26 March 2015

TO: Sarah Mangelsdorf, Provost

FROM: John Karl Scholz, Dean

RE: Proposal to Create a New Named Option, “GIS Development”, under MS-Cartography and Geographic Information Systems (Program Code 146)

CC: Greg Downey, Associate Dean for Social Science, L&S
Marty Gustafson, Assistant Dean, Graduate School
Kelly Haslam, Assistant Dean, Graduate School
Elaine Klein, Assistant Dean for Academic Planning, L&S
Daniel Kleinman, Associate Dean, Graduate School
Jocelyn Milner, Associate Provost and Director, Academic Planning and Analysis
Kris Olds, Professor and Chair, Geography

On March 17, 2015, the L&S Academic Planning Council considered the attached request from the Department of Geography, which seeks to create a new named option, “GIS Development”, under the existing MS-Cartography and Geographic Information Systems (Program Code 146). The proposed program is a 32-credit/8-course program designed to be a self-supporting educational initiative, to be offered fully online. It has been developed with extensive consultation and support from our colleagues in the Division of Continuing Studies, which has long encouraged Geography to build upon its successful Capstone Certificate in GIS.

The program is designed to meet the demand for professionals who are skilled in GIS software development and/or who can provide advanced application support for GIS. As noted in the proposal, interest in GIS continues to grow, and this new program would complement the department’s current offerings. In this tightly focused online program, cohorts of students will progress through a narrow range of courses. The faculty in Geography is experienced with online instruction (indeed, the current chair has long taught large enrollment online courses, and recently fielded one of the UW-Madison MOOCs). To assist them in this work, the Department has access to and support from DCS experts in instructional design.

We are pleased to see this new program, and believe it will be successful. As you know, Geography ranks among the top five departments in the US, and Cartography and GIS are among its particular strengths. This program will build upon that strength. The L&S APC enthusiastically approved this request.
5 February 2015

To Dean Karl Scholz:

RE: Professional Program in GIS Development

Dear Dean Scholz:

The Department of Geography is very pleased to submit the attached proposal for review by the L&S APC. The proposal is for a new named option, “GIS Development” (Non-thesis Master's option) under the current MS-Cartography GIS Master Program. The Department of Geography has met, several times, to discuss this proposed new program and we agree it answers an emerging need in the geographic information science (GIS) profession. Results from a UW Division of Continuing Studies (DCS) Market Analysis underscore our confidence in the demand for our proposed Program. Thus the Department's Executive Committee has voted unanimously to support the development of this professional program.

Our proposed program is a 32 credit program that students enrolled as full-time students would be able to complete it in 3 semesters (Fall, Spring and Summer). It would be oriented towards skills development and focused on training students in advanced geospatial database design, geospatial analysis, web-based/mobile mapping, geovisualization and programming skills. It is designed to meet the growing demand for individuals skilled in GIS software development and/or in advanced application support of GIS in various sectors of the economy. The program will be run on a program revenue model and is expected eventually to be fully self-supporting.

Thank you very much for considering this proposal.

Please do not hesitate to contact me if you require any further information.

Sincerely,

Kris Olds, PhD
Professor and Department Chair

Documents included in this submission (in one pdf file)

- The Proposal (22 pages)
- A note on the course numbers in the support letter from the Computer Science Department
- Support letter from Department of Computer Science
- Support letter from Department of Landscape Architecture
- Support letter from Department of Urban and Regional Planning
- The completed HLC template for the proposed program
- The completed minimum degree and satisfactory template form
- Letter of support from the Executive Committee of Department of Geography
Subject: preparing for the GFEC review

From: Lisa Naughton <naughton@geography.wisc.edu>
Date: 3/27/2015 12:00 PM
To: Elaine Klein <emklein@ls.wisc.edu>
CC: Kris Olds <olds@geography.wisc.edu>, A-Xing Zhu <azhu@wisc.edu>

Dear Elaine-

Thank you for your guidance as we prepare for the GFEC review of our proposed new named option in Cart/GIS called "GIS Development" (a non-thesis MSc).

In the revised proposal (attached), you'll see that we answered concerns raised in the APC review, e.g., we added more details on learning assessment and clarified our student recruitment strategies. And we corrected our Table enumeration error (sorry, good catch!). Please pardon the minor formatting problems on p. 17, 21-22 (A-Xing used some code that I was unable to decipher, my fault). The text is perfectly clear, but there are a few blank spaces.

We also carefully considered the GFEC checklist. All the Core and Additional checklist items are addressed in our proposal, except we have yet to prepare the student handbook and admission letter that will disclose policies, etc (the top two items on p. 3 of "UW-Madison Requirements and Process for Academic Programs with Fund 131/Non-pooled tuition." Nor have we completed the Appendix A (includes implementation checklist). We will turn to these tasks if and when our program is approved by GFEC.

Please contact me if you have any questions or concerns.

Thank you,

Lisa

Lisa Naughton, PhD
Professor
Department of Geography
UW Madison
Madison, WI 53706

Microsoft Word - 131_Program_Requirements_Process_3.10.2015.docx

— Attachments: —

Submission from Geography_Professional Program in GIS Development-2015-03-27.docx 1.1 MB
Proposal for a named option “GIS Development”

Proposal for a new named option, “GIS Development” (Non-thesis Master’s option) under MS-Cartography and Geographic Information Systems Program

Department of Geography  
College of Letters and Science  
University of Wisconsin-Madison

1. Summary/Overview

We propose to create a graduate level geographic information systems (GIS) program as a new option under the existing Master of Science in Cartography and Geographic Information Systems. It is a 32 credit program and when it is fully developed, students enrolled as full-time students would be able to complete it in 3 semesters (Fall, Spring and Summer) while part-time students would take longer. It will be a fully online program. Our proposed program would be oriented towards skills development and focused on training students in advanced geospatial database design, geospatial analysis, web-based/mobile mapping, geovisualization and programming skills. Thus our proposed program stands in contrast to our traditional research-oriented Master’s program in GIS and our application-oriented GIS capstone certificate program. We have designed our new program to meet the growing demand for individuals skilled in GIS software development and/or in advanced application support of GIS in various sectors of the economy.

The program will be run on a program revenue model. A detailed budget is being determined in collaboration with the L&S Dean's Office. The Geography faculty has explicitly discussed the use of the revenue generated from this program. As part of this discussion a finance committee was created to oversee the use of the revenue (as well as other departmental financial resources). Funds generated by the program beyond program costs (offering and maintenance) will be used to strengthen Geography Department teaching and research missions. Among the priorities we have considered are funding for a new faculty hire, faculty recruitment packages, or lecture support for high enrollment classes.

We intend to make this program available for enrollment Fall 2016 if approved. The program will be offered fully online to optimize convenience for working professionals and international students who are interested in GIS programming skills and new tools/techniques for advanced GIS application support but who are not able to take courses in residence. There is no plan to bring international students to WI or U.S. or to suggest any travel related to this online program.

2. Background/Rationale

The field of geographic information systems (GIS, including cartography) has experienced tremendous growth since its inception in the 1980s. GIS is a tool that supports analysis associated with location. Almost everything in our lives has a location and the economy associated with location is ever increasing due to the expanded availability of location-enabled devices (such as smartphones and other personal digital assistants).
GIS is impacting our everyday lives and is a major expanding sector in the global economy. It is not only a vital component of Geography, but has increasing importance to other academic and practitioner fields ranging from engineering to natural sciences to social sciences. The United States Department of Labor identifies GIS, and Geospatial Technology broadly as a key area of growth. It is indicated that there currently are approximately 424,000 Americans working in geospatial occupations and that an additional 148,700 jobs in geospatial occupations are expected to be created in the next ten years, a growth rate of approximately 35% (see US Department of Labor website). In addition, the initial wave of professionals in GIS who started their careers in the mid-1980s will be nearing retirement age, meaning the level of demand for GIS professionals should remain high for decades to come. The recent NRC report, Future U.S. Workforce for Geospatial Intelligence (2013), assesses the supply of expertise in 10 geospatial intelligence fields and identifies cartography/GIS as the core area of expertise needed. It indicates that due to competition from private companies it is already difficult to find qualified experts in GIS techniques. This shortfall is expected to continue for at least 20 years. The report also identifies that GIS programming (GIS development) is a skill in particularly high demand.

Taken together, these data support a significant need for the training our proposed program will deliver. The rapid growth of similar (but not interchangeable) professional GIS training programs in competing universities like Penn State provides further evidence of the high demand for this type of skills training.

The GIS profession generally encompasses three major groups: academics (research oriented), application users, and development professionals. The academic group is most concerned with teaching GIS and researching the science behind GIS. Application users are those who use GIS software in their respective fields. The development professionals we are targeting in our proposed new program option are those who develop software and support the application of GIS in various sectors of the economy. Indeed this is the realm experiencing the most growth due to the increasing popularity of GIS applications and the rapid advancements in digital technology.

