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**Operation GIS: Cooperation = Graduation**  
**Developing a GIS Skilled Workforce**

**ABSTRACT**

The US Air Force Academy faculty learned the secret to successfully graduating a GIS skilled workforce. In 2004, we formed a GIS Working Group and were amazed by the wealth of resources hidden within various departments. We had computers, software, expertise, and funds. Unfortunately, we did not have a strategic plan to develop students who were proficient in GIS technologies. Cooperation now results in advancement of educational outcomes. This approach is also providing more funds for GIS research and closer relationships with outside organizations.

Interested? Don't "reinvent the wheel." Learn how we educate GIS professionals (students and faculty) with our "start to finish" approach. We integrated across the Academy to develop a comprehensive, multi-disciplinary curriculum, See the positive synergistic outcome an integrated GIS solution brings to the academic environment and how it can translate into a more productive workforce.

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## **Operation GIS: Cooperation = Graduation** **Developing a GIS Skilled Workforce**

### **INTRODUCTION**

A little bit here, a little bit there, and a lot of misunderstanding everywhere. This phrase accurately described the GIS situation at the United States Air Force Academy (USAFA) when Mike Wermuth was asked to temporarily fill the Director of Geosciences position in the spring of 2004. Mike found himself responsible for a division that he knew little about. So he used a leadership technique that had worked well for him in the past. He grabbed a notebook, started wandering around, and asked a bunch of questions. He acted dumb, which was easy to do under the circumstances. He soon teamed up with Jeth Fogg from the Department of Civil and Environmental Engineering (DFCE). Mike learned early on that DFCE was leading the way in many areas of GIS at USAFA. What they learned is captured in this paper. They learned that the Academy has great GIS resources in the form of people and. They also learned that progress with GIS in the past was very slow and that most of the faculty has no idea what GIS is all about. They also learned that if you get the right group of people together you can make positive things happen in a hurry. In the next few pages we will share some of the steps we took in planning our program, what our program looks like, how we are promoting the program, as well as the valuable partnerships that we are forming. The goal is to share our story, in hopes that you can accomplish even greater success in GIS education.

### **PLANNING**

Reading some history might not be exciting, but we think you will discover some key lessons in our simple story. Mike started asking questions in the geography department. He asked all the basic who, what, where, and how questions. The faculty gave him some very concerned looks

when he started asking the “why” questions. Imagine what your reaction, if your boss asked you, “Why do we bother to teach GIS?” Why should the taxpayers pay for a GIS program at our university? And why on earth would a student ever want to take a GIS class?

Secret #1: If you want your GIS program to succeed, you must have compelling answers to these questions. If you cannot give compelling answers to these questions, there is no future for your GIS program and you are wasting valuable resources that should be used elsewhere. Fortunately, Mike and Jeth work with people who are excited about GIS technology and the impact it is having on the military. They were encouraged to press on!

Since Mike was clueless about GIS and teaching GIS, he wanted to surround himself with smart people. Therefore, he asked some of the “who” questions. Who has the money? Who can find the data sets? Who makes the electron flow? And who knows how to make the software hum? The answers to these questions were a little surprising and started to get the program rolling.

It turns out that the smart people were spread throughout the faculty. There were remote sensing expertise in the Physics Department, the civil engineers and geographers were experimenting with classroom teaching techniques. The Biology Department had field experience with data collection and there were a couple of faculty members in the Computer Science Department that were interested in software development. We invited this group of individuals to get together and we formed a “Working Group.” Once the word got out, we were pleasantly surprised to learn the library, Military Studies, and Space Operations programs were interested in what we were doing and became part of our working group.

Secret #2: No department at your university has a monopoly on GIS information, expertise, and experience. You can choose to compete with one another or cooperate. We chose to cooperate.

## **PROGRAM**

There is an efficiency associated with the working group. There is an economic efficiency related to sharing resources. There is also an intellectual efficiency associated with the working group. The collective knowledge and wisdom the group brings was instrumental to developing a comprehensive course curriculum. The Air Force Academy has a large academic core course requirement; therefore, it is nearly impossible to carve out distinct GIS courses within the core curriculum. However, through the cooperation of the working group, we were able to identify GIS curriculum “opportunities” within existing core courses. We used the versatile nature of GIS to gain footholds in many departments. For example, every cadet is required to enroll and successfully complete Social Science (Soc Sci) 112, which is a geopolitics course. An important learning objective of the course is to discuss the “Information Instrument of Power.” Since the Central Intelligence Agency (CIA) and the National Geospatial-Intelligence Agency (NGA) use remote sensing and ESRI ArcMap products to brief the National Security Council on current events, we use this as an opportunity to introduce the cadets to ArcMap software and the concepts of remote sensing. This introduction is the second step in our building block approach. The first step in our building block process is to load FalconView and ArcGIS 9.1 on the cadet computers. In Soc Sci 112 we only expect the cadets to point and click and manipulate data that is provided for them. In their sophomore year they will take Civil Engineering (Civ Engr) 210. In this course they will learn to build and manipulate a database. In one of the course exercises

the cadets are asked to “build” an expeditionary air base beddown location and populate the base with deployed units. This includes planning for utility systems, tent city layout and pre attack planning activities. They must also query the system to take post attack actions to recover the installation they have developed. This is all accomplished in an ArcMap 9.0 environment.

