

W UNIVERSITY *of* WASHINGTON | TACOMA

April 3, 2014
12:30-2:00 pm PNK 212

University of Washington Tacoma

Academic Policy and Curriculum Committee
Doug Wills, Ph.D., Chair

In Consideration of a Proposal for a MS degree in Geospatial Technologies
By the Urban Studies Program

Supported by the Office of Academic Affairs
Associate Vice Chancellor, Ginger MacDonald, Ph.D.

Agenda

1. Introduction to the process: Ginger MacDonald
2. Introduction to the proposal: Ali Modarres, Ph.D., Director; Matthew Kelly, Ph.D. Asst. Professor
3. Questions and answers by members and the proposers
4. Proposal writers dismissed for deliberations
5. Discussion by members of APCC
6. Vote by members of APCC

**COVER SHEET
NEW DEGREE PROGRAM PROPOSAL**

Program Information

Academic Unit Name: Urban Studies

Institution: University of Washington Tacoma

College/School: _____

Campus: Bothell Seattle Tacoma

Proposed Degree Title: Geospatial Technologies

Proposed Degree Option(s): If applicable

Proposed CIP Code: 45.0702 Total Quarter Credits: 40

Proposed Start Date: Fall 2014

Projected Enrollment (FTE) in Year One: 20 Full Enrollment by Year: 2016-2017 ; 40
(Quarter and year) (#FTE) (Academic Year) (#FTE)

Proposed New Funding: _____ Tuition Tier (if applicable): Tier II (\$5058/qt for residents and \$9209/qt for non residents)

Funding Source: State FTE Fee-based Other

Mode of Delivery / Locations

Campus Delivery Tacoma
(enter locations)

Off-site _____
(enter location(s))

Distance Learning _____
(enter formats)

Other _____
(describe if applicable)

Scheduling

Day Classes
 Other *(describe)*

Evening Classes
 Weekend Classes

Attendance Options

Full-time
 Part-time

Contact Information (Academic Department Representative)

Name: Ali Modarres
Title: Professor and Director
Address: Pinkerton 317, Box 358437, 1900 Commerce St., Tacoma, WA 98402
Telephone: 253-692-5706
Email: modarres@uw.edu


Endorsement by Ali Modarres, Director of Urban Studies

11/20/13
Date

Endorsement by Ginger MacDonald, Associate Vice Chancellor

Date

Section I – Executive Overview

In this document the Urban Studies Program proposes to establish a Master of Science degree in Geospatial Technologies at UW Tacoma. This graduate degree program will be housed and administered by new and existing faculty within the Urban Studies Program, and will build on existing geographic information systems (GIS) capacities within the Program. The MS in Geospatial Technologies will train students to use and apply geospatial hardware, software, and data in urban and environmental planning scenarios. Our aim is to prepare students to become leaders in the management and utilization of geospatial technologies within this rapidly growing job market in the public, private, and not-for-profit sectors. By building on Urban Studies' thriving GIS curriculum, the MS in Geospatial Technologies is well situated to leverage existing campus computing and technical infrastructure, faculty resources, student interest, and regional professional networks. And unlike regional graduate programs that focus primarily on GIS, the proposed MS program is distinct in its emphases on the breadth of geospatial technologies, including the increasingly central role of mobile computing. So while the graduate degree will provide advanced training in GIS, it will also offer considerable training in the development and deployment of location-based mobile applications and the management of web-based geospatial data. At UW Tacoma there is no other graduate program that focuses on geospatial technologies. At the national level, though there are analogs to the technical program that we propose, we aim to distinguish our program by maintaining a theoretical/critical focus on the application of these technologies to urban and environmental problem solving.

Section II- Goals, Relationship to Institutional Mission and Program Priorities

The MS in Geospatial Technologies provides the Urban Studies Program a much-needed advanced and applied degree that will allow our students to engage with and provide evidence-based planning solutions to current urban environmental problems. Further, given the centrality of social justice to the Urban Studies Program and its unique focus on providing service to the local and regional community, we expect that the proposed graduate program will amplify the impact that our students have on the 'real world'. It is important to note that this graduate degree is being proposed from within an urban serving university by the only program on the campus that is dedicated exclusively to engaging with contemporary urban issues. For these reasons the focus of the graduate degree on the application of advanced geospatial technologies in urban and environmental planning scenarios is the cornerstone of our proposal. We aim, in other words, not simply to train students to understand and utilize geospatial technologies. Rather, we aim to extend the existing mission of the Urban Studies Program by enhancing our students' abilities to engage with complex urban and environmental planning and policy problems that require the use of advanced geospatial technologies for acquiring, organizing, and analyzing large datasets. By training our students to serve as practitioners who understand the effective and appropriate usage of geospatial technologies, the impact of this graduate program will be significant and immediate for local and regional agencies that are grappling with an emergent technological landscape that is increasingly undergirded by geospatial information. Finally, as an urban serving institution, it is our mission to provide educational opportunities to segments of the population who might otherwise not participate in higher education. There have been, in recent years, well publicized efforts to provide STEM education to underserved urban populations. The proposed MS in Geospatial Technologies is situated precisely at the intersection of a discipline (Urban Studies) that appeals broadly to underserved urban populations and a fast-growing technological industry (geospatial tech). As such, since a large number of students at UW Tacoma are the first generation in their families to attend universities, are older, and/or are veterans, we (as a university and an academic unit) will contribute

significantly to the development of a diverse workforce within the geospatial job market. And because, historically, training and education in geospatial technologies has not adequately reached non-traditional students, our program will be uniquely positioned to reduce this gap by providing educational opportunities (training and access) to our diverse student population.

Section III – Demand (National, Regional, and Community)

The Department of Labor has defined geospatial technologies as one of 14 high growth job sectors.¹ This was further confirmed by a 2012 Google commissioned report by the Boston Consulting Group (see Appendix X). Based on our knowledge of the discipline and the marketplace, we expect high demand for this program for several reasons. First, the geospatial industry has infiltrated nearly every sector of the economy. And as mobile technologies continue to proliferate, the integration between locational data and everyday life is drawn even tighter. Graduates with advanced training in geospatial technologies are, therefore, in increasingly high demand. Second, agencies in the south Puget Sound are faced with the daunting task of moving toward more effective and efficient management of geospatial information—particularly in regards to the usage of mobile devices and web-based streaming geospatial data. In preliminary conversations with agencies that we would consider stakeholders in the formation of a graduate program in geospatial technologies (e.g. Pierce County, BCRA, City of Tacoma, NOAA, and the Center for Urban Waters) feedback has been overwhelmingly supportive of the design of this degree.

We believe that applicants for this degree program will consist of current public sector employees who need professional GIS training to improve their competitiveness in the market, veterans who have been exposed to the geospatial technologies and are interested in MSs that will give them access to civilian jobs, students at other universities who are unable to obtain such a degree locally (that would include a significant number of states close to Washington), and foreign students who may be interested in 2+1 programs that will provide them with a BA and an MS. The 2+1 idea may also be of equal interest to community college students in the region. Finally, the GIS Certificate Program (a 25 credit undergraduate certificate offered by the Urban Studies Program) has experienced rapid growth in the last five years. In 2008-2009 the program graduated fewer than 20 students, and it is on track in 2013-2014 to graduate more than 40 students. Anecdotal evidence suggests that a significant percentage of Certificate Program graduates will elect to enroll in the graduate program.

Nationally, a few universities are offering graduate degrees in geospatial technologies. However, only a handful of them offer one-year professional graduate degrees. Furthermore, while many offer training in GIS, they do not fully immerse students in GIS customization, application development, and mobile GIS. Additionally, many of them are online degrees, offering very little in terms of in-person training. For our non-traditional student population a high-end, high-tech degree, combined with in-person training and mentoring will be necessary. This will distinguish us in many ways from some of the existing programs nationally. Providing our students with programming and other geospatial training will make them highly competitive in the marketplace.

A larger number of universities offer traditional/two-year MS and degrees in GIS and geospatial technologies/sciences. The following are four examples of such programs:

1. **UT-Dallas** offers Masters of Science in Geospatial Information Sciences (MGIS).
<http://www.utdallas.edu/epps/geospatial-science/degrees.html#ms> This program focuses

¹ Please see the related 2012 report of the National Geospatial Advisory Committee in Appendix X.

primarily on GIS applications and does not provide training in other geospatial areas (such as mobile GIS and application programming). However, for some of our prospective MS graduates, UT-Dallas could become a destination place for a Ph.D. in GIS
<http://www.utdallas.edu/epps/geospatial-science/degrees.html#phd>.

2. **North Carolina State University** also offers a Master of Geospatial Information Science and Technology (MGIST). <http://gis.ncsu.edu/academic/academic.php> This program was launched in Spring 2010 and is offered as a hybrid model (i.e., a mix of in-person and online courses). With the exception of one course, all others are focused on GIS and GIS applications.
3. **University of Maryland** offers a Master of Professional Studies in Geospatial Information Sciences. <http://www.geog.umd.edu/gis/> This program is much closer, in design, to what we have in mind. However, we do not view this university as a competition for our program, due to differences in geography and the student population we service. Furthermore, the UofM program is a traditional two-year MS degree, whereas our proposed degree is designed to be completed in one year (12 months).
4. **Northern Arizona University** offers a Master of Science in Applied Geospatial Sciences. <http://catalog.nau.edu/Catalog/details?plan=APGSMS&catalogYear=1314> This program focuses mostly on GIS applications. However, it does include one course on programming and another on Enterprise GIS.

One-year geospatial graduate degrees are fewer in number than traditional two-year graduate degrees. Only a handful of universities are responding to the marketplace, which is keen on having short-term, but in-depth professionally-oriented degrees. We note that such highly-relevant (to the marketplace) compressed degree programs typically include capstone or practicum courses at the end (equivalent to thesis, but usually designed as a project plus a report).

To provide a comparative perspective, we offer four examples of 'compressed degree' programs as well:

1. **California State University, Long Beach** offers a Master of Science in Geographic Information Systems that can be completed in one year. http://www.ccpe.csulb.edu/continuing/course_listing/programdescription.aspx?Group_Number=305&Group_Version=1 This program is primarily focused on GIS and includes one course on programming. Given their emphasis on project management, grants and contracts acquisition, the training is focused on the management of private-sector GIS offices. This program is relatively new.
2. **Delta State University** also offers a one-year Master of Applied Science in Geospatial Information Technologies. <http://www.deltastate.edu/college-of-arts-and-sciences/biological-and-physical-sciences/mas-git/> This program focuses primarily on GIS training, GIS applications, and remote sensing.
3. **University of Arizona** offers a one-year Master of Science in Geographic Information Systems Technology. <http://geography.arizona.edu/gis-masters> Even though they offer both online and in-person options to prospective students, their training focuses mostly on GIS applications and does not include programming, mobile GIS and other high-end

geospatial technologies.

4. **University of Southern California**, through its Spatial Sciences Institute, offers a Master of Science in Geographic Information Science & Technology.

<http://spatial.usc.edu/index.php/graduate-programs/gist-m-s-degree/> This degree does include a number of courses similar to what we are proposing. However, given the cost of attending this private university, we believe that our in-person training, combined with reasonable tuition, will make us highly competitive and attractive for students.

Overall, given the success of geospatial degrees nationally, the growing interest in this discipline, and the expanding demand in the marketplace for highly trained individuals, we have little doubt about the success of the proposed degree program.

Section IV: Relationship to Institutions

Even though the proposed program will be housed in the Urban Studies Program, we believe that there will be significant potential synergies between this graduate program and various initiatives of the Institute of Technology (especially around 'big data') and Urban Waters (focused on geo-visualization and environmental modeling). These synergies will be developed between core geospatial faculty members and their counterparts in the Institute and in Urban Waters.

University of Washington in Seattle does offer an on-line graduate degree in GIS applications. <http://www.outreach.washington.edu/pmpgis/people/faculty.asp> However, the MS in Geospatial Technologies that is proposed here is significantly different, due to its emphases on the breadth of geospatial technologies, including the increasingly central role of mobile computing.

Section V: Academic Requirements

Admission: MS in Geospatial Technologies does not require a Graduate Records Exam (GRE). This is a common practice for professional degrees such as this (for example, see the program offered by University of Arizona).

Students apply by March 31st for admittance to the Fall Program.

Admission requirements:

- 1) BA or BS with a minimum GPA of 3. Students with GPAs below 3 will be considered on a case-by-case basis.
- 2) A minimum of one-year of experience in Geographic Information Systems or equivalent to three GIS courses.

Admission application package will include:

- Required university application (<http://www.grad.washington.edu/mygrad/>)
- Two letters of reference
- Statement of purpose, 2 page double-spaced maximum (including previous experience in GIS).
- Resume/CV

- College transcripts

We will create a waiting list for additional applications on a first-come, first-served basis.

Admission Process: We will form a Geospatial Admission Committee, consisting of the three faculty members who will be teaching in this program. They will review all applications and make admission decisions.

Degree Completion: To complete this degree a student must complete a total of eight courses at UW Tacoma. Each course will be five credits for a total of forty credits in the program. Course titles are listed in Appendix I and cannot be substituted or taken at any other institution.

Courses: Appendix I provides a list of required courses for this degree. Please note that these are new courses. As such, the exact titles and their detailed contents will be provided will be revised once all faculty members are on board and before the program is implemented in 2014. All classes will be offered in the evening and will not include any online courses.

Capstone Experience: This is a non-thesis MS program. The last two courses will focus on a capstone project which will be designed with the approval of a faculty member and completed as the final degree program requirement.

Expected Student Learning Outcomes: Each of the eight courses for this MS degree is linked to at least one of five program learning outcomes. The table below summarizes these learning outcomes, and links them to the particular topical courses. The learning outcomes for students who complete the MS program will be evaluated based on performance in six topical courses and two project-based capstone courses.

Learning outcomes: Students who complete the MS in Geospatial Technologies will...	Course(s) in which outcome is evaluated
1) Understand the increasingly central role that geospatial technologies play in the governance of contemporary lived and environmental spaces.	‘Introduction to Geospatial Technology’ ‘Geospatial Technologies for Urban Planning Applications’ ‘Geospatial Technologies for Environmental Planning Applications’
2) Be proficient in the automation and customization of geospatial technologies such as geographic information systems (GIS), web-based data services, locative mobile devices, and mobile & handheld geospatial sensors.	‘GIS Customization and Automation’ ‘Mobile Geospatial Application Development’ ‘Web-based GIS’
3) Recognize appropriate uses and limitations of geospatial technologies in	‘Geospatial Technologies for Urban Planning

urban and environmental planning scenarios.	Applications' 'Geospatial Technologies for Environmental Planning Applications'
4) Be equipped to carry out an independent geospatial project through all stages of conceptualization, planning, design, and implementation.	'Geospatial Technologies Capstone Practicum 1: Planning and Design' 'Geospatial Technologies Capstone Practicum 2: Implementation'
5) Geo-visualization and representation of modeling results	'Geospatial Technologies for Urban Planning Applications' 'Geospatial Technologies for Environmental Planning Applications'

In each course, learning outcomes will be evaluated based on students' performance in a particular assignment or project. Learning outcomes will be managed using the Canvas LMS's 'Learning Outcomes' tool. By doing so, the MS program in Geospatial Technologies will build, over time, an archive of data related to the performance of students relative to learning outcomes across multiple years of the program. These preliminary assignments and projects are detailed in the table below.