Results from a UW Division of Continuing Studies (DCS) Market Analysis underscore our confidence in the demand for our proposed Program. Completed in July 2014 (led by J. Viesselmann), this survey examined competing programs from other U.S. universities, provided employment projections and surveyed prospective students. In addition to confirming the labor trends presented earlier, analysis of the survey of GIS Certificate Alumni and Members of the WLIA (Wisconsin Land Information Association) found that: 1) 42% of respondents (n=111) stated that they were extremely or very interested in the proposed M.Sc. in GIS Development (nearly half of respondents left their email address to receive further communication on the proposed program); and 2) Within a subset (n=38) of respondents who manage workers who use GIS, 55% reported that they were moderately to extremely interested in the program for training their employees.

The current GIS programs in the Department of Geography at UW-Madison provide training to meet the needs of the academic group and the application users. We serve the academic group through our Masters of Science in Cartography/GIS (thesis required) and the Cartography/GIS
focus in our Ph.D. in Geography. We serve the application users through our capstone certificate in GIS. We do not yet have a program designed to meet the needs of the development professionals.

Although many geography programs in the nation and around the world are moving to provide training in GIS, the Cartography/GIS programs in Geography at UW-Madison have distinct advantages in this competition. The Cart/GIS program at UW-Madison Department of Geography is world renowned and has a long tradition of excellence in the field. Our Geography Department is ranked 1st or 6th in the U.S., according to R-rank or S-rank criteria, respectively (NRC 2011). Our excellence in GIS is recognized beyond the U.S. For example, the Chinese Academy of Sciences has contacted us about providing GIS training to their top students. We also have demonstrated experience in running a successful revenue-based professional program. Our current capstone certificate in GIS, developed based on the innovative idea of Chancellor Ward in 1999, has been running very successfully for over 10 years with an annual revenue of about $300,000. Through running the capstone program we also have gained a good sense of the growing need for training in areas beyond what the certificate program offers.

3. Redesign of Program/Name of Program and Implementation

3.1 Redesign of Program/Name of Program

The existing Cartography/GIS programs at UW-Madison Department of Geography are not designed to provide training in the development niche of GIS. The Cartography/GIS program currently houses an undergraduate major, a Master’s of Science Degree in Cartography/GIS (thesis required), and a capstone certificate in GIS. In addition students can focus on theoretical GIS at the PhD level via the Doctorate program in Geography. Our undergraduate major provides entry level training in GIS which is not sufficient for meeting the tasks of software development and advanced application support. Like most of the thesis-based MS programs around the world in GIS, our current Master of Science Degree program focuses on research training necessary for students to move into the Ph.D. program. The capstone certificate program was designed to provide the training needed by application users and was not designed to provide training to GIS professionals in software development and advanced application support.

The establishment of this new option focusing on GIS development and advanced application support, thus, does not compete with our existing offerings; rather, it complements and broadens our coverage of training in GIS. The added offerings in courses focusing on software development and geospatial database design and programming will enrich the training in GIS for students not only in geography but also across the campus.

Table 1: Current Degree vs. Proposed Options:

<table>
<thead>
<tr>
<th>Current:</th>
<th>Proposed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma:</td>
<td>Master of Science/Cartography and Geographic Information Systems</td>
</tr>
<tr>
<td>Transcript:</td>
<td>Master of Science/Cartography and Geographic Information Systems</td>
</tr>
<tr>
<td>Major:</td>
<td>Cartography and Geographic Information Systems</td>
</tr>
</tbody>
</table>
Proposal for a named option “GIS Development”  
Department of Geography

**Proposed:**

<table>
<thead>
<tr>
<th>Diploma:</th>
<th>Master of Science/Cartography and Geographic Information Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transcript:</td>
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</tr>
<tr>
<td>Major:</td>
<td>Cartography and Geographic Information Systems</td>
</tr>
<tr>
<td>Option:</td>
<td>GIS Development</td>
</tr>
</tbody>
</table>

### 3.2 Mechanism of offering:

The program will be offered online. This will allow us to capture the demands from distance trainees, such as working professionals and overseas students who would not be able to take the program if it were offered in residence. Initially, the courses will be offered in a sequence as demanded by the program. With sufficient demand, there is a future possibility of offering all courses every semester (See program pathway for details).

The Geography Department already has experience in offering online courses. Currently, the Department has two online courses (Geography 340: World Regional, and Geography 342: Geography of Wisconsin). We have a third course in the pipeline, Geography 378: Introduction to Geocomputing, a geospatial programming course that will eventually have a new option created for the proposed M.Sc. program. Not all of our Department’s online courses are relevant to the proposed named option, but they have given us invaluable experience in how to deploy programming courses and labs online, address technological glitches, and anticipate and set expectations for responding to requests from international students based in different time zones. Further, we have met with Steven Boldt, Director of Online Development-Educational Innovation at DCS and received a thorough overview of the process for developing online courses particularly those for program as technical as ours. We plan to work with DCS as closely as possible to take advantage of its expertise in developing online courses.

In addition, the Department has developed a plan for developing and offering the program online. First, individual faculty in GIS will each take ownership of required courses of their expertise for this program. They will develop the courses at the graduate level and thereafter regularly update the contents. The Department will devote two 50% TAs to assist the design of the labs for online deployment. Once the program is running, a 50% TA will be budgeted to support the online delivery of these technical courses.

### 4. Administrative Structure and Governance

This new program will be carefully integrated with the existing department administrative and governance structures. We will set up an oversight committee to oversee this program. The oversight committee will consist of the program director (faculty associate), a faculty member from the Cartography/GIS subfield who will serve as the Advisor to the program, at least 1 additional faculty member from the Cartography/GIS subfields, the chair of the graduate studies committee, the chair of the department finance committee, the chair of the department future directions committee, and the chair of the department. With the inclusion of the chair of the
graduate studies committee and the chair of the finance committee, the Department will maintain oversight of the academic and fiscal operation of this program. Issues such as admissions, curriculum, student services and assessment will be handled by faculty committees already in existence for our MS-Cartography/Geographic Information Systems.

5. Admissions and Degree Requirements

5.1 Admissions
Admissions to this program will follow the same admission process as for our regular Cartography and Geographic Information Systems M.S. graduate program (the thesis option) and admission decisions will be made by a subset of the oversight committee plus the faculty in the Cartography/GIS subfields.

Successful applicants must already hold a bachelor's degree by the time of admission with a GPA of 3.0 or equivalent. Basic training in GIS is expected before admission to the program, i.e., training comparable to our capstone certificate program. The admissions committee will review students’ experience and evaluate if applicants’ previous experience is sufficient or if those applicants without basic training in GIS should first take the GIS capstone certificate program or its equivalent before applying to this program. Courses in basic training of GIS will not be counted towards the credit requirements of the named option unless the specific courses are among the required courses of the named option and then a limit of 8 credits is applied for transfer of these credits (see Section 10: Overlap with other Programs for details). The Graduate School policy concerning English proficiency requirements will be rigorously applied because the program cannot admit students who have significant ESL needs.

5.2 Degree Requirements
The program requires 32 graduate credits, and consists of the following three elements: 1) skill development courses; 2) a capstone case studies course; and 3) a graduate practicum. The skill development courses build advanced competence among the students in geospatial analysis, web/mobile mapping, geovisualization, programming, database design and development skills needed in the development sector of the GIS profession. The capstone case studies course offers students an opportunity to work with the GIS faculty and other instructors on projects designed to strengthen students’ critical thinking (such as analytical, integrative and managing skills) and their ability to apply their technical skills to solving GIS development problems. During the capstone course students will work in groups to learn from each other and develop a sense of team work. By contrast, the practicum is an individual- and project-based course in which the student will choose a real world development project. The student will work with an individual faculty member or instructor during the course of completing the project. In addition, through these practica, students will develop new tools for projects which cannot be efficiently addressed by those available in existing GIS software.

The following menu presents highlights of the courses. The online versions of these courses are specifically designed for graduate students and are only available to students in the named program. All courses have either a lab exercise component or a project component. Lab exercises
Proposal for a named option “GIS Development”

Department of Geography

in GIS are “digital” in nature. This means that all tasks are expected to be completed independently using software with written instructions. The required software is easily accessible to students in the program because the software is either open source or available in student versions (from commercial software).

Core Courses: (24 credits)

Geocomputing (378) (4 credits)

Status
A three credit version of the course already exists, a course change proposal is underway to create four credit graduate version of this, currently under development for online delivery.

Goal:
Provide training in scripting for Geographic Information Science.

