A Flexible Traditional and Non-traditional Learner Program for Geospatial Knowledge and Training in Remote Sensing (RS), Geographic Information Systems (GIS) and Global Positioning Systems (GPS) for Cartographic Modeling and Representation

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1. Introduction

Marshall Community and Technical College (MCTC) in cooperation with Marshall University (MU) is implementing a scalable Geospatial Technician training program serving the largely rural region of southern West Virginia and including parts of eastern Kentucky and southeastern Ohio with instruction planned to begin in the fall of 2005. The Geospatial Technician training will consist of courses incorporating remote sensing (RS) and Geographic Information System (GIS), and Global Positioning System (GPS) technologies integrated as an Image Mapbase for Cartographic representation. This program has these goals: (1) Develop a series of Geospatial Technician courses within an Associate in Science (AS) transfer degree in partnership with high schools, business and government stakeholders; (2) Develop Geospatial content to be delivered in a number of traditional and non-traditional methods; (3) Enhance enrollment in MCTC continuing education and transfer courses via partnerships with high schools, and business and government stakeholders; (4) Establish co-operative work-experience opportunities for students; (5) Develop vendor certification opportunities through continuing education, college credit transfer programs, transfer degrees, and training workshops for non-traditional student retraining and life-long learning; (6) Develop articulation agreements to facilitate a seamless transition by featuring multiple exit and re-entry points for students to proceed from high school or the workplace to a vendor recognized certification through continuing education training or a two-year Associate in Science (AS) or Board of Governors (BOG) associate degree allowing transfer to a bachelor's Board of Regents (BOR) degree and then to an advanced non-traditional Master of Science (MS) degree in a Geospatial related field i.e., Physical Science of Geobiophysical Modeling, at Marshall University from the College of Science.

2. Objectives

The intellectual and academic merit of this project is in the adaptation of a geospatial curriculum to both traditional and non-traditional programs providing flexibility to students and professionals in terms of time, place, and pace of study.

3. Methods and Techniques

The broader impact of this project is in an expansion of Geospatial knowledge and skills into the science curriculum of schools, the workplace, and government, resulting in an increase in trained Geospatial technicians (Phase I). A potential impact of the project is in a strategic vision incorporating an avenue to obtain geospatial knowledge and training at advanced levels and in advanced environments (Phase II).

Step 1 Access is made to the West Virginia (WV) Image data stored at the West Virginia GIS Technology Center in Mr. Sid Format via the Internet.

Step 2 The WV Image data is transferred electronically (downloaded via file transfer protocol (FTP)) over the World Wide Web (Internet).

Step 3 The downloaded WV Image data is a compressed 7.1 MB Mr. Sid file representing the DOQQ's of 55 counties in West Virginia.

Step 4 Using Mr. Sid Viewer, the compressed image file is decompressed into 138.3 MB of data stored on-site as a series of geotiff files representing the 55 counties of West Virginia.

Step 5 Define geotiff's projection (UTM 17, UTM 18). 52.5 counties are UTM 17 and 2.5 counties are UTM 18.

Step 6 Each DOQQ is compressed to a Enhanced Compressed Wavelet (ECW) format with a 1:10 compression ratio using ERMapper.