Course within which learning outcomes are to be evaluated.	Assignment or project in the course that will be used to evaluate student performance relative to learning outcomes.
'Introduction to Geospatial Technology' <u>linked to learning outcome 1</u>	Students complete a final paper that requires them to engage with the ways in which geospatial technologies are embedded in everyday lived and environmental spaces.
'GIS Customization and Automation' <u>linked to learning outcome 2</u>	This course culminates in a final project in which students must design and program an automated GIS procedure that is linked to a live data source.
'Web-based GIS' <u>linked to learning outcomes 2 and 3</u>	This course culminates in a final project in which students must program a live geospatial data service.
'Mobile Geospatial Application Development' <u>linked to learning outcomes 2 and 3</u>	This course culminates in a final project in which students must independently design and create a mobile geospatial application that can be installed on a handheld computing device (smartphone or tablet).
'Geospatial Technologies for Urban Planning	Students complete a final 'report' in which they

Applications’ <u>linked to learning outcomes 1 and 4</u>	detail the range of uses, and limitations, of geospatial technologies in urban planning scenarios that they have been exposed to during the quarter. They will also learn about geo-visualization for the application of selected urban planning modeling techniques in GIS.
‘Geospatial Technologies for Environmental Planning Applications’ <u>linked to learning outcomes 1 and 4</u>	Students complete a final ‘report’ in which they detail the range of uses, and limitations, of geospatial technologies in environmental planning scenarios that they have been exposed to during the quarter. They will also learn about geo-visualization for the application of selected environmental modeling techniques in GIS.
‘Geospatial Technologies Capstone 1: Planning and Design’ <u>linked to learning outcome 5</u>	This course culminates in the completion of a practicum project proposal and plan for students to follow in the second capstone course.
‘Geospatial Technologies Capstone 2: Implementation’ <u>linked to learning outcome 5</u>	This course culminates in a final project based on the planning and design that students completed during the first capstone course.

Faculty will meet on a quarterly basis to evaluate the evidence of student achievement of the student learning outcomes, and will adjust the program as needed.

Faculty: Faculty and staffing needs of the MS program are included in Appendix II. At this point, we are recruiting two tenure track positions. After the completion of the first year, we plan to expand the program further. Given our understanding of the market for such a degree, we will fully consider up to two additional faculty positions to be recruited and have in place by the third year of this MS’s operation.

In addition to the two new hires, Dr. Matthew Kelley and Dr. Modarres will be involved in designing and offering of some of the proposed courses and will serve as assigned faculty members for the two capstone courses, as needed.

Faculty oversight will occur within the Urban Studies Program, following our current codes and academic practice.

The graduate faculty will consist of the two new hires, plus Dr. Matthew Kelley and Dr. Modarres. This means that by Fall 2014, there will be two tenured and two non-tenured faculty members among the graduate faculty. As such, during the first 5 years of the MS program, Dr. Kelley and Modarres will be play a leadership role in assessment and oversight of the program. As described in Section VI, the graduate faculty members will annually assess the quality and content of the program and make the necessary adjustments as needed.

Students: See Appendix III

Diversity: Our program has historically catered to non-traditional students, many of whom are the first generation in their families to attend a university, are older, and work. Offering all the required courses in the evening, we will be able to cater to this particular population. Furthermore, we plan to advertise this program widely, both locally and nationally, as well as internationally. As a one-year professional degree program, we will be marketable to all demographic groups.

Given the social justice focus of the Urban Studies Program, we will carry this theme into the design of particular activities within the MS program. This will also increase the awareness of our students regarding the urban/environmental experience of the minority population, embedding in them the importance of sensitivity to diversity and social justice issues.

Section VI: Assessment

Program Assessment: Given the design and the nature of this program, Thesis Projects will act as assessment tools for us. We will be able to measure their level of knowledge and what additional pedagogical and content issues need to be considered. In addition to internal assessment of these projects, we will also seek input from local employers (public, private, and community organizations who are in operate in our market area). This will be accomplished by inviting them to review some of the applied thesis projects.

University of Washington policy stipulates that new and established degree programs undergo periodic reviews. The Graduate School will conduct a review of the Master of Science in Geospatial Technologies 5 years after it has been implemented.

The graduate faculty, consisting of the two new hires, plus Dr. Kelley and Dr. Modarres, will be responsible for oversight and annual assessment of the MS program. Given the non-tenured status of the new hires, during the first 5 years of the MS program, Dr. Kelley and Dr. Modarres will play leadership roles in this process.

Student Assessment: This will be done through regular course evaluations, as well as exit interviews with students.

Accreditation: Not Applicable

Section VII: Administration & Structure

In Appendix IV, we provide a list of additional staffing needed to start and operationalize this program. In addition to personnel to recruit, manage, educate, mentor, and advise our MS students, we will need additional infrastructural supports. We would like to convert the classroom across from our current GIS lab in Pinkerton (PNK104) into an additional computer lab. With two cohorts in GIS certificate and additional group of MS students, it is important that we have adequate training and research facilities. Furthermore, having all students in the same building means that a sense of community will be created among undergraduate students (who are in the certificate

program) and the MS students. This will promote peer mentoring, as well as a natural way to promote our new MS program to our undergraduate students.

Section VIII: External Evaluation of Proposal

We recommend that the following individuals be contacted to serve as external reviewers of the proposed MS in Geospatial Technologies.

<p>Dr. Matthew Zook Associate Professor Department of Geography University of Kentucky zook@uky.edu 859-218-0955</p>	<p>For the past several years he has studied how the geoweb is produced (particularly the practices surrounding user-generated data) in order to better understand where, when, and by whom geo-coded content is being created. Dr. Zook focuses on how code, space and place interact as people increasingly use of mobile, digital technologies to navigate through their everyday, lived geographies. Of special interest to him is the complex and often duplicitous manner that code and content can congeal and individualize our experiences in the hybrid, digitally augmented places that cities are becoming.</p>
<p>Dr. Anthony Stefanidis Professor Department of Geography & Geoinformation Science George Mason University astefani@gmu.edu 703-993-9237</p>	<p>Dr. Stefanidis' areas of expertise include the analysis of digital imagery and video, spatiotemporal information modeling and analysis, geosensor networks, and the harvesting of geospatial intelligence from social media feeds. His current and past research activities include projects funded by NGA, IARPA, Draper Lab, NSF, NASA, USGS, and the European Union. In addition to his research, he is teaching courses in digital image analysis, geospatial intelligence, and spatial statistics.</p>
<p>Dr. Daniel Sui Professor and Chair Department of Geography Ohio State University sui.10@osu.edu 614-688-5441</p>	<p>Dr. Sui's current research focuses on four areas: 1. GIS-based spatial analysis and synthesis for urban, environmental, and public health applications; 2. Volunteered geographic information and the use of social media as a new data source for geographic research; 3. Legal and ethical issues of using geospatial technologies in society; 4. Coupling of human and natural systems and security implications of climate change.</p>
<p>Dr. Renee Sieber Associate Professor</p>	<p>Use and value of information technology by marginalized communities, community based</p>

Department of Geography McGill University renee.sieber@mcgill.ca 514-398-4951	organizations, and social movement groups; public participation GIS/participatory GIS/participatory Geoweb; use of GIS in the environmental movement; development of e- commerce tools for use in marginalized communities.
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Section IX: Approval

See Appendix V

Section X: NGAC and BCG Reports

See Appendix VI

APPENDIX I

REQUIRED COURSE WORK

Prerequisite Courses		
Course Number	Course Title	Credits
	Total Credits	
Program Requirements		
Course Number	Course Title	Credits
TGIS 5XX	Introduction to Geospatial Technology	5
TGIS 5XX	GIS Customization and Automation	5
TGIS 5XX	Web-based GIS	5
TGIS 5XX	Mobile Geospatial Application Development	5
TGIS 5XX	Geospatial Technologies for Urban Planning Applications	5
TGIS 5XX	Geospatial Technologies for Environmental Planning Applications	5
TGIS 5XX	Geospatial Technologies Capstone Practicum 1: Planning and Design	5
TGIS 5XX	Geospatial Technologies Capstone Practicum 2: Implementation	5
	Total Credits	40

APPENDIX II

PROGRAM PERSONNEL

Faculty				
Name	Degree (e.g. M.A.; Ph.D.; J.D.)	Rank (if applicable)	Status (e.g. full-time, part-time)	% Effort in Program
Jim Thatcher	Ph.D.	Assistant Professor	Full-Time	100%
Britta Ricker	Ph.D.	Assistant Professor	Full-Time	100%
Matthew Kelley	Ph.D.	Assistant Professor	Full-Time	80%
Ali Modarres	Ph.D.	Professor	Full-Time	20%
Total Faculty FTE				
Administration and Staff				
Name	Title	Responsibilities	% Effort in Program	
TBA	Staff Coordinator		50%	
TBA	Program Advisor		100	
Total Staff FTE				

APPENDIX III

ENROLLMENT AND GRADUATION TARGETS

Year	1	2	3	4	5
Headcount	20	30	40	40	40
FTE	20	30	40	40	40
Program Graduates	15	25	35	35	35

**APPENDIX IV
BUDGET**

To fully operationalize the new graduate program in Geospatial Technologies, we will need two faculty members and the help of a small cadre of staff. The following provides a list of required resources, a brief explanation for each, and the related estimated costs:



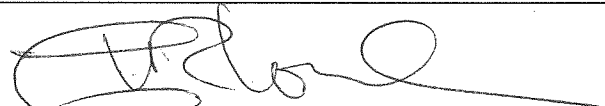

Resource	Description	Budget
<i>Faculty and Staff</i>		
Two Tenure Track	We have started recruitment for these positions, so this will not be a new cost. These faculty members will be responsible for curricular implementation and course modifications in the future.	\$70K + Benefits (Not new cost)
Office Staff	This position will be responsible for day-to-day administrative needs of the Geospatial curriculum and students in the program. Given the size of the program, we envision this to be a 20-hour per week position.	\$20K + Benefits
Program Advisor	This position will be responsible for recruitment and advisement for all MS students, interaction with students regarding their professional development and job placement, and assistance with GIS labs and teaching introductory GIS courses when needed.	\$50K + Benefits
Equipment		
Computational Facilities	While Urban Studies does have a GIS lab, we envision additional costs associated with the acquisition of needed computational equipment, such as GPS and mobile units. We will require start up funds (\$20K) to purchase some of the needed equipment and \$10 K per year for maintenance. The remainder of the funds will be acquired through course fees to be determined later. The estimated cost does not include computer stations. In conversation with Mr. Patrick Pow, we estimate that the total IT support, including the acquisition of new computers, to be an additional \$50K.	\$20K (initial) + \$10K (Annual)

Checklist of Stakeholders for UWT New Program Proposals

Provide signatures of consultation with appropriate stakeholders. If the proposal involves any new resources for that unit, provide a statement from the stakeholder regarding the proposals adequacy of budgeting for identified resources. Email documentation acceptable.

New Degree or Certificate Proposed: MS IN GEOSPATIAL TECHNOLOGIES

Faculty contact: ALI MODARRES

Unit	Signature (plus comments if relevant)
Academic technologies (for online, recommended for hybrid programs) (Colleen Carmean)	
Finance Office (Jan Rutledge):	 SEE ATTACHED DETAIL BUDGET
Information Technology (Patrick Pow):	SEE ATTACHED LETTER 
International Student Services (if identified population includes significant focus) (Sandra Spadoni):	
Library (Charles Lord):	
Teaching and Learning Center (Beckie Etheridge):	
Space if other than traditional classroom (Ross Johnson)	 See Emalus Appedix
Other Relevant Academic Units (list)	

University of Washington Tacoma
MS Geospatial Technologies Program Proposal

	Year 1	Year 2	Year 3	Year 4	Year 5
Administrative Salaries & Benefits	\$ 68,000	\$ 70,040	\$ 71,441	\$ 73,584	\$ 75,792
Faculty Salaries and Benefit	\$ 176,260	\$ 181,548	\$ 186,994	\$ 192,604	\$ 198,382
Clerical Salaries & Benefits	\$ -	\$ 27,836	\$ 28,672	\$ 29,532	\$ 30,418
Financial Aid specific to the program	\$ 60,000	\$ 90,000	\$ 120,000	\$ 120,000	\$ 120,000
Operations	\$ 4,650	\$ 5,097	\$ 5,105	\$ 6,128	\$ 6,245
Equipment (Replacement/Maint)	\$ -	\$ 10,000	\$ 10,200	\$ 10,404	\$ 10,612
Lease or Acquisition					
One Time Expenditures	\$ 20,000	\$ -	\$ -	\$ -	\$ -
Overhead Costs	\$ 120,929	\$ 145,332	\$ 164,009	\$ 169,638	\$ 174,667
Total Costs	\$ 449,839	\$ 529,854	\$ 586,421	\$ 601,890	\$ 616,115
General Funds: State Support					
Tuition and Fees(total)	\$ 268,100	\$ 414,215	\$ 568,855	\$ 585,920	\$ 603,498

Subject: MA in Geospatial Technologies

Date: Monday, November 25, 2013 4:11:53 PM Pacific Standard Time

From: Patrick Pow

To: GINGER L. MACDONALD

CC: ALI MODARRES

Hi Ginger,

I met with Ali last week to review his proposal on the new master program in Urban Studies.

Having discussed thoroughly, I have signed the necessary form and suggested that I will write to you to further clarify.

The following are my comments:

1. PNK-104 is currently a Smart classroom with good network infrastructure. It depends on the layout of the room required, I may not have to add any conduits or network drops. But we should still budget \$1,000 just in case. I discussed with Ali that he will need approval from Space Management under Harlan and Room Scheduling under the Registrar as this is used heavily for many other classes at present.
2. The budget of \$20,000 for equipment is really for portable devices including tablets and smart phones for student to use. It has nothing to do with the computers required for this classroom/lab. The annual maintenance is also for replacing the portable devices. We have already developed the security policy and guidelines for employees to use portable devices. However, it does not apply to the students at this point. I will work with Urban Studies to develop new ones for students if it is applicable. In short, my department will be able to support the portable devices.
3. I will submit a request for \$50,000 central funding to purchase and install new computers for the new computer lab, should this proposal is approved.
4. Currently University of Washington has the software licenses for ArcView and ArcInfo, covering tri-campus use. There is no other software requirement at this point.
5. When students write code to develop mobile GIS apps, IT will able to provide a development server and storage space for this purpose. I will work with the new faculty in Urban Studies to determine what kind of resources will be needed to support the students. Unless there are lots of technology requirements, I probably do not need to ask for funding for new servers.

