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## NSF GLOWIRE Proposal 2002

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Opportunities for Enhancing Diversity in the Geosciences (OEDG) Proposal  
for the National Science Foundation

Program Solicitation NSF-02-104

**Geoscience Learning Opportunities on the Winnebago Indian Reservation  
(GLOWIRE)**

Proposal submitted through a partnership between

**Grantee Organizations**

University of Nebraska at Omaha

NASA Nebraska Space Grant & EPSCoR Programs

Little Priest Tribal College

**Performing Organizations**

Winnebago Tribe of Nebraska

Winnebago Public Schools

Center for Advanced Land Management  
Information Technologies

## Project Summary

The high dropout rate and lack of continued education among Nebraska's Native American students have inspired Nebraska educators to combine forces to reduce these grim educational conditions. The Geoscience Learning Opportunities on the Winnebago Indian Reservation (GLOWIRE) initiative focuses on reversing these trends through systemic change within the Winnebago Public Schools (WPS) and the Little Priest Tribal College (LPTC), who have educational responsibility for the tribe. The vision guiding this proposal is to *improve access and retention for Native American students in the geoscience fields*. Three goals with corresponding objectives have been identified to make this vision a reality:

Goal I: Develop & deliver a more culturally sensitive curriculum in the geosciences to Native Americans.

Obj. 1.: Better prepare Native American graduates with an environmental emphasis to enter 4-year degree programs or transition into the workforce.

Goal II: Coordinate academic experiences in the geosciences through partnerships and feeder programs with other Native American educational institutions.

Obj. 2: Develop a Geoscience Bridge Program between LPTC and WPS beginning in Grades 7 & 8.

Goal III: Engage the Native American community in geoscience outreach initiatives.

Obj. 3: Create a center of excellence for Winnebago geospatial data to be utilized community wide.

Because of its vital role in the Winnebago community, LPTC will function as GLOWIRE's lead partner, providing the project oversight, training, data analysis and dissemination. The University of Nebraska at Omaha's (UNO) NASA Nebraska Space Grant Consortium (NSGC) & EPSCoR program have demonstrated commitment to Native American educational issues by fostering the growth of the Nebraska Native American Outreach Program (NNAOP), an initiative founded on cultural sensitivities and respect for Native American concerns. Based on the high success record that this partnership has enjoyed since its inception in 1997, UNO was selected to collaborate with LPTC and WPS in the implementation of this proposal.

### The Intellectual Merit of the Proposed Activity

An innovative and cooperative relationship exists between UNO Aviation Institute (UNOAI) and University of Nebraska at Lincoln Center for Advanced Land Management & Information Technologies (CALMIT). This flourishing relationship will also provide guidance for enhancing and expanding current LPTC and WPS geoscience curricula, developing innovative geospatial outreach projects and ensuring dissemination of geospatial data throughout the Winnebago community and the nation.

Several courses, programs, and activities will be established and developed through this proposal to enhance geoscience education and research on the Winnebago Reservation. GLOWIRE research on the Winnebago tribe of Nebraska will build on work regarding Native Americans and geoscience and expand this field of knowledge by specifically addressing the questions: (1) What are predictors of interest in geosciences among Native Americans? (2) What factors influence Native American career choices in the geosciences? and (3) What ideas do the Winnebago tribe of Nebraska have regarding the kinds of community problems that can be solved with geoscience technologies?

### The Broader Impacts Resulting From The Proposed Activity

GLOWIRE will also establish new collaborations between the partners and several Native American institutions of higher learning currently involved in the geosciences. LPTC and UNO geospatial personnel will closely monitor the efforts of Salish Kootenai College in Pablo, MT, and Diné College in Shiprock, NM, for further collaborative opportunities, based on their expressions of interest at the recent Native View conference at EROS Data Center.

Broader impacts of GLOWIRE research include an increased number of Native American students continuing their education at 4-year institutions and obtaining undergraduate degrees in geosciences. The proposed Geoscience Bridge Program and Native Image Institute will provide research templates that can be replicated nationwide. In addition, GLOWIRE will enhance the existing Native American and geoscience educational infrastructures with new and strengthened partnerships.

## Contents Page

This page will be generated automatically by the Fastlane Software.

## Project Description

### ***Background***

#### Native Americans' Academic Achievement

Poverty, unemployment, soaring school dropout rates, and dismal academic achievements plague the Nebraska Native American population on the state's reservations. In Nebraska, the percentage of the Native American population living below the poverty level was 46.2%, the highest percentage of any race/ethnicity in the state (Nebraska Health and Human Services System, n.d.). Native American students have the highest school dropout rate of any minority in the country (Delisio, 2001).

Students attending classes in reservation schools score considerably below the educational achievement levels of students at other schools in the state. Specifically, while the state of Nebraska average for students that meet or exceed the national average in reading for all 4<sup>th</sup> grade students is 72.2%, the same student average at WPS is 17.65%. In the 8<sup>th</sup> grade, the state average for reading at or above the national average is 75.59%, while the same grade students met or exceeded the same standard only 8.33% of the time (Nebraska Department of Education, 2002). The situation is similar for state mathematics test scores, with WPS lagging the state average considerably. In the 4<sup>th</sup> grade, only 5.88% of the students met or exceeded the national standard as compared to the state average of 65.7%; in the 8<sup>th</sup> grade, the state average was 65.22% and the WPS average is 4.17% (Nebraska Department of Education, 2002).

As a result (and as might be expected), school age children in this population often have difficulty staying in school until graduation. An even smaller number attend institutions of higher learning. Of those students that do continue their education, most have very minimal skills in mathematics and science (Ballinger & Lehrer, 2001). To start reversing these trends, the GLOWIRE initiative focuses on expanding the curriculum in the geosciences.

#### Tribal College Education in the Geosciences

The academic situation is no better in the tribal colleges in this nation. The statistical data illustrates a startling disparity in the number of Native Americans obtaining undergraduate degrees in the geosciences. As indicated in Table 1, only 31 Bachelors degrees were awarded in earth, atmospheric, and ocean sciences in 1997. The statistics show a sharp decline as well in the number of Native Americans obtaining advanced degrees. In 1997, five Master's degrees and a mere three Doctorate degrees were awarded in the geosciences.

