

APPENDIX M

Request to Plan a Doctoral Program in Computational Science and Engineering at North Carolina A&T State University

Introduction

North Carolina A&T State University requests approval to plan a doctoral program in Computational Science and Engineering (CIP: 30.9999).

Program Description (Revised)

North Carolina Agricultural and Technical State University (NCA&T) proposes to establish a PhD degree program in Computational Science and Engineering (CSE). The proposed program will be highly interdisciplinary, drawing expertise and resources from various disciplines across the University, and will be located in the Graduate School. It will offer an interdisciplinary curriculum combining applied mathematics, high performance parallel and scalable computing, scientific modeling and simulation, and data visualization with the domain areas such as physical science, engineering, life science, agricultural and environmental science, technology and business.

The aim of this program is for students (a) to master the engineering, physical sciences, technology and business disciplines coupled with mathematics and computer science to investigate and develop solutions to important computational problems in these areas; (b) to educate and train researchers, engineers and scientists who understand scientific, engineering, technology and business problems and the computational theories and methods needed to implement solutions to these problems; (c) to foster computationally oriented research among the fields of engineering, science, technology and business, and to prepare students to work effectively in such an environment; (d) to train students proficient in computational technology, including numerical computation and the practical use of advanced and high-end computing architectures, as well as in one or more applied disciplines; and (e) to create a next generation of qualified doctoral trained science, engineering, technology and business professionals who are simulation experts in mathematics and computer science

The proposed PhD degree program in CSE builds upon the University's current curricular strength and research capability in science, engineering, mathematics, technology, and business. It is a result of interdisciplinary collaboration among the College of Arts and Sciences, College of Engineering, School of Business and Economics, and the School of Technology. It will enhance and supplement current graduate research and education programs in science, engineering, mathematics, technology and business, and further the nurturing of cross-disciplinary interaction and collaboration in CSE among faculty and graduate students. As the first stand-alone CSE PhD degree program in the State of North Carolina and among HBCUs in the nation, the proposed program will increase the eminence of North Carolina A&T State University in this important technological area.

The academic program is designed to prepare men and women for highly specialized positions, for research and consulting in industry, government and service organizations,

and for teaching and research positions in colleges and universities. The interdisciplinary nature of this program will mean that students from across the colleges and schools of the University will be engaged in computational research. This diversity of backgrounds and training will contribute to a unique teaching and learning environment for students and faculty alike. While students will be permitted to pursue a plan of study individualized to their interests, all will be connected through a required group of selected core courses, common research themes, use of common research laboratories, and a program office housed within the School of Graduate Studies. After the required courses, students will choose courses from the existing courses based upon their research interests. The number and type of courses will depend on the research area and the student's background.

Some of the present research areas that could be selected by the student are:

- Multi-Scale/Multi-Physics Modeling - Nanotechnology
- Computational Biology – Bioinformatics, Genomics, Epidemiology, Bio Statistics
- Computational Chemistry – MD Modeling/Simulations
- Climate/Weather/Ocean Modeling and Simulation
- Image Analysis and Data Mining
- Environmental Quality Modeling and Simulation
- Quantum Simulation
- Computational Mathematics
- Numerical control machining, Remote Sensing, GIS/GPS
- Computational Finance

The Ph.D. program will have a unique interdisciplinary focus that will encourage students to pursue their interests from a wide range of perspectives and approaches, while forming a learner-centered community of interacting scholars. The new program will proceed through the Program Plan, Comprehensive Examination, and Dissertation stages. Options available to candidates will vary to meet program requirements. Doctoral students will have unique opportunities to form and reform collegial working relationships within the interdisciplinary faculty. The Ph.D. plan of work will be guided by a Computational Science and Engineering Interdisciplinary Steering Committee. Academic advisors will work closely with the Steering Committee.

Program Review

The review process for requests to plan is designed to determine if the proposal is developed to the stage appropriate for taking to the Graduate Council and if so what are the issues that may need further attention. Proposals to plan doctoral programs are reviewed internally. The concerns from the reviewers were summarized in a letter to the Chancellor prior to the presentation to the Graduate Council. That summary follows:

The reviewers recognize that the work done in the computational areas at NCA&T and the master's program in Computational Science and Engineering constitute a good basis for further work at a higher degree level in this field. While we recognize this is a conceptual portrait of the proposed new degree, there are some issues that raise some

concern. One set has to do with the three tracks, and one set has to do with the contrast between computational science and domains to which it may be applied. Regarding the three tracks, one reviewer wondered if the program was so interdisciplinary that students might get lost. There does appear to be some unevenness in the three tracks. The first track in computational science and engineering grows out of a strong basis of a disciplinary master's program and doctoral engineering programs. The basis for the other two tracks needs to have a lot more attention since there are not current doctoral programs in most of the other areas identified. So there appears to be considerable difference in the context for the three tracks. For a student in some of the domains without doctoral programs what is the plan for there to be doctoral level work both in computational science and in the domain to which the analysis is applied? That issue also raises the question of the compatibility of the name of the program and some of the domain areas of the second and third tracks. It appears that while computational science would be involved no engineering would be involved in domains such as agriculture, business, and economics. These are appropriate fields for the application of computational science but it is not clear that any engineering is involved.

While many appropriate steps for further planning are described in the proposal, earlier comments that few new courses will be needed and that the introduction of the program would have almost no effect on current faculty activity may need to be addressed in light of the higher grant, publication, and student interaction levels expected of doctoral faculty.

Graduate Council

The Graduate Council had, as a basis for its consideration, the proposal to plan the program, the summary letter to the Chancellor, and a presentation to the Council by representatives of the program. In addition to the issues raised previously, the following concerns were expressed by Council members: Concerns were expressed regarding the three tracks to be found in the first description of the program. The revised narrative has eliminated those tracks.

Response

The program is an interdisciplinary program that is proposed for building on the strengths in engineering and related science disciplines. The representative drew attention to the growing importance of computational methods for solving big science problems in a range of disciplines. The program has most of the computing power that will be needed for the program and expects to get at least two additional faculty members, though the faculty for the most part will be drawn from disciplines at NCA&T.

Need for the Program

Computational science and mathematics are growing fields and NCA&T can use this program to enhance the skills of doctoral students in other engineering and science fields as well as produce doctoral graduates in this field.

Recommendation by the Graduate Council

After consideration of the issues raised by previous reviewers and Council members, the Graduate Council voted, without dissent, to recommend approval for North Carolina A&T State University to plan a doctoral program in Computational Science and Engineering.

Budgetary Issues

When at full capacity the total enrollment funding requirement for the program would be \$326,169. If the program is composed of 70% in-state students and 30% out-of-state students, the State funding required (after tuition is charged) is estimated to be \$260,971 at 2006-07 tuition rates.

Issues to Address in Planning

While the revised description of the program has eliminated the tracks that would seem to take the proposal too far afield, careful attention needs to be given to the extent to which NCA&T is prepared to offer doctoral level work, and draw the contours of this program accordingly.

Recommendation

The General Administration recommends that the Board of Governors approve the request from North Carolina A&T State University to plan a doctoral program in Computational Science and Engineering.

Approved to be Recommended for Planning to the Committee on Educational Planning, Policies, and Programs

Interim Senior Vice President for Academic Affairs Alan Mabe

May 2, 2006