Please let me know if you have any questions. Thanks.

Patrick

Patrick Pow
Vice Chancellor for Information Technology
University of Washington Tacoma
1900 Commerce Street
Tacoma, Washington 98402-3100
Phone (253)692-5616 Fax(253)692-5738



ADMINISTRATIVE SERVICES

UNIVERSITY of WASHINGTON | TACOMA

November 26, 2013

Matt,

As requested, per our discussion on November 21 of 2013, my general understanding and any concerns related to campus space regarding the new Masters in Geospatial Technologies program are outlined below:

- Currently the usage for PNK 131 is (8) Courses of 20-25 students per year. This is expected to double by next year with (15) Courses at 45 students. With the addition of the Master's Degree program there will be an additional (20) Courses by Winter Quarter of 2015.
- Due to increased course load and with the addition of the proposed new program the request has been made to create a setup for a computer classroom/lab in PNK 104 similar to PNK 131.
- The intent is that PNK 131 would be fully utilized at all hours by the Urban Studies program starting in the Winter Quarter of 2015. PNK 104 initially would be used in evening hours with the ability for other campus programs to schedule the classroom as long as the setup meets their respective needs.
- It has been requested that PNK 104 be evaluated for new furniture and technology to better meet the needs of the program.

My comments regarding the space requirements and request are as follows:

- As we anticipate we will be at capacity for classroom space usage on campus for the foreseeable future it is extremely important that the Department Administrator communicates all anticipated classroom usage time blocks, including labs, to the Office of the Registrar so that we can maximize usage of all campus classroom space.
- Administrative Services will continually evaluate the overall usage of PNK 131 and PNK 104 to make any space modifications or space reassignments as necessary.
- As this is general campus space we will need to have a discussion in the summer of 2014, at the latest, regarding the furniture, classroom setup, and technology so that we maintain flexibility to meet the needs of all campus users.

Please let me know if there are any additional questions or concerns. I look forward to working with you in the future to ensure that the proposed classroom spaces meet your needs.

Sincerely,

A handwritten signature in black ink, appearing to read 'Ross C. Johnson'.

Ross C. Johnson, AIA, NCARB
Space Planning Manager
University of Washington Tacoma

Box 358431 1900 Commerce Street Tacoma, WA 98402

253.692.5660 fax 253.692.5661 www.tacoma.uw.edu/administrative-services

Appendix V

Approval and Support Letters from Stakeholders



TACOMA HOUSING AUTHORITY

Tacoma Housing Authority
902 S L Street
Tacoma, WA. 98405
(253) 207-4400
www.tacomahousing.net

November 18, 2013

To whom it may concern:

For a little over a year and a half, the Tacoma Housing Authority has provided an internship for students from the University of Washington – Tacoma. Through this partnership, we've recognized a much needed skillset that we had not yet realized. Our first intern constructed a detailed index of "opportunity" throughout the city of Tacoma to provide (1) a reference map for our clients who are searching for homes to better identify ideal locations for their families, and (2) to also provide our developing staff to focus new construction on areas that will benefit our clients best. Since then, THA has had many more GIS-related analyses performed by our interns that it has allowed a broader perspective look at our clients and properties.

With the ever-expanding growth of mobile applications and its use, THA (along with many other organizations) is continually trying to maintain pace. The difficult aspect of this task is the availability of qualified staff. Without the influx of people with this skillset, it only continues to place our organization behind the curve of this trend. By providing the data and tools that THA has available on mobile applications for its clients, then we are able to assist them at the palm of their hands with a detailed map of where services may be closest.

Overall, this new trade that we've acquired through our partnership with UWT has allowed our organization to be more innovative and is proving to be even more essential for years to come, to both THA and any other organization or company that has the benefit of this analysis and skillset.

Cordially,

Joshua Crites
Eric Lane

Tacoma Housing Authority

November 19, 2013

To:

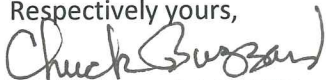
Matthew Kelley, Ph.D.
Assistant Professor
Urban Studies and Geographic Information Systems
University of Washington, Tacoma
Pinkerton 309 | 1900 Commerce Street
Tacoma, WA 98402
253.692.4679 | MJK3LL3Y@u.washington.edu

Dr Kelley,

I am writing this letter in support of the development of an advanced degree program related to geo-spatial technology at UWT. Pierce County Applications and Geographic Information Services requires a BS/BA with extensive course work in GIS and work experience for our entry level positions. Since we support a variety of departments we look for people with backgrounds in certain business areas such as engineering, computer science, biology, urban studies etc. Most of our work involves automating business workflows and integrating business systems with spatial databases using commercial off the shelf software and open source technologies. Advanced work requires a sound knowledge of spatial database design, computer programming, understanding the software development lifecycle and project management skills.

An MS/MA degree in Geo-Spatial Technologies would provide students the opportunity to gain the knowledge to operate at the advanced levels required in our profession. Software engineers with specialized training in geo-spatial science and GIS practitioners with solid software development skills provide the profession with the employees required for business system integration and workflow automation. Web development for mobile devices is a mandatory skill in order to support field asset collection, assessments, operations and management for a large sector of our businesses. Finding potential candidates with these skills is a difficult task so a local source of well trained talent is an exciting possibility. We look forward to the success of your program.

Respectively yours,



Chuck Buzzard, MS, GISP
Applications and Geographic Information Services Supervisor
Pierce County Information Services
950 Fawcett Ave, Suite 300
Tacoma, WA 98402
253-798-7703 | cbuzzar@co.pierce.wa.us



To Whom It May Concern:

RE: Letter of Support – University of Washington Tacoma Degree in Geospatial Technology MA

I am pleased to write this letter of support for the University of Washington Tacoma's proposed MA Degree in Geospatial Technology, and am excited for the potential for a program that could meet the desperate need for Technical Geospatial experts within the South Puget Sound Region.

I am Johnathan Laughery, the GIS Coordinator & Administrator for Metro Parks Tacoma. We are an 800+ person Municipal Corporation focused on managing parks, recreation, and providing zoological services and facilities for the citizens of Tacoma. As an organization, we are continuously looking to grow, adapt, expand and develop for future needs of our community and make sure our efforts are meeting the needs of our citizens and Organization. This means we need to be up-to-date on current spatial technology trends to ensure we are running as effective and efficient as possible.

GIS services are fast becoming the foundation for Metro Parks to manage various database related services, and spatial thinking is an integral way we strategically think in terms of parks, facility and open space management. In lieu of the latter facts, the benefit of having a world class University offering relevant Master's level classes in Geospatial Technology would be an invaluable resource to us as we look to push the envelope in areas of application development, web mapping, asset management, and many other areas where not only traditional GIS skills, but advanced broader concepts of Geospatial thinking is necessary for future development within our Organization.

As I have also worked on the private market side in the past, providing Geospatial Consulting services to large Development Companies, Non-Profit client, and Private Industry partners, I can see very clearly the incredible benefits such a relevant Degree would offer in the South Sound Region. There are countless Design, Architecture, Engineering, and Marketing companies in need of people with advanced understandings of how to apply Geospatial Technology, theory and concepts. Further, there is an exciting, and quickly expanding technical services sector within Tacoma and major opportunity for individuals whom have advanced knowledge and degrees related to Geospatial Technology however there needs to be individuals with advanced education to fill those positions. The University of Washington Tacoma's Geospatial Technology MA is the answer to a growing and open Market.

In closing, I am very much in support of this program as it will raise the bar in regards to not only GIS Technology advancement within the greater Tacoma Region, but it will continue to fortify an ever-growing technology sector which has the opportunity to be a major economic contributor to the South Sound Region.

Sincerely,

Johnathan Laughery GIS Coordinator
Metro Parks Tacoma
johnl@tacomaparks.com

4702 S 19th Street, Tacoma WA 98405-1175
Phone: 253.305.1000 • Fax: 253.305.1098 •
www.MetroParksTacoma.org

Board of Park Commissioners:
Larry Dahl
Erik Hanberg
Aaron Pointer
Tim Reid
Andrea Smith

Executive Director:
Jack C. Wilson

To whom it may concern:

As a culture, perhaps the international-world wide- community , we have become dependent on not just our everyday physical world but the world of unseen connections and the internet which pervades all. An education in Geospatial Technologies would be an asset to any person, whether scientist, researcher or businessman, who wishes to navigate the waters of both realities while finding connections and profits which link the two. Geospatial technology has already proved integral to our current culture. We utilize geospatial technology every day; to navigate the web, ship and receive packages, study class imbalances, plot courses for aircraft and space craft and model climate and other terrestrial phenomenon. There is no limit on what geospatial technology will be utilized for in the future and how integral an understanding in this technology will become.

As a geographer I can think of no greater skill to be equipped with. As a layman I can see the potential for more, in every application. As a student of knowledge the future geospatial technologies will unlock are not only limited to this planet or this time. A graduate degree in this field will equip myself and many other students with the tools to navigate the future in any field they wish to embark into.

To close allow me to posit a Master of Arts in Geospatial Technology has a value which cannot be stated for its value is in the future of understanding; the opportunities created are only limited to the imagination of the human mind.

Michael J Barnett
Graduate- University of Washington
BA - Environmental Studies
Geographic Information Systems Certificate holder.
barnettm@uw.edu
253 441 5201

To whom it may concern;

The Masters in Geospatial Technologies program here at University of Washington Tacoma is a great opportunity for anyone that has had any experience in the GIS or spatial analysis field. As of late it seem that even a Bachelors degree is almost becoming obsolete. As the student population continues to grow and more and more BA's are being earned, the less impressive they are becoming to potential employers.

To have an opportunity to obtain a graduate degree, it would separate those who have decided to continue their education and leaving them in greater demand. I am strongly considering the program and I look forward to learning more about it as the details are getting worked out.

Sincerely,

Lucas Liese
President, UW Tacoma GIS Society
GIS Certificate Program 2012-2013

To:
University of Washington-Tacoma
Dept. of Urban Studies and
Geographic Information Systems
Re: MA in Geospatial Technologies degree

17 November 2013

I have become aware of the potential for a new graduate program in Geospatial Technologies at the University of Washington – Tacoma. As I recently graduated from UWT, with a bachelor's degree in Environmental Studies and a certification in Geographic Information Systems I am very interested in this prospective program. During my time at the university I was what was considered to be a 'Non-traditional' student; I am forty-years old and began the pursuit of my degree more than twenty-years after graduating high school. In order to put myself in a field that offered a far more steadfast outlook my efforts at UWT were focused on courses of study targeted on the understanding of the environment around us, but with a brief introduction to GIS, my pursuits become augmented. I was truly impressed with the dynamic aptitude of GIS, and the way in which it could be applied to any discipline. I could see that the acquisition of knowledge in this growing specialty would surely aide me in the quest for gainful employment.

Upon graduating, and due to the tools I gained in the GIS program, I was offered and accepted an internship at the University of Washington – Tacoma Center for Urban Waters performing GIS analysis. That internship has led to a position as a research assistant. But, my hunt for a more established position within an organization has not diminished and I have recognized a pattern in the job market as it applies to GIS. The majority of positions that are available seem to be based on a more broadened version of GIS, encompassing programing, script writing and application development. As I understand it this will be the basis of the graduate program that is being discussed. The expansion of opportunities that would come from receiving a degree of this nature could be nearly immeasurable. The time invested in a graduate degree, in most cases, is seen by potential employers as an adequate substitution for relevant experience; something at this time I find myself lacking in.

I have had multiple discussions with other recent graduates as they are conducting their own explorations into the world of employment and there seems to be consensus on the need to take the next step in our educations. The hurdles that are placed in our paths are dependent on having enough experience, or enough education. I have looked into other graduate programs being offered, environmental and geospatial, but I can honestly say I would prefer to attend a graduate program at UWT, especially one of this manner. There is a limited amount of available graduate programs being offered in Geospatial Technologies and I believe a degree in this field could create a momentous boost to my and anyone else's prospects for the future.

Thank you for your time and consideration on this matter. If I can be of any further assistance, or you have any questions please do not hesitate to contact me.

Regards,
Bryan E. Huebner

Bryan E. Huebner
4402 N Vassault St
Tacoma, WA 98407
bryanhuebner@gmail.com
253.988.2963

Ali Modarres

P.O. Box 65918 • University Place, WA 98464 • Phone: (253) 355-1038
E-Mail: Carolynball9200@gmail.com



Date: December 7, 2013

To whom it may concern:

I am a recent graduate of the University of Washington- Tacoma and I also completed the GIS and Mapping Certification Program in the last year of my Bachelor's of Science Degree. I am very pleased to learn that the University of Washington- Tacoma Campus is implementing a Master's Degree Program in GIS and Technology and am very eager to be a candidate for this program.

Upon my graduation from the University in June 2013, I joined the pool of thousands of graduates in this area seeking an entry-level career. I can personally attest that the job search has been anything but easy. This is why I am so eager for the new Master's Program to begin. I am hoping that completing this program may be the doorway to a chance at a fulfilling and rewarding career. I believe that this program would give me the experience I need to find what I am having so much trouble finding in my career search now.

I think it will be pivotal in my career path to have the hands-on experience that I would learn in the Master's Program. The night hours of the program are also essential for those of us who have daytime jobs or a young child like myself. Opening up this program at the Tacoma campus would make it possible for Bachelorette graduates to continue our education locally, which otherwise may have been near impossible.

In summary, I believe that this completing program would be the tool I need to find a successful and meaningful career in my field. It will be of the utmost importance to me to be a candidate for this Master's Program at the University of Washington- Tacoma. This option of attaining a higher education would be an excellent achievement to add to my resume and would open doors for me that are not open at this point in my career.

If you have any questions please do not hesitate to contact me.

Sincerely,

Caroline Ball

Prospective Master's Student

Appendix VI

NGAC and BCG Reports

The Geospatial Growth Engine

DECEMBER 05, 2012

It could be the largest industry that no one has heard of. Consumers, businesses, and government agencies all rely on its services every day—local searching, online mapping, customer targeting, logistics and routing, urban planning, and disaster response are just some of the common applications and activities that it enables. Still, few people know its name.