**Table 1 - Degree Conferrals by Level and Field in 1997**

Degree & Field	White	Black	Hispanic	Asian/Pacific Islander	American Indian
Associate Degrees	419,994	55,054	42,568	24,586	5,852
Bachelor's Degrees	878,460	91,986	60,902	67,086	7,242
Master's Degrees	288,552	26,901	14,574	17,898	1,844
Doctorates	27,183	1,786	1,068	2,528	169
B.S. Science & Engineering	292,252	30,444	25,266	33,139	2,419
M.S. Science & Engineering	50,228	3,817	2,882	5,845	332
Doctorate Science & Engineering	13,929	639	752	2,140	96
B.S. Earth, Atmospheric, and Ocean Sciences	3,986	57	113	95	31
M.S. Earth, Atmospheric, and Ocean Sciences	1,084	12	23	30	5
Doctorate Earth, Atmospheric, and Ocean Sciences	462	9	16	50	3

\*Data for S&E PhDs are for 1998.

Source: National Science Foundation (2002)

### ***Overview***

The overarching vision of the GLOWIRE proposal is *improved access and retention for Native American students in the geoscience fields*. To realize this vision, GLOWIRE will establish a center of excellence to be housed at Little Priest Tribal College (LPTC). This center, the “Native Institute for the Management of Applications in Geoscience Extension” (Native Image), will provide extensive Winnebago geospatial data for those at LPTC and within the community to utilize for both educational and commercial purposes. LPTC is the optimal location for such a center of excellence in Nebraska, because it is a vital component of the Winnebago community, serving as a conduit by which the community members of Winnebago interact with one another. LPTC will function as GLOWIRE’s lead partner, providing the project oversight, training, data analysis and dissemination.

Organizationally, Native Image will include a founding director, selected LPTC faculty and staff, a USDA-funded extension agent, and other consultant trainers that will be available as needed. In addition, several community associates and other support personnel, particularly from UNO and the University of Nebraska at Lincoln Center for Advanced Land Management and Information Technologies (CALMIT), will round out the initial staffing for the organization. The formation of an advisory board consisting of selected local and state academic, scientific, and governmental officials will be a key initial activity.

Native Image will provide training on GIS and ARS components, as well as offer research opportunities in the geoscience fields. Additionally, this new institute will supply the community with resources such as information on well-mapping, land-use, and precision agriculture. Native Image will support outreach endeavors that will expose the community to new technology, such as shadowing and mentoring programs. Additionally, the community will have access to an innovative geospatial laboratory, offering a variety of GIS and ARS software, hardware, and equipment. Native Image personnel will organize regional geospatial workshops and coordinate the enhancement of LPTC’s traditional and on-line courses. Such workshops will allow LPTC and UNO to share collected data with the Winnebago geosciences community through specialized articles, posters, and presentations. Native Image will also establish an archiving process for GIS and ARS data collection and, thus, provide documentation for dissemination to other colleges and universities.

Of the 35 current tribal colleges, few are engaging in a geospatial emphasis. Salish Kootenai, Sinte Gleska, Diné, and Fond du Lac Tribal Colleges are among the exceptions. Native Image will highlight the Winnebago community’s involvement in the geosciences and also foster collaboration between the community, LPTC, and faculty participants from other tribal colleges including Shelley Avery and Leland Henke from NICC, Judy Colbert from Salish Kootenai College, and James Rattling Leaf of Sinte Gleska University, among others.

GLOWIRE will also allow LPTC to pursue other key interests including faculty development, library support, center website development, and establishment of an internship with the Winnebago tribal government which will then work closely with other tribes. Additionally, key geospatial faculty representatives will be trained in geospatial concepts and be able to transfer knowledge to the community. This community involvement will be incorporated through community-wide symposiums and developed further through already successful efforts with Native American tribes in not only Nebraska but in other tribes that border the Upper Missouri River.

### ***Goals, Objectives & Activities***

GLOWIRE will focus on three major themes: Geoscience Education and Research, Partnerships and Feeder Program Development, and Outreach and Community Enhancements. Each theme incorporates varied goals, objectives and activities that further the integration of geosciences into all levels of mathematics and science education.

***Geoscience Education and Research***

Goal I. Develop & deliver a more culturally sensitive course curriculum in the geosciences to Native Americans.

<b>Objective</b>	<b>Activities</b>	<b>Intellectual Merit</b>	<b>Broader Impacts</b>
1. Better prepare Native American graduates with an environmental emphasis to enter a 4-year degree program of transition into the workforce.	1.1 Geoscience course curriculum reform & enhancement 1.2 Faculty development 1.3 Research experiences & other active learning opportunities for students 1.4 Purchase of equipment or instrumentation to improve geoscience instruction 1.5 Direct student support 1.6 Career development for students 1.7 Internships for students 1.8 Academic activities for students	GLOWIRE research on Winnebago tribe of Nebraska illuminates predictors of interest in geosciences among Native Americans.  LPTC faculty will begin to engage in scientific research and inquiry in the geosciences and related areas.  More LPTC faculty members will seek terminal geoscience degrees.	Increased participation of Native Americans obtaining undergraduate degrees in geosciences.  LPTC faculty will provide Native American specific geoscience education leadership to other similar institutions that currently do not have such programs.

1.1 Geoscience Course Curriculum Reform and Enhancement

LPTC currently has limited geoscience courses and does not offer any type of computer geoscience courses such as Cartography, Geographic Information Systems (GIS), Global Positioning Systems (GPS), or Remote Sensing. The school is lacking other geoscience courses such as Meteorology, Climatology, Oceanography, and Geology to name but a few examples (Little Priest Tribal College, 2001). However, LPTC currently offers an Associate of Science with an environment emphasis. GLOWIRE will reform the current geoscience courses to introduce geoscience concepts and technologies into the curriculum. These additions and content enhancements will be designed to better prepare graduates with an environmental emphasis to enter a four-year degree program or transition to the workforce.

