MEMORANDUM

TO: Ann Wylie  
   Interim Dean, Graduate School

FROM: Phyllis Peres  
       Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to Add a Graduate Certificate in Professional Studies in Radar Signal Processing (PCC Log No. 05078)

May 18, 2006

At its meeting on April 21, 2006, the Senate Committee on Programs, Curricula, and Courses approved the proposal to add a Graduate Certificate in Radar Signal Processing. A copy of the approved proposal is enclosed. Please accept my apologies for the delay in formal notification.

The Graduate School should ensure that this program is appropriately reflected in all University documentation.

CWR/  
Enclosure  

cc: James Baeder, Chair, Senate PCC  
    Sarah Bauder, Office of Student Financial Aid  
    Mary Giles, University Senate  
    Barbara Hope, Data Administration  
    Anne Turkos, Archives  
    Linda Yokoi, Office of the Registrar  
    Gay Gullickson, Graduate School  
    Kristin Owens, Office of Professional Studies  
    John Benedetto, Norbert Wiener Center  
    Michael Dellomo, Norbert Wiener Center
THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM PROPOSAL

DIRECTIONS:
- Provide one form with original approval signatures in lines 1 - 4 for each proposed action. Keep this form to one page in length.
- Early consultation with the Office of the Associate Provost for Academic Planning & Programs is strongly recommended if there are questions or concerns, particularly with new programs.
- Please submit the signed form to Claudia Rector, Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.
- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.

DATE SUBMITTED April 17, 2006

PCC LOG NO. 05078

COLLEGE/SCHOOL
Office of Professional Studies, Graduate School and College of Computer, Mathematical and Physical Sciences

DEPARTMENT/PROGRAM Mathematics of Advanced Technology Program (MAIT)

PROPOSED ACTION (A separate form for each) ADD X DELETE ______ CHANGE_____

DESCRIPTION (Provide a succinct account of the proposed action. Details should be provided in an attachment. Provide old and new sample programs for curriculum changes.)

Attached is a program proposal for a Graduate Certificate in Professional Studies in Radar Signal Processing.

JUSTIFICATION/REASONS/RESOURCES (Briefly explain the reason for the proposed action. Identify the source of new resources that may be required. Details should be provided in an attachment.)

A new graduate program designed for a professional audience. After conducting market research, the need for increased proficiency in Radar Signal Processing studies is evident in the regional area. This program is self-support.

APPROVAL SIGNATURES

1. Department Committee Chair (see attached)

2. Department Chair N/A

3. College/School PCC Chair N/A

4. Dean

5. Dean of the Graduate School (if required)

6. Chair, Senate PCC

7. Chair of Senate

8. Vice President for Academic Affairs & Provost

DATE

5/23/06

4/21/06

5/17/06

VPAAP 8-05
PROPOSAL FOR

NEW INSTRUCTIONAL PROGRAM

UNIVERSITY OF MARYLAND AT COLLEGE PARK, MARYLAND

Graduate Certificate in Professional Studies - Radar Signal Processing

PROPOSED INITIATION DATE: FALL 2006
I. OVERVIEW and RATIONALE

A. Briefly describe the nature of the proposed program and explain why the institution should offer it. [You may want to refer to student demand, market demand for graduates, institutional strengths, disciplinary trends, synergy with existing programs, and/or institutional strategic priorities.]

The University of Maryland is committed to providing educational programs that meet the needs of a variety of audiences. As part of our graduate offerings, the Masters of Professional Studies and the Graduate Certificate in Professional Studies are designed for adult students who wish to increase their subject-matter knowledge as well as prepare them for new challenges related to their professional areas. These programs are managed by the Office of Professional Studies, with academic oversight by Academic units, and housed in the Graduate School.

