confirming communication with UCF and the lack of overlap with their programs are included in the proposal. (See Appendix I.14.)

The proposal provides evidence that start-up costs will be covered by the College of Sciences and the Department of Political Science and paid from new undergraduate growth money. (See letter of commitment from Dean Panousis in appendix II.3.) Documentation of an agreement with the College of Graduate Studies (see Appendix II.4) shows the programs intention to hire one senior and two junior faculty members with expertise in security studies for the program, and to fund Graduate Teaching Assistants (GTA) positions. (See section X, Table X.3) The Dean's letter also states that new faculty will be expected to help generate external funding for this program.

C. Assessment of the University Review Process in accordance with BOG Regulation 8.011:

Due to the system of stair-step accountability set in place by the Board of Governors in Regulation 8.011, it is now incumbent upon university boards of trustees to verify that all doctoral programs coming before the Board of Governors have met the requirements of the regulation. The following is an assessment of the university review process to ensure that all criteria set forth have been considered by the university prior to submission to the Board of Governors office.

ACCOUNTABILITY

Check 'yes' or 'no' box, and make comments beneath each criterion, as appropriate.

1. Overall – *The proposal is in the correct format, includes all necessary signatures, and contains complete and accurate tables for enrollment projections, faculty effort, and the proposed budget.*

YES NO

The proposal has been approved by the university board of trustees and includes all required signatures.

The University of Central Florida Board of Trustees approved the program on March 17, 2011.

The university has provided a proposal written in the standard SUS format which addresses new academic program approval criteria outlined in Board of Governors Regulation 8.011.

The Board of Governors new degree program proposal format was used, as expressed in Board of Governors Regulation 8.001.

The university has provided complete and accurate projected enrollment, faculty effort, and budget tables that are in alignment with each other.

The proposal provides information on each of these areas. Detailed tables are provided on projected enrollment (Table 1-B); on faculty effort (Table 4); and on budget (Tables 2 & 3).

- The university has included a statement in the proposal signed by the equity officer as to how this proposal will meet the goals of the university's equity accountability plan.**

The program plan for achieving diversity was reviewed and signed by the UCF Equal Opportunity Officer on March 9, 2011.

2. Budget – The proposal presents a complete and realistic budget for the program consistent with university and Board of Governors policy, and shows that any redirection of funding will not have an unjustified negative impact on other needed programs.

YES NO

- The University Board of Trustees has approved the most recent budget for this proposal.**

The proposal budget was approved by the UCF Board of Trustees on March 17, 2011.

- The university has reviewed the budget for the program to ensure that it is complete and reasonable, and the budget appears in alignment with expenditures by similar programs at other SUS institutions.**

Details of the budget in the UCF proposal reveal that the current budget will fully support the proposed program through Year 5. (See Appendix II.2.) According to the proposed budget, undergraduate growth funds within the College of Sciences (COS) and the Department of Political Science will cover most of the cost of the program. (See Dean's letter in Appendix II.3.) Commitments with the College of Graduate Studies and the College of Sciences will provide funding to hire three new faculty and to support graduate teaching assistant (GTA) positions. (See Appendices II.3 & II.4.) Staff review of the tables referenced in the UCF proposal confirm the proposal's explanation that the College's support will not exceed the annual tuition/stipend commitments (see section X, Table X.3 "total Student Support, COS Student Support, Department Student Support") and will not exceed the total recurring and non-recurring new program costs (\$585,975) by the end of Year 5.

The cost per FTE for the Ph.D. in Security Studies is calculated higher than the average cost per FTE in similar SUS programs. However, the System average is calculated at the two-digit CIP Code level (45) across all universities and programs, so it cannot be considered anything more than an average estimate for what a new program should

cost. The Ph.D. in Security Studies is a new, unique and specialized program requiring additional costs.

Additionally, the proposal explains that two tuition waivers will be provided by the Graduate College, and the department will transfer three masters' program tuition waivers to the doctoral program for a total of five tuition waivers. A review of Table X.4 shows that these waivers will offset tuition by \$29,560 to \$41,055 each year, depending on enrollment.

