

Tribal Colleges & Universities Project (TCUP)  
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PROJECT DESCRIPTION

NASA's Tribal Colleges and Universities Project (TCUP) is a science, technology, engineering and mathematics (STEM) educational grant and mentoring program that specifically targets Tribal Colleges and Universities. The overall goal of the project is to expand opportunities for the nation's STEM workforce through capacity building, infrastructure development, research and engineering experience, outreach, and information exchange.

Historically, the TCUP has supported a variety of activities for students, teachers, faculty, staff and researchers from the tribal college and university community in NASA-related STEM fields within the tribal college context of culture and traditions. The project represents one of the headquarters and center activities under the Minority University Research and Education Program (MUREP) to engage, educate, and employ underrepresented and underserved communities in NASA-related STEM fields through the tribal college and universities, as part of NASA's effort to ensure that we can meet future workforce needs in STEM.

Starting in late FY 2010, NASA's TCUP is implementing its program through its 3 primary new projects which resulted from a NASA announcement of opportunity released in the summer of 2010 by the NASA Office of Education, Minority University and Education Program (MUREP) and several other on-going projects. The three awards made under the opportunity (a Cooperative Agreement Notice) are intended to apply innovative new approaches to leverage NASA's unique assets for STEM education, enhance tribal college academic experiences, and improve educators' abilities to engage their students. The three awards – selected through a peer-reviewed competition - were made to a tribal college, a Native American-owned consulting firm, and a Native not-for-profit education organization, all of whom are helping NASA over the three years to strengthen research and mentoring relationships between NASA scientists and engineers and the TCUs that will lead to longer-term research and engineering collaborations, and increased research and engineering program capacity building at the TCUs.

As noted, the TCUP program consists of 3 primary elements plus 2 smaller activities. The three primary elements of the TCUP are as follows: 1) NASA TCUP "externship" opportunities or Research Experiences for Undergraduates (REUs), which provide NASA expertise and training in research, engineering, and education opportunities to Tribal College and University faculty and students out in Indian country – bringing NASA to the TCUs; 2) NASA TCUP Center Summer Research Experience (SRE) internships which provide NASA Center expertise, experiences, and mentoring; and (3) a special tribal college engineering internship program to participate in a NASA flight mission and enhance TCU engineering training. The two smaller activities included the American Indian Alaska Native Climate Change Working Group (AIAN CCWG), a TCUP STEM outreach and network activity which provided a venue for increased STEM planning, collaboration, and information exchange as well as an enrichment grant program to build capacity in climate change research and education and TCUP also provided

support to the Northwest Indian College REZriders team in the First Nation's Rocketry Launch Campaign.

## PROJECT GOALS

1. Focus the Agency's attention on identifying and removing barriers to TCU participation in NASA programs that support Science, Technology, Engineering, and Mathematics (STEM) education and achievement toward future workforce potential by providing NASA Research Experiences for TCU faculty and undergraduates out in Indian Country at tribal colleges or at NASA Centers. (Supports HE objectives 1.1, 1.2, and 1.3 for Outcome 1)
2. Expand outreach activities to attract and retain students in STEM and to increase the interactions between TCUs and NASA, with particular attention paid to activities designed to increase TCU familiarity with the Agency. Strengthen collaboration between NASA and tribal colleges to improve high quality NASA education and research opportunities at the 36 Tribal Colleges. (Supports HE objectives 1.1, 1.2, and 1.3 for Outcome 1)
3. Enhance TCU STEM infrastructure and help engage TCU students in NASA's missions, such as through development of local climate change research programs with faculty and students at TCUS or engineering flight mission internships which actively involve students in the engineering and implementation of NASA flight missions. (Supports HE objectives 1.1, 1.2, 1.3, 1.4, for Outcome 1)

## PROJECT BENEFIT TO OUTCOME (1, 2 OR 3)

### **The Tribal College and University Project (TCUP) supports:**

**Objective 1.1 Faculty and Research Support:** TCUP provides NASA competency-building education and research opportunities for faculty and researchers through the 3 new awards for the 2011 Summer Research Experience Internship/Externship Programs as well as the AIAN CCWG Mini Grant program, which all provided research opportunities for faculty members at tribal colleges and NASA centers.

**Objective 1.2 Student Support:** TCUP provides NASA competency-building education and research opportunities to individuals to develop qualified undergraduate students who are prepared for employment in STEM disciplines at NASA, industry, & higher education.

**Objective 1.3 Student Involvement Higher Education:** TCUP provides opportunities for groups of post-secondary students to engage in authentic NASA-related, mission-based R & D activities through the 2011 Summer Research Internship/Externship Programs in which students carry out NASA-related scientific projects in cooperation with NASA/science or engineering mentors at a Tribal College or NASA center.