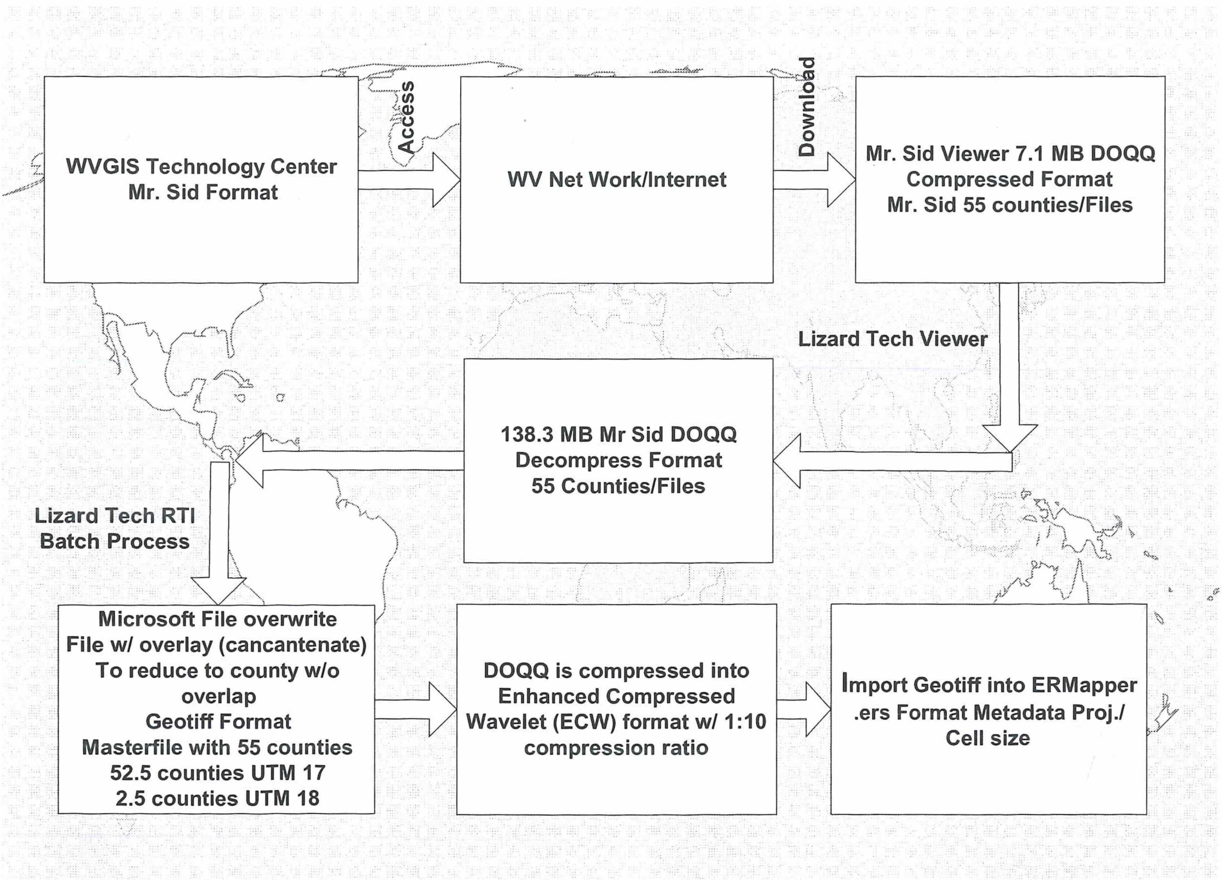

Figure 1: Image Process Flowchart.

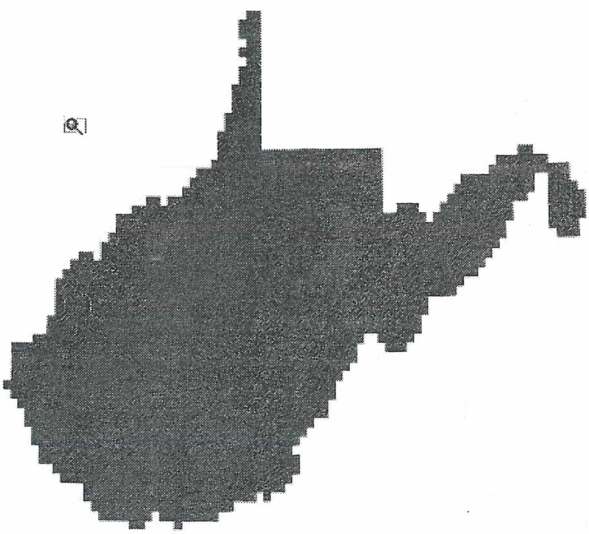

Figure 2: Over 2000 MR.SID Decompressed Format WV Digital Color Infared (CIR) –96, 97 Orthophoto Quad Quarter (DOQQ)'s at 138 MB each, mosaiced for a total 240GB 1-10 ratio ECW then a 1-3 ratio ECW of West Virginia State Image Mapbase results in a 9 GB Mosaiced Image.

Step 7 The compressed ECW files are imported into ER Mapper with an .ers file extension where they are mosaiced as in Figure 2 below.

The project will improve the technical education and training at the secondary, undergraduate and graduate levels within the academic fields utilizing Geospatial Systems such as: Remote Sensing (RS), Geographical Information Systems (GIS), Global Positioning System (GPS) techniques utilized in Image Mapbase Development for Cartographic representation.

