



Systemic Change in Advanced Technological Education

**External Evaluation Report**  
National Geospatial Technology Center (GEOTECH)  
YEAR 2  
February 13, 2009 through December 31, 2009

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## Executive Summary

The National Geospatial Technology Center (GeoTech) is working quickly to form a collaboration of community and technical colleges, universities, and industry to increase the quality, quantity, and diversity of workforce technicians in the geospatial technology industry. Year 2 activities have been far more focused than Year 1 activities, and the Center is benefitting from following last year's National Visiting Committee recommendations in setting priorities. Unforeseen opportunities continue to arise, however, so it continues to be important for the GeoTech team to remain focused on the core work of the Center.

Data collection for evaluation purposes improved dramatically over the past year, with all partner sites fully reporting and reporting on time. New data collection tools and timelines provided by the evaluators have helped. Baseline data is complete in all areas. Uniform surveys and data collection tools for faculty development and presentations have been developed in collaboration with the GeoTech teams and are now available for PIs and partners to use. These tools hold promise of streamlining and improving evaluation for the many professional development activities and presentations being provided by, or co-sponsored by, the GeoTech Center.

While there is insufficient data to draw conclusions about course/program growth and student demographics, there are early indicators that growth is already occurring in both numbers of courses and programs being offered as well as in student enrollments. Industry support for these programs also looks promising.

The website is evolving but is not yet fully functional or providing the anticipated Repository of educational support materials that have been aligned with identified national content standards. Website developer challenges have persisted and are not yet fully resolved.

The GeoTech team hit the ground running in September 2008 and has continued to function efficiently and collaboratively to achieve the goals of the Center. The PI/Center Director and staff at the GeoTech Center office at Del Mar College have sought and followed advice from other ATE Center Directors, are well organized, and appear to operate very efficiently and smoothly. The GeoTech team is improving in its ability to distribute responsibilities and yet function as a cohesive whole. Year 2 has been very successful by almost every measure, and the team is to be congratulated on a job well done.

## Introduction and Approach to Evaluation

SCATE Inc., lead by Elaine L. Craft, President/CEO, serves as the external evaluator of the Center. Assistance in this effort is provided by SCATE Inc. employee Melissa Miller, Data Analyst, and Special Projects Consultant, Dr. Helen Edens. Craft has worked with the GeoTech team on a regular basis throughout the year and periodically participates in team teleconferences. Face-to-face meetings have taken place at Hi-Tec and ATE PI conferences in Albuquerque and Washington D.C. respectively, and Craft met with GeoTech Co-PI Ann Johnson at the iGETT workshop in June 2009 in Corpus Christi, TX. The PI has been open and honest with sharing information. Numerous opportunities to observe the project team in action have been provided during the year.

The National Geospatial Technology Center (GeoTech) is working quickly to form a collaboration of community and technical colleges, universities, and industry, to increase the quality, quantity, and diversity of workforce technicians in the geospatial technology industry. All GeoTech partner institutions seek to engage under-represented minorities and women in geospatial technology programs. Co-PI Kenneth Yanow has specifically been assigned to coordinate the diversity effort.

The original evaluation plan for the project follows:

### **Goals and Outcomes of GeoTech**

The Center is seeking to

- Create a national clearinghouse of exemplary geospatial curriculum material and database web services.
- Increase the capacity to train geospatial technicians through new partnerships among colleges, universities, government, and industry.
- Increase the quantity, quality, and diversity of geospatial technicians to meet workforce needs.
- Increase the number of educators participating in geospatial professional development.
- Sustain the Center long-term by providing valued services to academic and industry partners and seeking collaborations and sources of funding to maintain and improve services and products.

If the Center meets its intended goals, the following outcomes should be attained.

- Models of exemplary geospatial programs in terms of technology, curriculum, articulation, and workforce education will be identified and broadly shared.
- The next generation of geospatial science students will include an increased number of under-represented minorities and women.
- The body of knowledge available to students, educators, researchers, and employers in the geospatial technology industry will be expanded.
- The capacity of two-year colleges to educate geospatial technicians will be increased.

- The quantity, quality, and diversity of geospatial technicians enrolling in and completing programs of study increased.
- Potential services, collaborations, and funding sources to sustain the work of the Center have emerged.