Radar Signal Processing is the theory and application of filtering, coding, transmitting, estimating, detecting, analyzing, recognizing, synthesizing, recording, and reproducing signals by digital or analog devices or techniques. Market research indicates that the majority of individuals in the market for radar technology training are in industries closely related to the defense industry. These individuals either work directly for a government or military agency or at a firm that serves these industries. A smaller segment of the target market is in scientific research that is not defense related, however, these individuals also tend to work for government research agencies and, to a smaller degree, private firms.

A key area of demand identified within the radar signal processing space is signal intelligence (“sigint”). Defined by the NSA as “the gathering of intelligence information through the interception of both foreign communications and electromagnetic non-communications transmissions, such as radar and missile signals,” sigint is in high demand. It is estimated that the hundreds of technology firms doing work in this area make up a $2 billion dollar a year market. Some examples of specific firms hiring individuals to do sigint work include Northrop Grumman, Boeing, and Booz Allen Hamilton, as well as government agencies such as the Department of Homeland Security, the National Security Agency, the Central Intelligence Agency, the Federal Bureau of Investigation, and the military services.

Market research identified 30,000 individuals in the public and private sector who work in these relevant occupations in the D.C. metropolitan area – not including military personnel. Nationally, 1.5 million individuals are working in these occupations and 200,000 in the military. While the military employs a large number of individuals in the target market for radar signal processing training, these individuals are largely provided on the job training.

A 2003 article in Aviation Week and Space Technology sought to identify general trends in defense technology that would emerge in the next 25 years. Among the key trends identified was a movement towards surveillance networks that would combine “a larger
number of sensing technologies, including radar, signals intelligence, infrared, optical, acoustic, and magnetic”. Thus, the demand for individuals trained in processing and interpreting these technologies would presumably increase, meaning that demand for a certificate providing training in these areas may also increase.

In the defense and intelligence industries, individuals with radar skills are currently in demand – especially in the area of sigint. Existing certificate and short course providers identified are predominately non-credit. Research identified only two institutions that offer certificates in radar signal processing – Georgia Tech and the University of Alabama at Huntsville. UMD will differentiate itself by offering a graduate credit certificate, which would make our program more attractive.

B. How big is the program expected to be? From what other programs serving current students, or from what new populations of potential students, onsite or offsite, are you expecting to draw?

Target audience includes the intelligence community; such as, Northrop Grumman, Boeing, and Booz Allen Hamilton, as well as government agencies such as the Department of Homeland Security, the National Security Agency, the Central Intelligence Agency, and the Federal Bureau of Investigation.

Initially courses will be small, targeting 5-10 individuals in each. The maximum will be 25 students for each class. If demand allows, additional sections will be offered as the program grows. Classes will be held in the evening on campus.

II. CURRICULM

A. Provide a full catalog description of the proposed program, including educational objectives and any areas of concentration.

Graduate Certificate in Professional Studies - Radar Signal Processing: This graduate certificate is intended to give the professional student access to the latest developments in radar analysis technology. Students will learn both the fundamentals of modern radar systems as well as the underlying mathematical basis for the processing of radar returns.

B. List the courses (number, title, semester credit hours) that would constitute the requirements and other components of the proposed program. Provide a catalog description for any courses that will be newly developed or substantially modified for the program.

The program will consist of the following (existing) required courses. Students are required take all four courses in order to receive a certificate. These courses are soft-numbered to allow for. Special topics courses provide the flexibility to disseminate the most up-to-date developments in technology (see admission requirements for necessary pre-requisite coursework).
MAIT679T Target Tracking and Filtering (3 credits): An advanced topics course selected by the faculty. This course will present the latest advances in tracking technology. The course would begin with a review of probability theory and discuss, briefly, Bayesian estimation techniques. The Kalman filter and its extensions are then introduced and studied. Related techniques including non-linear filters, modified gain techniques, Wiener filters, coordinate systems, and adaptive methods will also be discussed. Advanced techniques in particle filtering will be studied. Tracking problems such as neighbor association, track splitting, target re-acquisition, etc. will also be treated.