Geospatial technologies have been identified by the joint United States of America Department of Labor's Department of Education Career Voyages website (www.career-voyages.gov) as an "emerging field" of "hot jobs" (Ref. 1). Their report indicated the geospatial technology industry is expected to grow by 6 times to $30 billion by 2005 and to continue this rocketing growth into the future. Further justification for these programs has been verified by the results of an August 2004 survey sent to 161 business and government entities. This survey conducted by Marshall Community and Technical College (MCTC) and the Nick J. Rahall Appalachian Region Transportation Institute (RTI) corroborated these national emerging trends among the regional workforce (Ref. 2)

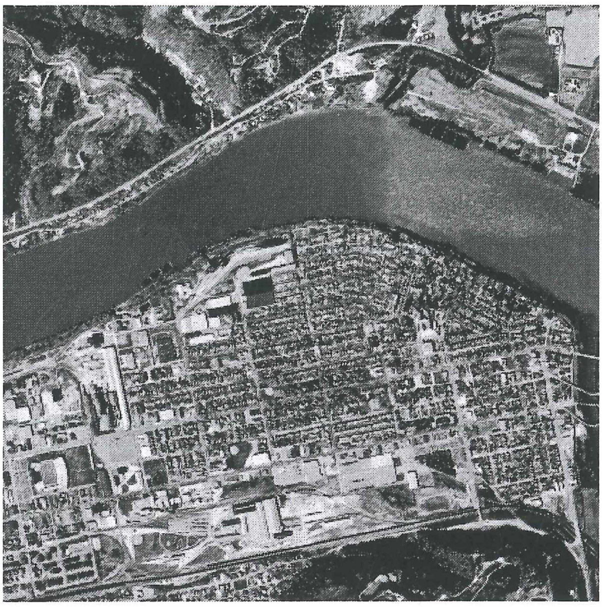

Figure 3: 73.4 Mb Section of a Digital Orthophoto Quad Quarter (DOQQ) of East Huntington, WV(Color 04).

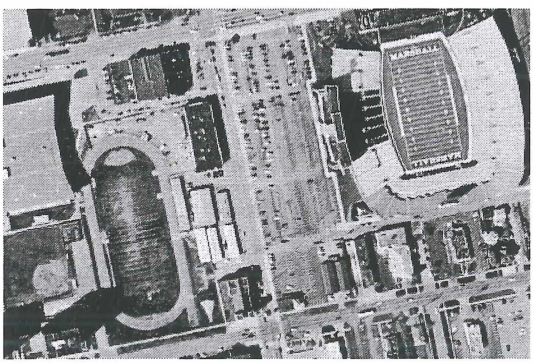

Figure 4: 1.24 Mb Section of Zoomed and Cropped(DOQQ) of Marshall University Stadium and Track, Huntington, WV(Color 04).

4. Results and Discussion

4.1. Survey

Fifty-one surveys on Geospatial technologies and activities were returned. This was an excellent response rate for a mailed survey. The results indicated that within the next three years, 55 % of the survey respondents indicated their firm planned to hire 1 to 5 employees, 5 % plan to hire 5 to 10 employees, and 5 % plan to hire more than 10 employees. Eighty eight percent of the survey respondents indicated their companies were willing to cover the cost of continuing education/workshop training for their employees. Ninety four percent of the survey respondents indicated they would be interested in receiving college credit for equivalent knowledge gained through their work history and life experiences. Eighty four percent of the survey respondents indicated they would be interested in applying training received in workshops to college credit at the associate degree or bachelor degree level. These statistics strongly support our program focus on reaching the non-traditional student through a non-traditional education path. The methods of training desired in the survey also supported our direction of program development. Most respondents indicated more than one training option. Forty percent would like web-based internet training, thirty percent would prefer the traditional college class/lab environment, twenty four percent would like on-site custom training, and sixty-eight percent would like to enhance their employee skills through short-term workshops or continuing education classes. There was a willingness to work with and support the Marshall Community and Technical College. Eight two percent of the respondents were willing to talk to a college representative about having customized training opportunities developed and delivered at their work site. Forty one percent of the respondents were willing to provide professional input into or serve on a college advisory committee as geospatial training options were being developed. From those surveyed, a Geospatial Advisory Committee has been established to guide curriculum development and secure business and government cooperation particularly reciprocity of internship opportunities for students of geospatial training programs at MCTC and MU and workforce training provided by MCTC. This Geospatial Advisory Committee reviewed the survey results, direction of training projects, and recommended in a September 2004 meeting that we proceed with the development of an integrated, non-traditional training program in geospatial studies between the high schools, the MCTC, business and government entities, and the four year institutions located at Marshall University. It also recommended that we pursue revenue sources to support the design, development and implementation of Remote Sensing, Geographic Information Systems, Global Positioning Systems, and technologies into geospatial education programs (Ref. 3).