The geospatial services industry is big and growing fast—and so is its economic impact, according to a BCG study that was commissioned and [recently profiled by Google](http://googleblog.blogspot.com/2013/01/mapping-creates-jobs-and-drives-global.html#1/2013/01/mapping-creates-jobs-and-drives-global.html) ([http://googleblog.blogspot.com/2013/01/mapping-creates-jobs-and-drives-global.html](http://googleblog.blogspot.com/2013/01/mapping-creates-jobs-and-drives-global.html#1/2013/01/mapping-creates-jobs-and-drives-global.html)). The industry provides the technology, expertise, tools, and data that connect consumers, businesses, and governments on a common, coordinated digital map. David Potere, an expert principal in BCG's Boston office and global lead of the firm's GeoAnalytics team, discusses the reach and ramifications of geospatial services.

How big is this industry? What is its economic impact?

Geospatial services—which includes data providers, location-enabled device manufacturers, app developers, experts, and educators—generated approximately \$73 billion in revenues in 2011 and accounts for at least 500,000 jobs—more than the U.S. airline industry. These are high-quality, high-paying jobs for software engineers, scientists, educators, surveyors, urban planners, traffic engineers, and experts in logistics and operations.

As BCG detailed in research earlier this year

(http://www.bcg.com/expertise_impact/industries/technology/publicationdetails.aspx?id=tcm:12-109383&mid=), we estimate that in the U.S., geospatial services help generate some \$1.6 trillion of revenue across the economy and save \$1.4 trillion in costs annually. They are also part of the daily jobs of 5.3 million U.S. workers. Once U.S. consumers are informed about what these services are, they place a direct value on geospatial services of \$37 billion a year—proof of the many ways geo-based applications and location-enabled devices have become central to our daily lives.

Why have we never heard of geospatial services?

This technology has been critical for defense, intelligence, and other government applications for more than 30 years. In 2000, President Clinton opened the GPS constellation for commercial use, and the first commercial, high-resolution imagery satellite achieved orbit. With the surge in mobile and smart devices that began mid-decade, all of the ingredients came together for geoservices to take off. Today the industry is increasingly providing a common, up-to-date, digital map of our world, allowing consumers, businesses, and governments to make place-based decisions and plans.

For anyone with a smartphone, the consumer uses of geospatial services are easy to grasp: navigation and local search, for example. How are businesses deploying these services?

Business use falls primarily into three areas: logistics functions, such as transportation and warehousing; sales and marketing; and strategic decision-making—such as determining where to locate a store or distribution facility. According to BCG's recent research, more than half of U.S. companies use web-based mapping services, more than one-third use geo-enabled devices, and nearly one-third credit local search services for helping them attract customers. Fully 40 percent cited geo-services as an important component of American competitive advantage. In sector after sector—from retail to health care and from construction to agriculture—significant percentages of companies acknowledge that geoservices generate revenues or cut costs—or both.

One global logistics and delivery company, for example, captures data on more than 200 aspects of its U.S. truck-fleet operations and then uses the data to help reduce its fuel consumption, emissions, and maintenance costs. In 2011, the company saved the equivalent of 528,000 gallons of fuel. Similar gains are possible in the air: geospatial services are helping U.S. airlines make real-time adjustments to routes, with the potential to reduce airplanes' fuel consumption by up to 2.5 percent—representing billions of dollars in annual savings.

Where else are these services having an impact?

In the last two years, our team at BCG has identified nearly 200 instances in which location-aware analytics have made a critical difference to companies and governments. Examples include optimizing fiber optic deployment for major telcos, targeting consumers for new auto model launches, and combating malaria. India provides just one example of the global impact. Our research shows that geospatial services deliver efficiency gains throughout the Indian economy equivalent to approximately US\$40 billion in revenue and approximately US\$70 billion in cost savings annually. Some 8 million to 9 million Indian employees use geospatial services in their daily work. The Indian ecosystem of geospatial services generates annual revenues of almost US\$3 billion and provides jobs for 135,000 people.

What does the future hold?

In emerging markets, geospatial services are still expensive, and the principal users are defense agencies, regional governments, and large enterprises. But that's changing fast as Internet access expands in many of these markets, driven by the increased penetration of mobile devices and smartphones.

In the U.S. and in other developed markets, a high-growth stage will continue for the next five years or more. In time, geospatial services will be integrated seamlessly into core business processes, and consumers will view them as an essential part of everyday life, much like basic computing and Internet access are seen today.

It is important to note, however, that a strong geospatial services industry in the U.S. requires continued support across several dimensions. Chief among these is support for geospatial education and training; talent is in short supply, and the industry needs access to skilled labor as demand continues to grow. Government investment in the collection of geospatial data is also key, since U.S. satellites and the U.S. Census feed the rest of the industry. Equally important are clear open-data policies, common standards for the exchange of geospatial information, and effective national infrastructures, so that investments in data collection flow to users.



THE BOSTON CONSULTING GROUP

Geospatial Services: A \$1.6 Trillion Growth Engine for the U.S. Economy

*How Consumers and Businesses Benefit from Location-Based
Information*

Heikki Henttu, Jean-Manuel Izaret, and David Potere

June 2012

FEW OF US THINK about it, but we all make use of the location-based tools and technologies provided by the geospatial services industry every day. Driving directions, delivery logistics, in-store promotions transmitted to GPS-enabled smartphones—these are just a few of the applications made possible by the data providers, location-enabled device manufacturers, app developers, experts, and educators who constitute the geospatial services ecosystem.

Geospatial Services: Big, Essential, and Growing

Although still young, the geospatial services industry is already an enormous force in the U.S. economy, generating annual revenues of almost \$75 billion (more than the U.S. paper industry), and providing jobs for 500,000 people—more than the number of airlines jobs and almost as many jobs as in residential construction.

The economic impact of the industry extends much further. Together, geospatial services companies drive \$1.6 trillion in revenues and \$1.4 trillion in cost savings throughout the U.S. economy. (See Exhibit 1.)

Geospatial services deliver location-based information to consumers and businesses; the industry employs some 500,000 people and generates approximately \$75 billion in annual revenues.

We All Use Them—Every Day

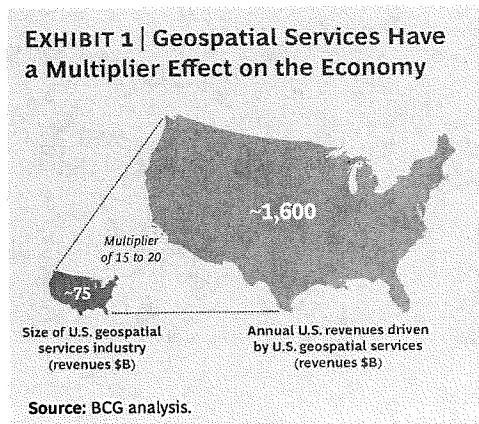
There are some 240 million connected consumers in the United States, and just about all of them access geospatial information on their computers, mobile phones, tablets, and GPS devices. (See Exhibit 2.) They place considerable worth on these services. The perceived value that consumers themselves believe they receive—over and above what they pay for devices, applications, and access—amounts to some \$37 billion a year, or more than \$350 per year for the average U.S. household.

Geospatial tools have long been essential to national security and law enforcement. Today, businesses are reaping big benefits as well. More than 5 million U.S. employees, in industries ranging from health care to food service, use geospatial services on the job. Companies rely on information rooted in computer mapping and satellite imagery to create new efficiencies, better target customers, create leaner operations, and make more strategic decisions. U.S. companies spend approximately \$1.2 trillion annually on logistics, much of which relies on location-based information. Geospatial services are having an increasing impact on the nearly \$400 billion that U.S. companies spend on marketing each year.

We expect that the economic impact of geospatial services in three key business functions—marketing, logistics, and strategic decision-making—will grow by at least 10 percent a year over the next five years.

Keeping the Growth Growing

Despite swift growth and extensive impact, geospatial services remains an emerging industry. We expect that it will keep growing rapidly, approaching \$100 billion in annual revenues in the next five years, while continued technological innova-



tions will lead to efficiency gains that add \$2.6 trillion to broader U.S. economic activity.

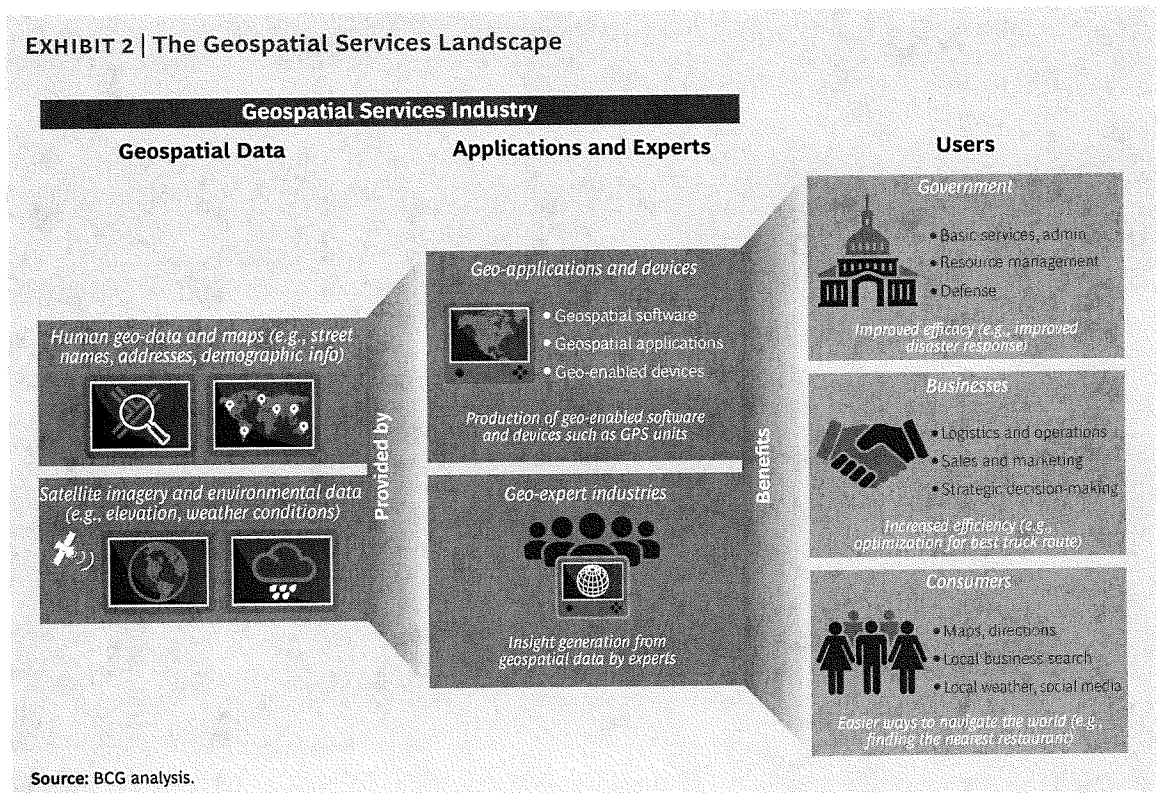
This continued growth will depend, however, on sustained public- and private-sector cooperation and partnership. Data collection requires government support for the constellation of satellites that generate much of the mapping and imaging data on which the industry's output depends. Clear and open policies governing collection and dissemination of location-based data facilitate the flow of vital information to businesses and consumers. As with many technology-based industries, a looming talent shortage demands greater emphasis on, and promotion of, technical education and training at all levels.

Implementing smart and informed policy now will generate a big payback. By encouraging continued growth of this vibrant industry, policymakers can boost revenues, jobs, economic impact, and U.S. competitiveness in the global information-based economy.

Among the many examples of how businesses—including small and medium-sized enterprises—use geospatial services are:

- Restaurants and hotels depend increasingly on geo-enabled recommendation services to bring in new customers.
- Farmers use mapping and environmental information and applications to optimize crop management.
- Geospatial services are crucial to site selection and land acquisition for construction companies.
- Real time, location-based information enables more efficient fleet management for all manner of transportation-related businesses, from trucking companies to car-rental firms.
- Energy companies use geospatial data to enhance exploration efforts.

EXHIBIT 2 | The Geospatial Services Landscape



For Further Contact

If you would like to discuss this report, please contact one of the authors.

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The Boston Consulting Group (BCG) is a global management consulting firm and the world's leading advisor on business strategy. We partner with clients from the private, public, and not-for-profit sectors in all regions to identify their highest-value opportunities, address their most critical challenges, and transform their enterprises. Our customized approach combines deep insight into the dynamics of companies and markets with close collaboration at all levels of the client organization. This ensures that our clients achieve sustainable competitive advantage, build more capable organizations, and secure lasting results. Founded in 1963, BCG is a private company with 77 offices in 42 countries. For more information, please visit bcg.com.

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Geospatial Workforce Development

A compendium of white papers focused on
advancing geospatial workforce development.



A Report of the
National Geospatial Advisory Committee

January 2012

Table of Contents

Preface	3
The Administration’s STEM Education Initiatives from a Geospatial Workforce Development Perspective.....	4
Background/Overview	4
Emerging Trends and Best Practices.....	5
Opportunities and Challenges	5
Active Organizations and Their Focus.....	7
Recommendations.....	7
Resources Reviewed and Related Links	8
Opportunities to Utilize the DOL Geospatial Competency Model to Meet Federal/State/Local/Tribal Government Needs	9
Background/Overview	9
Emerging Trends and Best Practices.....	9
Opportunities and Challenges	11
Active Organizations and Their Focus.....	12
Recommendations.....	12
Resources Reviewed and Related Links	13
Updating “Externally” Focused [GIS Themed] SOC Standard Occupational Classification Codes and “Internally” Focused Federal Occupational Series Classifications	14
Background/Overview	14
Emerging Trends and Best Practices.....	14
Opportunities and Challenges	15
Active Organizations and Their Focus Areas	15
Recommendations.....	16
Resources Reviewed and Related Links	16
Summary of Recommendations	18

Note – This paper was adopted by the NGAC on January 12, 2012

Geospatial Workforce Development

A compendium of white papers focused on
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Table of Contents

Preface	3
The Administration’s STEM Education Initiatives from a Geospatial Workforce Development Perspective.....	4
Background/Overview	4
Emerging Trends and Best Practices.....	5
Opportunities and Challenges	5
Active Organizations and Their Focus.....	7
Recommendations.....	7
Resources Reviewed and Related Links	8
Opportunities to Utilize the DOL Geospatial Competency Model to Meet Federal/State/Local/Tribal Government Needs	9
Background/Overview	9
Emerging Trends and Best Practices.....	9
Opportunities and Challenges	11
Active Organizations and Their Focus.....	12
Recommendations.....	12
Resources Reviewed and Related Links	13
Updating “Externally” Focused [GIS Themed] SOC Standard Occupational Classification Codes and “Internally” Focused Federal Occupational Series Classifications	14
Background/Overview	14
Emerging Trends and Best Practices.....	14
Opportunities and Challenges	15
Active Organizations and Their Focus Areas	15
Recommendations.....	16
Resources Reviewed and Related Links	16
Summary of Recommendations	18

Note – This paper was adopted by the NGAC on January 12, 2012

Preface

The United States is a world leader in geospatial technology and research, an area that represents a multi-billion sector of the US economy. This high growth, high technology industry acquires, manages, analyzes, integrates, maps, distributes, and uses geographic, temporal, and spatially based information and knowledge to fuel major sectors of the US economy. The industry includes research, technology development, education, and applications to address the planning, decision-making, and operational needs of people and organizations of all types.