- In the event that resources within the institution are redirected to support the new program, the university has identified this redirection and determined that it will not have a negative impact on undergraduate education, or the university has provided a reasonable explanation for any impact of this redirection.**

According to the budget description and supporting tables and documentation, the proposed Ph.D. program may impact the department's B.A. and M.A. programs in the area of faculty shifting from the bachelor's program to the doctoral program. UCF states that this impact will not be negative because of the intent to hire three new faculty members and the ability of the GTAs to serve as teaching assistants in their first year and as instructors of record in their second year. The proposal projects that the use of the GTAs in this manner will offset the need to hire adjuncts, saving money.

The proposal also describes benefits that students in the bachelor's and master's programs will receive from the advent of the new Ph.D. program. Students will benefit from access to new esteemed faculty, cutting-edge research opportunities, and the exposure to Ph.D.-level activities and courses, familiarizing master's-level students for future study.

READINESS

Check 'yes' or 'no' box, and make comments beneath each criterion, as appropriate.

3. Program Quality – The proposal provides evidence that the university planning activities have been sufficient and responses to any recommendations to program reviews or accreditation activities in the discipline pertinent to the proposed program have been addressed.

YES NO

- The university has followed a collaborative planning process for the proposed program in accordance with policies and procedures adopted by the university board of trustees.**

As described in the proposal, the planning process began with discussions in the Department of Political Science, with other UCF departments and administrators, and with other SUS institutions, conducted over the past 15 years. The growth of the master's degree program increased a focus on international studies and a program review conducted in 2003-2004 by an external consultant emphasized the need for the department to develop a Ph.D. program. A white paper describing a proposed program was accepted by the Dean of the College of Sciences and the Provost in spring 2010, and the program was added to the three-year Program Plan of the University. In spring 2010, a four-member departmental Ph.D. committee wrote the proposal for a Ph.D. in Security Studies. (See Table VI.1, Planning Process.) Upon approval of the proposal, the first students will be admitted in fall 2013 with an expected graduation date of spring 2016 (Table VI.2., Implementation Activities).

- An external consultant has reviewed the proposal and supports the department's capability of successfully implementing this new program.**

Dr. Richard K. Hermann, Director, The Mershon Center for International Security Studies at The Ohio State University, and Dr. Thomas M. Nichols, Professor, National Security Affairs, United States Naval War College, visited the UCF campus on August 25-26, 2010, at the request of the Department of Political Science to review the proposed Ph.D. in Security Studies. Their findings and comments were very favorable for the establishment of the new program. The reviewers commented that the new program would "advance the institution's goals for achieving greater international prominence in graduate study and research." They concluded by stating that, "there is a need for a program that focuses on Security Studies especially one as in this proposal that emphasizes this specific focus and career track by design." (See complete report in Appendix I.1.)

- The university has found the level of progress that the department has made in implementing the recommendations from program reviews or accreditation activities in the discipline pertinent to the proposed program to be satisfactory.**

According to the proposal, the Department of Political Science conducted a comprehensive review of its programs in 2003-2004. An external consultant provided a positive evaluation of the programs. (See Appendix I.9 for report.) The UCF proposal details the consultant's recommendations and the Department's plans to implement suggestions and changes in areas such as preparation for a Ph.D. program, growth of the M.A. program, faculty, and enrollment growth. (See pages 39-41.) The Dean of the College of Arts and Sciences also reviewed the program and provided a list of recommendations for the growth of the M.A. program and the development of the Ph.D. program (pages 40-41).

- The university has analyzed the feasibility of providing all or a portion of the proposed program through distance learning.**

As presented in the UCF proposal, the basic delivery system for doctoral programs is the small class size seminar. Currently, UCF personnel anticipate that all required courses will be offered as in-person seminars. Current faculty members have been trained in the use of online learning, and the ability to offer future courses online will be explored. According to the proposal, there is no expectation of collaboration with other institutions. All courses will be offered in face-to-face, on-campus seminars, and therefore a collaborative model would require travel to other locations. UCF reports that, in communication with other institutions, no one has expressed interest in collaboration or shared courses at this time. (See letters in Appendix I.14.)

- If necessary, the university has made allowances for licensure and legislative approval to be obtained in a timely manner.**

The proposed program does not lead to licensure and legislative approval is no longer required for such programs.