1.2 Faculty Development

GLOWIRE will implement faculty development at LPTC, allowing professors to be better informed and educated on current geoscience technology. Faculty members will attend training on geospatial technologies such as GIS, GPS, and remote sensing. This training will include workshops and on-site ESRI sponsored classes, giving individuals the opportunity to participate and attend geoscience conferences. Conferences will include those organized by the Association of American Geographers (AAG), the Missouri River Natural Resources Conference, and many others. Faculty members will also join key national and local geoscience organizations including the Intertribal GIS Council, National Consortium for Rural Geospatial Innovations in America, Association of American Geographers, the American Society for Photogrammetry and Remote Sensing (ASPRS), and the Nebraska GIS/LIS Association. These organizations are extremely important in the exchange of new ideas, technologies, and resources among those interested in geospatial science.

1.3 Research Experiences and Other Active Learning Opportunities For Students

Research experiences for students at LPTC are critical to engaging and retaining students in the geosciences. GLOWIRE will provide students a mentoring partnership experience with UNO and LPTC faculty, featuring faculty from the UNO Geography Department and the University of Nebraska Lincoln CALMIT as mentors.

Several key research issues have been identified for the Winnebago Reservation by the community; many of these can be expertly addressed using geospatial technologies such as remote sensing, GPS, and GIS. LPTC will work with the community to set up GLOWIRE research opportunities for students to assist in these issues. The GIS/GPS Specialist that the Winnebago tribe employs through the EPA collects spatial data with a GPS unit in the field to create maps of the Winnebago Reservation. The maps are used for water quality, pesticide, and air quality projects by the United States EPA Region 7. Students from LPTC will assist the specialist in collecting GPS data and using a GIS software program to input and analyze the data. The Winnebago Tribe also employs a Water Quality Specialist through the EPA. GLOWIRE will provide research opportunities through LPTC to collect field data for this activity. Another research area exists through the Winnebago Construction Department. Students will be able to assist in collecting GPS data to be used to identify property lines, plot subdivisions, and outline road and transportation planning on the reservation.

An important component of geoscience education and research is active learning opportunities for students. A key activity for Winnebago students is the statewide Nebraska Geography Bee held on the UNO campus in the Spring. GLOWIRE will facilitate Winnebago students to actively participate in a local Geography Bee at their school and strongly encourage them to qualify for the Statewide Bee.

Another opportunity for students to become actively involved in geoscience learning is through the Community Atlas Project with ESRI. Students learn how to use simple GIS software through a program called ArcExplorer. This software will be installed in institutional computers by GLOWIRE personnel. The Community Atlas project allows students to create an on-line product about their community. Activities such as this provide excellent academic opportunities and are a strong motivational force.

#### 1.4 Purchase of Equipment or Instrumentation to Improve Geoscience Instruction

Appropriate GIS equipment and software are necessary in order to utilize geoscience technology. GLOWIRE staff will develop a lab at LPTC with a geoscience emphasis. Large screen monitors will enable users to better see the images in remote sensing applications and all the map detail in the various GIS software programs. The purchase of GIS software, such as ArcView, (or GIS freeware like ArcExplorer) will enable LPTC to move toward the concept of a center of excellence. Use of ArcExplorer, while somewhat less powerful and more complicated than ArcView, may meet the needs of the community at large. Although there are currently several GPS receivers available on the reservation, LPTC would be a leader in providing new and more accurate GPS receivers for use by the community.

#### 1.5 Direct Student Support

The creation of a “Geosciences” scholarship for the students at LPTC will be an important component of direct student support. GLOWIRE scholarships will be given for students to obtain an Associate Degree in Science with an Environmental Emphasis. Scholarships will also be granted for those students who wish to continue their formal education at a four-year college or university in the field of geosciences. The field of geosciences includes such degree fields as Geography, Geology, and Environmental Science.

#### 1.6 Career Development for Students

Career development for students will be essential to improve access and retention of students from underrepresented groups in the geosciences. GLOWIRE activities specifically designed to further this goal will include guest speakers, geoscience career fairs, and partnerships with four-year degree colleges and universities that offer geoscience degrees. It is important for the students of the Winnebago Indian Reservation to see that other Native Americans are working in geoscience fields. Speakers from the Intertribal GIS Council as well as others in industry, government, and academia will be brought in to talk about how they became involved in the geosciences. GLOWIRE will enable Winnebago students to see others like themselves working in the geosciences, inspiring them to believe that they can also attain education and jobs in this field.

GLOWIRE will provide another dynamic forum for access and retention in the geosciences, by conducting career fairs where academia, industry, and government come together to showcase potential



careers and education in the geosciences. Colleges and universities will show students what geoscience degrees they offer and, by participating, have the opportunity to enroll more Winnebago students.

The creation of partnerships with other four-year degree colleges and universities that offer geoscience degrees is critical to improving access and retention of underrepresented groups. Several colleges and universities have been identified as partners, including: South Dakota State University, UNO, University of Nebraska at Lincoln, Creighton University, Wayne State, and the University of Nebraska at Kearney. All of these colleges and universities offer some type of four-year geoscience degree whether it is in Geography, Geology, or Environmental Science.

1.7 Internships for Students

A crucial tool for retaining students in the geoscience field is through internship programs. Students at LPTC will be exposed to GLOWIRE internships at either the local, regional, or national level. Many students at the college work full-time and are limited in the type of internships they can participate in. The creation of local internships with nearby Sioux City and within their own tribal government will be key in the success of this concept. CALMIT will also provide an excellent environment in which students could participate in internships. A national internship program will be fostered with the EPA. The agency actively recruits students for their internships and often they cannot find enough Native American students to participate; GLOWIRE can assist EPA in achieving their goal.

