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MapTEACH Project uses Geoscience and Technology to "Find New Ways to Tell Old Stories"

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"You can visualize Elders in their younger days traveling the rivers by kayak and seal skin boats, often for days. They camped for months at a time gathering food to see themselves through harsh winters. Out there were hundreds of sites they could choose to subsist on, knowing every site by heart and how far away it was. It was the land Cup'iks knew so well. They had to know it, and take care of it. It was everything—food, shelter and preservation of their distinct culture. These people left us a lasting imprint that we have always had land that will last beyond the future of generations to come. If we could read their minds and hear their voices now, this story would read like no other." (John Angaiak, 2003)

The Alaska Division of Geological & Geophysical Surveys is engaged in a multi-year collaborative project, "*Mapping Technology Experiences with Alaska's Cultural Heritage,*" or MapTEACH, funded by the National Science Foundation (NSF) under the Information Technology Experiences for Students and Teachers (ITEST) program. The ITEST program was established by the National Science Foundation in direct response to the concern about shortages of information technology (IT) workers in the United States, and is designed to increase opportunities for students and teachers to learn about and use IT within the context of science, technology, engineering, and mathematics. The ITEST program is anticipated to be an important tool in IT workforce development, and to address the growing issue of outsourcing United States technology jobs to other countries.

More than 300 pre-proposals were submitted nationwide to the ITEST program, of which 126 were selected for full proposals, and of those only 13, including the MapTEACH project, were selected for funding. With the support of 10 partner organizations (including private sector, non-profit, and educational institutions), DGGS is working with the University of Alaska-Fairbanks (UAF) Geography Department, and the University of Wisconsin-Madison Environmental Remote Sensing Center (ERSC) to develop a place-based geoscience education program for middle- and high-school students in rural Alaska that emphasizes hands-on experience with spatial technology (GPS, GIS, and remote sensing imagery) in conjunction with traditional activities.

The project draws upon the combined expertise of teachers, education researchers, remote-sensing specialists, geoscience professionals, Native Elders, and others with traditions-based knowledge, and will be piloted in the Minto–Nenana, Nome, and Fairbanks areas. Participants are working directly with DGGS geologists, and will be presented with a chance to authentically emulate scientific activities at a novice level, using real data in a real-world setting (fig. 1). Con-

Figure 1. *Geologists Gary Carver (emeritus professor of geology, Humboldt State University) and Dick Reger (retired, DGGS) using frost probe to measure depth to permafrost along the Minto fault, a poorly understood feature near Nenana, as DGGS geologist Patty Craw and landowner Mark Ebels look on. Potential student activities near this site include scarp profiling, mapping of landscape features, trenching, and frost probing.*

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currently, DGGS is learning to incorporate education and outreach into its geological practices when working in rural Alaskan communities.

Background

Rural areas of Alaska have historically had significant populations of Native Alaskans that face many challenges, including below average academic performance among K–12 students, a lack of cash economy opportunities, and high unemployment. Standards-based education has made little connection with traditional knowledge systems that include a deep and broad understanding of local landscapes, natural resources, and culture. This pattern is beginning to change as a result of new statewide educational initiatives, including the Alaska Rural Systemic Initiative (AKRSI). For many rural Alaskan students, however, opportunities to learn about geology and information technology are hampered by a lack of connection to their own cultural context and by deficiencies in math and science skills. Traditions-based community members have valuable expertise regarding harvesting and sustaining natural resources in the local environment, and possess a keen sense and extensive knowledge of place, and of physical and human geography. This local, culturally relevant knowledge base has potential for improving educational and career success for students, particularly in conjunction with the expertise of practicing physical scientists. MapTEACH developed from a belief that some traditional ways of knowing may be addressed in analogous areas of geology, information technology, and geospatial IT (fig. 2).

Place-based learning experiences that implement geographic information systems (GIS) science can provide students, teachers, and their communities with economic and cultural benefits that integrate well with local and traditional knowledge systems (Woodhouse and Knapp, 2000). The Alaska Rural Systemic Initiative demonstrated the benefits of linking math and science learning to local environment and culture through the development of new curriculum and sponsorship of science camps where parents, Elders, and teachers serve in instructional roles. AKRSI has reported improvements in standardized math-test scores for 8th and 11th grades, reduced dropout rates, and increased enrollment in the University of Alaska accompanied by dramatic increases in the numbers of students enrolling as math and science majors. Much of this improvement is attributed to helping students…

"…recognize the many facets of science that are practiced in the everyday activities of the people in their communities, including the scientific knowledge embedded in many of the traditional activities of the Native local people." Hill and others, 2001

Figure 2. *Minto Elders review trail information in GIS during summer data collection efforts in Old Minto.*

The MapTEACH Philosophy: Finding New Ways to Tell Old Stories

Our goal is to develop curriculum that combines traditional activities and rapidly evolving IT in the field of geospatial science. We are bringing together local Elders and scientists with students, teachers, families, and community members in landscape contexts where they have extensive expertise (fig. 3).