4. Curriculum - The proposal provides evidence that the university has evaluated the proposed curriculum and found that it describes an appropriate and sequenced course of study, and that the university has evaluated the appropriateness of specialized accreditation for the program.

YES NO

- The university has reviewed the curriculum and found that the course of study presented is appropriate to meet specific learning outcomes and industry-driven competencies discussed in the proposal.**

As presented in the proposal, the curriculum has been designed to prepare students for non-academic careers in security and international affairs careers, as well as careers in academia. According to the proposal, students will be prepared to analyze and understand a variety of problems related to the pressing problem of security in an increasingly interconnected world. A major emphasis will be on research.

According to the proposal, there are several professional organizations affiliated with the fields of political science or international studies. However, currently none of the organizations have accreditation standards or methods of review. The UCF proposal includes a detailed annual assessment plan for the program. (See pages 41-42.)

- The university anticipates seeking accreditation for the proposed doctoral program, or provides a reasonable explanation as to why accreditation is not being sought.**

There is no accrediting agency for programs in security studies at the doctoral level.

5. Faculty – The proposal provides evidence that the university is prepared to ensure a critical mass of faculty will be available to initiate the program based on estimated enrollments, and that faculty in the aggregate have the necessary experience and research activity to sustain a doctoral program.

YES NO

The university has reviewed the evidence provided and found that there is a critical mass of faculty available to initiate the program based on estimated enrollments.

There are 11 current faculty members (see Table 4) who will take on primary responsibility for program delivery. There is a commitment to hire three new faculty members. (See Table 4.) Financial support for hiring Graduate Teaching Assistants is also documented in the proposal (Table X.3).

The university has reviewed the evidence provided and found that the faculty in aggregate has the necessary experience and research activity to sustain the program.

All of the current faculty members hold terminal degrees in their fields. Five are full Professors, four are Associate Professors, one is an Assistant Professor, and one is Professor Emeritus and Lecturer. Nine are tenured and four are tenure-earning. (See Table 4.) According to the proposal, this will provide ample faculty resources for mentoring, research, and teaching.

The university has reviewed the evidence provided and found the academic unit(s) associated with this new degree to be productive in teaching, research, and service.

The proposal provides evidence that the 11 faculty members have been productive in teaching, research, and service, including publications and thesis and dissertation supervision. (See Tables 4, IX.1, & IX.2). According to the UCF proposal, growth in the total number of graduate students enrolled in the Department of Political Science from fall 2005 to fall 2009 increased more than 50%, from 42 to 65 (Table IX.2). Graduates increased as well, from 9 in AY 2005-06 to 15 in AY 2008-09. (See page 70.)

According to the proposal, since 2007, the academic unit has acquired external funding amounting to approximately \$1.9 million. Additionally, the proposal details plans for seeking grants and partnerships with federal agencies, private, and non-profit organizations, as well as international programs. (See pages 71-73.)

- If appropriate, the university has committed to hiring additional faculty in later years, based on estimated enrollments.**

According to the proposal, the College of Sciences and Department of Political Science has committed to hiring three new faculty members in advance of the establishment of the program. (See Dean's letter, Appendix II.3.)

6. Resources – The proposal provides evidence that the university has ensured the available library volumes and serials; classroom, teaching laboratory, research laboratory, office space, equipment, clinical and internship sites, fellowships, scholarships, and graduate assistantships will be sufficient to initiate the program, and that if applicable, funding has been secured to make more resources available as students proceed through the program..

YES NO

- The university has provided a signed statement from the Library Director verifying that the library volumes and serials available are sufficient to initiate the program.**

The proposal provides documentation from the library review (see Section X.B) showing that, although the library currently has adequate book collections to support this program, some additional resources will be needed. The authors calculate these additional resources to cost \$116,823 for Years 1-5. Costs will include non-recurring items (books) and recurring items (subscriptions to databases, etc.). It is proposed that library expenses will be covered by the College of Sciences and the Department's new enrollment growth funding. (See Table 2.) A memorandum from the Director of University Libraries is included in the proposal. (See Appendix II.10.)

- The university has ensured that the physical space necessary for the proposed program, including classrooms, laboratories, and office space, is sufficient to initiate the program.**

According to the proposal, regular classroom space for seminars is available. There will be a need for some office space for graduate students, which can be accommodated through reconfiguring of current space and some newly vacant faculty space. The proposal concludes that space will be sufficient to address identified needs through Year 5. (See page 79.)