1.8 Academic Activities for Students

GLOWIRE will organize a variety of academic activities for students to provide students opportunities to actively participate in geoscience learning activities. Geoscience field trips for LPTC students will be conducted, including a tour of the EROS Data Center in Sioux Falls, SD and the National Weather Service in Valley, NE. Students will be given the opportunity to engage in professional society sponsorships through such organizations as the Association of American Geographers, Intertribal GIS Council, the National Consortium for Rural Geospatial Innovations in America, and the American Society for Photogrammetry and Remote Sensing (ASPRS).

GLOWIRE will also foster a relationship with the Missouri River Natural Resources Conference. The conference provides broad perspective on Missouri River issues and serves as a forum for resource managers, citizens, and policy-makers. The students at LPTC will benefit greatly from participating and attending this conference particularly since tribal lands are a part of the nearby Missouri River watershed.

***Partnerships and Feeder Program Development***

Goal II. Coordinate academic experiences in the geosciences through partnerships and feeder programs with other Native American educational institutions.

<b>Objective</b>	<b>Activities</b>	<b>Intellectual Merit</b>	<b>Broader Impacts</b>
2. Develop a Geoscience Bridge Program between LPTC and WPS, beginning in Grades 7 & 8.	2.1 Expand Family Science Program with Geoscience Family Discovery Events 2.2 Conduct Community Geospatial Workshop Series 2.3 Establish Collegiate Tour Collaborations 2.4 Identify & Coordinate Community Resources 2.5 Foster partnerships with other Native American institutions of higher learning actively involved in the	GLOWIRE research reveals factors influencing Native American career choices in the geosciences.  WPS students will acquire more skill and knowledge in mathematics and science.  Geoscience content can be added to existing WPS curriculum.	Existing Native American and geoscience educational infrastructures are enhanced through new & strengthened partnerships.  Increased number of Native American community college students continuing their education at 4-year institutions.

	geosciences		
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### 2.1 Curriculum Enhancement Bridge Program

The development of a Geoscience Bridge Program (GBP) between the Winnebago Public Schools (WPS) and LPTC is a signature piece for GLOWIRE. Through a series of coordinated academic experiences in the geosciences, faculty at both schools will provide a series of academic experiences that will provide a structured developmental program, beginning in Grades and 7 and 8 and extending through the high school grades. This program will serve as a feeder program so that WPS students matriculate to LPTC, with the necessary geoscience knowledge and skills to successfully enter the college. In the past, a lack of preparation in mathematics and sciences has been identified by LPTC focus groups. The same lack of preparation was noted as a significant barrier to academic success in higher education (Nickerson, Bowen, & Lehrer, 2002). Outlined below are integral parts of this bridge program.

### 2.2 Expand the Family Science Program to include Geoscience Family Discovery Events

NNOAP & NSCG currently implement a Family Aeronautical Science (FAS) program in the WPS. The target group for this effort is 5<sup>th</sup> and 6<sup>th</sup> grade students and their parents (National Aeronautics and Space Administration, 1998 & 2000). Using a series of evening school meetings, participants are introduced math, science and technology involving aeronautics (Lehrer, 2000). It is found that when families engage in such activities through demonstrations, guest speakers and hands-on activities, the students as well as their parents develop a new appreciation for the subject and consequently do better in school (Scaife & Scaife, 2001). GLOWIRE will enhance family science to include geoscience subjects and expand the focus to include 7<sup>th</sup> and 8<sup>th</sup> grade students. A starter kit (Lehrer, 2002b) similar to that used by the FAS program will be developed to focus on geoscience subjects.

### 2.3 Identify Issues via Community Geospatial Workshop Series

The involvement of the community with WPS and LPTC in geoscience activities is a key partnership for GLOWIRE. Through a series of workshops led by faculty of the two educational institutions and in partnership with geoscience researchers at UNO, key questions will be addressed, i.e., “What is the best use of tribal lands?” or “What are community issues the effects of which can mitigated through the use of the Global Information Systems?”. A model similar to University of Connecticut’s (UConn, 2002) National NEMO (Non-point Education for Municipal Officials) will be used. The NEMO activities include:

1. Assemble a core group of local leaders and resource experts,
2. Determine the current status of reservation lands with respect to specific agricultural, range, commercial/industrial, residential, and other uses,
3. Determine future priorities for water, land, cultural resource areas,
4. Formulate an Action Plan based on the comparison of current land-use and future priorities,
5. Educate the populace on the key findings and recommendations of the Action Plan, and
6. Realize the Action Plan through well-crafted recommendations and continuing education.

A similar project is underway on the Santee Sioux Indian reservation. Currently, the project has completed steps 1 and 2 and is in the process of completing step 3 (Lehrer, 2002a).

### 2.3 Establish Collegiate Tour Collaborations

Collegiate tours to major university campuses are an important step for prospective students, particularly those students from small tribal colleges who often, when faced with matriculating at a large school, can initially feel extremely overwhelmed. While visiting, students are able to visit the various schools, groups, organizations, professors, and buildings on campus. This orientation will leave the tour participant with a better understanding of what to expect, how to prepare for the future, and how to become more comfortable in this new environment.

However, university campus visitations should not be limited to students but should include faculty, administrators, and staff as well. When instructors are aware of what students should expect in their future education, all can better prepared for the rigors of four-year institutional academics. Administrators can

also better prepare the students by setting up curriculum, technology, and teaching methods that mimic those of larger schools. Additionally, relationships between faculty members at each participating institution can be cultivated through tour collaboration and, thus, have the potential to flourish through such interaction. These relationships also strengthen the possibility of community college students continuing their education at four-year institutions.

