Master of Science Degree in Applied Spatial Information Science

An Inter-Disciplinary Degree at Michigan Technological University

General Program Description and Characteristics
This proposal is to create a Master of Science Degree in Spatial Information Science. The program will be an inter-disciplinary program involving faculty and graduate students across the campus and offer 3 specializations: Geographic Information Systems (GIS), Geomatics, and Environmental Remote Sensing. Course work will be designed and developed to meet the needs of two important, but distinct, groups of students. Those pursuing a traditional research program on the MTU campus, and professionals currently in the workforce who wish or need to obtain an advanced degree.

The Master of Science Degree in Spatial Information Science will prepare students from science, natural resources, engineering, computer science, and social science backgrounds to pursue careers in Spatial Information Science. The degree for both cohorts of students will be a thesis (Plan A) or project report (Plan B) and require 30 credit hours beyond the bachelor’s degree. A coursework option (Plan C) is not being considered as it is very important that students develop expertise in utilizing their knowledge either in a research or management project. On campus students will work in basic research, applied projects, and/or internships with groups involved in spatial information science such as the Michigan Tech Research Institute (MTRI). It is anticipated that students currently in the workforce would be able to utilize a work-related dataset for their thesis or project. The program will have a quantitative emphasis.

Initially, the program will be administrated by faculty in the School of Forest Resources and Environmental Science (Maclean) and the School of Technology (Amos). Primary faculty support will come from the School of Forest Resources and Environmental Science, the School of Technology and members of MTRI. In addition the School of Forest Resources and Environmental Science will request the additional of one new faculty member, and partial funding of 2 part time technical support personnel. The School of Technology will request .5 faculty member and partial funding for 1 technical support personnel.

Rationale
Spatial information science builds on the technologies of GIS, remote sensing and digital image processing, surveying and photogrammetry and provides an integrated approach of measurement, analysis, and management of the descriptions and locations of Earth-based data, often termed spatial data. These data come from many sources including airborne and satellite sensors, as well as ground based instruments. Spatial information science has applications in all disciplines which depend on spatial/temporal data including forestry, environmental studies, wildlife management, civil and environmental engineering, geology and geophysics, surveying, and regional planning to name a few.

The US Department of Labor has predicted that jobs in the various fields of spatial information science will increase by 20% by 2015 and currently there is a shortage of qualified personnel to fill open positions, particularly those with a strong quantitative background. The worldwide
market for applied spatial information science technologies has enormous potential. Estimated at $5 Billion in 2001, the market is expected to have annual revenues of $70 Billion by 2015.

**Related Programs**
The degree will provide a formalized program for students conducting GIS, remote sensing, image processing and/or geomatics research. In the past and currently, students are enrolled in various departments and schools across campus including Forest Resources and Environmental Science, Geological & Mining Engineering and Sciences, Computer Science, Social Sciences, Biological Sciences and Civil & Environmental Engineering. There have been numerous requests for an Applied Spatial Sciences Degree to highlight what a student’s course work and research has emphasized.

There are no other Applied Spatial Information Science Programs in the State of Michigan. The University of Michigan, School of Natural Resources and Environment offers a degree in Environmental Informatics. This program emphasizes methods and skills using computational and analytical techniques to solve environmental problems, as well as considering the science-social issues behind these problems. Students incorporate GIS and remote sensing into their studies, but are not required to take any geomatics courses, leaving a gap in their GPS and photogrammetry expertise. Quantitative depth is limited to only one required course in Natural Resource Statistics. Michigan State University offers a Master of Science in GIScience as a non-thesis degree that emphasizes applications of analytical techniques in the field of geography. Students are trained in advanced technologies such as remote sensing, geographic information systems, cartography, and spatial analysis. The degree is aimed toward professionals who want to acquire expertise in research techniques, but who may not necessarily wish to eventually pursue a PhD. This program is appropriate for persons with interest, but not necessarily strong training, in the geographical sciences.