Topics:
Geoprocessing with open-source GIS utilities. Python scripting with ArcGIS and open-source libraries

Lab assignments:
10 lab assignments

GIS and Spatial Analysis (579) (4 credits)

Status
Course already exists, only to be revised for online delivery

Goal:
Develop students’ advanced statistical/spatial analysis skills for geospatial data.

Topics:
Multiple regression, principal components, clustering methods, time series analysis, computer-intensive methods (e.g., bootstrapping), spatial autocorrelation, spatial interpolation, spatial pattern analysis, and machine learning techniques for geographic data.

Lab assignments:
8-10 lab assignments

Graphic Design in Cartography (572) (4 credits)

Status
Course already exists, only to be revised for online delivery

Goal:
Develop students’ cartographic design skills for visualizing and presenting geospatial information using open web standards.

Topics:
Visual perception, visual cognition, visual semiotics, visual aesthetics, and professional ethics, as applied for advanced thematic mapping and visual storytelling on the web.
Lab assignments:
3 lab assignments and 1 final project

**Interactive Cartography & Geovisualization (575) (4 credits)**

**Status**
Course already exists, only to be revised for online delivery

**Goal:**
Develop students’ skills on the design of interfaces for visualizing geospatial data in a web environment.

**Topics:**
User experience (UX) design, user interface (UI) design, human-computer interaction, usability engineering, web mapping, and visual analytics, as applied for client-side, interactive web map development.

**Lab assignments:**
3 lab assignments and 1 final project

**Spatial Database (574) (4 credits)**

**Status**
A course proposal has been submitted to create this course and we need to develop an online version as well.

**Goal:**
Develop student’s skills in geospatial database design, operations and implementation

**Topics:**
Fundamental database concepts, benefits of using databases, functions of database management systems; Data modeling and database design: Entity-Relation diagrams, relational model, object-oriented database design, object-relational database, georelational model; Geospatial database creation, query and manipulation through SQL; Usages of modern geospatial databases products (e.g., PostgreSQL/PostGIS and ArcSDE); Usages of NoSQL database (e.g., MongoDB) for big spatial data management.

**Lab assignments:**
8-10 lab assignments

**Spatial Web and Mobile Programming (576) (4 credits)**

**Status**
A course proposal has been submitted to create this course and need to develop an online version of this.

**Goal:**
Develop students’ skills to program spatial analysis functions in web and mobile environment.

**Topics:**
Software development and Object Oriented Programming: JAVA programming fundamentals; Geospatial programming tools, languages and libraries: Servlet, JavaServer Page(JSP), JavaScript (JS), Google Maps API, Leaflet, HTML, CSS, XML etc; Web and mobile GIS design and development;
Lab assignments:
8-10 lab assignments

Capstone in GIS Development (670, 4 credits):
Status
A course proposal has been submitted to create this course and we need to develop an online version.
Goal:
Develop student’s integrative skills and the ability to apply the learned development skills in solving development/supporting problems.
Topics:
4 challenging problems requiring skills in spatial analysis, mapping and programming

Practicum in GIS Development: (672, 4 credits)
Status
A course proposal has been submitted to create this course and we need to develop an online version.
Goal:
Develop students’ ability to conceive and solve real world development problems and provide GIS application support independently.
Topics:
Conception, development and implementation of a student specific real world development project

5.3 Program pathway and course availability:
The program pathway is shown in Figure 1. All courses are required for the program. The required pathway is to complete the core courses first and then the capstone and the practicum. Within the core course group, GIS and Spatial Analysis could be taken any time; Geocomputing must be taken before the two programming courses: Spatial Database and Spatial Web and Mobile Programming. Graphic Design in Cartography should be taken first before Interactive Cartography & Geovisualization (Figure 1). The Practicum should be not taken before the Capstone course but can be taken concurrently.
Proposal for a named option “GIS Development”  

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GIS and Spatial Analysis (579)</td>
<td></td>
</tr>
<tr>
<td>Geocomputing (378)</td>
<td></td>
</tr>
<tr>
<td>Graphic Design in Cartography (572)</td>
<td></td>
</tr>
<tr>
<td>Spatial database (574)</td>
<td></td>
</tr>
<tr>
<td>Spatial Web and Mobile Programming (576)</td>
<td></td>
</tr>
<tr>
<td>Interactive Cartography &amp; Geovisualization (575)</td>
<td></td>
</tr>
</tbody>
</table>

Capstone in GIS Development (670)
Practicum in GIS Development (672)

Figure 1: Program Pathway

During the early stage of the program offering we intend to offer courses in the sequence as shown in Figure 2. This allows full time students to complete the program in three semesters but also provides flexibility for the working professionals who take this program part-time to take the courses in the proper sequence without too long of gaps between courses. For example, a working professional who take this program part-time and is able to take two courses a semester would complete the program in five semesters, with the first two semesters focusing on programming and the second two semesters on cartography and spatial analysis, as shown in Figure 3. The frequency of course offerings will increase as enrollments grow.

![Course availability by semester at initial offering of the program](image)

Figure 2: Course availability by semester at initial offering of the program
Figure 3: A possible pathway for a part-time student with 2 courses per semester

<table>
<thead>
<tr>
<th>Semester One: Fall</th>
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<tbody>
<tr>
<td>Geocomputing (378)</td>
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<table>
<thead>
<tr>
<th>Semester Two: Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial database (574)</td>
</tr>
<tr>
<td>Spatial Web and Mobile Programming (576)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester Three: Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS and Spatial Analysis (579)</td>
</tr>
<tr>
<td>Graphic Design in Cartography (572)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester Four: Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive Cartography &amp; Geovisualization (575)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Semester Five: Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capstone in GIS Development (670)</td>
</tr>
<tr>
<td>Practicum in GIS Development (672)</td>
</tr>
</tbody>
</table>

6. Demand/Enrollment Projections

We expect a strong demand for this program. First, the majority of the already existing GIS Master’s programs at U.S. universities focus on the application of GIS. There are very few GIS Masters programs which offer training in GIS development. For example, the Pennsylvania State University online GIS Master’s program, the most successful program (largest, most well-known and comprehensive) in the nation, does not yet offer the development option. Further evidence of demand is the fact that the Penn State program currently enrolls about 200 students and only admits 1/3 of applicants. Second, we have seen a significant increase in the number of students applying to our regular MS in cartography/GIS over the past 5 years. Most of this increase is in students who are seeking professional development in GIS and we have to turn them away because our existing MS in cartography/GIS is not oriented to this type of training. Third, our Cart/Geographic Information Systems program has a long tradition of excellence in the field. This gives us distinct advantages in recruiting students. Fourth, recently, the Chinese Academy of Sciences has contacted us about enrolling their top GIS students in our non-thesis Masters’ degree option. All of these indicators suggest strong enrollment projections for this proposed program. We expect to enroll 20 students in the first year and then expand the number to 40 or higher. The projection on demand is supported by the results from the DCS Market Analysis. With this level of enrollment the program will generate a revenue surplus (discussed below) worthy of the considerable cost and effort of its development.

The particular number of students enrolled for a given semester is difficult to project because it depends on the combination of the number of part-time and full time students in the program and the course load of each part-time student. Nevertheless, Table 1 provides the credits taken by semester for the first two years of the program under two scenarios: one with 20 full time students...
Proposal for a named option “GIS Development”  

Department of Geography

and the other with 20 part-time students taking the pathway as shown in Figure 3. The number of credits taken by semester stabilizes in the second year for the part-time student scenario.

Table 1: Credits taken by semester for the first two years of the program

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits taken with 20 PT students</th>
<th>Credits taken with 20 PT students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester One: Fall, Year 1</td>
<td>20*4=80</td>
<td>20*12=240</td>
</tr>
<tr>
<td>Semester Two: Spring, Year 1</td>
<td>20*8=160</td>
<td>20*12=240</td>
</tr>
<tr>
<td>Semester Three: Summer, Year 1</td>
<td>0</td>
<td>20*8=160</td>
</tr>
<tr>
<td>Semester Four: Fall, Year 2</td>
<td>20<em>8+20</em>4=240</td>
<td>20*12=240</td>
</tr>
<tr>
<td>Semester Five: Spring, Year 2</td>
<td>20<em>4+20</em>8=240</td>
<td>20*12=240</td>
</tr>
<tr>
<td>Semester Six: Summer, Year 2</td>
<td>20*8=160</td>
<td>20*8=160</td>
</tr>
</tbody>
</table>

7. Faculty and Staffing:

7.1 Faculty expertise:

Although Geography only has 3.25 faculty FTE in the GIS area, the expertise of the faculty covers the program areas well. We have one faculty specialized in cartography (Roth), two in GIS (Zhu and Huang) and one in spatial analysis (Burt) (See Table 2). These faculty have the expertise needed to develop the online version of the required courses, which is currently under way in close collaboration with UW’s DCS program. Our recent hire (Huang) has significantly enhanced our offerings in geospatial programming.