2.4 Identify & Coordinate Community Resources

The following influential Winnebago tribal and community members have expressed their direct support of this proposal. GLOWIRE will coordinate efforts to forge partnerships and conduct research through these valuable resources. These individuals represent a broad cross-section of stakeholders for this research effort and include:

<u>Name</u>	<u>Affiliation</u>
Tony Provost	Omaha Tribal Employee
Louis LaRose	Board of Trustee Chairman, LPTC
Mark Versch	Manager, Winnebago Tribal Environmental Department
Ron Nohr	Construction Engineer, Winnebago Community
Dan Ferringer	Principal, Winnebago Public School
David Smith	Cultural Advisor, LPTC & Winnebago Tribal Historian
Ramona Travis	University Affairs Officer, John C. Stennis Space Center
Renee New Holy	Native American Program Specialist Educational Service Unit 1
Denise West	Water Quality Specialist, Winnebago Tribe of Nebraska
Keisuke Nozaki	GIS and GPS specialist, Winnebago Tribe of Nebraska

2.5 Other Native American Institutions of Higher Learning Involved in the Geosciences

Partnerships have been fostered with several other Native American institutions of higher learning actively involved in the geosciences. Salish Kootenai College in Pablo, MT, is engaging in research with specific applications in remote sensing and GIS of tribal lands. Students participate in internship experiences including working with faculty members, tribal natural resource departments, federal agencies, or researchers at other universities (Salish Kootenai College, n.d.). Diné College, located in Shiprock, NM, offers students opportunities to participate in research activities including a GIS Program. The GIS Program is currently working on two projects: invasive plant study and solid waste study (Diné College, n.d.). Fond du Lac Tribal and Community College (FDLTCC), located in east central Minnesota, has established a Center of Excellence. Some of the Center’s missions include introducing students to a scientific career, understanding basic soil survey and soil science concepts, and aerial photo interpretation and remote sensing fundamentals. GLOWIRE will forge a partnership between the Center of Excellence at FDLTCC and LPTC (Fond du Lac Tribal and Community College, n.d.).

***Outreach and Community Enhancement***

Goal III. Engage Native American community in geoscience outreach initiatives.

<b>Objective</b>	<b>Activities</b>	<b>Intellectual Merit</b>	<b>Broader Impacts</b>
3. Create a center of excellence for Winnebago geospatial data to be utilized throughout the community.	3.1 Enhance NNAOP activities to include geospatial components 3.2 Integrate geoscience technology into WPS curriculum to provide training on GIS & ARS components, as well as flight simulators and flight training 3.3 Establish new	GLOWIRE research examines Winnebago ideas of what kinds of community problems can be solved with geoscience technologies.  Better decisions can be made about the future utilization of tribal lands not only in agricultural and	Strengthen NSGC & EPSCoR specialized outreach  Introduce Nebraska’s Native American students to the basic aspects of flying and geospatial topics  Provide teachers in

	scholarships for completing LPTC 4-year degrees in geoscience fields 3.4 Disseminate geoscience information through increased pertinent LPTC library holdings 3.5 Integrate geospatial information into federally-funded GEAR UP program	range management areas but in issues of housing, impervious surfaces, environmentally sensitive land management, etc.  Reaffirm age-old cultural learning through the use of modern-age geoscience technology.	Winnebago community with increased exposure to geosciences.  LPTC will play a geoscience leadership role among members of the American Indian Higher Education Consortium (AIHEC).
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### 3.1 NNAOP Specialized Outreach

In 1996, NSGC researchers addressed the college presidents at the American Indian Higher Education Consortium in Rapid City, SD, heralding the first involvement of NSGC and EPSCoR with the Native American community (Lehrer, 1996). This event brought to light the need to build stronger relationships among Nebraska’s two tribal colleges, LPTC, Nebraska Indian Community College (NICC), and UNO. “The outreach initiative was quickly conceived, with the initial focus being educational partnerships, enhancement grants, and infrastructure building” (Lehrer, 1996, p.1). This exploration into the needs of Nebraska’s Native American community resulted in the establishment of the NSGC & EPSCoR Nebraska Native American Outreach Program (NNAOP).

The NNAOP has been a highly successful endeavor since its inception 6 1/2 years ago. “The NSGC and EPSCoR programs have a rich tradition of reaching out to Nebraska’s Native American educational community, particularly in the areas of improving mathematics, science, and technology” (Nickerson, Bowen, & Lehrer, 2002, p. 3). Numerous activities to enhance the viability of the program have been funded. “The programs in place, such as the Family Science Nights, Aeronautics Day, and Geospatial Workshops, have assisted educators within the Native American community to obtain and incorporate new and innovative resources into their curriculum” (Nickerson, Bowen, & Lehrer, 2002, p. 3).

The NNAOP has provided many of Nebraska’s Native American students with new opportunities to experience a variety of scientific and technological activities. The NSGC recognizes and embraces the advantages in identifying, exploring, and linking cultural heritage contributions to NNAOP activities. These activities include, model airplane construction, interactive physics lectures, and rocket launchings. GLOWIRE’s enhancement of current NNAOP activities to include geospatial components will distribute such material throughout Nebraska’s Native American population, while providing information regarding new career opportunities.

### 3.2 Technological Integration

NSGC & EPSCoR and LPTC recognize the importance of weaving technology into the local educational fabric. The NSGC & EPSCoR Airborne Remote Sensing (ARS) collaborative research team is currently reviewing images obtained through data collecting techniques involving photography equipment onboard a single engine-aircraft. Aerial photographic missions and, thus, flight operations are becoming increasingly necessary for precision agriculture, wetland preservation, and well mapping, among others important environmental issues. Through GLOWIRE, WPS may see the incorporation of flight simulators and flight training into their curriculum. This project would introduce Nebraska’s Native American students to the basic aspects of flying and geospatial topics, while creating a new and exciting use for computers, math and science. Discovery flights as well as actual flight instruction could motivate students to complete these activities. Mini-ground schools and flight training could be conducted at the South Sioux City airport.

### 3.3 Enhancing Scholarship

Funding this proposal also allows the NSGC & EPSCoR to expand the opportunities for more WPS and LPTC students to attend and remain in college until graduation. New GLOWIRE scholarships offer LPTC students additional options for completing a four-year degree. A multi-year educational initiative through this proposal will add specific transfer scholarships each year, thereby enhancing and strengthening the relationship that has been established between WPS, LPTC, and UNO.