**Evaluation Plan  
National Geospatial Technology Center (GeoTech)**

<p>Goal 1: Create a national clearinghouse of exemplary geospatial curriculum material and resources website and a national geodatabase web service, aligned with nationally recognized core competencies as identified in University Consortium GIScience (UCGIS) Model Curriculum Body of Knowledge (BoK).</p>		
<b>Evaluation Questions</b>	<b>Data collected</b>	<b>Methodologies</b>
<p>Was a national clearinghouse of geospatial curriculum material established?            How many items have been added to the clearinghouse?            How effective was the clearinghouse in disseminating information?            Were effective methods developed for ascertaining the quality and usability of learning material submitted to the clearinghouse website?</p>	<p>-number of lessons, teaching/learning units, courses, etc.            -number of other teaching/learning resources            -number of geodatabase links and resources            -website usage statistics            -number of regional and national presentations made to promote the wide-spread use of the clearinghouse.            -number of products listed in the clearinghouse database.            -evidence of use of the clearinghouse by geospatial educators.            -review criteria and process documents            -NVC reports</p>	<p>-monitor and document the development of the clearinghouse.            -review and analyze website statistics            -review and document quality control processes            -review and document the quantity of materials available on the website            -monitor web-based evaluations by clearinghouse users.            -regular emails and conference calls with institutional partners            -review of NVC reports regarding effectiveness            -comparison of evidence to project goals/metrics</p>
<p>How were nationally recognized geospatial core competencies determined?            Were geodatabase and other web-based services developed by the Center useful to</p>	<p>-core competency determination process and reference source documents            -frequency of high school use of clearinghouse and web-based services            -frequency of college use of clearinghouse and web-based services</p>	<p>-monitor alignment of core competencies with documented state and/or national standards            -analyze website usage statistics            -on-site visits to attend planning and implementation sessions.            -partner surveys and/or</p>

secondary schools and colleges?		focus groups
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Goal 2: Increase the capacity to train geospatial technicians through new partnerships among community and technical colleges, universities, secondary schools, industry and government.		
<b>Evaluation Questions</b>	<b>Data collected</b>	<b>Methodologies</b>
<p>Are there more qualified geospatial technology teachers at educational institutions? Have more educational institutions introduced or expanded geospatial education courses or programs? Were partnerships among colleges, universities, government, and industry increased? By how many? Did articulation of credit increase between high school and college and between college and university?</p>	<ul style="list-style-type: none"> <li>-numbers of faculty trained through Center-offered or Center-supported faculty development events.</li> <li>-number of faculty attaining GST credentials, e.g., certification.</li> <li>-number of programs of collaboration between institutions and industry.</li> <li>- number of articulation activities/agreements between secondary schools and colleges, and between colleges and universities.</li> <li>-number of geospatial programs that currently exist in partner institutions.</li> <li>- titles of geospatial-related courses and programs offered at partner institutions during 2007-2008 academic year.</li> <li>-number of GST courses, programs, or programs adding a GST requirement at partner institutions.</li> </ul>	<ul style="list-style-type: none"> <li>-analyze project documentation related to faculty development</li> <li>-document baseline number and type of courses and then of programs being added or expanded over the course of the project</li> <li>-survey Co-PIs concerning programs at their institutions.</li> <li>-monitor the growth of geospatial programs at partner institutions</li> <li>-analyze evidence of articulation at all levels.</li> <li>-regular conference calls with partner institutions.</li> <li>-three on-site visits annually by evaluators to attend PI meetings, NVC and other advisory committee meetings, and to observe classes, interview instructors, students, and industry partners.</li> <li>-comparison of evidence to project goals/metrics.</li> </ul>

<p>What mentoring links exist between secondary school teachers and college faculty? Between college faculty and industry representatives?</p>	<p>Documented mentoring activities:</p> <ul style="list-style-type: none"> <li>• One-on-one meetings between teachers</li> <li>• Number of contacts with high school teachers about GST education</li> <li>• Number industry contacts</li> <li>• Number of visits to industry</li> <li>• Number of industry visits to college</li> </ul>	<p>-analyze project documentation related to mentoring activities</p> <p>-survey and/or interview Co-PIs concerning partnerships and collaborative activities.</p>
<p>What geospatial industries are available and willing to collaborate with secondary schools and colleges?</p>	<p>-number of existing industry partners          -number of new industry partners and partnership programs/activities          -partner survey results          -documented partner contributions to GST programs:</p> <ul style="list-style-type: none"> <li>• Dollars</li> <li>• Professional time</li> <li>• Equipment and/or software</li> <li>• Other</li> </ul>	<p>-establish baseline of industry partnership across partner institutions          -review project documentation regarding the number of new partnerships and partnership programs/activities          -evaluate impact of new industry partnership by surveying secondary school administrators, college faculty, industry representatives.          -analyze growth in industry support over time.</p>

<p>Goal 3: Increase the quantity, quality and diversity of geospatial technicians to meet workforce needs.</p>		
<p><b>Evaluation Questions</b></p>	<p><b>Data collected</b></p>	<p><b>Methodologies</b></p>
<p>Were effective recruitment models for attracting students to geospatial technology programs developed</p>	<p>-recruitment resource materials          -communications between secondary schools and colleges          -institutional enrollment data provided by partner</p>	<p>-monitor web site and published materials          -regular conference calls with partner institutions.          -analyze enrollment data and trends          -comparison of evidence to</p>