Table 2: List of Faculty

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Status</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>James E. Burt</td>
<td>Professor</td>
<td>Quantitative analysis, GIS</td>
</tr>
<tr>
<td>Qunying Huang</td>
<td>Assistant Professor</td>
<td>GIScience, distributed computing, cloud computing, cyberinfrastructure</td>
</tr>
<tr>
<td>Robert E. Roth</td>
<td>Assistant Professor</td>
<td>Cartography, geovisualization, and geovisual analytics</td>
</tr>
<tr>
<td>A-Xing Zhu</td>
<td>Professor</td>
<td>GIS, remote sensing, artificial intelligence</td>
</tr>
</tbody>
</table>

The strategy for effective quality delivery of the program is for the faculty to develop and maintain the online version of the courses so that their expertise is captured in these online courses. The Department will hire a program director (faculty associate) and instructors (adjunct faculty) to deliver the online courses. We will employ a strategy with which faculty will take ownership of these courses (in maintaining the contents) and periodically cycle in to teach these online courses. This strategy will allow the faculty in GIS area to stay engaged in our named option but not be taken away from their teaching for our other programs once this online program is deployed.

7.2 Staffing:

We will hire a full time program director (academic staff/faculty associate) to manage this program under the auspices of a faculty advisor. The program director will be someone well versed in the field of GIScience and in the professional world. The program director will initially teach one online course per semester (Geog. 378: Geocomputing in Fall, Geog. 574: Spatial
Proposal for a named option “GIS Development”  

Department of Geography

Database in Spring, and Geog. 670: Capstone in GIS Development in Summer) and coordinate with the faculty in GIS to direct student practicums (Geog. 672). The program director will also provide student services for this program. We will hire two 40% instructors to teach the rest of the courses: one teaching the cartography courses (Geog. 572 for Fall and Geog. 575 for Spring); the other teaching the GIS courses (Geog. 579 for Fall and Geog. 576 for Spring). The instructors will be qualified individuals who have a Ph.D. in areas related to GIS and cartography or advanced PhD students who have already earned their M.Sc. (Our graduate students must first earn a M.Sc. to go on to pursue a PhD). In all cases we will recruit instructors who are well versed in the GIS profession. With the growth of this program, the department will recruit new faculty lines (using the revenue from this program) to further strengthen the staffing of this program.

With the level of staffing and the faculty commitment in program design and administration we are confident that we can offer a high quality program.

Table 3: Program staffing

<table>
<thead>
<tr>
<th>Courses</th>
<th>Staffing</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS and Spatial Analysis (Geog. 579)</td>
<td>Instructor 1 (40%)</td>
</tr>
<tr>
<td>Geocomputing (Geog. 378)</td>
<td>Program Director</td>
</tr>
<tr>
<td>Graphic Design in Cartography (Geog. 572)</td>
<td>Instructor 2 (40%)</td>
</tr>
<tr>
<td>Interactive Cartography &amp; Geovisualization (Geog. 575)</td>
<td>Instructor 2 (40%)</td>
</tr>
<tr>
<td>Spatial Database (Geog. 574)</td>
<td>Program Director</td>
</tr>
<tr>
<td>Spatial Web and Mobile Programming (Geog. 576)</td>
<td>Instructor 1 (40%)</td>
</tr>
<tr>
<td>Capstone Course (Geog. 670)</td>
<td>Program Director</td>
</tr>
<tr>
<td>Practicum (Geog. 672)</td>
<td>Faculty, Other GIS Professionals</td>
</tr>
<tr>
<td>IT and Program Admin Support</td>
<td>50% TA</td>
</tr>
</tbody>
</table>

7.3 Course offering schedule:

During the early stage of the program offering we intend to offer courses in the sequence as shown in Figure 2. As discussed earlier (Section 5.3), this offering allows full time students to complete the program in three semesters but also provides flexibility for working professionals to take this program part-time and take the courses in the proper sequence. The availability of courses will increase when enrollments grow.

7.4 Additional resources:

The department has three units that are directly related to this program: the Cartography Lab, the State Cartography office, and the Robinson Map Library. The broader UW campus has expertise in remote sensing (much of it based in the Nelson Institute and the Department of Forest and Wildlife Ecology) and GIS applications (Urban & Regional Planning, Landscape Architecture/Soils). Faculty members/staff related to GIS in these units have the option to provide opportunities for students to conduct their practica in a mutually beneficial way, that is, the student gets an opportunity to work on a real world problem and the hosting unit benefits from the technical expertise of the student.

8. Financial Support

Due to the fact that this program will be a self-supporting revenue generating program (i.e. not supported with 101 or GPR funds) students in this program will not be eligible for university
funding in the form of TA/PA/RAships. Moreover, the fact that they are not on campus would make it difficult for them to perform TA/PA/RA duties. Finally, we expect many of the students to be working professionals and it is in their best interest to complete this program as quickly as possible.

9. Budget Implications

9.1 Pro Forma Program Budget:
We view our proposed program as part of the Education Innovation initiatives. The program is expected to be fully self-supporting, with a detailed budget to be determined in collaboration with the L&S Deans Office and the Division of Continuing Studies. A pro forma program budget (revenue vs. operating costs) is given in Table 4 with multiple scenarios given the differences in student make-up (in-state vs. out-state and part-time vs. full-time). Revenue per student is calculated based on tuition capped at 8 credits minus the expected segregation fee. For example, we calculate the revenue per in-state student to be approximately $14,080 per person per year (including summer) ($15,499.27 - $1,419.40) to complete the program. The revenue per out-state student will be roughly $31,571 per person per year (including summer) ($32,990.8 - $1,419.4). These values assume that each student will be enrolled in 12 credits in Fall and Spring semesters and 8 in the summer (full-time status). For part-time students the revenue will spread over a long time period. Given this, the budget outlined for every scenario in Table 4 is conservative. The current deliberation on a new fee structure for online courses and online program will have significant implications for this program.

Given the significant budget permutations of in-state vs. out-state and part-time vs. full-time fees, the budget tables below can only provide scenario-based estimates. The initial offering contains three scenarios: with 20 part-time in-state students (year 1 and year 2), 20 full-time in-state students, 10 full-time in-state students and 10 full time out-state students. The full rollout contains two scenarios: with 40 full time in-state students and 20 full time in-state students and 20 full-time out-state students.

Table 4A: Pro forma program budget at initial offering with 20 part-time in-state students

<table>
<thead>
<tr>
<th></th>
<th>Initial Offering (20 part time in-state students)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
</tr>
<tr>
<td><strong>REVENUE:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total Tuition per year</strong></td>
<td>Enrollment</td>
</tr>
<tr>
<td>In-state students</td>
<td>20</td>
</tr>
<tr>
<td>Out-state students</td>
<td></td>
</tr>
<tr>
<td>LESS: Segregated Fees:</td>
<td>$17,563</td>
</tr>
<tr>
<td><strong>GROSS Revenue</strong></td>
<td>$160,845</td>
</tr>
<tr>
<td>LESS: Revenue sharing:</td>
<td>$53,610</td>
</tr>
</tbody>
</table>
# Proposal for a named option “GIS Development”

## Department of Geography

<table>
<thead>
<tr>
<th>Revenue to Department</th>
<th>$ 107,235</th>
<th>$ 259,215</th>
</tr>
</thead>
</table>

## EXPENSES:

### Program Director (100%)

- **Salary ($80,000/year 100%)**: $ 80,000
- **Fringe benefits (33.7%)**: $ 26,960

### Instructors

- **1 @ $60,000/year at 40%**: $ 24,000
- **Fringe benefits (33.7%)**: $ 8,088
- **1 @ $60,000/year at 40%**: $ 24,000
- **Fringe benefits (33.7%)**: $ 8,088

### TA Support (50%) - TA

- **Salary ($36,913/year 50%)**: $ 18,457
- **Fringe Benefits (24.5%)**: $ 4,522

### Supplies

- **Materials/Marketing**: $ 5,000
- **Travel (recruiting trips)**: $ 10,000
- **Faculty Summer (practicum)**: $ 0

### Others

<table>
<thead>
<tr>
<th>Total Expenses per year</th>
<th>$ 209,114</th>
<th>$ 249,114</th>
</tr>
</thead>
</table>

**DEPARTMENT NET REVENUE**: - $ 101,879 $ 10,102

---

### Table 4B: Pro forma program budget at initial offering with 20 full time students

<table>
<thead>
<tr>
<th>REVENUE:</th>
<th>Initial (Scenario Res)</th>
<th>Initial (Scenario Combo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Tuition per year</strong></td>
<td>Enrollment</td>
<td>Tuition</td>
</tr>
<tr>
<td>In-state</td>
<td>20</td>
<td>$309,917</td>
</tr>
<tr>
<td>Out-state</td>
<td>$ -</td>
<td>$28,320</td>
</tr>
<tr>
<td>LESS: Segregated Fees: $1,419.4</td>
<td>20</td>
<td>$281,597</td>
</tr>
</tbody>
</table>