### 3.4 Dissemination of Geospatial Information

GLOWIRE allows for the addition of library holdings in geoscience subjects for LPTC's library. Such materials include all levels of education including: books, visual aids, software, and journals. GLOWIRE also provides for development of geospatial on-line information. Such enhancement will offer not only additional outreach information, but also announcement of upcoming geospatial activities for Nebraska's Winnebago community. Funds from this proposal will also assist in dissemination of geospatial information throughout Nebraska. After obtaining the much-needed Winnebago geospatial information, LPTC will showcase the GLOWIRE findings and future activities by participating in the combined annual Dakota/Thurston County Fair.

The proposed geospatial data collection provides unique information for a variety of local Winnebago organizations including: the Winnebago Tribal Council, water-quality specialists, educators, construction companies, and planning boards among others. WPS and LPTC will host a combined Geoscience Fair that will include scientific guest speakers and interactive demonstration activities.

A variety of Winnebago tribal and community members will be involved in the implementation of this proposal. The outcomes from their participation will create the opportunity for guest speakers from within the Winnebago community to present their research to students during regular classroom meetings, as well as at workshops and special geospatial events. Such involvement would provide role models for students considering the pursuit of careers in the geosciences. These community members would also assist Winnebago educators in creating clubs and societies devoted to the geosciences in an effort to stimulate additional interest in the subject and motivate Native American students to remain in the geosciences throughout their undergraduate and graduate studies.

### 3.5 Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP)

A variety of already successful activities will be enhanced through GLOWIRE. Winnebago educators are experiencing many achievements through the federally funded Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP). Available to all 5<sup>th</sup> through 10<sup>th</sup> grade students within the Winnebago community, GEAR UP prepares these students with the necessary attitudes, skills, and knowledge needed to succeed in college. Skills workshops vary from homework management tips to test taking skills. The integration of geospatial information into the GEAR UP curriculum would ensure that all students are introduced to this innovative science, while offering new opportunities for careers and fields of study. These programs give students positive extracurricular activities and help reduce violence in the community. Substantial exposure to geospatial information prior to attending any institute of higher learning increases the possibility of students pursuing careers in the field. Additionally, assimilating geospatial information into GEAR UP would provide teachers in the Winnebago community with increased exposure to such activities and, thus, enhance knowledge of the geosciences.

## **Evaluation and Three-Year Plan**

### Intellectual Outcomes

The proposed evaluation research will provide vital information on how Native Americans conceptualize the value of geosciences education, a vital first step towards developing assessment measures for student readiness into the geospatial sciences, refining recruitment and retention programs to improve access and retention of Native American students (an underrepresented group) in the geosciences. The data collected from this evaluation will yield a greater understanding of how the relevancy of geosciences concepts may differ for Native Americans. Other outcomes include (1) information on how geosciences focused

academic activities are perceived and valued by Native Americans, which could be used to develop more culturally sensitive course curriculum; (2) information on predictors of interest in geosciences among Native Americans; and (3) information on the factors influencing Native American career choices in the geosciences.

The proposed project involves primary data collection using focus groups. The proposed work encompasses two interrelated parts. First, we will conduct focus groups with the Winnebago tribe of Nebraska to gain an understanding of their concepts of the utility of the geosciences. We will also use the focus groups to examine Winnebago ideas of what kinds of community problems can be solved with geosciences technologies and the types of careers that students can pursue in this field. Focus groups are useful for collecting information on a cultural domains (Scrimshaw & Gleason, 1992), and eliciting “natural language discourse” (Schensul & Lelomph, 1999) allowing for the identification of idiom expressions, common terminology, and communication patterns. Qualitative data allows for culturally grounded exploration of theoretical constructs, which is an essential step when conducting cross-cultural research (Hughes & DuMont, 1993).

#### Documentation

Documentation is expected to take many forms and will be an essential object of the data collection plan. Efforts will be made to collect various documents, including: letters, memoranda, and other communiqués; agenda, announcements and minutes of meetings, and other written reports of events; administrative documents--proposals, progress reports, and other internal documents; formal studies or evaluations of the same "site" under study; and newspaper clippings and other articles appearing in the mass media.

### **Three Year Evaluation Plan**

#### ***Year One***

Task 1: LPTC Faculty Training. Faculty at LPTC will be mentored as they conduct the GLOWIRE program evaluation. The faculty will be trained in the use of qualitative research at the Bureau of Sociological Research (UN-L), specifically in the use of the DICE Model. LPTC faculty will provide general oversight of the project evaluation; training, data analysis, and dissemination.

The DICE Model. The Development-in-Context-Evaluation (DICE) model (Lerner, 1996) provides a framework for program development that includes community members in all phases of research. As a collaborative model, the research process incorporates community-specific values and norms and the community gains knowledge and expertise to sustain effective programs.

Task 2: Hire Program Evaluation Coordinator. A program evaluation coordinator will be hired who will: help identify advisory board members, act as liaison between the advisory board, university personnel, and the community, locate participants, and make all logistical arrangements (e.g., site, location) for focus groups.

Task 3: Develop Advisory Board. Advisory boards will consist of 8 to 10 individuals representing numerous community sectors (e.g., school, community agencies, and religious organizations) and key formal and informal Native American representatives. In the capacity of the GLOWIRE program evaluation, the board will: offer evaluative comments and suggestions, assist in identifying and recruiting participants, provide advice regarding data collection strategies, and assist in developing focus group questions.

Task 4: Focus Group Selection and Preliminary Data Collection. Eight focus groups will be conducted. Participants will be identified with the assistance and guidance of the site coordinator and advisory board. Questions will be semi-structured and open-ended. Upon advisory board advice, questions will center around 6 areas: *Geosciences Course Curriculum and Reform and Factors which might serve as barriers to academic achievement* (e.g., acculturative stress), *Research Experiences and Other Learning Activities*

*in conjunction with Protective Factors* (e.g., familial support), *Career Development for Students in light of Personal Use and Decision-Making* (e.g., reasons for use of geosciences concepts), *Access to Academic Activities for Students* (e.g., where obtained/how accessible), *Curriculum Enhancement Bridge Program* (e.g., factors associated with the success of the program and its participants), and *Community Geospatial Workshops and Issue Identification*. Given the sensitive nature of the topics, it is deemed necessary to employ community members, or “insiders,” for data collection. Thus, 4 to 6 Native American community members will be hired as focus group facilitators. BOSR will provide all facilitator training. Focus groups will be tape-recorded and last 2 to 4 hours each.