<p>and utilized?</p> <p>How was the website used to increase national awareness of employment opportunities for graduates?</p>	<p>institutions, including demographics</p> <p>-website usage statistics by page</p> <p>-project documentation of career opportunities and its presentation on the web</p>	<p>project goals/metrics.</p>
<p>What is the baseline of current college and secondary enrollments at partner institutions? What student populations are under-represented at partner institutions? Are women and other minorities successfully recruited to the geospatial programs, by partner location and overall? How are students tracked to determine retention? Are students completing programs and being employed as geospatial technicians? Are transfer options available and being pursued by students?</p>	<p>--institutional enrollment, demographics ,and graduation data provided by partner institutions</p> <p>-survey data</p> <ul style="list-style-type: none"> <li>• Program enrollments</li> <li>• Course enrollments</li> <li>• Graduates</li> <li>• Placement in GST jobs or transfer</li> <li>• Employer feedback on graduates</li> </ul>	<p>-analysis of on-line surveys</p> <p>-analysis of institutional student data that include demographics of students, graduation data, placement data, transfer data, and term-to-term student retention.</p> <p>-comparison of evidence to project goals/metrics</p>

Goal 4: Increase the number of community and technical college geospatial faculty and secondary school teachers participating in geospatial professional development.

<b>Evaluation Questions</b>	<b>Data collected</b>	<b>Methodologies</b>
<p>What geospatial professional development opportunities exist for secondary and college instructors? Do teachers implement or enhance GST instruction as a result of participation?</p>	<ul style="list-style-type: none"> <li>-data regarding number of professional development events available in geospatial technology from <a href="http://www.TeacherTechnicians.org">www.TeacherTechnicians.org</a>.</li> <li>-attendance reports and rosters for Center-provided or Center-supported faculty development events</li> <li>-number of course or program completers</li> <li>-number of institutions and educators implementing or enhancing GST following Center-provided or Center-supported faculty development events.</li> </ul>	<ul style="list-style-type: none"> <li>-monitor and analyze faculty development offerings announced at <a href="http://www.TeachingTechnicians.org">www.TeachingTechnicians.org</a></li> <li>-analyze baseline completion information for Center-offered or Center-sponsored events</li> <li>-analysis of high school and college instructor participation in faculty development in geospatial technology and subsequent implementation activity.</li> <li>-comparison of evidence to project goals/metrics.</li> </ul>
<p>Were new geospatial professional development courses/programs developed by the Center? How many geospatial educators were impacted?</p>	<ul style="list-style-type: none"> <li>-course names, numbers, and syllabi for new courses</li> <li>-curriculum layouts showing GST requirements</li> <li>-names and characteristics of new programs</li> <li>-participant rosters</li> </ul>	<ul style="list-style-type: none"> <li>-analysis of project data regarding programs and courses being offered</li> <li>- communicate through regular conference calls and emails.</li> <li>-monitor web-based participant rosters and analyze evaluations</li> <li>-comparison of evidence to project goals/metrics.</li> </ul>

Goal 5: Sustain the Center long-term by providing valued services to academic and industry partners and continually seeking collaborations and sources of funding to maintain and improve services and products.

<b>Evaluation Questions</b>	<b>Data collected</b>	<b>Methodologies</b>
<p>What new collaborations hold potential for future funding of the Center?</p>	<ul style="list-style-type: none"> <li>-donations to Center</li> <li>-requests to Center for materials</li> <li>-requests to Center for consulting or technical assistance</li> <li>-number of collaborations that resulted in follow-up work or interaction/sharing</li> <li>-requests to Center to partner in grant proposals or other initiatives involving financial support of the Center or Center personnel</li> <li>-number of grant proposals sought/received by partner institutions to expand or support geospatial programs</li> <li>-NVC reports</li> </ul>	<ul style="list-style-type: none"> <li>-analysis of project data on requests and results of those requests</li> <li>-analysis of project data on donations or in-kind contributions of the type that could sustain the Center over time</li> <li>-industry/institution surveys to determine demand for fee-based services of the Center.</li> <li>-review of NVC recommendations regarding sustainability</li> <li>-project data regarding initiatives by partners designed to provide funding to support or expand geospatial programs</li> <li>-comparison of evidence to project goals/metrics.</li> </ul>
<p>What fee-based services are offered? How are fee-based services determined, evaluated, and advertised?</p>	<ul style="list-style-type: none"> <li>-requests for specific fee-based services</li> <li>-feedback from institutions/industries regarding quality and usefulness of fee-based services.</li> </ul>	<ul style="list-style-type: none"> <li>-analyze project data regarding fee based services and demand</li> <li>-attend PI and NVC meetings</li> <li>-review of NVC recommendations regarding sustainability</li> <li>-communicate through regular conference calls and emails.</li> </ul>

## Data Collection Methodology

Extensive work has been completed in the past year to establish systems of data collection for the evaluation of GeoTech and to assist the Center with other NSF reporting such as the annual report and the annual ATE Survey. Initially, it was hoped that an on-line data connection system could be established in conjunction with the creation of the Center's website. Difficulties experienced in working with multiple web designers negated the feasibility of including this feature. A system of spreadsheet data collection has been initiated instead.