**GROSS Revenue**

| 20 | $281,597 | 20 | $456,513 |

**LESS: Revenue sharing:**

- **L&S: 33.33% of Gross Revenues**: $ 93,856 $ 152,156

**Revenue to Department**

| $ 187,741 | $ 304,357 |

### EXPENSES:

### Program Director (100%)

- **Salary ($80,000/year 100%)**: $ 80,000
- **Fringe benefits (33.7%)**: $ 26,960

### Instructors
### Proposal for a named option “GIS Development”

<table>
<thead>
<tr>
<th></th>
<th>Full (Scenario Res)</th>
<th>Full (Scenario Combo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Tuition per year</td>
<td>Enrollment 40</td>
<td>Enrollment 20</td>
</tr>
<tr>
<td>In-state</td>
<td>$619,835</td>
<td>$309,917</td>
</tr>
<tr>
<td>Out-state</td>
<td>$20,000</td>
<td>$659,748</td>
</tr>
<tr>
<td>GROSS Revenue</td>
<td>40 $563,195</td>
<td>40 $913,025</td>
</tr>
<tr>
<td>LESS: Segregated Fees:</td>
<td>$56,640</td>
<td>$56,640</td>
</tr>
<tr>
<td>L&amp;S: 33.33% of Gross Revenues</td>
<td>$187,713</td>
<td>$304,312</td>
</tr>
<tr>
<td>Revenue to Department</td>
<td>$375,482</td>
<td>$608,714</td>
</tr>
<tr>
<td><strong>EXPENSES:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Director (100%)</td>
<td>Salary $80,000</td>
<td>Salary $80,000</td>
</tr>
<tr>
<td>Instructors</td>
<td>Fringe benefits (33.7%) $26,960</td>
<td>Fringe benefits $26,960</td>
</tr>
<tr>
<td>TA Support (50%)-TA</td>
<td>Salary ($36,913/year at 50%) 2 $36,913</td>
<td>$36,913</td>
</tr>
</tbody>
</table>

Table 4C: Pro forma program budget at full rollout with 40 students (full time scenario)
These budget scenarios underscore the importance of strategic student recruitment. Specifically, we will invest considerable effort in advertising and recruiting students from other states and other countries, in addition to serving Wisconsin students. Our department’s long-standing and fruitful collaboration with Beijing Normal University, Nanjing Normal University and with members of the Chinese Academy of Science will significantly aid our effort to recruit students from China. Our faculty also have close connections with academic and professional Geography institutions in many other countries (e.g. England, Brazil, Chile, Taiwan). Given that our program is entirely online, we expect success in recruiting students from across Wisconsin as well as from elsewhere in the U.S. and abroad.

9.2 Development Budget:

Development and maintenance of the online version require the involvement of the faculty, the program director (faculty associate) and graduate teaching assistants. We seek initial support from the university to develop the courses and initial staffing of the program. The development timeline and resources needed are shown in Table 5.

Table 5: Development timeline and resources needed.

<table>
<thead>
<tr>
<th>Courses (Deliverables: complete online version)</th>
<th>Term for Development</th>
<th>Professors and key personnel (PD=Program Director)</th>
<th>Resources needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic Design in Cartography 572</td>
<td>Spring, 2015 Roth</td>
<td>One course release + TA</td>
<td></td>
</tr>
<tr>
<td>GIS and Spatial Analysis 579</td>
<td>Spring, 2015 Zhu</td>
<td>One course release + TA</td>
<td></td>
</tr>
<tr>
<td>Geocomputing 378</td>
<td>Summer, 2015 Burt</td>
<td>One month salary + TA</td>
<td></td>
</tr>
<tr>
<td>Interactive Cartography &amp; Geovisualization 575</td>
<td>Summer, 2015 Roth</td>
<td>One month salary + TA</td>
<td></td>
</tr>
<tr>
<td>Spatial database 574</td>
<td>Fall, 2015 Huang, PD</td>
<td>One course release + TA</td>
<td></td>
</tr>
<tr>
<td>Practicum 571 and preparation for program launch.</td>
<td>Fall, 2015 Zhu, PD</td>
<td>One course release +TA</td>
<td></td>
</tr>
<tr>
<td>Spatial Web and Mobile Programming 576</td>
<td>Spring, 2016 Huang, PD</td>
<td>One course release +TA</td>
<td></td>
</tr>
<tr>
<td>GIS and Spatial Analysis 579 (update)</td>
<td>Spring, 2016 Burt, PD</td>
<td>One course release +TA</td>
<td></td>
</tr>
<tr>
<td>Capstone 570</td>
<td>Summer, 2016 Burt, Huang, Roth, Zhu, PD</td>
<td>One quarter of one month salary each + TA</td>
<td></td>
</tr>
</tbody>
</table>

The detailed budget required for development is shown in Table 6 under the course release with lecturer replacement scenario. Much of the budget is self-explanatory except the following three items. The first is the need to involve four faculty members for the development of the capstone course (670). This is necessary because the capstone contains four important projects the students need to work on using the skills they learn in the program. The four projects are: Cartographic development, Spatial Analysis, GIS database development and Web-GIS programming. Each
faculty member will contribute one project from his/her own specialty: Roth for cartographic development, Burt for spatial analysis, Zhu for GIS database development, and Huang for Web-GIS programming. The second item is the use of year-around TAs. We have three year-around TAs (two for 2015 and one for 2016). The 2015 TAs will assist faculty members in their efforts to develop the online courses. The key duties of TA include development of materials and tools for teaching computer programming online, gathering example geospatial datasets for online courses, development of visuals to be used for the online courses, and testing online modules of the courses under development. The hiring of these TAs is important to develop a well-polished online program and to serve the online courses well. The 2016 TA will assist the faculty in developing courses for the Spring and Summer semesters and will work with the Program Director to launch the program in Fall 2016. The third item which needs explanation is the hiring of the Program Director in Summer 2015, who will participate in the development of online courses and to prepare for launching the program in Fall 2016.

We would like to point out that although a total of 6 course releases are needed in the development of the online courses, but only a maximum of two course releases are needed in each of the 3 semesters. In addition, these course releases are only for the period of developing the online courses for the program. We expect the impact of these course releases on our existing offerings to be minimal.

Table 6: Detailed budget required for development (with lecturer replacement):

<table>
<thead>
<tr>
<th>Courses</th>
<th>Term for Development</th>
<th>Professors responsible</th>
<th>Resources needed</th>
<th>Amount</th>
<th>Fringe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Design in Cartography 572</td>
<td>Spring 2015 Roth</td>
<td>Lecturer 40%</td>
<td>$ 5,842</td>
<td>$ 1,969</td>
<td>$ 7,811</td>
<td></td>
</tr>
<tr>
<td>GIS and Spatial Analysis 579</td>
<td>Spring 2015 Zhu</td>
<td>Lecturer 40%</td>
<td>$ 5,842</td>
<td>$ 1,969</td>
<td>$ 7,811</td>
<td></td>
</tr>
<tr>
<td>Geocomputing 378</td>
<td>Summer 2015 Burt</td>
<td>One month salary</td>
<td>$ 14,255</td>
<td>$ 4,804</td>
<td>$ 19,059</td>
<td></td>
</tr>
<tr>
<td>Interactive Cart &amp; Geovis 575</td>
<td>Summer 2015 Roth</td>
<td>One month salary</td>
<td>$ 8,509</td>
<td>$ 2,868</td>
<td>$ 11,377</td>
<td></td>
</tr>
<tr>
<td>Programmer Director (PD)</td>
<td>Start Summer 2015 TBA</td>
<td>Program impl and launch</td>
<td>$ 80,000</td>
<td>$26,960</td>
<td>$106,960</td>
<td></td>
</tr>
<tr>
<td>Spatial database 574</td>
<td>Fall 2015 Huang, PD</td>
<td>Lecturer 40%</td>
<td>$ 5,842</td>
<td>$ 1,969</td>
<td>$ 7,811</td>
<td></td>
</tr>
<tr>
<td>Practicum 571</td>
<td>Fall 2015 Zhu, PD</td>
<td>Lecturer 40%</td>
<td>$ 5,842</td>
<td>$ 1,969</td>
<td>$ 7,811</td>
<td></td>
</tr>
<tr>
<td>TA to assist development for 2015</td>
<td>2015 (whole year) TA 1</td>
<td>50% (Annual Basis)</td>
<td>$ 18,457</td>
<td>$ 4,522</td>
<td>$ 22,979</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015 (whole year) TA 2</td>
<td>50% (Annual Basis)</td>
<td>$ 18,457</td>
<td>$ 4,522</td>
<td>$ 22,979</td>
<td></td>
</tr>
<tr>
<td>Spatial Web and Mobile Programming</td>
<td>Spring 2016 Huang, PD</td>
<td>Lecturer 40%</td>
<td>$ 5,842</td>
<td>$ 1,969</td>
<td>$ 7,811</td>
<td></td>
</tr>
<tr>
<td>GIS and Spatial Analysis 579(update)</td>
<td>Spring 2016 Burt, PD</td>
<td>Lecturer 40%</td>
<td>$ 5,842</td>
<td>$ 1,969</td>
<td>$ 7,811</td>
<td></td>
</tr>
<tr>
<td>Capstone 570</td>
<td>Summer 2016 Burt, Hu, Roth</td>
<td>1/4 month salary for Burt</td>
<td>$ 3,564</td>
<td>$ 1,201</td>
<td>$ 4,765</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zhu, PD</td>
<td>1/4 month salary for Hu</td>
<td>$ 2,104</td>
<td>$ 709</td>
<td>$ 2,813</td>
<td></td>
</tr>
</tbody>
</table>
Proposal for a named option “GIS Development”