Thanks to the coordination efforts of the working group, we now use ArMap 9.0 as a standard software application across the curriculum, with an expected faculty and student wide upgrade to ArcMap 9.1 in the near future. Previously, students were getting frustrated and their learning was stunted when one department used an Arc 3.3 platform for classroom activities, while another department used an 8.3 platform. Thanks to the working group, these problems have been solved and we continue to move ahead. As juniors, every student is required to take one of three core option courses. One third of the students (about 300) select Geo 310, the Geospatial Information Analysis course. This course requires students to understand how GIS works and how to make the technology work for them. If students continue in the Geo-Intelligence (GEOINT) major, they will take Geo 410, the Advanced Geospatial Information Analysis course and a Remote Sensing Course, Geo 382. Unfortunately, enrollment numbers start to drop off to approximately 20 students in each of these courses, but the options at the senior level are growing rapidly. Many upper division courses across the curriculum are seeing the advantages of integrating GIS technology into their research in almost every discipline. They are starting to recognize that many businesses are using GIS in disciplines like biology, management, and political science. Therefore, the demand is increasing for graduates to understand GIS technology. While our core course building block approach works well in Soc Sci 122 and Civ Engr 210, it falls apart a little during the transition from Civ Engr 210 to the upper division courses for non-GEOINT majors. We have computer scientists that see the demand for the

technology but do not receive the much needed education and training in geospatial analysis concepts. We have the same challenge with biologists and operations research scientists. Bridging this educational gap will be a challenge we will continue to address in the coming academic year.

The economic advantage comes in the sharing of resources. We have several departments that receive small grants from organizations like the National Science Foundation (NSF), Headquarters Air Force (HAF), and the National Geospatial-intelligence Agency (NGA). Each grant has its own restrictions. However, the equipment and services purchased by one department can be used by many other departments. For example, the Geography Department (DFEG) and the Civil and Environmental Engineering Department (DFCE) both use Trimble GPS backpacks and handheld GPS equipment. DFCE has the greatest demand for the equipment during their summer academic program, whereas DFEG uses the equipment during the traditional academic year. Last year DFEG bought two handheld GPS units to satisfy a DFCE. In turn, DFCE is using GEOBASE funds from the Headquarters Air Force to develop GIS tutorial software for classroom use. During our working group meetings we learned a lot about existing capabilities just by having a needs discussion. We were surprised to learn what already existed within other departments by talking about needs and wants. We also prevented duplication of effort. For example, in our spring working group meeting we had a discussion about multispectral analysis software. We learned that two departments had undertaken projects to identify software and funding and learned that the operations research staff was ready to fund the purchase of ArcLogistics software. They were very excited to learn from the technology staff that ArcLogistics was already included in the Academy's ESRI site license.

## **PROMOTION**

Building support for the program is critical. We are working to inform the leadership and our colleagues about GIS technology and its application. Within the Air Force we have many people that do not understand GIS. We are at the point with our program that cadets are eager to use GIS technology in course projects, but they are being discouraged by faculty because GIS is a non-traditional approach. Our experience is that the older faculty members either do not appreciate the analytical power of GIS methods or do not know how to grade GIS products. We are all creatures of habit and need some encouragement and motivation to change. The faculty members that we have reached responded favorably to our presentations and are generally willing to explore the capabilities and pursue GIS technology integration. We admit that it has been very time consuming to sit down with individual instructors and teach them the software and it is difficult to get larger groups together for more efficient training. Our most successful large scale presentations were in the form of GIS Day displays with question and answer time and a 45 minute lunchtime presentation. We are scheduled to give a brief presentation at our new faculty orientation course in early July and in the fall we plan to write an article for our faculty newsletter. We are also negotiating to present an executive brief of GIS in the curriculum at a meeting of the Dean and Department Heads.

## **PARTNERSHIPS**

The program at the Air Force Academy would not be possible (as we know it) without the support we have received from partners like the National Geospatial-Intelligence Agency, the Army's Spectral Operations Resource Center (SORC), and the Headquarters Air Force Geo-Integration Office (HAF /GIO). The HAF/GIO and the InnoVision Directorate of NGA are financial partners. The local NGA offices and the SORC are wonderful about sharing experience

and resources. We are working with several other partners in the region to include the City of Colorado Springs and the University of Colorado. Similar to what we are doing on campus, we continue to expand our contacts within the local GIS community. We encourage you to network with like minded geoscientists in your area. Talk to them about potential student research projects, funding opportunities, and data sharing (meaningful data is powerful classroom instruction material). Look around and we believe you will be surprised at what is available with regard to expertise, equipment, and funding\*.

## **CONCLUSION**

We are excited about what we have seen and done in the past year. The working group has developed a first draft strategic plan addressing curriculum development (the GIS Program), promoting GIS at the Academy, and leveraging Partnerships for intellectual and financial gain. Thirty-five percent of the Class of 2005 graduated knowing how to use GIS software that is loaded on their computers. Approximately 50% of the Class of 2006 will be GIS literate and have ArcMap loaded on their computers. We are on track to see 100% of the Class of 2007 (and beyond) GIS literate and ready to use their geospatial skills in their military careers. We hope we have stimulated some ideas for your GIS program and we wish you much success!

\* You can start looking for grants with a Google search for "NGA Academic Research Program (NARP)"

## **AUTHOR INFORMATION**

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