Regionally, the University of Wisconsin-Madison has discontinued their graduate program in Photogrammetry and recently suspended their program in Environmental Remote Sensing. They do offer a one-year non degree program in GIS as a capstone certificate through the Department of Geography. The University of Minnesota (Twin Cities) offers a Masters of Natural Resource Science and Management with a track in Assessment, Monitoring, and Geospatial Analysis.

**Projected Enrollment**
Based on the current job market and the need for qualified personnel, it is anticipated the program would have 10 – 20 students involved with the on campus program, and the same number pursing a degree who are already in the workforce.

**Scheduling Plans**
Classes will be taught on the MTU campus and at the MTRI facility in Ann Arbor. Course content will be delivered in the classroom using a traditional format as well as long-distance. Some courses may have a field component as well.

**Curriculum Design**
Students, enrolled in the on campus program, will be required to complete a minimum of 4 courses in their information science specialty, 1 course in each of the other 2 specialties for
broadth development and 2 supporting quantitative courses. Students must also enroll for FW5559 each semester they are in residence on campus. As noted above, the 3 specialties will be Geographic Information Systems, Environmental Remote Sensing and Geomatics.

Geographic Information Systems
FW5550 GIS for Resource Management (existing)
FW5551 Advanced GIS for Resource Management (will be developed)
FW5552 Spatial Interpolation (will be developed)
FW5553 GIS Programming with Python (will be developed)
FW4551 Digital Cartography and Mapping (will be developed)

Environmental Remote Sensing
FW5560 Digital Image Processing: A Remote Sensing Perspective (existing)
FW5561 Advanced Digital Image Processing: A Remote Sensing Perspective (will be developed)
FW5558 Special Topics in Applied Spatial Information Science (i.e. Radar Course (long distance delivery from MTRI- Bob Shuchman)- planned for academic year 2007-08)
FW4540 Introduction to Environmental Remote Sensing (existing)
GE4250 Fundamentals of Remote Sensing (existing)

Geomatics
FW3170 Land Measurements and GPS (existing)- Fall Field Camp
SU 5150 Adjustments (3)
SU 5250 Geodetic Models (3)
SU 5570 Geospatial Positioning (3)
SU 5990 Special Topics in Geomatics (variable)
SU 5992 Practical Experience in Geomatics (variable)
SU 5999 Graduate Research (variable)

Cross-disciplinary
FW5559/SU5559 Spatial Information Science Seminar (will be developed)
FW4552 Field Data Collection Methods (will be developed)

Supporting Statistics Courses
FW5411 Applied Regression Analysis (existing)
FW5421 Regression with the R-Environment for Statistical Computing (existing)
MA4730 Nonparametric Statistics (existing)
MA4740 Sampling Methods (existing)
MA4750 Applied Multivariate Methods (existing)
MA5791 Categorical Data Analysis (existing)

It is anticipated that students, currently in the workforce, will complete a major portion of their course work via distance education, attending evening classes to be offered at the MTRI facility in Ann Arbor, and spending a minimum of 4 weeks on the Michigan Tech campus to complete
one or two courses to be taught at an accelerated pace. The on campus requirement will permit closer interaction between faculty and students which cannot be achieved via distance education. Work experience should not be discounted. For example, it is pointless to have a student with 5 years of work experience complete an entry level GIS course. Instead, a customized course work plan will be developed by the advisor and the student to best meet her/his educational needs.

Library and Other Learning Resources
Critical learning resources exist primarily on line. There is adequate access to the peer-reviewed literature via the VanPelt Library, online tutorials and classes such as those offered by the Environmental Systems Research Institute (developers of ArcMap) and other sources too numerous to list.

Computing Access Fee
Computing is a key component of this program. Students will be using computers extensively and will have 24/7 access to the Spatial Analysis Teaching Laboratory located in room 139 of the Forest Resources and Environmental Science Building. This lab houses 16 networked PC workstations with a full complement of GIS, remote sensing, image processing, photogrammetry and GPS software, as well as standard word processing and spreadsheet software and internet access. Maintaining this lab with adequate computing and software resources is critical to the program. Students will charged a $350 computing access fee for each semester they are enrolled on campus. Off campus students may have adequate hardware software resources available to them through their work place. If not they will be setup with remote access to MTU and charged the computing fee.