<table>
<thead>
<tr>
<th></th>
<th>1/4 month salary for Roth</th>
<th>$2,127</th>
<th>$717</th>
<th>$2,844</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/4 month salary for Zhu</td>
<td>$3,913</td>
<td>$1,318</td>
<td>$5,231</td>
</tr>
<tr>
<td>TA to assist develop and impl for 2016</td>
<td>TA</td>
<td>50% (Annual Basis)</td>
<td>$18,457</td>
<td>$4,522</td>
</tr>
<tr>
<td>Request to DCS</td>
<td></td>
<td></td>
<td></td>
<td>$199,915</td>
</tr>
<tr>
<td>Geography's share</td>
<td></td>
<td></td>
<td></td>
<td>$68,937</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$268,852</td>
</tr>
</tbody>
</table>

10. Overlap with other Programs

Currently, there are three units on campus offering courses in GIS: Geography, Urban and Regional Planning, and Landscape Architecture/Soils. Urban and Regional Planning offers a course on GIS application in Urban Planning which focuses on the application of GIS. Landscape Architecture/Soils offer a course on GIS application in natural resources, which again focuses on GIS application. The Landscape Architecture is also in the process of developing a Geodesign program which focuses on the use of GIS as tools for planning and designing, not on GIS programming and development (Geography and Landscape Architecture have jointly approved a memorandum of understanding to ensure ongoing coordination between the Geodesign program and Geography's GIS programs). In addition, Department of Forest and Wildlife Ecology together with the Nelson Institute for Environmental Studies offers courses in remote sensing which again does not provide GIS programming and development training. Thus, we see no prospect of overlap with these programs on campus in the area of GIS development. The Computer Science Department does offer computer algorithm, database design and programming but it offers these courses from a general computing perspective and does not cover GIS development, nor does it plan to offer a program in the area of GIS.

Table 7 provides a comparison of the requirements for the proposed professional program with our existing programs. The new program differs from our existing programs in its learning goals and course requirements.

The students enrolled in this named option are not permitted to enroll in the thesis option of the MS-Cartography and Geographic Information Systems nor in the GIS capstone certificate program at the same time, nor vice versa. However, students who have completed the thesis option or the GIS capstone certificate program can be admitted to this named option through the admission committee. The maximum possible overlap in courses between the thesis option/the capstone certificate and the named option is two courses (up to 8 credits) (see Table 7). Thus, up to a total of 8 credits can be transferred from these programs as part of the credit requirements for the named option given that these credits are for courses required for the named option.

The establishment of this new program will bring direct benefits to the existing research-oriented MS cartography/GIS program and the Ph.D. in Geography. For example, during some semesters
students in the research program may need certain courses in Cartography/GIS that are not offered due to a faculty shortage. At the approval of the graduate studies committee and the approval of the named option oversight committee, these students could be granted the option to take the online equivalents. This option is currently not available. As a result students in this situation now have to wait for the course offering or faculty have to teach an overload to provide the needed courses. Another example of broader benefit would be the hiring of advanced Ph.D. students (who have already earned M.Sc.) in Cartography/GIS to teach some of the online courses. This not only provides financial support to these Ph.D. students but also gives them invaluable teaching experience which will certainly make them more competitive for faculty positions.

We do not see our program in competition with other programs or courses in GIS offered by other units on campus (including those mentioned above). In fact, we see it as a complement to the existing programs and course offerings in GIS on this campus, and also as a way to raise UW’s visibility in GIS at national and global levels in such a way that benefits all.

The various programs and courses in GIS on this campus could potentially confuse students. To avoid this we will take the lead to work together with the campus community, UW-Madison Geospatial Alliance and other units to develop a GIS portal to guide students to the right program for them. In fact, Geography has played this role in the past and will continue this tradition.

**Table 7: Comparison of program requirements between the proposed program and the two other programs in GIS in Geography**

<table>
<thead>
<tr>
<th>Programs</th>
<th>MS CARTOGRAPHY/GIS</th>
<th>MS CARTOGRAPHY/GIS OPTION: GIS Development</th>
<th>CAPSTONE CERTIFICATE IN GIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROGRAM GOALS</strong></td>
<td>•Conduct research in GIS (Studying GIS to develop new concepts and new algorithms/methods in GIS). Emphasis is on the development of new GIS algorithms/methods.</td>
<td>•Develop GIS analytical tools. Emphasis on the development of GIS software (such as programming, database design and development, geovisualization design and development)</td>
<td>•Apply GIS to geography related disciplines in a non-academic setting. Emphasis is on the use GIS tools, techniques/methods.</td>
</tr>
<tr>
<td><strong>ADMISSION REQUIREMENTS</strong></td>
<td>•Bachelor’s degree</td>
<td>•Bachelor’s degree</td>
<td>•Bachelor’s degree</td>
</tr>
<tr>
<td><strong>TESTING</strong></td>
<td>•GRE general test required</td>
<td>•GRE not required</td>
<td>•GRE not required</td>
</tr>
<tr>
<td><strong>Assistantships</strong></td>
<td>Eligible</td>
<td>Not eligible</td>
<td>Not eligible</td>
</tr>
<tr>
<td><strong>REQUIRED COURSEWORK</strong></td>
<td>•Geog 765, 766, 377 &amp; 572</td>
<td>•Skill courses (online version): Geog. 378, 579, 572, 575, 574, 576</td>
<td>•Core courses: Geog 370, 377, 560, and 578</td>
</tr>
</tbody>
</table>
11. Assessment and Program Review Plan

11.1 Assessment:

**Learning outcomes:**

a) Ability to articulate and critically assess the needs for GIS development, that is the ability to conceive and formulate projects requiring GIS development technology and approaches to address the needs of an organization in the increasingly digitalized world

b) Ability to identify the methodological and technological needs for completing the GIS development projects for a given need

c) Ability to demonstrate understanding of the field of GIS development, that is, the ability to critically assess the evolving trends in GIS development and the capacity to acquire the needed skills/methods on his/her own for GIS development projects

d) Ability to select and utilize the most appropriate methodologies/technologies for GIS development, to develop strategies (plans or designs) by effectively assembling and efficiently integrating the methodological/technological skills acquired for a given GIS development need

e) Ability to evaluate the effectiveness of the solutions and to assess the potential for perfecting the solutions

f) Communication skills that allow the trainees to clearly and effectively communicate with non-specialists about the needs and the outcomes of a GIS development project using flow charts, diagrams and maps, and the ability to effectively teach non-technical people to make use of the outcomes from such a project

g) Be able to recognize and apply principles of ethical and professional conduct such as copyright and proprietary information

h) Development of technical skills in the following areas:

- Geospatial programming for extending/modifying industry leading GIS software
- Geospatial database design and development
- Implementation of advanced geospatial analysis algorithms and geocomputational routines
- Client-side and server-side web mapping
- Cloud computing and mobile mapping
- State-of-art geospatial programming tools, languages and libraries (such as Python, Java, Google Map APIs, Dojo, Leaflet, SQL, Arcpy, GDAL, OGR, HTML5/CSS3, TileMill).
Assessment:
Students in the program will be assessed in stages, progressively more comprehensive in the order described below. The assessment covers both the conceptual and the technical learning dimensions. The program director will gather the related statistics/measures and discuss them annually with the faculty in GIS as well as the oversight committee.