MAIT 623 Modern Mathematical Methods of Signal and Image Processing I (3 credits): Introduction to current signal/image processing techniques, including wavelets and frames, in the context of applied and numerical harmonic analysis. Topics include time-frequency and time-scale representations, sub-band filterbanks, and applications to compression and denoising.

ENPM 808V Principles of Radar I (3 credits): An advanced topics course selected by the faculty. This course introduces the student with the basic radar principles with emphasis on radar applications, radar types and sub-systems, target radar cross section, detection theory, propagation, clutter, waveforms, and processing.

ENPM 808Z Principles of Radar II (3 credits): An advanced topics course selected by the faculty. This course builds on the student’s knowledge of introductory concepts and advanced radar principles with an emphasis on radar antennas and corresponding signal processing techniques. (pre-requisite: ENPM 808V)

Program Sequence:

Courses will follow a traditional semester format.

<table>
<thead>
<tr>
<th>Fall 2006</th>
<th>MAIT 679T</th>
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<tr>
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<td>MAIT 623</td>
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<tr>
<td>Spring 2007</td>
<td>ENPM 808V</td>
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<tr>
<td>Summer 2007</td>
<td>ENPM 808Z</td>
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<tr>
<td>August 2007 – Certificate Awarded</td>
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C. Describe any selective admissions policy or special criteria for students selecting this field of study.

The admissions policy will reflect current university standards, including the prerequisite bachelor's degree and a 3.0 GPA cumulative average. Official undergraduate transcripts from all colleges attended must be provided. Professional experience may be substituted for an admissions exam and students must have completed all prerequisites for courses in the program. In addition, students are required to have a
technical undergraduate degree (such as engineering, physics or mathematics). They are also expected to have successfully completed coursework in advanced calculus and linear algebra.

III. STUDENT LEARNING OUTCOMES AND ASSESSMENT

The purpose of this plan is to set clear guidelines identify articulated outcomes and ensure avenues for continuous improvement for each graduate certificate and program managed by the Office of Professional Studies. It is our mission to provide programs that meet UMD’s institutional goals and objectives for educational activities.

<table>
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<tr>
<th>Student Learning Outcomes</th>
<th>Assessment Measures and Criteria</th>
<th>Assessment Schedule</th>
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<tr>
<td>1. Students will demonstrate understanding of both the fundamentals of modern RADAR systems as well as the underlying mathematical basis for the processing of RADAR returns.</td>
<td>all program students are required to maintain a cumulative 3.0 in all GCPS coursework in order to successfully complete program</td>
<td>This data will be collected annually, beginning Fall 2006.</td>
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<tr>
<td>2. Students will be able to apply the coursework in their technical professions through an enhanced knowledge of RADAR technology and the latest signal processing techniques.</td>
<td>Coursework includes practical application of theory throughout curriculum Criterion: An exit interview will be conducted with a random sample of graduates (20%) to assess their overall satisfaction with the certificate.</td>
<td>All data will be collected annually, beginning Summer 2007. Responses will be collected and discussed with the Program Oversight committee for retention purposes.</td>
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IV. FACULTY AND ORGANIZATION

A. **Who will provide academic direction and oversight for the program? [This might be a department, a departmental subgroup, a list of faculty members, or some other defined group.]**

The Program Oversight Committee will provide direction and oversight for the program. Members include:
CORE Representative (committee champions):
John J. Benedetto
Faculty and Distinguished Scholar-Teacher, Department of Mathematics
Director, The Norbert Wiener Center for Harmonic Analysis and Applications
College of Computer, Mathematical and Physical Sciences

Michael R. Dellomo
Lecturer, ENGR-ECE-Telecommunications Program
Program Coordinator, Mathematics of Advanced Industrial Technology Program (MAIT)
College of Computer, Mathematical and Physical Sciences

Graduate School Representative:
Ann Wylie
Dean, Graduate School

Elective Area Representative:
George Syrmos
Director, Office of Advanced Engineering Education
A. James Clark School of Engineering

OPS Program Manager:
Kenneth J. Carter
Program Manager, Professional Studies

B. If the program is not to be housed and administered within a single academic unit, provide details of its administrative structure.