- The university has ensured that necessary equipment is available to initiate the program.**

The proposal states that all Political Science faculty members are provided with computer equipment and software for research and teaching needs. No additional specialized equipment is needed. (See page 79.)

- The university has ensured that fellowships, scholarships, and graduate assistantships are sufficient to initiate the program.**

As specified in the proposal, all full-time Ph.D. students will be funded with a stipend of \$17,000 per year based on three semesters (fall, spring, and summer). The proposal shows evidence that students' tuition will be covered by waivers from the Graduate College and by tuition payments by the College of Sciences and the Department of Political Science. (See Tables X.2 and X.3.)

- If applicable, the university has ensured that the department has arranged a suitable number of clinical and internship sites.**

According to the proposal, internships and practicum experiences are not central to the program. Because students will be able to take up to six hours of elective credit as internship credit, the possibility exists for a placement at an approved internship site. (See list on page 84.)

Florida Board of Governors

Request to Offer a New Degree Program

University of Central Florida
University Submitting Proposal

Fall 2013
Proposed Implementation Date

College of Sciences
Name of College or School

Political Science
Name of Department(s)

Security Studies
Academic Specialty or Field

Ph.D. in Security Studies
Complete Name of Degree
(45.1001 - Proposed CIP Code)

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

March 17, 2011
Date Approved by the University Board of Trustees

John C. Hill 3/15/11
President Date

[Signature] 03/17/11
Signature of Chair, Board of Trustees Date

[Signature] 3-14-11
Provost and Vice President Date
For Academic Affairs

Provide headcount (HC) and full-time equivalent (FTE) student estimates of majors for Years 1 through 5. HC and FTE estimates should be identical to those in Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Table 2. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 (Total E&G divided by FTE).

Implementation
Timeframe

Projected Student
Enrollment (From Table 1)

Projected Program Costs
(From Table 2)

	HC	FTE
Year 1	5	2.97
Year 2	10	6.88
Year 3	15	9.69
Year 4	17	10.44
Year 5	20	11.83

Total E&G Funding	Contract & Grants Funding	E&G Cost per FTE
329,265	0	110,910
552,083	0	46,662

*Year 4 and 5 include part-time students

INTRODUCTION

I. Program Description and Relationship to System-Level Goals

- A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.**

This proposal is for a Ph.D. degree in Security Studies. National security is one of the primary concerns of U.S. policy and has been particularly prominent since the terrorist attacks on the United States on September 11, 2001. The attacks made it more obvious than ever that national security is intrinsically linked to international factors. Since then, national security has permeated all facets of political life as well as citizens' daily life, from airplane travel and civil liberties to the deployment of American troops in Afghanistan and Iraq. The U.S. defense budget totaled \$693 billion and the intelligence budget amounted to \$75 billion in 2009, signaling the crucial importance of security for the nation; the economic impact of the defense and security industry on the state of Florida amounts to \$52 billion per year. The study of national security in an international context is thus of highest priority and has implications for UCF and the state of Florida, but also for the country at large.

Despite the urgency of the issue, only a few programs exist nationally with this focus. No institution of higher education, public or private, in the state of Florida offers specialized advanced graduate education in this field. The proposed program aims to fill the need for such a program to prepare graduates for careers in government, non-profit, and academic settings.

The proposed Ph.D. in Security Studies offers rigorous training for students interested in national security, international affairs, world politics, and transnational problems. The program emphasizes considerable flexibility in terms of the theoretical diversity and intellectual breadth that characterizes security studies. Students will be confronted with traditional theoretical approaches to international security such as realism and traditional topics such as the causes of war, terrorism, and political violence, but they will also be trained in the use of more recent theories such as social constructivism, feminism, and critical theory, and in "new" security issues such as environmental issues, genocide, poverty and inequality, economic security, and the global spread of epidemics such as AIDS. International security scholars today offer a broad range of theoretical approaches to a variety of traditional and non-traditional issues, and the program is designed to reflect this diversity in its course offerings. That diversity is also reflected in its broad theoretical and methodological eclecticism; students will be trained in both quantitative and qualitative methods, for instance, as appropriate to their chosen emphasis within security studies. Large-N quantitative surveys have traditionally been thought most appropriate in the study of war, for example, while more qualitative, case study-based approaches are often utilized in the study of terrorism. The program is designed to ensure that students graduate with a full range of theoretical tools and methodological skills. The external consultants that visited the UCF campus to evaluate the proposal conclude in their final report that "there is the need for a program that focuses on Security Studies especially one as in this proposal that emphasizes this specific focus and career track by design." (See Appendix I.1 for complete consultants' report).