This vital industry faces a serious workforce development challenge. A shortage of qualified and skilled workers exists to meet the demands of this fast growing industry. Efforts must be undertaken across all levels of government, private sector, academic community, and professional associations to prepare workers to take advantage of new geospatial job opportunities in high demand and economically vital sectors of the American economy.

Establishing an effective geospatial job market requires a direct connection between the employer's job requirements and the geospatial skills of the workforce. Determining the competencies that employers require in order to satisfy their business needs in the geospatial industry is critical. A competency-based approach for defining required skills becomes necessary in technology-based occupations such as the geospatial profession. Solving these workforce issues requires new methods, practices, partnerships, and outreach for this high growth, high technology industry among industry, academia, and government.

Advancing the Nation's geospatial workforce will result in a set of benefits where:

- Public awareness of geospatial technologies and their applications are raised, and better connections are built between the geospatial industry and diverse populations of potential workers;
- Public and private organizations can build partnerships with educational institutions at all levels to create effective and efficient geospatial training and education, and recruitment programs;
- Commercial, academic, nonprofit organizations, and all levels of government use a complementary set of geospatial competencies to support systematic geospatial learning and development of training and education programs and curricula;
- Effective and compelling public outreach programs and informational materials about the geospatial profession are distributed through geospatial professional organizations and existing DOL-supported education and information channels; and
- A set of skills standards describe the kinds of workers needed to support the geospatial industry; improve employee recruitment and selection; and advance geospatial technology.

These direct and indirect benefits ultimately work to better align educational, employment, and workforce development programs with employers' labor needs, ultimately providing public and private organizations with the knowledge and skills employees need to be successful.

The Subcommittee has developed this white paper to describe the challenges and advancements with geospatial workforce development and to set a context from which in part we will base our future discussions. While this paper is not meant to be all-inclusive with geospatial workforce development, we do believe it highlights the major elements and identifies a number of recommendations for moving forward. We encourage the reader to follow our deliberations and progress at www.fgdc.gov/ngac. Special thanks go John Mahoney and Tricia Longo Gibbons for their direction and support in developing this document.

Dave DiSera
Chair, NGAC Geospatial Workforce Development Subcommittee

The Administration's STEM Education Initiatives from a Geospatial Workforce Development Perspective

By: Matt O'Connell, Don McKay, Joanne Gabrynowicz
Research Assistance and Contributions by Uyen Dinh

Background/Overview

The goals of this paper are to examine opportunities for synergies with the Administration's Science, Technology, Engineering, and Mathematics (STEM) education initiatives, assess opportunities to incorporate Geospatial and Geomatics education into the four STEM categories, and assess potential role/involvement/support from FGDC and NGAC.

As a job sector, the geospatial technology field is exploding. Jobs are being created faster than we can find the minds we need to fill them. The Department of Labor recently identified geospatial technology as one of fourteen sectors "projected to add substantial numbers of new jobs to the economy or affect the growth of other industries or are being transformed by technology and innovation requiring new sets of skills for workers." Furthermore, geospatial technology requires cutting edge scientific and engineering analyses, utilizes high-end computing technology, and involves fundamental understanding of mathematical principles. Despite this amazing industry growth and innovation, and congruence with all aspects of STEM, few educational programs integrate geography and geospatial education within the STEM curriculum.

The Workforce Development Subcommittee believes that inclusion of geospatial disciplines in the White House STEM initiatives would increase the probability that the initiatives will be successful and increase the degree of their success. To that end, the Subcommittee believes NGAC should engage those decision makers entrusted with implementing the Administration's vision, e.g., the White House Committee on Science, Technology, Engineering, and Math education (CoSTEM) and the National Science Foundation (NSF), to illuminate the importance and benefits of developing a highly skilled geospatial workforce through STEM education.

Emerging Trends and Best Practices

The Administration's Support for STEM

Science, Technology, Engineering, and Mathematics (STEM) education is a national imperative. In the 21st century, technology is a fundamental driver of economic growth and prosperity, especially in the U.S. Studies show that technological innovation accounted for almost half of U.S. economic growth over the past 50 years. Almost all of the 30 fastest-growing occupations in the next decade will require a background in STEM.ⁱ

President Obama identified STEM education as a "national priority" and established the "Educate to Innovate" campaign in 2009 to mentor the next generation of technological leaders. Congress also strongly supports STEM, as evidenced by the passage of "America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Reauthorization Act" or "America COMPETES" in 2010. This act called for the creation of the Committee on Science, Technology, Engineering, and Math Education (CoSTEM) within the White House's National Science and Technology Council (NSTC). Launched in March 2011, CoSTEM seeks to develop the strategic groundwork for effective STEM education investments. CoSTEM's focus is to create an inventory of federal STEM education activities and to develop a five-year strategic federal STEM education plan.ⁱⁱ

Today, the Federal Government has a handful of programs directly related to geospatial or remote sensing. For example, the National Science Foundation's (NSF) Geography and Spatial Sciences (GSS) Program seeks to

advance discovery, basic understanding, and education in geography and the spatial sciences.ⁱⁱⁱ In addition, the National Oceanic and Atmospheric Administration's (NOAA) Cooperative Remote Sensing Science and Technology (CREST) Center encourages research on all aspects of remote sensing including sensor development, satellite remote sensing, ground-based field measurements, data processing and analysis, modeling, and forecasting.^{iv} However, the fact that only a couple of Federal agencies have created STEM programs to directly promote the geospatial and remote sensing fields indicate there are challenges in Federal STEM education prioritization and implementation.

Opportunities and Challenges

Challenges to Government-wide STEM Education

For fiscal year 2012, the President's total budget request was \$3.4 billion for STEM programs across all federal agencies.^v Despite this robust political support for STEM education, planning for STEM education is inconsistent. No single definition exists delineating which subject areas STEM education incorporates. The closest Administration-approved description of STEM is from a September 2010 President's Council of Advisors on Science and Technology report stating:

"STEM education," as used in this report, includes the subjects of mathematics, biology, chemistry, and physics, which have traditionally formed the core requirements of many state curricula at the K-12 level. In addition, the report includes other critical subjects, such as computer science, engineering, environmental science, and geology, with whose fundamental concepts K-12 students should be familiar. The report does not include the social and behavioral sciences, such as economics, anthropology, and sociology; while appropriately considered STEM fields at the undergraduate and graduate levels, they involve very different issues at the K-12 level.^{vi}

The definition's ambiguity hampers everyone's ability to determine what programs fall under a STEM curriculum. Members of the Coalition of Geospatial Organizations (COGO) expressed concern, in a letter to the Director of the Office of Science and Technology Policy, that this report defines STEM fields far too narrowly, thus excluding core social science disciplines such as geography.

In a 2005 report on Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends, the GAO attempted to classify STEM programs into nine STEM fields for students, eight STEM fields for graduates, and the four broad STEM fields for occupations.^{vii} This list of classifications differs from other federal lists, such as the Department of Homeland Security's STEM-Designated Degree Program List, which endeavors to list every possible collegiate degree related to STEM.^{viii} With the recent creation of CoSTEM, the members of this committee will begin the challenging process of creating a cohesive strategy to classify STEM education in order to introduce clarity, prevent redundancies, and improve program effectiveness.

With almost every federal agency hosting several STEM-related programs, there are many niche projects across the government that might be used to advance STEM in a coordinated fashion but are not. The same 2005 GAO report found that in the 13 federal civilian agencies surveyed, the Federal Government spent over \$2.8 billion on STEM for 209 different programs. It further reported that coordination among these programs was limited.^{ix} STEM education programs focus on topics ranging from long division for kindergarteners to molecular biology for doctoral candidates.

In measuring the effectiveness of any initiative, the outputs of the programs must be examined in order to evaluate successes and areas for improvement. Many of the STEM programs do not undergo rigorous analysis to understand what inspires students to enter STEM degrees and occupations. Initial findings from university officials and researchers indicate that quality of teachers in kindergarten through 12th grades and the levels of mathematics and science courses completed during high school ultimately influence decisions to pursue STEM degrees.^x

The Associate Executive Director of the STEM Coalition, an alliance working aggressively to raise awareness and foster policies to support STEM education, confirmed in an interview that there is no central location where STEM programs are administered within the Federal Government. Programs are scattered among many federal (and state) agencies. Therefore, different agencies may interpret the list of STEM degree programs to suit their agencies' unique needs. While most agencies with active programs maintain their own lists and requirements, it is often difficult to ascertain where they are located organizationally.

Currently, the Coalition is observing the work of the White House CoSTEM and expects the Inventory of Federal STEM Programs being conducted by a working group of the CoSTEM to be available in the next few months. There is also a CoSTEM Working Group to explore federal coordination of STEM programs. It is anticipated that once both reports are completed, programs will be evaluated as to results and impact.

It was also noted in the interview that the GAO was in the process of updating its 2005 Report: Higher Education Federal STEM Programs and Related Trends. The 2005 Report included data on over 200 Federal STEM programs as well as data on students and graduates in STEM fields.

Challenges with Geography/Geospatial Education

The geospatial field is accelerating rapidly; however, geographical education lacks proper funding. The No Child Left Behind Act of 2001 (Elementary and Secondary Education Act) recognizes geography as a "core academic subject," but it remains the only core subject that never received any funding authorizations or appropriations.^{xi,xii} Therefore, it is not surprising that in 2010, the National Assessment of Educational Progress rated only 21% of 12th graders proficient or better in geography education.^{xiii}

Students are not the only group that needs geospatial education or improvement. A National Geographic survey of educators found that 7 of 10 believed their professional development opportunities in geography were inadequate.^{xiv} Without proper funding for geography at elementary and secondary levels, both students and teachers are unaware of the various career opportunities in the geospatial industry. The U.S. News and World Report is a well-known source on university ranking that many students use when evaluating schools and programs. The Report does not list geography or geospatial sciences when rating degrees for Masters' programs, further exemplifying the public's lack of awareness on the subject of geospatial sciences.^{xv}

While the aforementioned NSF and NOAA programs benefit the advancement of geospatial technology, these programs are also underfunded. Only 12-15% of applicants receive grants through the NSF's GSS Program due to the sheer volume of qualified applicants.^{xvi} The CREST Center is funded through a single five-year grant from NOAA's Office of Education' Educational Partnership Program, which expired in September 2011.^{xvii} Without federal support for geography and geospatial technology education for both students and teachers, serious shortfalls will exist in the geospatial workforce in the coming years.

Emerging Opportunities

There are not-for-profit organizations that support STEM education inclusive of geography and geospatial curricula, tools, materials, and technology. TERC, an education research organization with a broad definition of STEM, offers professional development training, curricula, and materials in support of geography and geospatial technology as well as other STEM disciplines.

Recently, The National Science Foundation awarded a 2.2 million dollar grant to National Geographic, the National Council for Geographic Education (NCGE), the Association of American Geographers (AAG), and the American Geographical Society to collaboratively develop a "Roadmap to Implement 21st Century Geographic Education." The project will bring together industry experts, educators, and researchers to focus on improving geography education including instructional materials, teacher professional development, research, and assessment.

Active Organizations and Their Focus

The President's Council of Advisors on Science and Technology (PCAST) is an advisory group of the nation's leading scientists and engineers who directly advise the President and the Executive Office of the President. PCAST makes policy recommendations in the many areas where understanding of science, technology, and innovation is key to strengthening our economy and forming policy that works for the American people. PCAST is administered by the Office of Science and Technology Policy (OSTP). In September 2010, PCAST released a plan for improvements in K-12 STEM Education.

<http://www.whitehouse.gov/administration/eop/ostp/pcast>

TERC is a not-for-profit education research and development organization dedicated to improving mathematics, science, and technology teaching and learning. Founded in 1965, TERC works at the frontiers of theory and practice to enhance instruction through teacher professional development, develop applications of new technologies to education, create curricula and other products, and support reform in both school and informal settings. STEM education and professional development for teachers is a core mission area. Geography and geospatial topics are included as part of their professional development, curricula, and materials.

<http://www.terc.edu/>

The **STEM Coalition** represents the broadest voice in advocating for policies to improve STEM education at all levels. The alliance of more than 500 business, professional, and education organizations works aggressively to raise awareness in Congress, the Administration, and other organizations about the critical role that STEM education plays in enabling the U.S. to remain the economic and technological leader of the global marketplace. The Coalition supports an inclusive definition of the term "STEM" education by federal programs that is not limited to math and science, but embraces each STEM discipline and its unique needs.

www.stemedcoalition.org

The National Council for Geographic Education is a non-profit organization, chartered in 1915 to enhance the status and quality of geography teaching and learning. NCGE supports geography teaching at all levels from kindergarten through university. Activities include conducting and gathering research, producing journals and other geography publications, developing curricular resources at the K-12 and university levels, providing professional development opportunities, and organizing an annual conference.

<http://www.ncge.org/>

Recommendations

The NGAC recommends that FGDC engage the Federal Government to include geospatial and geomatics studies in STEM programs through the following actions:

- 1.1 The FGDC leadership should work with and encourage CoSTEM to include geospatial technology and geomatics as components of the STEM disciplines.
- 1.2 The FGDC Secretariat and agency members should review and comment on the results of the CoSTEM Inventory of Federal STEM Programs and the CoSTEM Report on Federal Coordination.
- 1.3 The FGDC leadership should encourage awareness among FGDC member agencies regarding the importance of opportunities for geospatial technology related grants, such as the NSF's Geography and Spatial Sciences Program and NOAA's Cooperative Remote Sensing Science and Technology Center. Consider inviting NSF and NOAA to brief FGDC on how this model may be applied at other departments and agencies.
- 1.4 The FGDC leadership should encourage FGDC member agencies to establish internship, fellowship programs, cooperative education, or exchange programs that give students practical understanding and real-world experience with geospatial technology and applications.

- 1.5 The FGDC leadership should encourage FGDC member agencies to support geographic literacy through their respective education and outreach programs.