The SCATE Inc. evaluation team developed a list of data elements that was reviewed by the GeoTech team to ensure that the data being requested could be collected and reported. The data collection spreadsheet is distributed to all Core and affiliate college partners. Semi-annual data collection dates have been established that will remain unchanged from year to year that enable colleges to work with institutional research personnel to capture and report data in a timely fashion. Data for spring semester is due by October 31 each year, and data for summer and Fall Semesters is due by March 31 each year. To ensure student confidentiality, no individual student identifiers are required. Partners submit data directly to the GeoTech Center where the data is summarized into a single spreadsheet with individual college data provided as verification. This combined data file is then forwarded to the evaluators. Collected fall 2008 and spring 2009 data have enabled evaluators to establish baselines to which future outcomes may be compared.

Capturing uniform data for professional development activities and outreach presentations, however, has been challenging. In addition to numbers of people participating in these activities, it is important to capture demographic data and to evaluate participant response to the activity. Over the summer various drafts and approaches were developed and considered by evaluators with input from project PIs. Ultimately, two registration/survey tools were completed. One is designed for awareness-level events where participants may not pre-register, the event is relatively short, and specific follow-up with participants is not anticipated. These events are referred to as "presentations." The other type of event is referred to as a workshop. Workshops are events where participants register (thus providing a better opportunity to capture demographic information), training/education (vs. "awareness") is involved, and follow-up with participants is possible. These evaluation/data collection tools are now available for use by all partner and affiliate institutions that make presentations or provide training on behalf of or in partnership with the GeoTech Center.

Another objective in developing common forms for use is to encourage consistent and uniform use of GeoTech branding. The forms may include logos and names of other institutions and/or projects along with the GeoTech logo and information, but if GeoTech is supporting the event in any way, use of the uniform "header" is expected.

The GeoTech Center staff has been very helpful and supportive in the development of these tools, distributing data collection forms to partners, collecting data from partners,

and following up with missing data or problems that have been encountered. After working diligently to resolve some institutional-level issues, partners have provided most of the requested data. To Dr. Davis's credit, he made the decision early on to terminate a partnership with one college that would not comply with data reporting requirements for the GeoTech Center. Ironically, this institution has received NSF ATE grant awards and thus should have understood the necessity of data reporting. Dr. Davis has provided excellent leadership in supporting evaluation as a critical component of the Center's success. It is anticipated that the overall data collection process will be easier in future years as a result of the work that was completed this year to standardize processes and tools.

## **Assessment of Progress towards Achievement of Goals and Objectives**

### **Center Management and Processes**

While not listed as a goal, a well-run ATE Center is critical to the success of stated goals and objectives. As with any endeavor of this magnitude, the early months involve some trial and error. This process of discovering what works and what does not work has been shortened by the leadership team's willingness to listen to and learn from others. Having technologically-savvy personnel involved has also been an asset to the GeoTech Center. The team is not afraid to make changes and try new things to find the best solution for their needs. The team meets regularly with partners, and periodically with evaluators and advisors, and uses technology effectively in doing so. One helpful tool is having teleconferences archived for access after the "live" meeting. The evaluation team has taken advantage of this feature on multiple occasions where there were scheduling conflicts and the agenda for the meeting was of particular interest in evaluating the project. The PI keeps Co-PIs and partners involved at every step, and this is a primary factor in the considerable progress and impact the GeoTech Center has achieved in a very short time. Management team meetings have increasingly focused on the work of partners towards the vision of the whole. This cohesiveness of partners focused on the national mission of the Center has increased over the last year.

Progress is being made in focusing more clearly on work that needs to be done at this point in time in the life of the Center. Saying "no" and scaling back in some areas is never easy, but the GeoTech team is proving that they are capable of evaluating and prioritizing opportunities to use resources to best advantage in accomplishing the Center's vision. Exercising this type of project discipline will need to continue as more people across the country (and beyond) learn about and want to partner with the GeoTech Center in a variety of ways: What and how much can you do for whom and when?

Excellent leadership; strong, dedicated PIs/partners; teamwork; and, effectively distributed responsibility are central to the early success experienced by the GeoTech Center. Another factor is the national environment where geospatial technology is becoming more essential and more mainstream across multiple disciplines and innumerable applications.

## **Baseline Data and Activities**

It is not the role of this evaluation report to reiterate the activities completed by the Center over the past year (this information will be provided by GeoTech) but rather to denote specific evidence that shows progress, or lack thereof, towards the goals of the Center.

### **Goal 1: Create a national clearinghouse of exemplary geospatial curriculum material and resources website and a national geodatabase web service, aligned with nationally recognized core competencies as identified in University Consortium GIScience (UCGIS) Model Curriculum Body of Knowledge (BoK).**

The development of the GeoTech Center website has not progressed as quickly as planned. The site is very attractive but has not yet achieved the sophistication and depth necessary to serve its intended purpose. The Center has contracted with more than one website developer in an attempt to create the envisioned site, however, the searchable repository of educational materials aligned with the USGIS BoK and associated resources that Goal 1 calls for is not yet a reality. As these technical challenges are being addressed, other important progress is being made. Perhaps most significant is the work being done to define the subpart of the USGIS BoK that is applicable to technician education. Also criteria for accepting materials into the repository are being developed. The innovative approach of combining DACUM outcomes from various locations where industry and geospatial technology applications differ is helping to guide this work of defining core competencies for geospatial technicians. Evaluation data from the individual DACUM events have been reviewed by the SCATE Inc. evaluation team, and it is clear that these activities were conducted according to design, participants were well chosen and had the necessary expertise, and the process was impartial and thorough. The level of satisfaction of participants was consistently high.