The first level of assessment is done in individual courses through quizzes, student questions, and discussion boards to see how well the students are capturing the concepts. The lab exercises and questions will also allow us to see how well the students are developing technical skills. In addition, this assessment together with student evaluation will allow us to see how effective the particular course is and will help us to further improve each course. This student work will periodically be evaluated from a program perspective, to help us understand how students have mastered one or more of the learning outcomes listed above.

The capstone course will assess student’s integrative skills and the ability to apply the learned development skills in solving development/supporting problems provided by faculty. At this level, the assessment aims to test the integrative ability of students in applying the concepts and skills learned in particular areas. For example, one of the capstone projects will focus on web-based cartography. The project will assess student’s integrative ability to apply the skills learned from the cartography courses. The other projects in the capstone courses will focus on Spatial Analysis, GIS database development and Web-GIS programming, respectively. The program director, who is tasked to teach this class, will capture how well students are developing the integrative skills and the ability to apply the learned development skills through the assessment of the projects and the student performance during the process of completing the projects, and will work with the GIS faculty periodically to confirm that the students can do what we want them to do. Like other courses the assessment also gives us the insight as to how the individual core courses and the program as a whole are achieving the goals we set for students and how we can enhance the effectiveness of the individual core courses and the program as a whole.

The practicum will examine student’s ability to conceive and solve real world development problems and provide GIS application support independently. This is the highest level of assessment and is most comprehensive. It requires students to evaluate the nature of real world problem and devise the appropriate solution for it. This will require students to independently apply the concepts and technical knowledge and skills learned in the program in a holistic fashion. In short, if a student can do this well, then the student has achieved the learning goals of this program. The pratica will be taught by GIS faculty. Periodically, the faculty together with the program director and the instructors will meet to discuss the performance of students in these practica and to assess how the students are learning in the program. This assessment can also help us to enhance the effectiveness of the program.

Team building:
Team building is important in this program. This is achieved in two major avenues. One is through class group projects and discussion sessions of the skill courses. The other is through the
Capstone Course (Geog. 570) focusing on skills for solving comprehensive problems in a group environment. Team building will be assessed in the Capstone course where each member in a group working on a project will be required to evaluate other members of group discretely to the instructor as how each of the members are contributing to the project. We have accumulated experience in this area in our capstone certificate program. All students in this capstone program need to take Geography 578: GIS Applications in which the student form groups and work together to develop a project and to complete the project together. The team evaluation strategy worked very well in creating a team working environment.

11.2 Program Review Plan:

The program will be reviewed 3 years after its initial launch and will then every 5 years thereafter. The following metrics will be used:

Assessment information from the three levels presented above.
Revenue generated and program costs
Number of students enrolled
The percentage of students graduated, time to completion, and persistence
The percentage of students who finds a job or earns a promotion one year after graduation
The percentage of students who use development skills learned from this program

12. Summary

The Department of Geography, University of Wisconsin-Madison, proposes to develop a named option (GIS Development, a non-thesis program) under the existing Master of Science in Cartography and GIS. The professional program provides training for geospatial/GIS developers. Different from the traditional Master’s program in Cart/GIS which is academic/research oriented and different the capstone GIS certificate program which focuses on the use effective use of existing GIS software, the new program focuses on the design and the development of new geospatial analytical and mapping tools. The program emphasizes both background concepts and programming languages needed to implement these tools. The program will allow graduates to fill the growing demand in geospatial software development, competing for employment in advanced application support and software development in the rapidly growing and evolving field of GIS.

The program requires a total of 32 graduate credits consisting of three elements: 1) skill development courses; 2) a capstone case studies course; 3) a practicum. The program is designed for students to complete in three semesters (fall, spring and summer) and is offered online only. The program is designed to meet a new demand and does not compete with our existing program in the area.

This program is part of the Education Innovation initiatives. The program is expected to be fully self-supporting, with detailed budget to be determined in collaboration with the Division of Continuing Studies.
13. Relevant Appendices
   13.1 Support letter from Department of Computer Science (see attached)
   13.2 Support letter from Department of Landscape Architecture (see attached)
   13.3 Support letter from Department of Urban and Regional Planning (see attached)
   13.4 The completed HLC template (attached)
   13.5 The completed minimum degree and satisfactory template form (attached)

14. Letter of support from the Executive Committee (attached)
15. Letters of support from the Dean and School/College APCs of associated programs (attached)
A note on the course numbers in the support letter from the Computer Science Department

The course numbers in the proposed program have been changed. Below is the match-ups between the course numbers cited in the support letter and those in the proposal:

Geography 761 is now replaced with Geography 378 (existing course)
Geography 762 is replaced with Geography 572 (existing course)
Geography 775 is replaced with Geography 575 (existing course)
Geography 776 is now renumbered to be Geography 576

Please note that Geography 378, 572 and 575 are existing courses which we have been teaching for over 5 years.
Hi Kris -

I apologize again for the delay. The CS department curriculum committee met this week. Our stance is that this looks like a fine program, but there is some overlap with computer science.

In particular, the classes 761 has overlap with our new course 301, 762 with 570, 776 with a new data-visualization class taught by Michael Gleicher and 776 with our 564. For a professional masters program with a single focus like GIS, it makes sense to have a single course incorporation GIS and computer science material. But, for other students, it would be helpful in the future to consider students who want to take the CS material as CS courses and add the GIS-specific material, rather than take a combined course.

In addition, it may be useful in the future to consider sharing material between geography faculty and CS faculty teaching related subjects, both to make our courses more relevant to your students and to bring more applications of technology to our students.

At this point, we see no reason to request specific changes.

Mike Swift
Associate Department Chair / Curriculum Committee
February 4, 2015  
Kris Olds, Chair  
Department of Geography  

Dear Kris:  

The Department of Landscape Architecture supports the Department of Geography proposal for a Professional Program in GIS Development. We do not see overlap in our offerings or others that we engage with on campus. We do find the proposal to complement our efforts, however, in its development of GIS analytical and programming tools.  

The Department wishes a successful start to this program.  

Sincerely,  

[Signature]  

John A. Harrington Professor and Chair
Memorandum

To: Kris Olds, Department Chair
   Geography

From: Dave Marcouiller, Department Chair
      Urban & Regional Planning

Date: February 3, 2015

Subject: URPL Curriculum Committee response to Geography

The following provides a response from the Curriculum Committee of the Department of Urban and Regional Planning to your professional program proposal.

“URPL faculty discussed the GEOG proposal for a "Professional Program in GIS Development" at the faculty meeting on Friday, January 30, 2015. Faculty determined that the proposed program would fill an important professional need and would be a useful addition to UW-Madison. We felt URPL students would have interest in several of the proposed courses, and to the extent possible, we would request that Geography make those courses accessible to students from other programs, including URPL.”

If you need further clarification, please let me know.
Higher Learning Commission (HLC) Related Policies:
Program Update Template

The template is designed to allow programs to include all degree levels of a single program on one template. However, multiple templates can be used for a single program, if preferred. In many cases, graduate programs can set more rigorous requirements than the Graduate School’s baseline requirements. Please reference the GFEC-Approved Policy Vote Items and FAQ’s for full policy details. If your program seeks to require the same requirements as dictated by Graduate School policy, please confirm by inserting the appropriate details. Otherwise, programs are free to state more rigorous requirements.

Program (Major) Name:
GIS Development (Non-thesis Master’s option) under MS-Cartography GIS Master Program

1. Minimum Graduate Residence Credit Requirement:
The Minimum Graduate Residence Credit Requirement requires at least 16 credits for master’s degrees, 24 credits for MFA/specialist certificates, and 32 credits for doctorate degrees. Programs may require a higher Graduate Residence Credit minimum. If you have different credit requirements for different tracks of students at the same degree level, please note that accordingly.

<table>
<thead>
<tr>
<th>Name of degree level and any applicable options/tracks</th>
<th>Residence Credit Requirement</th>
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<tbody>
<tr>
<td>GIS Development</td>
<td>24 credits</td>
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2. Minimum Graduate Degree Credit Requirement:
The Minimum Graduate Degree Credit Requirement requires at least 30 credits for master’s degrees, 42 credits for MFA/specialist certificates, and 51 credits for doctorate degrees (may include master’s, minor, and dissertator credits). Programs may require a higher Graduate Degree Credit minimum. If you have different credit requirements for different tracks of students at the same degree level, please note that accordingly.

<table>
<thead>
<tr>
<th>Name of degree level and any applicable options/tracks</th>
<th>Degree Credit Requirement</th>
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<tbody>
<tr>
<td>GIS Development</td>
<td>32 credits</td>
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3. **Minimum Graduate Course Work (50%) Requirement:**

The Minimum Graduate Course Work Requirement states that at least 50% of credits applied toward the program’s graduate degree credit requirement must be with courses designed for graduate work. Graduate course work can include UW-Madison courses (including but not limited to online, thesis/research, independent study, and practicum/internship credits) that satisfy one of the following guidelines:

- numbered 700 and above;
- numbered 300-699 that are specifically designed for graduate students in a graduate program;
- numbered 300-699 that assess graduate students separately from undergraduate students; or
- numbered 300-699 that have a graduate student enrollment >50% in any given semester.