Figure 3. *Minto Elder Vernell Titus shares knowledge about the landscape with MapTEACH collaborators during summer data collection efforts in Old Minto.*

We are introducing students and other community participants to innovative geospatial IT applications, GIS, and science knowledge that will support informed decision-making and the use of state-of-the-art tools to manage local natural resources. Since participants will have opportunities to work with geologists, geospatial scientists, and geographers, they will also be offered a chance to participate in scientific activities at a beginning level. Once students and community members go through the pilot program, they should have the skills needed to read and use geologic maps.

MapTEACH will give students the opportunity to make a connection between traditional ways of viewing the landscape, scientific methods of making observations about the landscape, and the process of using cutting-edge information technologies to gather and disseminate information about the landscape.

Specifically, our goal is to provide geospatial IT science and technology education for teachers and students in rural Alaska settings that:

- is directly applicable to understanding the local geographic context and problems;
- relates modern science and information technology to traditional knowledge; and

- will help to develop a growing and sustainable rural economy.

The MapTEACH Project

MapTEACH will be implemented in two separate but content-equivalent formats to meet the unique requirements of reaching students in rural Alaska. Students serviced by centralized school districts will take part in an 18-week (standard school semester), after-school, classroom-based curriculum that will culminate in a 7-day summer Capstone Field Experience during which students and teachers will interact with Native Elders, traditions-based community leaders, and professional geologists from DGGS in a field camp setting. Other, more geographically dispersed students will be brought together in Intensive Studies Institutes at established living–learning facilities for 2 weeks of full-time classroom instruction, followed by a 7-day Capstone Field Experience. Both formats will be piloted through two schools or learning centers each for two consecutive years, resulting in four iterations of each format prior to general publication and distribution of the curriculum materials. The project is working with an advisory board composed of Alaskans with extensive experience in developing and improving new educational strategies and activities in rural Alaska; they will guide the shaping of effective MapTEACH curriculum that builds on local expertise and traditions.

The academic foundation of the program includes classroom modules in geology and geomorphology, topographic maps, remote sensing and aerial photography, GIS and GPS, and Native American cartography. The Capstone Field Experience is the hands-on segment of the program in which participants will follow up their classroom learning by going into a field setting and working their way through structured curricular experiences using mobile geospatial IT and field-geology tools organized into *Field Kits*.

Field Kits will include GPS units, digital cameras, audio recording equipment, geological tools and supplies, manuals, curricular and data gathering guides, and laptop computers with software for GIS, remote-sensing image processing, writing, recording, and communication. These will allow participants to gather geolocated data that will serve academic, standards-based needs for school, as well as provide a spatial information framework for family and community-initiated activities such as fishing, hunting, berry-picking, and travel (fig. 4). During these activities students will maintain field journals to record their process, findings, and consideration of their inquiry and problem solving efforts.

Participants will spend the final two days creating digital geospatial data and maps that can be disseminated to Alaska communities via web-served mapping and public spatial databases accessible via the internet, and as assisted by templates provided by the University of Wisconsin ERSC. Some spatial information may be considered sensitive by cultural groups; this material will not be shared beyond the designated local community members.

The planned activities will provide opportunities for learning within the context of science, but their unique character stems from their mission to acculturate the science to the context of the local Alaskan communities in which it is piloted. Of the many resources provided by this program, customized *Field Kits* and *Trail Guides,* are among the most vital. While there is no shortage of curricular materials available in the form of books and generic manuals, even for such a new science as geospatial IT, the resources critical to success for MapTEACH are those that enable students and teachers to guide inquiry and to bolster problem solving within the local cultures and landscape.

The *Field Kits* will go where both scientists and local people travel, and will be maintained in durable, waterproof cases.