Resources Reviewed and Related Links

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- ⁱⁱⁱ "Geography and Spatial Sciences (GSS)." National Science Foundation. 2011. <http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5410>.
- ^{iv} "CREST Research Overview." NOAA-CREST. 2010. <<http://crest.cuny.cuny.edu/research/>>.
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- ^{vi} "Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future." President's Council of Advisors on Science and Technology. September 2010. <<http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf>>.
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- ^{xii} "No Core Subject But Geography Left Behind: Program Funding Levels for Core Subjects under NCLB – FY 2002-2007." National Geographic. <<http://www.nationalgeographic.com/foundation/pdf/NCLBAcademicAppropriations.pdf>>.
- ^{xiii} "Geography 2010: National Assessment of Education Progress at Grades 4, 8, and 12." National Center for Education Statistics. U.S. Department of Education. July 2011. <<http://nces.ed.gov/nationsreportcard/pdf/main2010/2011467.pdf>>.
- ^{xiv} "Teaching Geography is Fundamental Act." H.R. 885. Rep. Chris Van Hollen. 112th Cong., 1st Sess. (2011); "Teaching Geography is Fundamental Act." S.434. Sen. Thad Cochran. 112th Cong., 1st Sess. (2011)
- ^{xv} "Education: Grad Schools." *U.S. News and World Report*. <<http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools>>.
- ^{xvi} Phone discussion with a director for the GSS Program.
- ^{xvii} "NOAA-CREST Center Based At CCNY Receives Five-Year, \$12.5 Million Funding Commitment." The City College of New York. <<http://www1.cuny.cuny.edu/prospective/gsoe/news/noaa-funding.cfm>>.
- ^{xviii} Jodi Peterson, Associate Director of STEM Coalition, Interview with Tricia Gibbons indicated that the GAO will be releasing an updated report in late 2011 or early 2012.
- ^{xix} "President Obama Announces Goal of Recruiting 10,000 STEM Teachers Over the Next Two Years." White House. 27 September 2010. <http://www.whitehouse.gov/the-press-office/2010/09/27/president-obama-announces-goal-recruiting-10000-stem-teachers-over-next->
- Discussions with representative and trainer from TERC
Press Release: National Science Foundation Funds Experts To Develop Road Map To Implement 21st Century Geographic Education, National Geographic Press Office, 6/17/2011
Coalition of Geospatial Organizations, Resolution on Geospatial Education
(http://www.urisa.org/files/COGO_Education_Resolution_press_release%2006_02_2010.pdf)

Opportunities to Utilize the DOL Geospatial Competency Model to Meet Federal/State/Local/Tribal Government Needs

By: Dave DiSera, Randy Johnson

Background/Overview

The shortage of trained geospatial technology professionals reflects a number of issues among the geospatial profession and the industries it serves. Among these issues, geospatial technology is used in hundreds of fields, but despite its widespread adoption, there is a lack of awareness regarding geospatial technology in general and the related career opportunities. As a result, training and educational programs have been unable to meet the growing demand within both the public and private sectors. In addition, the skill sets and competencies needed to prepare for career opportunities in geospatial technology have not been well defined or understood. This has resulted in a lack of consistent curricula, standards, and credentials within the profession. A geospatial competency model can provide a common language among employers, educators, human resource professionals, and the like to address these issues.

The goal of a geospatial competency model and the data they provide is to help organizations better prepare for the future. If developed properly, a geospatial competency model can become an effective tool for performing gap analysis to assist in succession planning, knowledge management and transfer, employee development, and work or organizational change. Specific examples include:

Training and Development

- Identify existing geospatial competencies
- Evaluate and assess current employees to determine existence of geospatial competency gaps and surpluses
- Use coaching, mentoring, training, and recruitment methods that match personnel requirements and future needs
- Individual developmental planning

Workforce Planning

- Identify current and future human capital needs including workforce size, distribution, and competencies needed to achieve the geospatial needs of the organization
- Redeploy or temporarily rotate staff to fill some of the gaps
- Reorganizing or restructuring positions or organizations to make better use of existing geospatial resources and match skills to functions

Succession Planning

- Address skills needed to meet complexities associated with geospatial technology
- Identify, develop, and select successors who are the right people with the right skills
- Motivate and retain top geospatial talent

Emerging Trends and Best Practices

Department of Labor's Geospatial Technology Competency Model

The U.S. Department of Labor's Employment and Training Administration (DOLETA) announced the release of an industry competency model for geospatial technology in July of 2010. The model is available on the Competency Model Clearinghouse available through the department's One-Stop Career Centers website. The **Geospatial Technology Competency Model (GTCM)** was developed to provide an employer-driven

framework of the skills needed for success in geospatial technology. The GTCM is a profile of the knowledge, skills and abilities required for the worker in the geospatial industry. The GTCM has been in development at the DOLETA since 2005, shortly after DOLETA highlighted geospatial technology as a high growth industry, along with biotechnology and nontechnology. These industries were also identified as having the greatest potential impact on the economy. <http://www.careeronestop.org/competencymodel/>

DOLETA worked with employer and education partners for two years to develop and validate a model that represents the broad range of services, technical and manufacturing professions, and products within the fields of geography, surveying and mapping, computer science, information science and other specialized areas of application that comprise geospatial technology. The GeoTech Center, a government, academia and industry partnership funded, in part, by a grant from the National Science Foundation and based at Del Mar College, led the validation process.

The model builds on previous efforts to describe geospatial industry skill needs, including the Geospatial Technology Competency Model developed at the University of Southern Mississippi. The new model groups competencies into foundational competencies, core geospatial competencies and competencies for three geospatial sectors: positioning and data acquisition, analysis and modeling, and software and application development.

The model is currently serving as a resource for career guidance, curriculum development and evaluation, career pathway development, recruitment and hiring, continuing professional development, certification and assessment development, apprenticeship program development and outreach efforts to promote geospatial technology careers.

Geographic Information Science and Technology BoK2: Foundational Research Project

The **Geographic Information Science and Technology Body of Knowledge** (GIST BoK) is a reference document produced by the University Consortium for Geographic Information Science (UCGIS) as the first product of its Model Curricula project. The GIST BoK is the most successful effort to date to create a comprehensive outline of the concepts and skills unique to the geospatial realm, including geographic information systems, geographic information science, remote sensing, satellite navigation systems, and cartography. It is also missing some topics, such as geocoding, and has significant granularity issues: large, mature subfields such as surveying, GPS, and remote sensing are covered in small sections. <http://www.ucgis.org/priorities/education/modelcurriculaproject.asp>

The follow-on project – called the GIS&T BoK2 -- will enable the maintenance and expansion of the knowledge base of GIS&T in a more dynamic, interactive, and collaborative manner than the original project. A new environment will be developed to provide for ways of understanding and experiencing the GIS&T Body of Knowledge and help to facilitate teaching, research, and professional advancement. Developing a common language was recognized early on and the University Consortium for Geographic Information Science (UCGIS) led the creation of the GIS&T BoK1. The GIS&T BoK2 project will:

- Map out the strengths and weakness of the BoK1 and develop a more comprehensive and inclusive organizing framework for GIST BoK2
- Examine a methodology for generating ontology
- Develop visually interactive representations of the Geographic Information Science and Technology knowledge domain
- Examine and test different environments for realizing the BoK2

The impact that the BoK1 has helped refocused educational and research activities in the GIS&T sector. The GIS&T BoK2 will create a dynamic environment for teaching, knowledge building, dialogue, collaboration, and research in GIS&T.

Project GTCM

Project GTCM is a national effort to develop curriculum based upon the Department of Labor's Geospatial Technology Competency Model by the Geotech Center. The objective of this project to develop a set of course pack outlines and assessment tools that allow community college educators to assess their own curriculum while developing new material, based upon industry standards. The Center is working to complete a "Model Geospatial Certificate" outline of courses and their required and recommended student learning outcomes content by late summer of 2012. <http://www.geotechcenter.org/Projects/Research-Projects/Geospatial-Technology-Competency-Model/>

Opportunities and Challenges

Starting as far back as the early 1990's, many organizations were having discussions about geospatial competency development and management within the GIS community. Over the years, many public and private organizations have struggled attempting to develop, implement, and effectively using a geospatial competency based system within their respective organizations. Understanding why this has happened and learning from the challenges of these organizations, is an important part of ensuring the success of the DOLETA's Geospatial Technology Competency Model going forward. While the excitement over the Geospatial Technology Competency Model has helped to fuel the sometimes-inflated expectations of its promise, there is not a quick and easy fix to the limited geospatial resources and lack of formalized competencies across the public and private sectors. The types of challenges that competency models and management have solved in other industries have evolved over the years. The complex problems associated with the application of geospatial technology don't have simple answers when you consider the accelerated use of geospatial data and technology, the continuing advances in technology, and the limitation of qualified resources, educational and training programs.

Before an organization begins looking at how to successfully apply the elements of DOLETA's Geospatial Technology Competency Model and implement a program for internal use, it is necessary for the organization to consider and build what is needed, use the right tools to make changes easy and dynamic, and respond to the organizational changing needs so that the program is both useful and used. Organizations need to address several pertinent questions before moving forward on a geospatial competency program initiative.

Question	Answer
Why are we developing a program?	To address the business value.
What will the program be used for?	To determine what geospatial lines of business or business processes it will support and manage.
What will the program include?	To define what elements are needed to make the program work.
How will the program be created?	To identify the process and procedures, and the resources necessary to implement and manage the program.

A successful geospatial competency program initiative will allow an organization to be consistent with what you hire geospatial resources for, train them in, what you measure performance against, and develop leadership potential. There are also opportunities in addressing the issues of demographics by developing new leaders, identifying where bench strength is lacking, and dealing with the retirement of experienced people in senior level positions. A program will also improve talent retention in today's highly competitive

market, and support employee-owned career development to further their competencies with geospatial technology.

Active Organizations and Their Focus

The U.S. Department of Labor's Employment and Training Administration has lead development of 16 models, including the Geospatial Competency Model. These models are available on the Competency Model Clearinghouse available through the department's One-Stop Career Centers website. They serve as a resource for career guidance, curriculum development and evaluation, career pathway development, recruitment and hiring, continuing professional development, certification and assessment development, apprenticeship program development and outreach efforts to promote geospatial technology careers.

ETA worked with Geospatial employers, associations, and education partners for a period of two years to research, develop, and validate a model that represents the broad range of services, technical and manufacturing professions, and products within the fields of geography, surveying and mapping, computer science, information science and other specialized areas of application that comprise geospatial technology. The GeoTech Center, a government, academia and industry partnership funded, in part, by a grant from the National Science Foundation and based at Del Mar College, led the model validation process. It should be noted that the model builds on previous efforts to describe geospatial industry skill needs, including the Geospatial Technology Competency Model developed at the University of Southern Mississippi.

Recommendations

The NGAC recommends that FGDC begin engaging appropriate federal agencies to identify opportunities to utilize the DOL Geospatial Competency Model to meet Federal/State/Local/Tribal government needs, by acting on the following:

- 2.1 The FDGC should collaborate with UCGIS and AAG to determine if the Body of Knowledge for GI Science and Technology's knowledge areas encompasses the breadth of the geospatial technology field from a government perspective.
 - Use the content of the BoK to construct a workforce survey where the current government geospatial workforce can validate and prioritize the content of the BoK.
 - Develop/adapt an introductory course or modules that provide the fundamental (core) geospatial skills as outlined in the BoK (or subsequent improved version of it) that are needed by the mainstream geospatial workforce across the government.
 - Create additional units under existing knowledge areas and create additional knowledge areas related to government workforce-driven applications for specific job classifications.
- 2.2 The FGDC should work with the geospatial community to develop a communication infrastructure and methods to facilitate geospatial information exchange, such as a website and e-mail list to facilitate communication.
 - Disseminate current information on professional geospatial development opportunities, training materials, tutorials and links to online resources.
 - Provide information about geospatial internship and mentorship opportunities.
 - Participate in and help coordinate GIS awareness events, such as GIS day and GIS education conferences.
- 2.3 The FGDC Secretariat should follow up with UCGIS and the Department of Labor on the status of the partnerships for developing mutual goals and programs to establish a clearinghouse for internship, work experience, and service learning programs; and the GeoTech Center on building

partnerships for developing a competency model for a program of study that provides guidelines for geospatial education programs for Federal government employees.

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Geographic Information Science and Technology Body of Knowledge; David DiBiase, University Consortium for Geographic Information Science, Model Curricula Task Force, Body of Knowledge Advisory Board - Association of American Geographers 2006.

Secrets to Developing a GIS-Skilled Workforce; Lt Col. Mike Wermuth and Lt. Col. Jeth Fogg; January – March 2006, ESRI ArcUser Online.

Defining the Components of the Geospatial Workforce—Who Are We?; Dr. Duane F. Marble, Castlereagh Enterprises, Inc.; Winter 2005 – 2006, ESRI ArcNew Online.

Geography Matter, an ESRI White Paper, September 2002.

Learning to Think Spatially; The National Academies, Report in Brief, July 2005

Integrating Geographic Information Systems and Remote Sensing for Technical Workshop Training at Two-Year Colleges; National Science Foundation, August 15 and 16 2005 Workshop Outcomes.

What is GIS: A Profession, Niche, or Tool? Geospatial Information & Technology Association (GITA) White Paper; June 2005.

Geospatial Technology Competency Model

<http://www.careeronestop.org/competencymodel/>

Department of Labor Employment and Training Program

<http://www.doleta.gov>

UCGIS Geographic Information Science and Technology Body of Knowledge

<http://www.ucgis.org/priorities/education/modelcurriculumproject.asp>

GeoTech Center – GTCM Page

<http://www.geotechcenter.org/Projects/Research-Projects/Geospatial-Technology-Competency-Model/>

United States Geospatial Intelligence Foundation

<http://usgif.org/>

United States Geospatial Intelligence Foundation – Accreditation

<http://usgif.org/education/accreditation>

National Geospatial Technology Skills Competition

<http://www.geotechcenter.org/Maps-Competitions/Competitions>

Competency Model Clearinghouse

<http://www.careeronestop.org/competencymodel/default.aspx>

Office of Apprenticeship, U.S. Department of Labor

[http://www.doleta.gov/OA/bul05/Bulletin%202005-08%20Occ%20\(lms\)-Occ-Geospatial%20Specialist.pdf](http://www.doleta.gov/OA/bul05/Bulletin%202005-08%20Occ%20(lms)-Occ-Geospatial%20Specialist.pdf)

Updating “Externally” Focused [GIS Themed] SOC Standard Occupational Classification Codes and “Internally” Focused Federal Occupational Series Classifications

By: Dave DiSera

Research Assistance and Contributions by DOI Interns Edgar Pedroza and Chad Rogers

Background/Overview

Both the Department of Labor’s Bureau of Labor Statistics (BLS) and the Office of Personnel Management (OPM) produce occupational classifications which assist in federal, public, and private sector workforce development through the development of guidelines which outline general responsibilities, qualifications, and characteristics for particular fields of employment.