This program will be housed in the Graduate School and administered by the Office of Professional Studies. The academic home is the Department of Mathematics, College of Computer, Mathematical and Physical Sciences. Additional coursework will be provided by the A. James Clark School of Engineering.

C. Indicate staffing

Faculty selection and appointments are made by the College of Computer, Mathematical and Physical Sciences and the A. James Clark School of Engineering. All faculty will be members of the Graduate Faculty and approved by the Dean to teach.

V. OFF-CAMPUS PROGRAMS (if necessary)

A. If at Shady Grove – indicate how students will access student services

Not applicable.
B. If on-line – describe the concerns in “Principles and Guidelines for Online Programs” are to be addressed.

Not applicable

VI. OTHER ISSUES

A. Describe any cooperative arrangements with other institutions or organizations that will be important for the success of this program.

Not applicable.

B. Will the program require or seek accreditation? Is it intended to provide certification or licensure for its graduates? Are there academic or administrative constraints as a consequence?

Not applicable.

VII. COMMITMENT TO DIVERSITY

The University of Maryland is an equal opportunity institution with respect to both education and employment. The University does not discriminate on the basis of race, color, national origin, sex, age, or handicap in admission or access to, or treatment or employment in, its programs and activities as required by federal (Title VI, Title IX, Section 504) and state laws and regulations.

Through its actions and statements of policy the University of Maryland has demonstrated a commitment to diversity by creating programs of study which explore the experiences, perspectives, and contributions of a wide variety of cultures, groups, and individuals; and has sought to create a campus environment which encourages tolerance and respect for individuals regardless of differences in age, race, ethnicity, sex, religion, disability, sexual orientation, class, political affiliation, and national origin.

VIII. REQUIRED PHYSICAL RESOURCES

A. Additional library and other information resources required to support the proposed program. You must include a formal evaluation by Library staff.

There will be no impact on existing resources

B. Additional facilities, facility modifications, and equipment that will be required. This is to include faculty and staff office space, laboratories, special classrooms, computers, etc.

There will be no impact on existing resources.
C. Impact, if any, on the use of existing facilities and equipment. Examples are laboratories, computer labs, specially equipped classrooms, and access to computer servers.

There will be no impact on existing resources

IX. RESOURCE NEEDS AND SOURCES

A. List new courses to be taught and needed additional sections of existing courses. Describe the anticipated advising and administrative loads. Indicate the personnel resources (faculty, staff, and teaching assistants) that will be needed to cover all these responsibilities.

There will be no impact on existing resources. This program is self-support. Courses may be cancelled due to low enrollment.

B. List new faculty, staff, and teaching assistants needed for the responsibilities in A, and indicate the source of the resources for hiring them

Faculty will be compensated in overloads.

C. Some of these teaching, advising, and administrative duties may be covered by existing faculty and staff. Describe your expectations for this, and indicate how the current duties of these individuals will be covered, and the source of any needed resources.

Any additional resources required will be compensated in overloads.

D. Identify the source to pay the for the required physical resources identified in Section VIII. above.

There will be no impact on existing resources

E. List any other required resources and the anticipated source for them

There will be no impact on existing resources

F. Complete the additional proposal and financial tables as required by MHEC.

Not applicable for MPST/GCPS programs.
Campus Approvals:

Judith K. Broida
Associate Provost and Dean, Office of Professional Studies

Stephen Halperin
Dean, College of Computer, Mathematical and Physical Sciences

John J. Benedetto
Director,
The Norbert Wiener Center for Harmonic Analysis and Applications

Nariman Farvardin
Dean, A. James Clark School of Engineering

4/16/06

4/18/06

17 April 2006

4/19/06