### ***Year Two***

Task 5: On-Going Evaluation. Data will be transcribed following each focus group by trained, Native American research assistants. Evaluation will follow in which the research assistants will listen to all tape-recorded material while subsequently reading all transcribed text. This process ensures fidelity (i.e., quality control) to protocol and may reveal unanticipated themes (e.g., patterns) in participants’ responses that deserve attention in future focus groups; protocol modifications will be made if deemed necessary.

Task 6: Consultation with Advisory Board. The Advisory Board will be consulted on preliminary findings to solicit recommendation for further inquiry.

### ***Year Three***

Task 7: Data Analyses. Data will be analyzed using Thematic Analysis, a technique for identifying patterns, themes, and sub-themes in text-based data and interpretation of data based on cataloguing patterns across participants. Analysis of qualitative data typically involves selecting and reducing the data of interest into manageable units and displaying the data in ways that permit the detection of patterns and relationships (Miles & Huberman, 1994). All focus group interviews will be audio taped and transcribed to facilitate this process. For each mental health concept examined during a focus group session, a trained coder will develop a list of categories and themes related to that construct. Methods to ensure validity and reliability will be used (e.g., investigator triangulation on 20% of sessions, saturation). QSR NUDIST NVivo software will be used to analyze the data.

Task 8: Preparation of Final Evaluation Report.

Program Evaluation Coordinator The GLOWIRE program evaluation coordinator will commit approximately 60 hours per month to the evaluation with responsibilities including: identifying potential advisory board members, attending board meetings, acting as liaison between university staff and the community, locating and recruiting potential participants, and setting up all focus group sessions.

The following specifics for evaluation include (1) Advisory Board Members: community members who will receive a \$100 stipend and will meet regularly to provide advice and suggestions on recruitment of participants, data collection strategies, questions to ask participants, and assist in data dissemination to the community; (2) Selected Participants: focus group members who will be compensated \$25 for their time; (3) Research Assistants: LPTC research assistants who will be trained by BOSR to provide assistance to the focus group facilitators, transcribe focus group data, evaluate the consistency of the transcribed data with the taped data, and assist in analyzing and disseminating data; (4) LPTC Faculty: faculty members that will provide oversight of project, training, data analyses, and will disseminate the findings.

Other specifics will include (1) personnel from UNL’s Bureau of Sociological Research (BOSR) who will provide training and technical support for the LPTC faculty and focus group facilitators; (2) On-site staff that will include two professional staff, a senior project manager, a research assistant, an office to provide for develop and production of training materials/documents. A Native American facilitators will also be secured to direct training implementation and focus groups. Appropriate tape and digital recorders are necessary for taping all focus group conversation.

## Expected Outcomes

First Year:

- Establishment of Native Image
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## The Partners

### *Academic Partners*

#### 1.1 Little Priest Tribal College (LPTC)

LPTC was founded by the Winnebago Tribe in May 1996. In June 1998 the college was declared a land-grant institution. In August 1998, two years after the first class was offered, the college was accredited from the North American Central Association of Colleges and Schools. LPTC is affiliated with the American Indian Higher Education Consortium (AIHEC), the American Indian College Fund, and other associations of higher education.

LPTC currently offers Associate of Arts (AA) and Associate in Science (AS) degrees. The AA degree offers an emphasis in the following areas: liberal arts, American Indian studies, human services (alcohol and drug counseling, general human services), education, and English. The AS degree offers areas of emphasis in: math, business (general business, computer information systems), and science (environment, health, Bachelor of Science 2+2 with Briar Cliff University). The college also offers diplomas (computer information systems and early childhood education) and certificates (early childhood education). Enrollment at LPTC averages over 100 students per semester and typically the student body represents over twenty tribes.

The college currently offers several geoscience courses through the Associate of Science degree program. These courses are limited as far as introducing and engaging students in geoscience technologies and research; rather, they focus on the fundamentals of geoscience: Earth Science, Introduction to Natural Resources, and Soil and Hydrology. GLOWIRE will enhance the curriculum to introduce geoscience technologies and research opportunities for the students.

#### 1.2 The University of Nebraska

The University of Nebraska collegiate system is collaborating on a variety of innovative geospatial endeavors. Such cooperative relationships have already been established between UNO and the University of Nebraska at Lincoln Center for Advanced Land Management and Information Technologies (CALMIT).

**Nebraska Space Grant Consortium (NSGC):** The Nebraska Space Grant Consortium (NSGC) and Experimental Program to Stimulate Competitive Research (EPSCoR) are housed within the University of Nebraska at Omaha Aviation Institute (UNOAI). One of the primary goals of the NSGC & EPSCoR programs is to assist students pursuing higher education. Additionally, the NSGC, a multi-affiliate organization, provides a forum for neutral cooperation. The NSGC will derive incidental and valuable benefit by serving as coordinator and exporter of expertise, data application, and operational support as funded through this proposal. Furthermore, the mission of the NSGC includes public outreach and support throughout Nebraska, and has included the Native American community as an affiliate member for over six years. The NSGC will provide necessary education, science, and cultural leadership with a long history of outreach to Nebraska's Native American community in cooperative education, outreach, applications and research activities.

**Department of Geography and Geology:** GLOWIRE promises to create a variety of academic partnerships and cultivate current partnerships, utilizing the newly created Geospatial Lab at UNO. Dr. Jeffrey Peake, Associate Professor of Geography/Geology at UNO, will be the geoscience representative and correspondent for this project. Dr. Peake's duties as a geospatial liaison will ensure a successful



working relationship between UNO and LPTC's proposed National Center for Native American Geospatial Education. This linkage will assist LPTC in meeting national and other educational standards important to the National Science Foundation.