While the Repository and other web features are being defined/developed, a growing list of web links likely to be of interest to the high school and two-year college geospatial technology educator community has been placed on the site. These resources are varied and their potential interest to geospatial educations is generally apparent.

Web usage data will be monitored by the evaluation team in part by using statistics reported during the last week in November and first week of December each year. Data to be used as baseline for GeoTech is taken from a Google Statistics report dated November 30-December 6, 2009 (the week after Thanksgiving). This is an arbitrary point in time but was chosen to follow the annual ATE PI Conference, not fall on a holiday, and coincide with the last weeks of fall semester. Table 1 reflects the data that will be monitored over time and includes the 2009 baseline data. How many people visit the site, the amount of time visitors spend on the site, and the percent new visitors may all be indicative of the success of the site. If the site becomes a useful, frequently visited resource for members of the geospatial education and related communities, the percentage of new visitors may decrease as a percentage if repeat visits out-number

new website traffic. Other criteria may be added as web features make tracking possible (e.g., downloads from the Repository, number of registered users).

**Table 1: Website Statistics**

Year/week	Visits	Avg. Time on Site	% New Visits
2009 (Nov. 30-Dec. 6)	209	00:03:44	49.76%
2010			
2011			
2012			

**Goal 2: Increase the capacity to train geospatial technicians through new partnerships among community and technical colleges, universities, secondary schools, industry and government.**

To evaluate the degree to which this goal is being met, data are being collected to track the growth in programs and courses across the partnerships, articulation agreements, mentoring/collaboration, and presentations. Fall 2008 and spring 2009 data are being used as the baseline.

Table 2

<b>Number of GIS courses offered by all partner institutions</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
25	41								
<b>Number of Certificate Programs</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
14	35								
<b>Number of Associate Degree Programs</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
5	9								
<b>Number of high school to 2-year college Articulation Agreements</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
5	7								
<b>Number of 2-year college to 4-year college Articulation Agreements</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
12	15								

<b>Number of high school to 2-year college Articulation Agreements for concurrent matriculation</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
10	10								
<b>Number of 2-year college and 4-year college Articulation Agreements for concurrent matriculation</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	
5	1								
<b>Number of Geospatial Mentoring Activities/Contacts</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Totals
293	255								

**Goal 3: Increase the quantity, quality and diversity of geospatial technicians to meet workforce needs.**

Student enrollment data and demographics will be used in the evaluation of the extent to which this goal has been achieved. Although this initial data is considered to be the baseline for the Center, the growth from fall 2008 to spring 2009 is already noticeable. Student demographics were not always reported. Therefore, percentages for each characteristic cannot be calculated.

**Table 3: Student Enrollment (2008-2012)**

Data	Fall '08	Spg '09	Fall '09	Spg '10	Fall '10	Spg '11	Fall '11	Spg '12	Fall '12	Totals
<b>Total enrollment</b>	<b>360</b>	<b>612</b>								
Males	190	387								
Females	108	171								
Hispanic/Latino	62	66								
Am. Indian or Alaska Native	3	12								
Asian	15	21								
Black or African American	35	31								
Hawaiian or Pacific Islander	1	1								
Multiracial	0	21								
White Non-	148	380								

Hispanic/Latino										
Ethnicity unkn.	96	60								

Independent of data collection being directed by the external evaluation team, PI Phil Davis created a “2009 Annual Survey of Geospatial Education Programs” for web delivery using Survey Monkey. The survey was sent to a network of educators at high schools, two-year colleges, and 4-year colleges in fall 2009. The purpose of the survey was not for project evaluation but rather to enable Dr. Davis to capture feedback “from the field” to guide activities and services of the GeoTech Center. Since no information was collected about respondents, the data from the survey is of limited use for project evaluation. After the survey was administered, the survey instrument was jointly reviewed by the PI and lead evaluator. It was agreed that if the survey is to be administered in future years, some changes will be made to render the tool more useful for both project evaluation and for other Center work.

Relevant information from the responses to the 2009 Annual Survey of Geospatial Education Programs has been extracted. Most informative is that of 74 respondents to a question about geospatial technology programs, nine reported starting new programs and 55.4% of the 74 respondents reported enrollment growth over the past year. Also, in another question, 70.7% of the 75 respondents indicated a preference for 1-3 day training in geospatial technology (of the formats that were given as choices). This information can guide GeoTech in planning professional development events for this community of educators.

Another data-capturing instrument has been developed under the leadership of Co-PI Ann Johnson. The purpose of this instrument is to capture information about GeoTech Center outreach activities in a way that will enable this outreach to be mapped. This new instrument was completed in fall 2009.