4.2. Image Processing for Image Mapbase

Figure 1 represents the sequence of processing results that are mosaiced into a file of ECW format in ERMapper at a 1-10 ratio and further compressed by ECW to a 1-3 ratio which can be used in ArcGIS/MAP.

Figure 2: over 2000 DOQQ's are mosaiced at an ECW ratio of 1-10, then to an ECW ratio of 1-3 for an Image Mapbase of the State of West Virginia.

Figure 3 is a cropped image with a 60 cm Instantaneous Field of View (IFOV) RGB DOQQ section.

Figure 4 is a cropped figure 3 image with a 60 cm Instantaneous Field of View (IFOV) RGB DOQQ section.

5. Conclusions

While threads of associate, bachelor's, and master's level geospatial programs are extant among several campus departments at Marshall University, these threads have yet to be woven into a structured curriculum that would provide students geospatial training beginning in the public high school and continuing education workshops leading to proficiency certificates, two-year transfer options, four-year, and advanced degrees in geospatial studies. It is our intent to integrate existing and developing academic components into a structured organized education and training program at the high school, associate degree, and bachelors' degree levels. By focusing these efforts at the community college level we will also address identified goals established by the state for community colleges. In addition, a secondary longer-term advanced technology project will be identified that will build on the initial planning proposal providing an avenue for advanced education and training, research and development, image database management, and operational support.

Within the entire scope of geospatial training goals for the Marshall Community and Technical College and Marshall University, The focus of efforts will be the implementation of geospatial courses at the two-year level and requisite materials development and delivery methods. Year-one will involve the design of the over-all curriculum structure, travel to study, development of articulation agreements with high schools and vocational schools. The first year will include the development of an Introduction to Geospatial Technology course; development of content and lab modules for delivery by internet; short-term workshops; in the high school classroom; in traditional college classroom/labs, and in the training of high school teachers in geospatial content and instruction methods. Year-two will continue by evaluating the success of the first geospatial course and revising it where necessary, and training additional high school teachers in geospatial techniques. Additional articulation agreements will be developed with regional high schools. Further, depending on curriculum requirements, additional geospatial courses and their associated delivery methods will be developed.

The following Phase I diagram is a visual representation of the component elements that will come together to support the project that is being undertaken. They include:

- High School and Vocational Training Center components
- Two-year Continuing Education and Community College and Associate Degree components
- Four-year Cooperative Bachelor Degree components
- Supporting Government Agencies

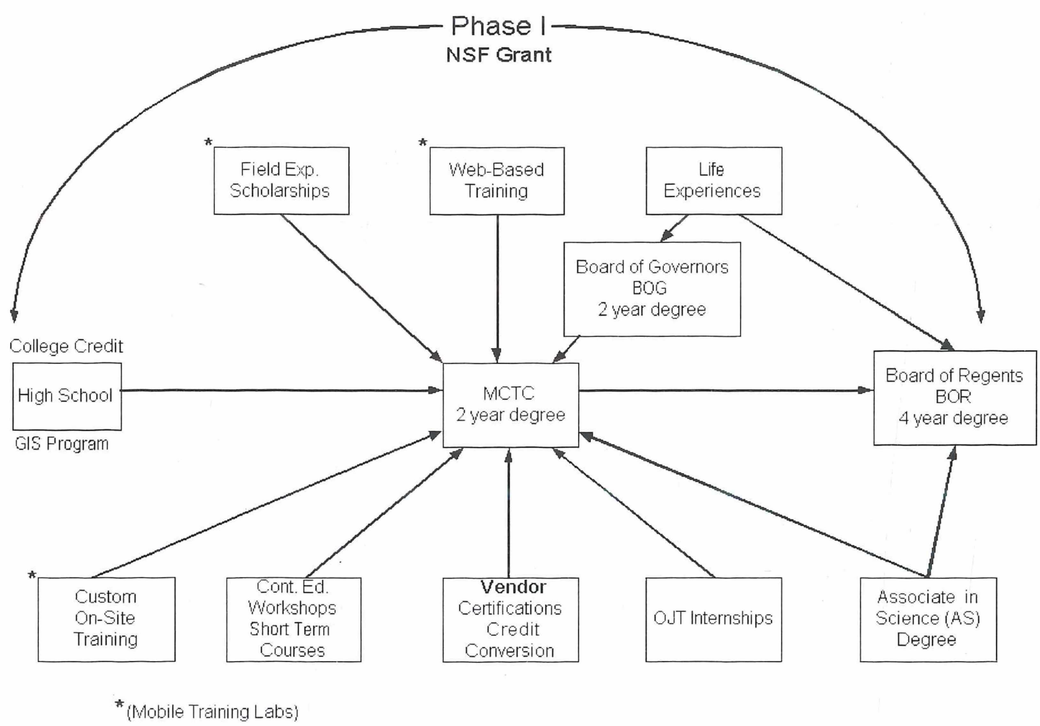

Figure 5: Phase I Structure.