Figure 4. *DGGS geologist Patty Craw guides UAF graduate students documenting "Outhouse Hole Stratigraphy" during the MapTEACH summer data collection efforts in Old Minto.*

MapTEACH
...new ways to tell old stories

This will allow students and teachers to take their science and technology along with them to conduct fieldwork as geoscientists do. The *Field Kit* can go along on boats to fish camps, be driven or carried to geological field sites, or flown in bush planes to other schools and villages. Essentially, the *Field Kits* are mobile information-gathering and processing nodes within our extended geospatial IT system, a system that includes not only hardware, software, and data, but people, organizations and cultures.

The *Trail Guides* are digital and printed media that are organized around geolocated information about environmental features of interest (fig. 5). These features may include a rock outcrop displaying characteristics distinctive to the geology of the region, a great place to fish during a salmon run, or a historic place of interest. Students will find their way to each of these 'geocaches' using their new map-reading and GPS skills. Digital images and audio recordings will illustrate unique qualities of each cache that are preserved in geospatial data records that can be shared electronically, web-served, or added to GIS data sets. The data students collect during their Capstone Field Experience will be added to the basic *Trail Guides* compiled by DGGS geologists, which will serve as the core onto which an essentially unlimited amount of additional geospatial data can be attached and expanded on.

Conclusion

MapTEACH is currently working in Minto–Nenana, Nome, and Fairbanks to determine which specific local areas are of greatest interest to Elders and community members who will be sharing knowledge of the landscape with students. We are collecting geospatial and geologic data based on our interactions with the Elders and community members in these areas, assembling *Field Kits*, developing curricular and *Trail Guide* materials, and function testing IT equipment in a field setting (fig. 6). The first pilots are currently scheduled to be run in spring and early summer of 2006 in the Fairbanks and Minto–Nenana areas, followed by a Nome pilot in the late summer or early fall of 2006. Following revision of the curriculum, additional pilots will be run in the spring and summer of 2007. The venues for the second round of pilots remain to be determined. Pending successful outcomes of these pilot efforts, DGGS and its collaborators will seek additional funding to extend the customized curriculum to other Alaska communities in the future.

Introducing students, their families, and their communities to geoscience and geospatial technology in a culturally responsive and stimulating field setting will enhance public understanding of the role of natural resources in developing viable economies for rural Alaska and foster informed management practices using state-of-the-art technology tools and data sets. At the same time, incorporating cultural knowledge into IT-intensive studies will serve as a bridge between old and new perspectives on the natural landscape and highlight the continued relevance of traditional teachings in the modern world.

