

3/31/00 *DRAFT*

## **GIS CERTIFICATION AND ACCREDITATION: IT'S TIME TO GET SERIOUS**

**(LEST WE ALL BECOME "DATA MAPPERS")**

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It's time for GIS professionals and academicians to define what a GIS professional does and what skills it takes to become a good GIS professional. Why? Because if we don't, it is likely that others who have no expertise in geographic information systems will. This may not seem important to us who already are GIS professionals, but think about what it means for the future.

Consider the periodical, *U.S. NEWS*(1), that told the world in its issue of November 1, 1999, that one of the 21 "Hot Jobs for the 21<sup>st</sup> Century" is that of the "Data mapper". (See **Figure 1**.) The "Data mapper", *U.S. NEWS* reports, makes about \$30,000 in the Midwest with no experience and no advanced college degree. Experience or a master's degree raises that salary to about \$40,000 per year. What does it take to be one of these "Data mappers"? "...expertise in information systems, computer science, or public administration.", the authority says. More importantly, what does a "Data mapper" do? Make maps of crime in Pittsburgh, *USN* says. While they do report that "...experts predict nearly all local governments will join in over the next decade..." , they seem to miss the point about why these governments use GIS technology, stating that it is to "...make government data available in clickable maps on the Internet. (*MapQuest.com* is one example.)".

As a former GIS practitioner, and as a current GIS educator, this "news" that *U.S. NEWS* is disseminating, alarms me. I don't know what the circulation of *U.S. NEWS* is, nor do I have any idea how many people have read this particular article, but I can make a pretty good guess that there are a lot of young people investigating possible careers and a lot of parents helping their children decide on their future careers. Many have probably formed an opinion about our profession based upon the news that is given in **Figure 1**. That opinion might be that:

***The Data mapper is a good job that pays well, requires skills in computers and public administration, and works with crime reports over the Internet.***

*(Think about that, geographers, surveyors, etc.!)*

Now, I've been involved with GIS technology since 1974 (yes, 26 years) and in all that time I have never heard of a position in government called "Data mapper". My experience tells me that *U.S. NEWS* is talking about the GIS profession. What do you think?

If you knew nothing about the GIS profession but had a child who needs career guidance, wouldn't you appreciate this information about hot jobs that *U.S. NEWS* provides and encourage your child to become a "Data mapper"? Wouldn't you read this web page – this issue of the periodical and suggest that your child study computer science or public administration at a university that specializes in those fields? Where do you think high school guidance counselors get the information that students need to plan for their future: their career and their degree? Not from URISA, UCGIS, GITA, or the others. I suspect that they, or at least the students, get it from The Web – like this piece from *U.S.NEWS*.

What worries me is that young people are making decisions about their future without receiving guidance or other information from professional and academic institutions who are knowledgeable about what it takes to become a GIS professional – or what a GIS professional does.

### **The government steps in**

Whether it is fortunate or not, the U.S. Department of Labor has seen this need and has studied our profession for inclusion in its O\*NET, The Occupational Information Network(2). O\*NET is a database that contains "information on the knowledge, skills, abilities, interests, preparation, contexts, and tasks associated with 1,122 occupations." According to O\*NET:

***The Geographic Information System Specialist "Design[s] and coordinate[s] the development of integrated geographical information system database of spatial and non-spatial data; and develop[s] analyses and presentation of this data, applying knowledge of geographic information system."***

Further, O\*NET lists 13 specific tasks that make up the position (**See Figure 2.**). This definition and the tasks appear to me to fairly represent the job of a GIS Specialist as I know it, but it is clear that *U.S.NEWS* had no idea that O\*NET existed (or, at least, did not have an occupation listed for "Data mapper"! ). My guess, also, is that far fewer young people and their parents know about O\*NET and those who actually have visited the site may not have observed this title (among the 1,122 available), and certainly did not get any job outlook information for the GIS Specialist since the O\*NET job outlook for this position includes the job outlook for all computer-related jobs.

### **Educators in the dark, too**

Another reason why we need to get serious about defining the profession and the skills needed to be good at it because some educators of these young people are in the dark about the GIS profession, too. The National Center for Geographic Information and Analysis (NCGIA) has developed a model curriculum for GIS education(3), however, that curriculum

is directed towards “Geographic Information *Scientists*” rather than practitioners filling these Geographic Information *System Specialist* positions. The University Consortium for Geographic Information Science (UCGIS) is now in the process of developing a model undergraduate GIS curriculum, but that also will be focused on producing GI Scientists. Nowhere are guidelines provided on what GIS *practitioners* should be taught.