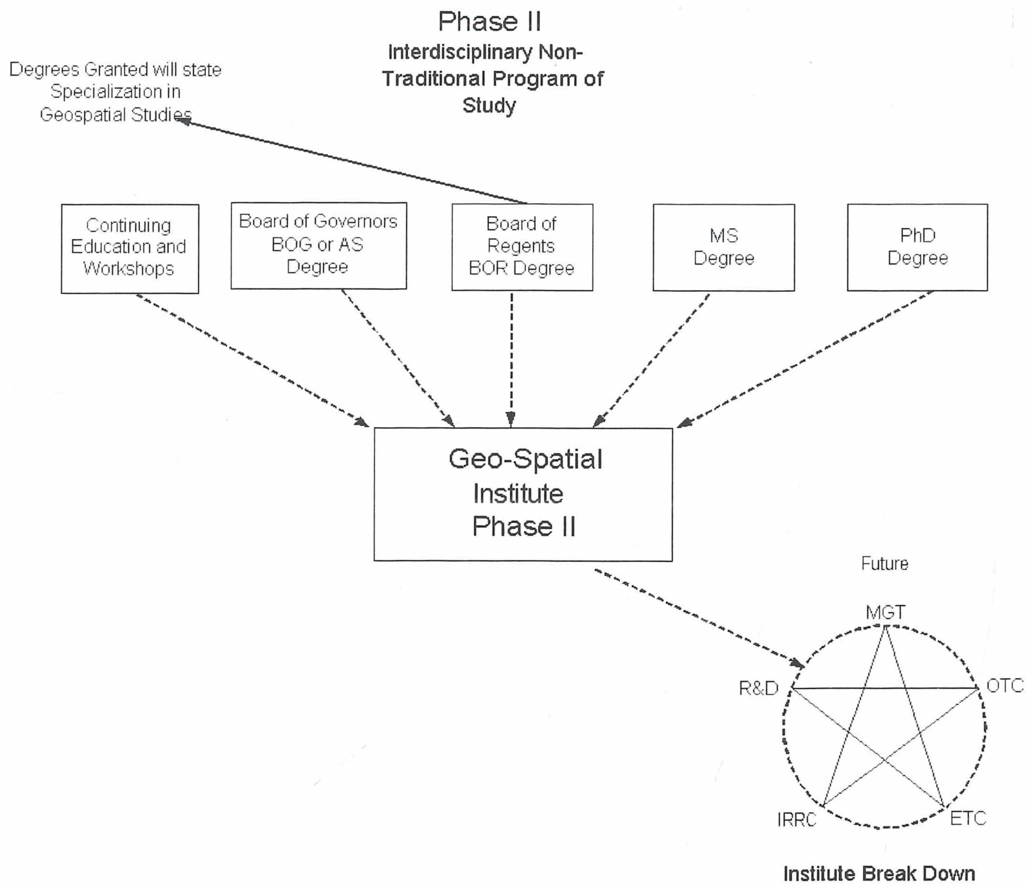

Figure 6: Phase II Structure.

- Supporting Business and Industries
- International Organizations
- Links to Graduate Programs

6. Future Directions

Interdisciplinary, non-traditional programs of study under the umbrella of an Institute of Geospatial Studies are being developed. This will be an umbrella organization tying together the associate, bachelor, master, and doctorate degrees. It will consist of five interrelated components: Education and Training, Research and Development, Information Resource and Retrieval, Operational Support, and Management.

References

(1) US Department of Labor—Department of Education Career Voyages website. [Online], Available from: URL http://www.careervoyages.gov, [Accessed 5 October 2004].

(2) Geospatial Survey, conducted by Marshall Community and Technical College (MCTC) and the Nick J. Rahall Appalachian Region Transportation Institute (RTI), August 2004.

(3) Geospatial Advisory Committee, September, 2004.

ERMapper 6.4, ERMapper Inc., San Diego CA and Perth, Australia.

Mr. Sid Viewer, Lizard Tech, Seattle, Washington.

ArcGIS/MAP, ESRI, Redlands, CA.

Nick J. Rahall II Appalachian Transportation Institute, Huntington West Virginia.

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