**Goal 4: Increase the number of community and technical college geospatial faculty and secondary school teachers participating in geospatial professional development.**

The number of participants attending GeoTech-provided or co-sponsored presentations will be monitored as one indicator of the number participating in geospatial professional development. The number of geospatial technology professional development events being advertised via [www.TeachingTechnicians.org](http://www.TeachingTechnicians.org) is increasing and will also be monitored over time. The archive for the TeachingTechnicians.org website has not yet been mined for this data. GeoTech partners are diligent about posting their events at this website that serves the ATE and broader two-year college and high school STEM community.

**Table 4: Geospatial Presentations and Participants**

<b>Number of Geospatial Presentations</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Totals
47	47								
<b>Number of Geospatial Event Participants</b>									
Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Totals
1838	6537								

**Goal 5: Sustain the Center long-term by providing valued services to academic and industry partners and continually seeking collaborations and sources of funding to maintain and improve services and products.**

Sustainability of the Center will result from a successful, multi-dimensional strategy to generate funds to support activities and institutionalize programs and best practices for the future. The Center has already been approached to participate in various ways in other grant proposals and already funded projects both within and outside of the geospatial discipline. The GeoTech team has evaluated each opportunity and is learning how to balance commitments to other endeavors with their primary commitment to the goals of GeoTech. This is a challenge faced by all ATE Centers, but GeoTech – because of its early success – is facing these decisions earlier than most.

One way in which progress towards the sustainability goal will be evaluated is by monitoring industry donations, industry personnel involvement in terms of hours and service, and student internships (paid and non-paid). Baseline data for this assessment have been collected.

**Table 5: Industry Support for Geospatial Technology Programs/Geotech (2008-2012)**

Data	Fall '08	Spg '09	Fall '09	Spg '10	Fall '10	Spg '11	Fall '11	Spg '12	Fall '12	Totals
Donated Money Total \$ Value	0	\$3,900								
Donated Equipment or Software Total \$ Value	\$900	\$2,975								
Total Donated Time/#Hours	63	111								
Total paid Interns	0	5								

Total non-paid interns	0	16								
# serving as advisors	15	23								
# recruiting activities with industry help	5	14								

### Summary and Findings

The GeoTech Center has probably made more progress and achieved greater impact more quickly than any other National ATE Center in its first 18 months of operation; however, no Center matures without experiencing bumps in the road. One of the biggest bumps for this Center has been website development. The time and energy spent on this one task has delayed the launch of the envisioned clearinghouse of educational materials and, while very attractive in design, the site has not “arrived” in terms of depth of information and breadth of resources to serve the two-year college geospatial community and others.

In most other areas, however, the Center has excelled. The progress made on the GeoTech Center/Department of Labor collaboration on job classifications in geospatial technology is a case in point. David DiBiase’s support and participation in this endeavor has not only ensured that the effort has continued to move forward in a productive way at the right “political” level but will also that the outcome will garner the national attention and broad dissemination this work deserves. The connection of GeoTech to ESRI through Co-PI Ann Johnson has also expanded the center’s influence exponentially. The Center has made noticeable progress in establishing effective management systems and in moving forward on schedule with Goals 2, 3, and 4. Goal 5, sustainability, is one where achievement should peak near the end of the grant. Very quickly the word is getting out that if you are doing anything in geospatial technology at the high school or two-year college level, you should be talking to and working with the GeoTech Center. Networking across the ATE program is also helping direct people to GeoTech.

There has been more outreach and professional development than the data fully reflect. Improved reporting from each event to the Center and evaluators will help ensure that this important aspect of GeoTech Center work is not underreported. In response to recommendations of the GeoTech National Visiting Committee (NVC) and evaluators, the GeoTech team has done an admirable job over the last year of bringing more focus to outreach efforts to specifically address the needs of two-year college geospatial educators first.

Using the mapping capabilities inherent in this discipline is surfacing as a powerful collaboration tool and also shows promise as a potential strategy for sustainability. The team will need to carefully consider how to manage this talent and capability effectively.

The development of a map of two-year colleges in the United States to show the current prevalence of Geospatial courses and programs developed by GeoTech Co-PI Mike Rudibaugh and his students at Lake Land College (IN) is landmark work. Using the information attained in developing this map, the GeoTech Center has a baseline of the state of two-year college geospatial education at the start of the GeoTech Center. As this national map is updated over time, especially at 6-year and 10-year milestones in the life of the GeoTech Center, the change will be one indicator of the national impact of the GeoTech Center that would not be available any other way.

### **Formative Evaluation Recommendations and Food for Thought**

#### Goal 1:

In the absence of a searchable data base, the ever-growing list of web links for geospatial and related resources in the repository should be annotated and perhaps numbered. It is difficult list determine exactly how many entries there are on the list.

Criteria for accepting materials for the Repository have been considered by the GeoTech Management Team but should be articulated as written procedures to guide the Center. The development of a Vision and Guiding Principles for the site to which procedures and future website features can be evaluated is recommended.

The manner in which entries into the Repository will demonstrate alignment with the USGIS BoK should be clearly determined. It would be ideal if each entry could be accompanied by a list indicating specifically which competencies are addressed by the material, learning unit, etc. This could be a category in the "full record" if the web design remains in its current format.