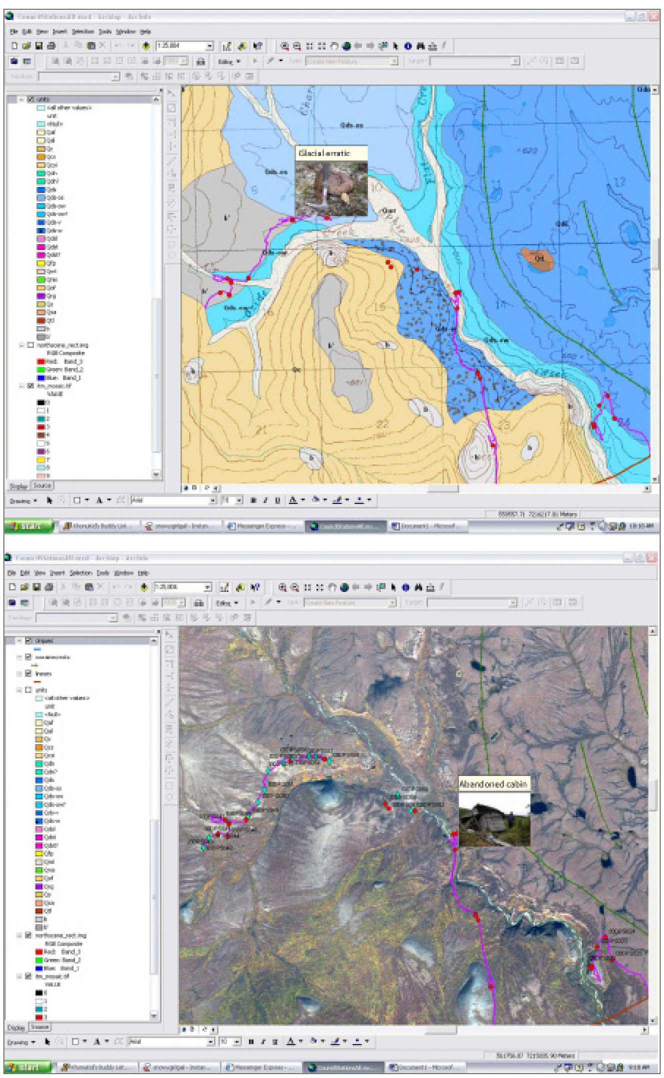

Figure 5. *These screenshots illustrate how different kinds of data can be layered together to create the MapTEACH Trail Guides. The upper screen shows GPS track logs and waypoints collected in the Council area near Nome, overlaid on a geologic map with a topographic map background. The red dots are locations where digital photographs of features were taken, and are dynamically linked to captioned thumbnail images and full-size images. The lower screen shows the same area with a QuickBird satellite image as the background. Audio, video, graphics, and text documents can also be linked to points. Students will be able to interact with these base images and linked files, and add their own geospatial data that they collect in the field.*

Figure 6. *DGGS geologist Patty Craw function tests an external antenna for use with a handheld GPS unit.*

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Woodhouse, J.L., and Knapp, C.E., 2000, Place-based curriculum and instruction: Outdoor and Environmental Education Approaches; ERIC Clearinghouse on rural education and small schools: retrieved from the World Wide Web, http://www.ael.org/eric/digests/edorc006.htm.

For more information about MapTEACH, please go to the web site at www.mapteach.org.

NEW DGGS PUBLICATIONS

GEOPHYSICAL MAPS & REPORTS

GPR 2005_1. Plotter format and Adobe Acrobat format files of the geophysical survey of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**. 1 CD-ROM**. **Includes 13 maps** (aeromagnetic or resitivity) listed below as GPR2005_1_xy as **plot files** in both HPGL/2 format and postscript printer format and as **Adobe Acrobat format** files. For the plotter files, software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet Designjet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. $10.

GPR 2005_1_1a. Total magnetic field of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; topography included.** $13.

GPR 2005_1_1b. Total magnetic field of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; magnetic contours and section lines included.** $13.

GPR 2005_1_1c. Color shadow magnetic map of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; State section grids included.**$13.

GPR 2005_1_1d. Total magnetic field and electromagnetic anomalies of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; topography, flight lines, and simplified electromagnetic anomalies included.** $13.

GPR 2005_1_2a. 56,000 Hz coplanar resistivity of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; topography included.** $13.

GPR 2005_1_2b. 56,000 Hz coplanar resistivity of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; resistivity contours and section lines included.** $13.

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GPR 2005_1_3b. 7200 Hz coplanar resistivity of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; resistivity contours and section lines included.** $13.

GPR 2005_1_4a. 900 Hz coplanar resistivity of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; topography included.** $13.

GPR 2005_1_4b. 900 Hz coplanar resistivity of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Full-color map; resistivity contours and section lines included.** $13.

GPR 2005_1_5a. Total magnetic field and detailed electromagnetic anomalies of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, **Parts of Big Delta B-3 and B-4 Quadrangles,** by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:31,680. **Full-color map; topography, flight lines, and detailed electromagnetic anomalies included.** $13.

GPR 2005_1_5b. Total magnetic field and detailed electromagnetic anomalies of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, **Parts of Big Delta B-2 and B-3 Quadrangles,** by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:31,680. **Full-color map; topography, flight lines, and detailed electromagnetic anomalies included.**$13.

GPR 2005_1_6. Flight lines of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2005, 1 sheet, scale 1:63,360. **Black and white map; topography and flight lines only included.** $13.

GPR 2005_2. Line, gridded, and vector data of the geophysical survey of part of the Goodpaster River area, Goodpaster mining district, Interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**. 1 CD-ROM**. Line data in ASCII format; gridded data in Geosoft and ER Mapper formats; vector files in Autocad version 13 dxf files. **Most of the gridded and vector data (aeromagnetic and resistivity only) include the area for the Salcha River-Pogo (released by DGGS in 2000) and Southeast Extension of the Salcha River-Pogo survey (released by DGGS in 2002) as well as the new Goodpaster River area data. The linedata only includes the new Goodpaster River survey.** $10.

PRELIMINARY INTERPRETIVE REPORT

PIR 2004-4b. Summary of coalbed methane studies, Delta Junction, Alaska, by P.R. Peapples, 2004, 11 p. $2.

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