This means that, right now, anyone can teach anything and call it a “GIS Education”. Right now there are six formal Masters programs in the US for GIS(4), sixteen professional certificate programs at US universities(4), and countless other GIS courses and certificate programs being conducted by non-academic and commercial institutions (including an “Introduction to GIS Certificate(5)” one can obtain on the Internet after completing only 12 lessons). Who knows if the skills being taught in these programs are needed to become a GIS professional?

If, as *U.S.NEWS* predicts, there will be a need for 16,000 more GIS professionals in the next decade in local government alone, then GIS educators in the U.S. appear to be pretty well set as far as job security goes. But, there are no guidelines for them on what to teach. Take, for example, the following two email messages I received last year:

*“Professor William Huxhold:*

*‘I am setting up a GIS Certificate program for...Community College. You had mentioned that GIS professional standards would be coming out before too long. Do you know if there are state or national standards for GIS professionals in place? Do we need to apply for accreditation for the certificate to be valid? Is there other information that I should pursue regarding a certification program? Thank you for your time.’*

*“Hello:*

*‘I am interested in learning more about GIS Certification Standards and what steps we need to take to become an accredited community college. Do you have this information? If not, what is the status of certification standards for GIS professionals? Thank you.’*

My response to these messages was this:

*“The status is this: There are no GIS professional standards. There are no state or national standards for GIS professionals. There is no process for accrediting GIS certificate programs or any GIS educational programs, for that matter. There is, however, a lot of information about the topic available and many people believe that GIS certification and/or accreditation is imminent. Some organizations are even doing something about it. So, for now, you can do anything you want to “certify” the GIS skills you teach – but keep informed because the situation is likely to change .”*

After 30 or more years of experience in implementing and using geographic information systems, the state of GIS professionalism in the US remains as it was back in the 1960s and 1970s: **no professional standards** for GIS professionals, and **no evaluation of educational programs** for institutions that confer GIS certificates on its graduates about to enter the GIS profession. Can it be that anyone can pass himself off as a “GIS Professional”? Worse, can it be that anyone can pass herself off as knowing what to teach the student of GIS? Have we not learned anything in 30 years that we should pass on to our successors in the field of geographic information systems?

Of course we have learned things, and of course we have passed on our knowledge to others just beginning the trek into GISland. What we have not done, however, is to institutionally acknowledge that people who work with GIS have unique skills because we have not recorded what those unique skills should be and we have not evaluated those who claim to possess them. We have not, it turns out, defined what skills are needed to be a good "GIS Professional".

### **Is there a GIS profession?**

Are the size of the workforce, the formalization of educational programs, and the establishment of an occupational title by the federal government enough to make a "GIS Profession"? "No", D.L. Pugh (Pugh 1989) would say. As reported by Dr. Nancy Obermeyer (1993), Pugh's research (into another profession) found no less than eight attributes that are common among all professions. Let's see how GIS stacks up against other professions with regards to these attributes:

*Does GIS have a **Specialized Body of Knowledge**?* **YES**

The work of NCGIA, UCGIS, URISA, the U.S. Labor Department, and the academic institutions with formal GIS educational programs are evidence of this. (They might not all agree on what that body is, but they do agree that there is one!)

*Does GIS have a **Mission**?* **YES**

Ask anyone working with geographic information systems why they believe geographic information systems are important. They all will tell you that geographic information systems are a way for organizations to become more efficient and more effective to the benefit of all people. (For sure, many young people place GIS more on the order of a religion.) Our Vice President has even defined a mission for GIS technology in his call for the "Digital Earth" (Gore, 1998)

*Is there a **Formal Organization**?* **YES**

Some feel that there are more formal organizations than necessary. In addition to the aforementioned NCGIA, UCGIS, and URISA, the National States Geographic Information Council (NSGIC), the US Government's Federal Geographic Data Committee (FGDC), the Open GIS Consortium (OGC), and the Geographic Information Technology Association (GITA), which was formerly know as AM/FM International, also have GIS as a primary interest. In addition, geographic

information systems are an important part of the American Association of Geographers (AAG), the American Society for Photogrammetry and Remote Sensing (ASPRS), the American Congress on Surveying and Mapping (ACSM), the Management Association for Private Photogrammetric Surveyors (MAPPS), the National Imagery and Mapping Agency (NIMA), and the National Transportation Research Board (NTRB) that has a special GIS conference, GIS-T.

*Does GIS have a **Common Language**?*

**YES**

Not to mention the common acronyms (NAD, DEM, OGC, O-O, NSDI, etc.), words are also unique to GIS people. Ask a botanist, a physicist, an astronomer, a doctor, or a playwright what a "node" is. You will get five different answers and none will be the same as a GIS professional's node. GIS jargon runs rampantly throughout the dozens of professional publications dedicated to GIS technology.