Occupational classifications focusing on geospatial workforce positions are found under both the BLS Standard Occupational Classifications, as well as under the OPM Federal Occupational Series Codes. The categories are as follows:

- BLS 17-2021 - Cartographers and Photogrammetrists
- BLS 17-3031 - Surveying and Mapping Technicians
- OPM GS-1370 - Cartographer
- OPM GS-1371 - Cartographic Technician

In an effort to guide recommendations, on behalf of the National Geographic Advisory Committee, regarding geospatial workforce development in public and private sector, a comparative analysis of both occupational codes is suggested to determine opportunities for revision. These revisions would focus on the sector areas where the occupational codes may best address recent changes in technology, operations, and current geospatial competencies.

Emerging Trends and Best Practices

Existing occupation models in geospatial workforce development have relied on pairing positions to the occupational codes developed by BLS and OPM. Yet, as with many industries that have been impacted by advances in technology, workforce activities in the geospatial field have also been transformed by changes in technology regarding cartographic functions, operations, and services. Therefore, there is a significant opportunity to modernize the schedule of occupational characteristics to address changes in relevant technologies.

Emerging trends in geospatial workforce development have focused on the application of competency models as opposed to delineating a finite set of skills that may be performed at each occupational level. This has been advanced by the release of the Geospatial Technology Competency Model, developed by the Department of Labor’s Employment and Training Administration (ETA). The Geospatial Technology Competency Model accounts for all position levels within the geospatial technology sector and pairs each with respective competencies. The model provides for competency requirements for personal, academic, professional, technical, and managerial positions. The model demonstrates skills, critical work functions, and technical content areas respective to each competency level.

Opportunities and Challenges

Position classifications often focus on specific skills, some which do not reflect current occupation-specific trends in technology. This includes both the BLS Standard Occupational Classifications and the OPM Federal Occupation Series Codes.

To address the changing requirements of the geospatial workforce, in both the public and private sectors, revisions to the occupational series codes should be made to reflect advances and changes in technology and industry practices.

These changes would reflect professional and technical work in the physical science sector encompassing of the cartography related positions under both sets of occupation specifications. With respect to professional and technical work, the skills, critical work functions, and technical content areas that may need revision include technology oriented services, operations, and functions. Many of these revisions will relate to understanding, operating, and managing computer-based Geographic Information Systems.

BLS Standard Occupational Classifications

Potential changes or revisions to the BLS Standard Occupational Classifications may include the following:

17-2021 Cartographers and Photogrammetrists

- Increase the number of illustrative examples to include GIS Technician and GIS related positions.

17-3031 Surveying and Mapping Technicians

- Indicate there may be distinctions between physical and digital operations.
- Include provisions noting that surveying, mapping, and analysis functions may occur primarily in digital forms.

OPM Federal Occupational Series Codes

Potential changes or revisions to the OPM Federal Occupational Series Codes may include the following:

GS-1370 Cartographer

- Include provision that mapping duties may occur primarily in computer-based GIS environments.
- Brief description of Geographic Information Systems as related to cartography duties.
- Include mention of orthographic imagery, aerial imagery, and satellite imagery, LIDAR, and other related technologies:

GS-1371 Cartographic Technician

- Indicate that many operations will occur as computer-based analyses and calculations.
- Include provisions noting that that many operations will occur in GIS environments.

Beyond the Standard Occupational Classification Codes and Federal Occupational Series Classifications listed above, the Subcommittee recommends that additional analysis be conducted to address additional occupations related to Surveying (Geomatics) and Geodesy as a "Phase 2" of this project for potential updates or changes.

Active Organizations and Their Focus Areas

The **Bureau of Labor Statistics** at the **U.S. Department of Labor** sponsors SOC Standard Occupational Codes which briefly describe position characteristics, in respect to subject matter, responsibilities, and technical involvement. The SOC codes also include illustrative examples of likely positions under the classification, as well as the code relation to the SOC Broad Occupation, Minor Group, and Major Group. The SOC codes are intended for external use as a tool for position classification, as they do not include grading criteria for position grades within the federal government.

The **Office of Personnel Management** sponsors Federal Occupational Series Classifications which also account for position characteristics, in respect to subject matter, responsibilities, and technical involvement. The codes also include specifications as to the professional/ technical nature of the classification. Respectively, these specifications include grading criteria illustrations and factor level illustrations to determine position grades within the federal government. For this reason, Federal Occupational series Classifications are intended for internal use within the federal government.

The **Employment and Training Administration** at the **U.S Department of Labor** has developed the Geospatial Technology Competency Model. The model seeks to serve as guidance to help determine the responsibilities, skills, and technical proficiencies necessary at different grades of employment within the related family of geospatial occupations.

Figure 1 contains a table a comparison of workforce development model characteristics between the Standard Occupational Classification Codes, the Federal Occupational Series Classifications, and the Geospatial Competency Model.

Recommendations

The NGAC recommends that FGDC work with the appropriate organization to update “externally” focused [GIS themed] SOC Standard Occupational Classification Codes and “internally” focused Federal Occupational Series Classifications, by acting on the following:

- 3.1 The FGDC should partner with the DOI Office of Human Resources to engage OPM in an effort to review, update, and modernize the geospatially-oriented Federal Occupational Series Codes (including the Cartography, Cartographic Technician, Surveying [Geomatics] and Geodesy series). The revisions to the Federal Occupational Series Codes should incorporate themes and approaches from the Geospatial Technology Competency Model.
- 3.2 FGDC, DOL, and the Federal human resource management community should collaborate with non-federal partners to encourage the use and adoption of the Geospatial Technology Competency Model and the updated Occupational Classification Codes and Series.
- 3.3 FGDC partner agencies should communicate with their academic partners about the revised occupational codes and competency model to facilitate development of appropriate training and curricula to address emerging geospatial workforce needs.

Resources Reviewed and Related Links

Standard Occupational Classification, Bureau of Labor Statistics

<http://www.bls.gov/soc/2010/soc171021.htm>

<http://www.bls.gov/soc/2010/soc173031.htm>

Federal Occupational Series Classifications, U.S. Office of Personnel Management

<http://www.opm.gov/fedclass/g31300p.pdf>

<http://www.opm.gov/fedclass/g31300t.pdf>

Qualification Standards, U.S. Office of Personnel Management

<http://www.opm.gov/qualifications/standards/IORs/g31300/1370.htm>

<http://www.opm.gov/qualifications/standards/IORs/g31300/1371.htm>

Geospatial Technology Competency Model, Employment and Training Administration, U.S. Dept. of Labor

<http://www.careeronestop.org/competencymodel/pyramid.aspx?geo=Y>



Figure 1. Workforce Development Model Characteristics

Summary of Recommendations

The following includes a summary of recommendations from each of the three white papers.

- 1. Identify synergies with the Administration's Science, Technology, Engineering, and Mathematics (STEM) education initiatives, assess opportunities to incorporate Geospatial and Geomatics education into the four STEM categories, and assess potential role/involvement/support from FGDC and NGAC.**
 - 1.1 The FGDC leadership should work with and encourage CoSTEM to include geospatial technology and geomatics as components of the STEM disciplines.
 - 1.2 The FGDC Secretariat and agency members should review and comment on the results of the CoSTEM Inventory of Federal STEM Programs and the CoSTEM Report on Federal Coordination.
 - 1.3 The FGDC leadership should encourage awareness among FGDC member agencies regarding the importance of opportunities for geospatial technology related grants, such as the NSF's Geography and Spatial Sciences Program and NOAA's Cooperative Remote Sensing Science and Technology Center. Consider inviting NSF and NOAA to brief FGDC on how this model may be applied at other departments and agencies.
 - 1.4 The FGDC leadership should encourage FGDC member agencies to establish internship, fellowship programs, cooperative education, or exchange programs that give students practical understanding and real-world experience with geospatial technology and applications.
 - 1.5 The FGDC leadership should encourage FGDC member agencies to support geographic literacy through their respective education and outreach programs.
- 2. Utilize the DOL Geospatial Competency Model to meet Federal/State/Local/Tribal Government needs for assisting in succession planning, knowledge management and transfer, employee development, and work or organizational change.**
 - 2.1 The FGDC should collaborate with UCGIS and AAG to determine if the Body of Knowledge for GI Science and Technology's knowledge areas encompasses the breadth of the geospatial technology field from a government perspective.
 - 2.2 The FGDC should work with the geospatial community to develop a communication infrastructure and methods to facilitate geospatial information exchange, such as a website to improve communication.
 - 2.3 The FGDC Secretariat should follow up with UCGIS and the Department of Labor on the status of the partnerships for developing mutual goals and programs to establish a clearinghouse for internship, work experience, and service learning programs; and the GeoTech Center on building partnerships for developing a competency model for a program of study that provides guidelines for geospatial education programs.
- 3. Update externally" focused [GIS themed] SOC Standard Occupational Classification Codes and "Internally" focused Federal Occupational Series Classifications.**
 - 3.1 The FGDC should partner with the DOI Office of Human Resources to engage OPM in an effort to review, update, and modernize the geospatially-oriented Federal Occupational Series Codes (including the Cartography, Cartographic Technician, Surveying and Geodesy series). The revisions to the Federal Occupational Series Codes should incorporate themes and approaches from the Competency Model.
 - 3.2 FGDC, DOL, and the Federal human resource management community should collaborate with non-federal partners to encourage the use and adoption of the Geospatial Technology Competency Model and the updated Occupational Classification Codes and Series.
 - 3.3 FGDC partner agencies should communicate with their academic partners about the revised occupational codes and competency model to facilitate development of appropriate training and curricula to address emerging geospatial workforce needs.

- ⁱ "Why STEM?" *Change the Equation*. 2011. <<http://www.changetheequation.org/why/why-stem/>>.
- ⁱⁱ "NSTC Committee on Science, Technology, Engineering, and Math Education." OSTP. 2011. <<http://www.whitehouse.gov/administration/eop/ostp/nstc/committees/costem>>.
- ⁱⁱⁱ "Geography and Spatial Sciences (GSS)." National Science Foundation. 2011. <http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5410>.
- ^{iv} "CREST Research Overview." NOAA-CREST. 2010. <<http://crest.ccny.cuny.edu/research/>>.
- ^v "Improving Science, Technology, Engineering, and Mathematics (STEM) Education. U.S. Department of Education. 14 February 2011. <<http://www2.ed.gov/about/overview/budget/budget12/crosscuttingissues/stemed.pdf>>.
- ^{vi} "Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future." President's Council of Advisors on Science and Technology. September 2010. <<http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf>>.
- ^{vii} "Higher Education: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends." Government Accountability Office. October 2005. <<http://www.gao.gov/new.items/d06114.pdf>>.
- ^{viii} "STEM-Designated Degree Program List." Department of Homeland Security. 2008. <<http://www.ice.gov/sevis/stemlist.htm>>.
- ^{ix} "Higher Education: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends." Government Accountability Office. October 2005. <<http://www.gao.gov/new.items/d06114.pdf>>.
- ^x IBID p. 32-35.
- ^{xi} "No Child Left Behind Act of 2001." Definitions: "Core Academic Subject." 115 STAT. 1958. <<http://www2.ed.gov/policy/elsec/leg/esea02/107-110.pdf>>.
- ^{xii} "No Core Subject But Geography Left Behind: Program Funding Levels for Core Subjects under NCLB – FY 2002-2007." National Geographic. <<http://www.nationalgeographic.com/foundation/pdf/NCLBAcademicAppropriations.pdf>>.
- ^{xiii} "Geography 2010: National Assessment of Education Progress at Grades 4, 8, and 12." National Center for Education Statistics. U.S. Department of Education. July 2011. <<http://nces.ed.gov/nationsreportcard/pdf/main2010/2011467.pdf>>.
- ^{xiv} "Teaching Geography is Fundamental Act." H.R. 885. Rep. Chris Van Hollen. 112th Cong., 1st Sess. (2011); "Teaching Geography is Fundamental Act." S.434. Sen. Thad Cochran. 112th Cong., 1st Sess. (2011)
- ^{xv} "Education: Grad Schools." *U.S. News and World Report*. <<http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools>>.
- ^{xvi} Phone discussion with a director for the GSS Program.
- ^{xvii} "NOAA-CREST Center Based At CCNY Receives Five-Year, \$12.5 Million Funding Commitment." The City College of New York. <<http://www1.ccny.cuny.edu/prospective/gsoe/news/noaa-funding.cfm>>.



THE GRADUATE SCHOOL

UNIVERSITY *of* WASHINGTON

OVERVIEW OF GRADUATE SCHOOL COUNCIL ROLE IN REVIEWING

NEW GRADUATE CERTIFICATE AND GRADUATE DEGREE PROGRAM PROPOSALS

(REVISED SEPTEMBER 23, 2013)

The Graduate Council plays an important role in the university's process for designing and implementing new graduate certificate and degree programs. Below is a brief description of the Council's role for each kind of program:

New Graduate Certificate Programs

A graduate certificate program is a linked series of credit bearing graduate courses that constitutes a coherent body of study. It is designed to enhance the education of matriculated graduate students and professional students or to provide continuing education to graduate non-matriculated (GNM) students. Graduate certificate programs require a minimum of 15 quarter-credits, the successful completion of which yields notation on the student's transcript.

Any proposal for a new graduate certificate will go through a proposal development process, facilitated by staff in the Graduate School (as outlined in the document found at: <http://www.grad.washington.edu/fac-staff/programreviews/guidelines-certificates.shtml>). This process helps the proposing unit develop a proposal that will address issues such as demand/need for the program, purpose of the program, curriculum and course evaluation/student assessment, governance and structure, admissions and graduation standards, and budget.

Once the proposal is fleshed out, it will be sent to internal and external constituents for comment. It is after this 10-day comment period that a revised proposal will be put before the Graduate School Council, along with an oral presentation by the proposing unit, for review.

The Council's Role:

1. The Council's role is, fundamentally, to either:
 - a. Provide the Dean of the Graduate School with a formal recommendation to advance the proposal—pending the unit's revisions according to the Council's recommendations—to the Board of Regents for formal approval; or
 - b. To provide the Graduate School with concrete feedback it can communicate back to the proposing unit that outlines specific issues that must be addressed before the Council can recommend advancement to the Board of Regents.

2. The Council should use its discretion, as a multi-disciplinary body of duly elected faculty members, in asking questions of the proposing unit that help make the case for the proposed program's positive impact on the intellectual life of graduate students at the university. It should also consider the program's ability to stimulate the intellectual work of faculty and the proposing unit(s).