The proposed Ph.D. program will admit students who have completed a Master's degree in Political Science, International Studies, or a related field. This ensures that admitted students will have a solid grounding in mainstream political science or international relations and are well prepared to take on the more specialized coursework and research required for a Ph.D. in Security Studies. Students admitted to the program will complete 62 hours of course work beyond the Master's degree, including dissertation research, to obtain a Ph.D. in Security Studies. The course work consists of 15 hours of required core classes in issues and theories of security studies as well as advanced quantitative and qualitative research methods; 15 hours of restricted electives in courses on security; 12 hours of unrestricted electives, which can include up to 6 hours of internship credit; and a minimum of 18 hours of dissertation research. In addition, students will be required to complete two 1-credit hour professional development courses that will prepare them for a career in academic and non-academic environments, including questions of research ethics in the field, grant proposal preparation, and teaching preparedness. Student progress will be assessed through annual reviews, an oral qualifying exam at the end of the first year, a written candidacy exam prior to enrollment into dissertation hours, an oral defense of the dissertation proposal, and an oral defense of the dissertation.

The proposed Ph.D. satisfies an existing demand among students in Florida and will equip graduates with qualifications that will make them highly competitive for employment in an academic career as well as for employment with government agencies or non-profit organizations. Students in the undergraduate program in political science as well as students in the M.A. program in political science at the University of Central Florida have expressed great interest in and enthusiasm for the proposed Ph.D. program and have shown a strong interest to apply. Student applications are expected to come primarily from universities located within the state, especially the M.A. program in Political Science – International Studies track at UCF, but also from other graduate programs within the SUS system and the M.A. in Conflict Analysis and Resolution at Nova Southeastern University.

In addition to a need for this program, there is also a clear demand for a Ph.D. in Security Studies. Employment opportunities for those with expertise in security studies are expected to grow faster than the national average. According to the Bureau of Labor Statistics, "demand for political science research is growing because of increasing interest in politics, foreign affairs, Political scientists will use their knowledge of political institutions to further the interests of nonprofit, political lobbying, and social and civic organizations." Agencies such as the CIA list multiple employment opportunities that require the qualifications Ph.D. graduates from the proposed program would possess, as do several government agencies, including the Department of Defense and the Department of Homeland Security. Dennis Bowden, Director of Policy Support at the CIA, states that "I can say that there is a need at CIA, and elsewhere in the Intelligence Community, for people with advanced security studies credentials, whether they came from the University of Central Florida or elsewhere. Given the spectrum and importance of challenges facing the country, there is a need in our national security establishment for a new generation of leaders with such academic training" (see letter of support in Appendix I.2). Focusing on Florida, the state's need for persons with advanced security studies training is tied to its political, economic, geographic, and military characteristics. Florida is home to one of the

nation's largest defense and homeland security clusters with an economic impact on the state of \$52 billion. The military and defense communities now support more than 723,000 jobs with an additional \$8 billion expected to be flowing into the state's defense and security sector in the next two years, providing new job prospects. Sarah Bynum, the Director of Security at Siemens confirms that the program will be of "great benefit" to businesses (see Appendix I.3). Dr. Joan Johnson-Freese, Professor at the Naval War College states that "Within Florida, organizations from CENTCOM and SOUTHCOM to Kennedy Space Center (and the associated aerospace industries) and Florida-based non-governmental organizations have strong demands for specialists in human security issues, as well as within the constituencies they serve" (see Appendix I.4). Many of these jobs require skill sets that the proposed Ph.D. program will provide its graduates. The external consultants comment that "The demand for expertise that the nation is currently in short supply of has become clear as the national security community within the Federal Government struggles to train and educate its work force. The military services and the civilian agencies have turned to the university system in the United States for expertise related to the numerous topics central to security studies." Dr. James Ludes, Executive Director of the American Security Project, similarly comments that "Graduates with a Ph.D. in security studies from UCF ... would find many opportunities for government service" (see Appendix I.5).