*Is there **Specialized Training** for GIS?*

**YES**

Academic degrees, specializations, certificate programs, university courses, and a variety of workshops by professional organizations, vendors, institutes, and educational organizations are available for specialized GIS training throughout the nation.

*Does GIS have a special **Culture and Lore**?*

**YES**

Those of us two dozen "old-timers" who helped celebrate Jack Dangermond's 50th birthday a few years ago (sorry, Jack) provided a fascinating three-hour oral anecdotal history of GIS. Many of the GIS tall tales were repeated (and embellished?) there. Now, Timothy Foresman (Foresman 1998) has captured some of this culture and lore in his edited book about the history of GIS, many chapters of which having been written by those who were at the birthday party. Even a "Hall of Fame", of sorts, has evolved through the publishing of the top ten GIS movers and shakers by a professional GIS publication. There even exists a "History of GIS Project" listserv at H-GIS@lsv.uky.edu.

*Is there a **GIS Code of Ethics**?*

**NO**

In spite of Will Craig's plea for a GIS Code of Ethics (Craig, 1993), no such standard has been established. Metadata standards of the National

Spatial Data Infrastructure (NSDI) effort include a disclosure of data accuracy and quality, and proposed legislation in some states call for restrictions on who can maintain cadastral records in a GIS. These two small steps indicate a trend towards some consensus on the normative aspects of data in a GIS, but there still is no standard of human or professional character of the people working with GIS.

*Is there a **Licensing or Certification** program?*

**NO**

Outside of ASPRS's adoption of the certification of a "Certified Mapping Scientist, GIS/LIS", there is no licensing or certification of GIS generalists. Two related efforts, however, are underway: A committee of the International Organization for Standardization (ISO) in March, 1999, approved a work item to "develop a Type 3 report, which describes a system for the qualification and certification, by a central independent authority, of personnel in the field of Geographic Information Science/Geomatics" for each country; and some states have adopted a law that would restrict "creating or updating subdivision data in a GIS" to a licensed surveyor or civil engineer. Certification has also been addressed in the literature (Obermeyer, Burley, Goodchild and Kemp), and URISA has established a GIS Certification Committee charged with implementation of such a program. (URISA has established a Web presence, [www.urisa.org](http://www.urisa.org), for issues regarding certification including a "Decision Room" where interested people can (and do) post their opinions on the topic.)

Judging the GIS occupation against the criteria established by Pugh, it would appear that there is no GIS profession (in spite of the number of people in it) because we have no Code of Ethics and we have no licensure or certification of those who work in it, although some efforts are close with regards to some aspects of the technology. (Note: Measuring the GIS Profession against Pugh's criteria was first done by Michael Goodchild and Karen Kemp in 1992 (Goodchild and Kemp 1992), and then later in 1994 by Nancy Obermeyer (Obermeyer 1994). Both also concluded that GIS had not yet met all criteria.)

### **Certification or accreditation?**

There are two ways to determine if a person has the skills needed to practice a profession:

1) Identify the skills needed and then evaluate each person's proficiency in those skills (certification); or, 2) Identify what skills should be taught to aspiring professionals and then

evaluate how well each educational program teaches those skills (accreditation). Some professions use both (planners and engineers, for two).

### **Why certify individuals?**

Other than completing the requirements (at least Pugh's) for defining a profession, why is certification important - or, at least, being discussed?

The practical mind might think the answer to that is easy: a certificate will help new professionals enter the job market easier or with a higher salary and it will make it easier for GIS managers and human resource professionals to identify qualified candidates for job openings. But when one reviews other professions on the topic, the answer becomes broader.

The National Certification Commission, an independent not-for-profit organization established in 1993 consists of 150 professional organizations representing 200 categories of professions (2.2 million professionals). Its 1999 National Certification Census obtained responses from 188 programs that certified professionals in 390 different categories of certification(6). Of these responses, the major benefits of certification reported were:

- Practitioner recognition
- Advancement of knowledge; and
- Promotion of skills to the public

Wikle (1998) would believe that these same benefits apply to GIS certification, citing Morrison (1993):

- Recognition and professional development that is valued by employers
- The addition of prestige to a field
- Public benefit by the encouragement of higher levels of competency among practitioners

Other benefits that have been realized by other professions include:

- Higher salaries of certified professionals
- Substitution for years of experience for new hires
- More objective means for Human Resource Managers to screen applicants

### **Why Accredited GIS Education Programs?**

“Accreditation is an institutional rather than an individual designation that can be bestowed upon an academic programme in recognition for meeting specific criteria involving curricula, faculty numbers and qualifications, and facilities.” (Wikle 1998)

Why, one asks, would a profession accredit educational programs? Other than the fact that it is more efficient (evaluating one educational program that matriculates scores or hundreds

of students is much more efficient than evaluating each one of those students), the literature reports the following reasons:

Accreditation of educational programs **assures competency** of individuals because it ensures that a standard set of skills is presented to all potential professionals. The criteria established by the profession are used during the accreditation process as a measure of the skills available for learning.