Programs may be more restrictive with how they define graduate-level work (than the above parameters). Please provide the program’s policy around this requirement. If you have different requirements for different tracks of students at the same degree level, please note that accordingly.

<table>
<thead>
<tr>
<th>Name of degree level and any applicable options/tracks</th>
<th>Graduate Course Work Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Development</td>
<td>24 credits</td>
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</tbody>
</table>
4. **Prior Course Work Requirements:**
   The Prior Course Requirements state a student’s program may decide to accept coursework completed outside of the student’s graduate career at UW-Madison when those courses are rigorous and meet the expectations of graduate work for the degree. The chart below summarizes the policy and its intersection with other policies:

<table>
<thead>
<tr>
<th>Requirement</th>
<th><strong>Prior Graduate Course Work from Other Institution(s)</strong></th>
<th><strong>Course Work from Graduate Undergraduate Career at UW-Madison</strong></th>
<th><strong>Transfer from University Graduation Credit Program or Other Institution(s)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Graduate Residence Credit Requirement</td>
<td>No</td>
<td>No</td>
<td>8 (must be from the courses required by this program)</td>
</tr>
<tr>
<td>Minimum Graduate Degree Credit Requirement</td>
<td>No</td>
<td>No</td>
<td>8 (must be from the courses required by this program)</td>
</tr>
<tr>
<td>Minimum Graduate Course Work (50%) Requirement</td>
<td>No</td>
<td>No</td>
<td>8 (must be from the courses required by this program)</td>
</tr>
</tbody>
</table>

*Fulfillment of requirements is allowed only if approved by the student’s graduate program up to any stated maximum.*

**Course work earned five or more years prior to admission to a master’s degree or course work earned ten or more years prior to admission to a doctoral degree is not allowed to satisfy requirements.**

Programs may be more restrictive regarding the type and number of prior course work credits that are allowed to fulfill requirements. Please provide the program’s policy around this requirement. If you have different requirements for different tracks of students at the same degree level, please note that accordingly.

<table>
<thead>
<tr>
<th>Name of degree level and any applicable options/tracks</th>
<th>Prior Course Work Requirements: Grad Work Other Institutions; UW-Madison Undergraduate; and UW-Madison University Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Development</td>
<td>Up to a total of 8 credits can be transferred from prior course work given that these credits are for courses required for the named option</td>
</tr>
</tbody>
</table>

5. **Maximum Credits per Term:**

The Maximum Credits per Term allows non-dissertator students to enroll for a maximum of 15 credits per term. Dissertators must continue to enroll in exactly 3 credits related to their dissertation. Programs may set a lower Maximum Credits per Term for non-dissertators through advising or program policy. Please provide the program’s policy around this requirement. If you have different requirements for different tracks of students at the same degree level, please note that accordingly.

<table>
<thead>
<tr>
<th>Name of degree level and any applicable options/tracks</th>
<th>Maximum Credits per Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Development</td>
<td>12 credits (monitored by the</td>
</tr>
</tbody>
</table>
6. Effective Dates:

The GFEC approved the following implementation effective date parameters:

- Any student entering or readmitted to a graduate program on or after Fall 2014 must adhere to the above requirements.
- Currently enrolled master’s students have the option to complete their degree under the prior policy requirements if they can complete all degree requirements and are awarded the degree before Fall 2016.
- Students enrolled in a MFA, specialist certificate, or doctoral degree prior to Fall 2014 have the option to complete their degree under the prior policy requirements.
- A student who chooses to discontinue their degree program for a semester or more will return under the new policy requirements.

Please provide the program’s policy around these parameters. If you have different requirements for different tracks of students at the same degree level, please note that accordingly.

<table>
<thead>
<tr>
<th>Name of degree level and any applicable options/tracks</th>
<th>Effective Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Development</td>
<td>New master’s students must adhere to new program requirements effective Fall 2016 when the program launches.</td>
</tr>
</tbody>
</table>
7. Communication Implementation:
Please check and insert any relevant notations to each of the following communication steps necessary for appropriate and full implementation of the new policies.

We have or will notify prospective and incoming students about these new policy requirements so they can make informed decisions regarding enrollment.

Notes:

Yes, we will do this through our marketing materials

— We have or will notify current students about these new policy requirements so they understand how they may or may not be impacted.

Notes:

Not applicable (program starts Fall, 2016)

— We have or will update our Fall 2014 (or 2014-15) program handbook and website where appropriate with these new policy requirements prior to the start of the Fall 2014 term.

Notes:

Not applicable

— We will be ready to update the Graduate Catalog with these and any other program requirements during the update cycle set to occur between November 2013-April 2014. Please retain a copy of this form as a reference.

Notes:

Not applicable

8. Notes (Optional):
Please provide any additional information relevant to your program below or as an attachment.

This is a revenue generating program and the courses (32 credits) are specifically designed for this program. The students have to take all of these courses to earn this degree.
### GEOGRAPHY MINIMUM DEGREE REQUIREMENTS & SATISFACTORY PROGRESS

To make progress toward a graduate degree, students must meet the Graduate School Minimum Degree Requirements and Satisfactory Progress in addition to the requirements of the program.

**Master’s Degrees:**
GIS Development Option under the MS-Cartography and Geographic Information Systems

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Graduate Degree Credit Requirement</td>
<td>32</td>
</tr>
<tr>
<td>Minimum Graduate Residence Credit Requirement</td>
<td>24</td>
</tr>
<tr>
<td>Minimum Graduate Coursework (50%) Requirement</td>
<td>24</td>
</tr>
<tr>
<td>Prior Coursework Requirements: Graduate Work from Other Institutions</td>
<td>No</td>
</tr>
<tr>
<td>Prior Coursework Requirements: UW-Madison Undergraduate</td>
<td>No</td>
</tr>
<tr>
<td>Prior Coursework Requirement: UW-Madison University Special</td>
<td>8 (must be from the courses required by this program)</td>
</tr>
</tbody>
</table>

**Credits per Term Allowed**
12 credits

**Program-Specific Courses Required**
Yes – Geocomputing (Geog. 378), GIS and spatial analysis (Geog. 579), Graphic Design in Cartography (Geog. 572), Spatial database (Geog. 574), Spatial web and mobile programming (Geog. 576), Interactive cartography & Geovisualization (Geog. 575), Capstone in GIS development (Geog. 670), Practicum in GIS Development (Geog. 672).

**Overall Graduate GPA Requirement**
3.00 GPA required.

**Other Grade Requirements**
No

**Probation Policy**
The Department of Geography expects graduate students to progress through a sequence of benchmarks within prescribed time periods. These benchmarks constitute a reasonable rate of accomplishment for full-time students holding teaching or research appointments. The department recognizes that individual circumstances vary, and not all students progressing toward their academic goals will hit the benchmarks exactly. Thus a student’s progress is considered unsatisfactory only after a period of time elapses following an unmet benchmark. A student not making satisfactory progress is placed on probation. For detailed information about these benchmarks and triggers for probationary status, see the department’s Criteria for Satisfactory Progress.

**Advisor / Committee**
All students are required to conduct a yearly progress report with the program director, scheduled by December 17 and completed by April 30. Failure to do so will result in a hold being placed on the student’s registration.

**Assessments and Examinations**
No formal examination required.

**Time Constraints**
For program-specific time constraints, please see Probation Policy above.

**Language Requirements**
No language requirements.
4 February 2015

To Whom It May Concern:

**RE: Department of Geography Support for Professional Program in GIS Development**

The Department of Geography has met, several times, to discuss the emerging proposal for a Professional Program in GIS Development. On 15 December 2014, the Department’s Executive Committee unanimously voted to “enthusiastically support the Professional Program in GIS Development” and communicated its desire to ensure the development process is formally and informally supported to achieve success.

Thank you very much for considering this proposal.

Please do not hesitate to contact me if you require any further information.

Sincerely,

Kris Olds, PhD
Professor and Department Chair
March 20, 2015

To: John Karl Scholz  
    Dean, College of Letters and Science

From: Kathryn VandenBosch  
       Dean and Director

Subject: Proposed New Named Option, “GIS Development”

During their March 16, 2015 meetings, the CALS Academic Planning Council discussed the Department of Geography proposal for a new named option, “GIS Development”. The Council had no objections to the proposal and noted that letters of support from the two CALS units, Landscape Architecture and Urban and Regional Planning, most affected by this activity had already been obtained.

The council noted this type of knowledge and training is needed in the workplace and this program will fill both student and market needs.

cc: Elaine Klein  
    Kris Olds