Academic demand for qualified Ph.D.s in fields related to security studies is similarly strong. During the last five years, 332 open academic positions were listed by the American Political Science Association in the security-related fields. There are, however, only three Ph.D. programs in the country that specialize in security studies (Tufts, Georgetown, George Washington; a new interdisciplinary program at Kansas State University is too young to contribute to the job market), and none in the state of Florida. Given the focus of the proposed program, our graduates would thus be uniquely qualified for academic careers in the field of security studies.

In short, there is both a strong demand and need for a Ph.D. program in Security Studies, and the proposed curriculum will qualify graduates to pursue careers in the academic and non-academic sectors. Dr. Bernard Finel, Associate Professor at the National Defense University, comments that "The UCF program is, if anything, better integrated" than similar programs "at Georgetown, George Washington, and Tufts" (see Appendix I.6).

The external consultants conclude in their report (see Appendix I.1) that this program "would advance the institution's goals for achieving greater international prominence in graduate study and research." They judge that the proposed curriculum is sound and that the faculty members are well qualified to implement the program. They also state that there is a need for this program. The proposed program would benefit UCF, the state of Florida, and the nation by adding highly educated Ph.D. graduates that are qualified to join the workforce in Florida and nationally in an area of central concern to the national interest.

Furthermore, undergraduate students at the University of Central Florida and the Department of Political Science will benefit from the new program. The Ph.D. program will make it easier to attract and retain top faculty members, outstanding graduate students conducting research, and will open broader opportunities to obtain federal funding. It will also increase the number of doctoral degrees granted by UCF. Furthermore, the proposal includes the hiring of three new

faculty members, whose primary responsibility will be to support the Ph.D. program but who will also teach undergraduate courses as the departmental teaching effort collectively shifts among the faculty within the program. Furthermore, undergraduates will benefit because the Ph.D. students, starting in their second year, will have the opportunity each year to teach at the undergraduate level as instructors of record. This will help meet the expected undergraduate course demand in a growing program, will increase the number and range of course offerings available to undergraduate students, and will further compensate for a shift in effort of existing faculty members from the undergraduate to the graduate level. Currently, many of the introductory sections Ph.D. students will be assigned to teach are covered by adjunct faculty or occasionally M.A. students. Consequently, having highly trained Ph.D. students cover some of these sections will reduce the need for adjunct faculty and Master's students, thereby saving money and improving the quality of instruction. During their first year, all Ph.D. students will serve as Graduate Teaching Assistants. This will increase the total number of GTAs available to assist professors with instruction, providing needed support to existing faculty in a growing undergraduate program. Undergraduate students will also benefit from the added emphasis on cutting-edge research that the Ph.D. will incentivize and from the additional library resources that are part of this proposed Ph.D. program. We will further strive to reduce the cost of the program by pursuing additional GTA support through external grants as well as external and UCF scholarships and fellowships. In sum, the proposed Ph.D. in Security Studies will be of benefit to the state, the region, and the University of Central Florida.

- B. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which goals the program will directly support and which goals the program will indirectly support. (See the SUS Strategic Plan at <http://www.flbog.org/about/strategicplan/>)**

The 2005-2013 SUS Strategic Planning Goals state that the Board of Governors encourages the advancement or establishment of world-class doctoral programs especially when they are (see SUS Strategic Plan, p. 6):

- Consistent with institutional mission and statewide goals
- In targeted fields
- Non-duplicative or sufficiently unique compared to similar SUS programs
- Demanded by both students and employers
- Capable of demonstrating that their costs, when weighed against their measurable benefits, make a compelling argument for return on investment

The proposed Ph.D. program in Security Studies directly supports the following criteria:

- a. The proposed Ph.D. program is consistent with institutional mission and statewide goals.**
- *Institutional mission – UCF:*
The University of Central Florida is a public multi-campus, metropolitan research university that stands for opportunity. The university anchors the Central Florida city-state in meeting its economic, cultural, intellectual, environmental and