It also **evaluates competency** because the program assesses how much each student masters through the process of testing and grading.

It **allows for disciplines** (planning, surveying, geography, MIS, etc.) to determine a specific GIS skill set necessary to apply the technology to the needs of that discipline. This means that a GIS professional need not know everything there is to know about the technology (as the U.S. Department of Labor would like in its O\*NET description), but will know the basic concepts that all GIS professionals must know plus those that are specific to a given.

It **assures quality** of the individuals coming out of the educational process because educational programs have strict requirements for matriculation. In many cases, individuals are screened both when they enter the program (meeting certain criteria just to be allowed to study the subject), and when they graduate (meeting criteria on courses completed and grade point average). Educational institutions have a "built in" quality control assurance process - grades and course requirements.

Perhaps the most compelling incentive for an educational institution to support an accreditation process is that once accredited, it can **attract more and better students** because those students would most likely not desire to be educated at institutions that do not meet accreditation standards.

But there are many reasons for educational institutions to oppose the accreditation process - not the least of which is academic freedom - the power to control the transfer of knowledge from instructor to student. Without a specific "GIS Department" in these universities, it would be difficult to hold any particular person or office within a university responsible for delivering the prescribed curriculum. Accrediting the formal programs - GIS degrees and certificates - is much more feasible, but has very little impact on the profession as a whole, considering the small number of formalized GIS education programs available

### **So, if we don't, who will?**

The **International Organization for Standardization (ISO)**, prepared a document in May of 1998 that was entitled "Qualifications and Certification of Personnel (IST/TC 211), proposing that each country administer individual certification or institutional accreditation for three GIS job titles: GIS/Geomatics Technologist, GIS/Geomatics Professional, and GIS/Geomatics Manager.

In March, 1999, the ISO/TC 211 Committee on Geographic Information/Geomatics approved a work item to “develop a Type 3 report, which describes a system for the qualification and certification, by a central independent body, of personnel in the field of Geographic Information Science/Geomatics”. If adopted, this standard would require each country to establish a single organization that would:

- Define the boundaries between GIS/Geomatics and other related disciplines and professions.
- Specify the technologies and tasks pertaining to GIS/Geomatics.
- Establish skill sets and competency levels for technologists, professional staff, and management in the field.
- Research the relationship between this initiative and other similar certification processes performed by existing professional associations.
- Develop a plan for the accreditation of candidate institutions and programs, for the certification of individuals in the workforce, and for collaboration with other professional bodies.

Clearly, if this standard becomes adopted, the U.S. will be required to either create an organization or designate an existing organization that will be responsible for determining the skills and competency levels required for GIS professionals as well as planning for the accreditation of GIS educational programs. Which organization will that be? Will those who make these decisions be knowledgeable about the "GIS Profession"?

#### **NOTES:**

- (1) Go to [www.usnews.com](http://www.usnews.com) and then to the back issues: November 1, 1999. Then to “2000 Career Guide”, “Hot Jobs Tracks 2000”, and “Government”. Direct at: ([www.usnews.com/usnews/issue/991101/nycu/core13.htm](http://www.usnews.com/usnews/issue/991101/nycu/core13.htm) )
- (2) O\*NET, The Occupational Information Network can be downloaded free of charge from: [www.access.gpo.gov/o\\_net/download\\_onet.html](http://www.access.gpo.gov/o_net/download_onet.html) . A description of O\*NET is available at: [www.doleta.gov/programs/onet/onet2txt.htm](http://www.doleta.gov/programs/onet/onet2txt.htm)
- (3) The National Center for Geographic Information and Analysis (NCGIA) Core Curriculum in GIS Science can be seen at: [www.ncgia.ucsb.edu/pubs/core.html](http://www.ncgia.ucsb.edu/pubs/core.html)
- (4) Karen Kemp maintains a web site for the UCGIS Education Committee that identifies GIS Certificate and Masters Programs at: [www.gisc.berkeley.edu/~kemp/certificates.html](http://www.gisc.berkeley.edu/~kemp/certificates.html)
- (5) I hesitate to publicize this commercial GIS training enterprise by providing its URL because I have not yet researched its program. I know only that there is a web site course where anyone can go to, pay a fee, and eventually receive a "GIS Certificate".
- (6) Go to the National Certification Commission at: [www.inc.com/users/jaffeson.html](http://www.inc.com/users/jaffeson.html)

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NOTE: The most comprehensive bibliography on this topic can be found in the Thomas A. Wikle paper (Wikle 1998) near the end of this list.

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