#### Goal 2:

PIs and partners need to be diligent about using the uniform reporting forms when they provide workshops (or other forms of training) and presentations on behalf of the GeoTech Center and/or in partnership with GeoTech. Since the forms were completed and made available in summer 2009, no completed forms have been submitted to the GeoTech Center or evaluators. This may only mean that this has been a period when there have been no activities; however, the number of participants at GeoTech presentations in fall 2008 makes this possibility unlikely. The survey developed under the leadership of Co-PI Ann Johnson may be perceived by those asked to complete it as a duplicate effort since providers of presentations and workshops are already being asked to complete other informational forms about these activities. To prevent reporting fatigue, all of the data collection forms related to these activities should probably be re-visited and consolidated to the extent possible.

#### Goal 3:

Data on graduates and certificate completers will need to be added to the data collection chart for the 2010-2011 year and thereafter. In addition, the feasibility of

capturing the number of students participating in articulation agreements (i.e., actually enrolling for dual credit, receiving articulated credit for high school work, or transferring to the 4-year college with two-year college GIS credit) needs to be considered. Negotiating these agreements to create smooth pathways for student advancement is only the first step in the process, additional data will be needed to evaluate the impact these agreements are having on students.

In Year 1, Co-PI Ken Yanow worked on collecting and sharing best practices for increasing diversity in geospatial technology education. It is unclear what activities GeoTech is engaging in to help ensure that educators are proactively employing proven strategies or are trying new ideas for broadening participation.

#### Goal 4:

Geotech staff should register for notices from [www.TeachingTechnicians.org](http://www.TeachingTechnicians.org) so that the events posted in the field of geospatial technology can be monitored in real time and collated for evaluation purposes. By listing geospatial technology as a search preference, notices will only be received when events of interest to the GeoTech Center are posted. The TeachingTechnicians.org archive can be reviewed to determine what has been posted in the past two years.

It is unclear what activities the Center is engaging in to stimulate teachers to engage in professional development in geospatial technology. Although many events are occurring, and GeoTech PIs and partners are frequently participating in conferences and events hosted by others, what appears missing are specific strategies for increasing participation in faculty development. Just increasing the number of opportunities is probably not sufficient to achieve the goal.

#### Goal 5:

Sustainability, while important to the Center, should not be a primary focus at this point in the Center's life. Energy and resources should be directed foremost at achieving goals 1-4. It is likely that if goals 1-4 are successfully achieved, goal 5 will become much easier. Charging for services or committing Center staff and resources to other projects/Centers should be approached very carefully and thoughtfully in the early years of the Center. There can be unexpected negative consequences to becoming "profitable" in an educational environment.

### **Food for Thought**

Avoid proliferation of data collection forms used by GeoTech. Evaluators are currently requesting completion of 3 types of documents: the semi-annual data form completed by each site; pre- and post-event professional development workshop surveys; and, the professional development presentation form. Other forms being used include, but may not be limited to, the "Impacts Activities-Professional development and Outreach Activity Report" for mapping purposes and a GeoTech Annual Survey of Geospatial Programs, a web-based survey developed and conducted by the GeoTech Center Director. How the data collected can and will be used should be discussed by the team, and redundant elements should be eliminated to the extent possible.

Developing an annual GeoTech Business (work) Plan is a good idea. Using the term “goals” in the *GeoTech Business Plan 2009-2010*, however, is confusing. Listed “goals” in the document are actually activities, and the alignment of each activity to specific goals of the Center is not immediately clear to the reader. These activities will be more meaningful if they are clearly aligned with overarching GeoTech Center goals. If the alignment does not come naturally, then perhaps either the activities or the overall goals of GeoTech should change. Also, the GeoTech management team is encouraged to spell out acronyms more frequently to help both NVC members and evaluators more quickly understand the text (e.g., GTCM is explained in “Goal 1” but is used in “Goal 2” without explanation).

As website development proceeds (activities in the *GeoTech Business Plan 2009-2010*), use of 2.0 and 3.0 is confusing. It would be helpful to know if the numbers refer to a new website design, a new effort by a different developer, or advanced functionality as the result of new/completed features to the existing site. The status of website development is central to GeoTech Center goal 1, so from an evaluation standpoint, the more clearly progress is reported the better.

Given the negative impact the economy has had and continues to have on college budgets, the GeoTech team may want to consider strategies for providing travel support for educators to take advantage of professional development opportunities. Many of the events currently being offered were designed when it was more reasonable to expect a college to pay travel expenses for their faculty. When GeoTech support is provided, it may be possible to require the participant to contribute to the achievement of one or more of GeoTech’s goals. For example, a participant could write about his or her experience for the GeoTech website or a publication, make presentations or provide workshops for others after being provided with an opportunity to learn, or perhaps even develop teaching materials for submission to the Repository.