Faculty Resumes
Ann Maclean- http://forest.mtu.edu/faculty/maclean/

Description of Available/Needed Equipment
The School of Forest Resources and Environmental Science maintains two spatial analysis laboratories- one devoted primarily to teaching, the second is a dedicated research lab. The teaching lab is located in room 139. It has 16 networked PC workstations with 17” flat screen monitors. There is also access to text and color printers located in Rm. 142. The full suite of ArcMap GIS, ERDAS Imagine, Leica Photogrammetry Suite, Microsoft Office and additional supporting software is available on every computer in the teaching lab. There are 3 dedicated networked PC Workstations in the lab for spatial analysis and the same suite of software packages. Currently, there is 1 eCognition image processing software license available for use. Ann Maclean and Richard Powell (MTRI) are currently negotiating with Defienens, the developers of eCognition, for multiple licenses at academic pricing. This room also provides desk space for 5 graduate students (2 GIS/3 biometrics).

Program Costs
New faculty hire in SFRES, 1/3 time support for two technical support personnel.
Remodeling of Rm 135 to split room into 2 separate rooms to allow for additional student seating and equipment
5 eCognition licenses
5 PC workstations

**Space**
The research lab is located in Rm 135. This facility is shared with the biometrics research group program.

**Policies, regulations and rules**- not applicable

**Accreditation requirements**- not applicable

**Planned Implementation Date**- Spring Semester 2008
Dual Degrees – Proposed Policy Statement for Graduate Faculty Council Consideration

Purpose:
Formalize guidance about issues related to dual degree programs.

Background:
There is growing interest among students in obtaining a dual graduate degree from Michigan Tech. For example, students might be interested in obtaining both a master’s in engineering and an MBA because both degrees will assist them in their future careers. To assist students who are interested in pursuing dual degrees, the graduate school would like to make it clear that dual degrees can be earned and to outline some basic guidelines that should be followed.

The proposed policy allows students to earn a second master’s degree or a master’s degree in addition to a Ph.D. while at Michigan Tech. It builds on Michigan Tech’s current policy of allowing transfer of up to 1/3 of the non-research credits required for a degree by allowing students to double-count up to a maximum of 1/3 of the non-research credits required for the dual degrees. Students may only double count courses that are deemed appropriate by the academic advisors or graduate program directors in both of the program areas.

No discussion is included for dual Ph.D. programs. To date, no students have expressed interest in working toward more than one Ph.D. at the same time. Therefore, there appears to be no need for a statement of policy regarding dual Ph.D. programs at this time.

Planned Location of Policy Statement:
This information will be added under the graduate school’s policies and procedures for students section on the web using the heading "Dual Degrees"

DUAL DEGREE GRADUATE PROGRAMS

Michigan Tech graduate students are eligible to obtain a second master's degree from a program other than their primary master's or doctoral program. Students must apply to and be accepted into the second master's program using standard application process. Admission to the second master’s program is not automatic; students are accepted at the discretion of the department to which the application for acceptance is made.

Students working on dual degrees must complete all requirements for both programs. If appropriate, students working on dual graduate degrees may double count up to a maximum of 1/3 of the required non-research credits required for the two degrees. Double counting of credits is appropriate only when it does not hinder the students' ability to completely satisfy all requirements for both degrees. Every department will review students' requests to double count credits on case-by-case basis and will disallow double counting if the practice will have a negative impact on the student's education. If double
counting is to be allowed, all courses and credits to be double counted must be clearly identified on the student's degree schedule for their secondary program using the wording "also used for (MS or PhD) in (Primary Program Name)". The advisor and department for a student's second degree program will indicate approval of the use of double-counted credits by signing the degree schedule.