3. A flowchart depicting the approval process is attached, but can also be found at: <http://www.grad.washington.edu/fac-staff/programreviews/new.shtml>

New Graduate Degree Programs

Designing, gaining university and state-level approval, and launching a new graduate degree program is a major undertaking. The Graduate School has created a detailed process description, which can be found at: <http://www.grad.washington.edu/fac-staff/programreviews/guidelines-new-degrees.shtml>

What's important to keep in mind from the Council's perspective is that proposals that come before the Council for consideration will have already undergone an extensive array of steps, including an initial design process with staff in the Graduate School, a 10-day internal comment period, and peer review by external experts.

The Council's Role:

1. The Council's role is, fundamentally, to either: a. Provide the Dean of the Graduate School with a formal recommendation to advance the proposal—pending the unit's revisions according to the Council's recommendations—to the Board of Regents for approval or
b. To provide the Graduate School with concrete feedback it can communicate back to the proposing unit that outlines specific issues that must be addressed before the Council can recommend advancement to the UW Board of Regents.

2. Like above, the Council should use its discretion, as a multi-disciplinary body of duly elected faculty members, in asking questions of the proposing unit that help make the case for the proposed program's positive impact on the intellectual life of graduate students at the university. It should also consider the program's ability to stimulate the intellectual work of faculty and the proposing unit(s).

3. Attached (and also found at: <http://www.grad.washington.edu/fac-staff/programreviews/flowchart-newprogram.pdf>) is a flow chart that depicts these steps.

Here are some additional thoughts...

The Graduate Council is the only elected body of faculty that comes together to provide a comprehensive, three-campus, voice for graduate education at the University of Washington. The Council has the benefit of seeing across the multitude of programs at the university, given its unique composition of members. As such, it can give proposing units great insight into how their proposed programs fit into the landscape of our university's program offerings. The Council also has the ability to offer proposing units insight into how their proposed new programs can collaborate with, and even leverage, existing efforts within other departments, schools, or colleges.

Moreover, because all new programs will eventually undergo an academic program review, the Council should consider offering the proposing units with any and all feedback it believes the unit should aim to address in the first years of the new program's existence. The Council might consider these issues five years later, when the program undergoes its first mandatory academic program review.

Review of Master of Science in Geospatial Technologies Proposal

Urban Studies Program, University of Washington-Tacoma

By Daniel Sui
Department of Geography
The Ohio State University

Guiding Questions for New Degree Proposals

1) Does the program demonstrate a coherent design, reflecting appropriate depth and breadth, curriculum, sequencing of courses, synthesis of learning, and assessment of learning outcomes?

The proposed program is a good start and its design still needs a bit more work to balance breadth vs. depth. The sequencing of courses is pedagogically sound with built-in synthesis of learning at the interface of GIS and planning. Assessment of learning outcomes is also reasonably well thought out at this stage, although I expect that further fine-tuning may be needed periodically according to students' feedbacks.

2) How does the program compare to other institutions' programs? Is it traditional? Is it innovative ("cutting edge") in some way(s)?

The proposed program is not traditional, in the sense that it is significantly different from those programs currently offered by other institutions (i.e. those mentioned in the proposal). The emphasis on web and mobile GIS is innovative— I need more detailed course materials to provide more substantive comments, but based upon the two syllabuses sent to me (for courses on *Introduction to Geospatial Technology* and *GIS Customization and Automation*), topics covered are quite up to date. The only caveat I have is that "geospatial technology" is a much broader umbrella term, and the course syllabus sent to me seems to cover only portions of GIS technology. If the course is titled "geospatial technology," I suggest to broaden the topics a bit to include GPS, remote sensing, spatial statistics, etc.

3) Does the program respond to current trends in the field?

Yes, the proposed program in general reflects the trends in the field, but the proposal does not adequately define the market niche and potential customers it serves. I think it is crucial for the faculty and staff involved in the program to clearly define the market and customers the proposed program serves at this stage. Are they training GIS analysts for local planning and environmental agencies? If so, what skills and knowledge are needed for those positions? Are the proposed courses capable of meeting these demands? I noticed that the initial plan is to enroll 20 students in the program, which seems to be reasonable according to the faculty and staff size, but I am unclear on how they come up with the number of 20? Have they conducted

any detailed market analysis? Any backup plans for the program in case the enrollment is below 20?

4) Are student learning outcomes appropriate and clearly defined?

In general, yes. Perhaps there is not enough emphasis on issues related to database development and data quality assessment. Coverage on the social and political dimensions of geospatial technologies can also be expanded.

5) Is the student assessment system adequate, stellar, innovative? Why?

According to the two syllabuses provided, the student assessment portion of the program is not adequately developed. This part of the proposal needs more work. The student assessment system presented in the proposal is too general and vague, more detailed metrics for evaluating students need to be produced.

6) Is the program assessment system adequate, stellar, innovative? Why?

Similar to the student assessment, the overall program assessment is limited, it needs more work. Instead of the solo thesis option, I suggest more options (e.g. professional projects) should be given to students. I also noticed that graduation rates and student placements are really critical for the long-term success for programs like this. From the proposal, I wasn't clear on where students enrolled in this program will be placed. A clear vision on student place issue will be extremely helping for marketing this program. I also suggest student placement should be tracked annually as an integral part of the program assessment system once the program is in full operation.

7) Are the resources (faculty, administrative, facility, equipment) appropriate?

Yes, the resources (faculty, administrative, facility, equipment) seem to be adequate/sufficient, but for its long-term sustainable growth, the two temporary instructors should be upgraded to tenure-track positions.

8) What are the program's strengths and weaknesses?

The proposed program could potentially make its trademark based upon its emphasis on web and mobile GIS, spatial/analytical, and cartographic skills. For its actual implementation, the program needs to clearly define its market niche. For successful GIS applications in urban and environmental planning, students enrolled in the program need to understand that it takes more than cutting edge technologies to succeed. The proposed program is a bit too technocratic without any due attention to the social and political dimensions of geospatial technologies.

9) What are your recommendations?

Here are my suggestions to improve the proposed program:

- a. Beefing up both the student assessment and program assessment system, spelling out measurable metrics and milestones;
- b. Instead of all required courses, I suggest putting only 2-3 mandatory courses in the curriculum and making all other courses as electives so that students can have some choices according to their interests and professional development goals. More specifically, I suggest you consider the following curriculum changes:
 - 1). One course on geo-design will serve the students well if they are interested in GIS and planning;
 - 2). In the web/mobile GIS courses, put more emphasis on open GIS and crowdsourcing, volunteered geographic information (VGI), and the growing importance of location-based social media;
 - 3). In collaboration with other programs on campus (i.e. statistics/computer science), develop an optional/general elective course on big spatial data and data analytics;
 - 4). To expose students to the complex social and political dimensions of geospatial technologies, one required course on alternative GIS (alt.gis), critical GIS, or GIS & Society will be very helpful.



Department of Geography and Geoinformation Science

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March 9, 2014

Re: Review of the proposal for a new Master of Science in Geospatial Technologies program

Reviewer:

Anthony Stefanidis

Acting Chair, Department of Geography and Geoinformation Science

George Mason University

Email: astefani@gmu.edu

1) Does the program demonstrate a coherent design, reflecting appropriate depth and breadth, curriculum, sequencing of courses, synthesis of learning, and assessment of learning outcomes?

The proposal is for the establishment of a MS degree in Geospatial Technologies at the University of Washington – Tacoma (UW-T). In order to provide it with a particular identity, the faculty behind this effort have identified location-based mobile applications, and the management of web-based geospatial data as the particular thematic focus of the program. I believe that selecting this thematic focus is a smart move, as it is both forward looking and academically exciting.

According to Appendix I, the program requires 8 5-credit courses (including a two-part Capstone course), and it is expected that students will be able to complete the program within a year. Based on a quick search through the UW-T website it appears that the 40 credits is not uncommon for MS programs (e.g. the capstone-option MSCSS program).

The program is intended for students who have some work experience, and as such it is expected that they will already possess a base-level of understanding and knowledge in GIScience. However, given the focus of the program I expect that the program may also attract graduates from other programs. Currently, the proposed curriculum would make it impossible for such students to enter the program. Therefore, I would propose that some consideration is given on adding an Intro GIScience course (as an option) so that students with diverse backgrounds can take that course and raise to the level where they can pursue the rest of the program. My understanding is that 'Intro to Geospatial technology' is not this type of course, but of course I could be wrong as I do not have the course syllabus.

Besides this issue the proposed layout of the program appears to be very reasonable and well thought. The plans to assess the program are rather generic, but this is to a certain extent expected given that this is a new program. There is a reference to a review of 'applied thesis projects' (Section VI) which I assume refers to the review of the Capstone projects. Involving the broader community in this assessment is not a bad idea, and presumable this will also include their involvement in the project definition stage. Furthermore, it seems to be implied that the projects may be performed in groups (rather than individually).

2) How does the program compare to other institutions' programs? Is it traditional? Is it innovative ("cutting edge") in some way(s)?

In Section III the proposal lists some other programs that may be considered comparable to this one. I could argue that this list is a bit arbitrary, as there are dozens (to say the least) GIScience programs that may be viewed as comparable to this effort. Nevertheless, the proposal makes a very smart choice to identify the program's thematic focus to be location-based mobile applications, and the management of web-based geospatial data. This provides the program with a particular character that will help it attract students from other competitors.

3) Does the program respond to current trends in the field?

Yes, very much so. The thematic areas of the proposal reflect current trends in our field.

While this is clearly a very strong point for the proposed program, it also imposes a challenge. Currently the program is staffed with 2 faculty, with 2 more additions planned for next academic year. Needless to say, these additions will be critical to the success of the program, and expecting to hire in such cutting-edge areas may prove to be slightly challenging.

4) Are student learning outcomes appropriate and clearly defined?

They are appropriate indeed, and they are adequately identified. The challenge again is that these courses are planned, and lacking particular syllabi and past performance metrics makes it difficult to assess them in more detail.

5) Is the student assessment system adequate, stellar, innovative? Why?

As I mentioned earlier, if there is a weakness to be found in this proposal, it is the assessment part. It can be considered adequate, but it lacks innovation.

Regarding student assessment, other than standard in-course options, and a reference to 'faculty meeting quarterly to evaluate the evidence of student achievement', we do not get much else. This is one part where the proposal could be improved. For example, the instructors could set tangible targets for the students to achieve (ranging from the development of new apps to publications for appropriate outlets) that could both set expectations of excellence for the students, and provide metrics for their assessment.

6) Is the program assessment system adequate, stellar, innovative? Why?

The above statement applies here too. Section VI provides a rather generic plan for program assessment (e.g. after 5 years), but it would be nice to set targets that will help evaluate the performance of the project (e.g. faculty employment data, graduation rates, etc.)

7) Are the resources (faculty, administrative, facility, equipment) appropriate?

The *planned* faculty resources (a total of four faculty, including two hires over the next few months) should be adequate to handle the program. The administrative and equipment requests appear adequate.

8) What are the program's strengths and weaknesses?

The particular thematic focus of this program is its major strength. It is appropriate, forward-looking, and has a level of uniqueness that will make it attractive.

The major weakness is that we have to project when trying to assess its likely success, lacking syllabi and metrics of past performance.

But I believe that the promise of success justifies the risk of proceeding with it.

9) What are your recommendations?

I believe that UW-T should support the faculty proposing this new program, and provide the support they need to make it a reality.

Respectfully,



Dr. Anthony Stefanidis
Acting Chair, Dept. of Geography and Geoinformation Science
Director, Center for Geospatial Intelligence
astefani@gmu.edu

To: APCC
From: Ali Modarres, Urban Studies
CC: Ginger McDonald and Augustine McCaffery
Date: March 10, 2014

Re: Response to External Reviewers

We are grateful for the positive and informative comments made by external reviewers on this proposal. As indicated below, their comments and suggestions do not require any changes in the latest version of the proposal sent to Ms. McCaffery. Therefore, I will provide our response in the form of a memo.

Response to External Reviewers:

- We do plan to conduct annual assessments of the courses and the program, at least during the first few years. Each summer, the proposed graduate faculty will evaluate learning outcomes and programmatic outcomes. For the latter (as mentioned in the proposal), we will be using the capstone courses as a major tool. Annual assessments will occur during summer 2015 and 2016, and any necessary fine-tuning will be implemented in the following academic years. As indicated by one of the reviewers, we will be looking at student projects and products (e.g., new apps) to assess the quality of each course. We will also use graduation rates and employment placement to monitor the quantitative outcome of the MS program.
- GPS, remote sensing and statistics are incorporated in the proposed courses. We do not need to offer separate courses in these subjects.
- We have worked closely with various employers in this region. As our letters of support suggest, they are fully aware of what we have been teaching and are enthusiastic about the implementation of this MS program. We are confident not only that this program will be well-received by local and regional employers, but also that our graduates will be competitive nationally.
- The choice of 20 students as our initial target is by necessity and choice. At this point, we are offering a certificate in GIS. Our current GIS lab and computational facilities do not allow us to accept more students. However, this works perfectly for our assessment and the plan for fine-tuning the program. By Fall 2016, we will be ready to respond to the market, expand our computational resources, and grow the program (to annual cohorts of 40). Please note that we will be providing students with mobile technologies and should have little difficulty expanding the number of majors by Fall 2016.
- Students enrolled in this program will largely come from our certificate program, but also will be recruited regionally and nationally. We will be hiring a Program Advisor who will also have the job of recruiting students for this MS program.
- Social and political issues are interwoven into the proposed program. After all, we already teach courses on critical GIS. As a program dedicated to social justice issues,

we consider sociopolitical dynamics an important component of our ecology of knowledge.

- Database development, data quality assessment, and geo-design are also interwoven into the proposed courses. Open GIS and crowdsourcing, volunteered geographic information (VGI), and location-based social media are fully incorporated as well. In fact, both of our faculty hires specialize in these topics.
- Please note that we have already recruited two faculty members who will join us in Autumn 2014.
- Big Data is a part of the Institute of Technology. We will be working with their mobile technology faculty members, as needed, to address any needed/specialized training in this area.
- As indicated in our proposal, we are not hiring temporary faculty members. Both positions are tenure-track.
- Since we are following the cohort model, the program cannot provide the suggested model of two or three mandatory courses and having the rest as electives. This is a one-year MS program. We need to make sure that the necessary knowledge transfer and training occurs within the span of four quarters.
- Intro to Geospatial Technologies does include Intro to GIScience. However, if the reviewer's suggestion is that students without a GIS background be admitted to this program, it would be impossible to do so. As a one-year program, students need to have a sufficient background (as described in the proposal) to handle the proposed eight courses. In special cases, however, we will admit a student with deficiencies. Such students will first finish our GIS certificate and then begin the MS program in the autumn quarter after the completion of the certificate program.