**University of Nebraska at Lincoln (UNL):** GLOWIRE will cultivate a collaboration of the UNL Center for Advanced Land Management and Information Technologies (CALMIT), LPTC, NSGC & EPSCoR to allow for intense cooperative research as well as statewide dissemination of outcomes. CALMIT was founded to significantly enhance and expand research and instructional activities in remote sensing, geographic information systems (GIS), automated cartography and image processing. The USDA recently funded LPTC to provide a state cooperative extension specialist for Winnebago Reservation. The University of Nebraska at Lincoln (UNL) posted the job opening. Although LPTC received the funding for the position and new facility, there was no funding for implementing such programs.

CALMIT has been instrumental in the completion and enhancement of various projects under investigation by the NSGC & EPSCoR Airborne Remote Sensing (ARS) collaborative research team (CRT). Current ARS activities include the utilization of AISA (airborne imaging spectrometer), which is currently being used on missions across the United States, constructing the multiwavelength lidar system, designing the synthetic aperture radar (SAR), and exploring various options for the design of the laser fluorescence sensor for crop stress monitoring, among other innovative accomplishments. Such research enhances agricultural knowledge and techniques for producing better crops, while providing new opportunities for addressing environmental concerns throughout Nebraska. The ARS CRT's research will provide necessary direction and support of GLOWIRE through their investigative activities.

### ***Community Partners***

#### **2.1 Winnebago Tribe of Nebraska**

The Winnebago tribe has identified higher education and preserving tribal culture as an important asset to the community. One of the purposes of LPTC is to provide language, culture classes, and training opportunities for tribal employees. LPTC serves not only to educate its students, but to also engage the community in life-long learning and cultural activities. Many courses are offered at LPTC through the Community Education Department. The community of Winnebago can engage in employment training, workshops, continuing education classes, and GED preparation and testing. To further enhance the interaction between the college and the community, the LPTC campus houses the college library, which also serves as the Winnebago Public Library. A new library is being planned on campus and will offer a computer lab, a larger storage area, and more office space. A new log cabin styled building will be completed in the early Fall of 2002. The new building will include a student center, student computer lab, the Winnebago Tribal Museum, the Language and Culture Department, and a Faculty Development Center.

#### **2.2 Winnebago Public Schools**

The Winnebago Public Schools are located on the Winnebago Indian Reservation in Northeast Nebraska. The school system is composed of elementary, middle, and high school students housed in a single building. For grades K through 8 in 2000-2001, enrollment reached 306 with Native Americans comprising 98% of the elementary student population. There were 30.3 full-time classroom teachers for the elementary through middle school. For grades 9-12, 116 students were enrolled; 97% of these students were Native American. There were 12.7 full-time classroom teachers at the high school (Great Schools, n.d.).

### ***Federal Partners***

Federal partnerships are necessary and will also be pursued through this proposal. There are several federal partners already involved with LPTC in current research projects. GLOWIRE will integrate these agencies' activities to provide value-added results for all participants.

### 3.1 United States Department of Agriculture (USDA)

The USDA recently funded LPTC to provide a state cooperative extension specialist to serve the reservation. A partnership has been created between LPTC, the Winnebago Tribal Council, and the University of Nebraska Cooperative Extension to conduct non-formal education and outreach activities to help meet the needs of the Winnebago people and provide essential services to their community. The target audience will include all Winnebago Tribal youth and their families, with an emphasis on ages 10-18. A tribal youth development plan will be launched, focusing on character education, youth leadership, lifelong learning skills, healthy lifestyles, and exploration of science and technology (Little Priest Tribal College, 2002).

### 3.2 Environmental Protection Agency (EPA)

LPTC will assist the Winnebago tribe of Nebraska to take over EPA regulatory authority for the reservation. The Tribal Council of Winnebago obtained an Environmental Assistance grant from the EPA in the Fall of 2000. The primary environmental issue on the Winnebago Reservation is the management and use of pesticides and how they have impacted surface groundwater quality. Several positions have been created under the Environmental Department in the Winnebago Tribe of Nebraska including a water quality specialist, an air quality specialist/solid waste manager, a geographic information systems specialist, and a pesticide administrator. The GIS Specialist currently collects spatial data with a hand-held GPS receiver and utilizes the GIS software program ArcView to analyze the data. The spatial information gathered will inform tribal leaders, tribal employees, and the community on how to make better decisions to preserve and protect the land on the reservation (Winnebago Tribe of Nebraska, n.d.).

## **Past Grant Accomplishments**

LPTC has received numerous grants to further the educational endeavors of Nebraska's Winnebago population. The U.S. Department of Agriculture has allocated \$51,619.00 for a wildlife biology field research project, \$135,000.00 for library construction, and \$51,619.00 for the Winnebago site selection and restoration plan. The U.S. Department of Education has provided \$350,000.00 for strengthening educational aspects of LPTC, \$122,380.00 for program development and implantation for bilingual education, and \$131,492.00 for gaining early awareness and readiness for undergraduate programs. Additionally, the U.S. Department of Health and Human Services has given \$200,000.00 for a family community violence prevention program. Finally, the U.S. Department of Defense has contributed \$52,565.00 for "Beyond the Textbook Improved Experimental Science and Math Education," \$293,154.00 for an Ellsworth Air Force Library contract, and \$292,398.00 for an Offutt Air Force Library contract.

The University of Nebraska system has received various awards in relation to GLOWIRE. NSGC was recently upgraded to Designated status within the NASA Space Grant system. Most of NSGC's current funding has been allocated directly from NASA in the following grants: \$218,750.00 for Nebraska Space Grant Consortium Designated Status Upgrade, \$2,100,000.00 for the Aeronautics Education, Research, and Industry Alliance (AERIAL), and \$82,500.00 for workforce development. Additionally, the University of Nebraska – Lincoln received a National Science Foundation grant in the amount of \$450,000.00 for the establishment of the University of Nebraska Airborne Remote Sensing Facility.

## **Budget**

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