## **APPENDICES**

Appendix A: GEOTECH Data Collection for Project Evaluation (data elements)

Appendix B: GEOTECH Aggregate Data File for fall 2008 and Spring 2009

Appendix C: Sample Uniform Professional Development Survey (Pre-workshop survey)

## Appendix A: GEOTECH Data Collection for Project Evaluation

- Data Elements Included in the Spreadsheet
- Name of Institution
- Academic Term for Data Reported
- Year
- GIS Degree or Certification offered (Type of Certification, # of Degrees or Certifications)
- GIS Courses offered at the college during the reporting term(course name, course number, credit hours, course student contact hours)
- Student Enrollment Information for Each Course
  - Number enrolled at end of non-penalty drop-add period
  - Number of males
  - Number of females
  - Number of Hispanic/Latino
  - Number of American or Alaska Native
  - Number of Asian
  - Number of Black or African American
  - Number of Hawaiian or other Pacific Islander
  - Number of Multiracial
  - Number of White Non-Hispanic/Latino
  - Number of students requesting accommodation under the Americans with Disabilities Act
  - Number of incumbent workers (individuals employed as technicians at the same time they are taking coursework)
- Articulation Agreements for Geospatial Technology Courses/Programs
  - Number of Articulation agreements in place for high school to 2-year college
  - Number of Articulation agreements in place for 2-year college to 4-year college
  - Number of Articulation agreements in place that provide for concurrent matriculation – dual enrollment of student at high school and 2-year college
  - Number of Articulation agreements in place that provide for concurrent matriculation – dual enrollment of student at 2-year college and 4-year college
- Mentoring Activities in GIS by semester
  - Number of one-on-one meetings with another college teacher about GIS education
  - Number of contacts with high school teachers about GIS education
  - Number of industry contacts About GIS education or students
- Number of visits to industry
- Number of times industry has visited your institution
- Industry partners
  - List of industry partners for [time frame]
- Industry contributions

- Name of industry partner
  - Donated money/\$ value
  - Donated equipment or software/ \$ value
  - Donated time/ # of hours
  - Used a paid intern from your college, # of interns
  - Used a non-paid intern from your college, # of interns
  - Provided advice/ # of meetings
  - Assisted with recruitment/ # activities
  - Other?
- Outreach in past semester:
    - List venues where presentations were made (date of event, audience, age/type group (i.e., K-8, 9-12)
    - Specify the number of papers or articles submitted for publication (number of papers submitted, number of articles submitted, name of publication(s), number of article published/accepted).

## Appendix B: GEOTECH Aggregate Data File for Fall 2008 and Spring 2009

### Student enrollment and demographics

	Fall 2008	Spring 2009
<b>Total Number of students enrolled at end of no-penalty drop-add period</b>	360	612
<b>Total Number of males</b>	190	387
<b>Total Number of females</b>	108	171
<b>Total Number of Hispanic/Latino</b>	62	66
<b>Total Number of American Indian or Alaska Native</b>	3	12
<b>Total Number of Asian</b>	15	21
<b>Total Number of Black or African American</b>	35	31
<b>Total Number of Hawaiian or other Pacific Islander</b>	1	1
<b>Total Number of Multiracial</b>	0	21
<b>Total Number of White Non-Hispanic/Latino</b>	148	380
<b>Ethnicity Unknown</b>	96	60
<b>Total Number of students requesting accommodation under the Americans with Disabilities Act</b>	0	0
<b>Total Number of incumbent workers (i.e., individuals who are employed as technicians at the same time they are taking coursework)</b>	13	22

**Appendix C: Sample Uniform Professional Development Survey (Pre-workshop survey)**



(Logo of institution sponsoring the workshop)

**Pre-Workshop Survey**

**Title of Workshop** \_\_\_\_\_ **Date of Workshop** \_\_\_\_\_

Participant Information:

Name: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Email: \_\_\_\_\_

Contact phone: \_\_\_\_\_

School, Organization, or Institution: \_\_\_\_\_

The GeoTech Center seeks to improve faculty readiness to provide state-of-the-art instruction in geospatial technology. Your participation in this workshop and answers to the following questions will help evaluate the degree to which we are achieving this goal, and your feedback will help us improve future geospatial technology education workshops.

1) How did you learn of the workshop?

- GeoTech Center website
- C3GIS website
- TeachingTechnicians.org website
- Conference flyer
- Word of mouth
- Other \_\_\_\_\_

2) How long have you been teaching?

- I am not currently teaching
- less than 2 years
- 2 to 5 years
- 5 to 8 years

- 8 to 10 years
- more than 10 years

3) What is your primary discipline or department?

\_\_\_\_\_

4) Please estimate the total number of students you teach in an academic year: \_\_\_\_\_

5) What is the educational “level” of the majority of the students you teach?

- Not applicable
- Elementary school or grades K-6
- Middle school or grades 7-9
- High school or grades 10-12
- Technology Center (CTE)
- Two-year college
- Four-year (undergraduate) college or university
- Master’s or Doctorate (graduate) level

6) Have you participated in other geospatial workshops?

- Yes

List name of organization, if applicable, that sponsored the workshop and general topics

\_\_\_\_\_

- No

7) Briefly describe how you think you will use the skills and knowledge you gain in the workshop in your teaching or in your work.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.



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