**Objective 1.4 Course Development:** (NASA-related course resources for integration into STEM disciplines) in several ways: (1) provided NASA engineering expertise and teaching materials associated with development and implementation of a design review and mission development on a payload design at Salish Kootenai College, and (2) the 2011 REU Externship created extensive special course materials for the 3-weeks teaching experience at Haskell Indian

Nations University for the 28 students and 15 faculty in attendance in such areas as climate change, GIS, GPS, remote sensing, and the scientific method. A specific example of special course development is a geospatial training tutorial specific to tribal trainees for the NASA Summer REU by the Kiksapa group managing the externships. This tutorial was implemented during the Summer 2011 externship. To meet the broad impacts requirement of the CAN, Kiksapa has made the tutorial available at no cost to the general public. They have posted it to their website and have made it available upon request. To date, Kiksapa has responded to a request by the tribal network from TribalGIS.com to make the tutorial available to many Tribal GIS users. Turtle Mountain Community College is considering using the tutorial for their GIS class Spring, 2012. Finally, Kiksapa, in partnership with ESRI is exploring using training exercises and elements of the Kiksapa tutorial to contribute ESRI's Tribal GIS book, an annual publication by ESRI. Kiksapa has contributed significantly to ensuring that NASA resources have made a broad and meaningful impact across Indian Country and the Nation.

**Objective 1.5 Targeted Institution Research and Academic Infrastructure:** TCUP provided individual climate change research and education to TCUs through the Kiksapa REU Academic Research Experience to develop an institutional research agenda at tribal colleges on climate change and through the American Indian Alaska Native Climate Change Working Group (AI AN CCWG) Mini-Grants. These activities build TCU capacity in climate-change related research activities and fund unique projects involving undergraduate students in hands-on research conducted on tribal lands and focused on issues relevant to Native peoples.

**PROJECT ACCOMPLISHMENTS (CONNECTION BACK TO ANNUAL PERFORMANCE GOALS AND PLANS)**

1. **Removing barriers to TCU participation through NASA Research Experience for Faculty & Students.** One of the major barriers for TCU students traditionally has been the inability to leave home for any significant length of time due to family obligations so NASA TCUP created its "externship" program several years ago. This program has dramatically removed that barrier and, for those students reluctant or unable to leave their homes, children, families, and jobs, NASA continued to improve its "externship" program in which the initial 3-week NASA portion of the program was held at a tribal college (within driving distance for many of the participants) rather than a NASA Center and then the remaining 7 weeks of research was conducted at their home institutions, resulting in a minimum amount of time away from families. Result of this externship program has markedly improved retention in the program and enthusiastic completion of the externships by registered student interns.

2. **Outreach.** NASA increased communications to TCUs through active support of TCU student and faculty participation in meetings such as the American Indian/Alaska Native Climate Change Working Group (AIAN CCWG), and through portals/websites such as the American Indian/Alaska Native Climate Change Working Group and AIHEC. As part of a special outreach effort, NASA TCUP continued to support the American Indian Alaska Native Climate Change Working Group (AI AN CCWG). The AI AN CCWG was formed in response to the need for education and research programs in climate change at Tribal Colleges and Universities (TCUs). Its overarching goals are: to prepare future generations of American Indian and Alaska Native earth science professionals; to ensure that indigenous tribal knowledge of landscapes and climates are valued and incorporated into the tribal exercise of earth science education and research; and to promote communication and partnerships among the TCUs, federal partners, colleges and universities, and NGOs. The AI AN CCWG is housed and coordinated by Haskell Indian Nations University and has working group membership among all of the TCUs.

**3. Enhance TCU STEM infrastructure such as through creation of pre-engineering or engineering courses program.** Provided NASA engineering expertise and support to strengthen engineering infrastructure at Salish Kootenai College (SKC) through the new SKC program which is significantly increasing the participation of TCU engineering and science students and faculty in NASA flight missions through their direct participation in the design, building, testing, and flight of the proposed SKC CubeSAT mission and in the 2011 Mars Science Laboratory rover mission.

PROJECT CONTRIBUTIONS TO PART MEASURES (INCLUDE DATA PLUS EXPLANATION)

**1. Continue TCU STEM faculty and students summer research experience programs at the NASA TCUP “externship” at Tribal Colleges in Indian Country or at NASA Center internships during FY 11 (Maps to APG 1 and Outcome 1: 1.1, 1.2, 1.3)**

1.1: Faculty received training in science, engineering, GIS and remote sensing at NASA Centers as well as during training sessions out in tribal colleges and universities that prepared them to conduct earth surface dynamics research activities locally.

1.2: Students worked with their faculty mentors on research teams that were given research methods training at a tribal college, after which they returned to their home institutions to conduct research on topics ranging from the impacts of climate changes on traditional Yup'ik Eskimo food in the Yukon River Estuary to the impacts of changes in temperature and precipitation on the agriculture of the Navajo Nation.

The 2011 NASA REU externship program involved 15 faculty and 28 students from 14 TCUs: College of Menominee Nation, Dine College, Haskell Indian Nations University, Iisagvik College, Leech Lake Tribal College, Navajo Technical College, Northwest Indian College, Nebraska Indian Community College, Saginaw Chippewa Tribal College, Sinte Gleska University, Southwestern Polytechnic Institute, Tohono O'odham Community College, Turtle Mountain Community College, and White Earth Tribal and Community College.

**Examples of GSFC “Externship” Student Projects for the 2011 Kiksapa Research Experience for Undergraduates (REU):**

**Haskell Indian Nations University,** “Oceanic Manifest Destiny: Climate Change, Relocation and Indigenous Peoples”

**Tohono O'odham Community College,** “Environmental Conditions Promoting the Proliferation of Buffelgrass on the Tohono O'odham Nation”

**College of Menominee Nation,** “Eneq kanawehenah enoh maeqtekuahkihkiw "We keep/ take care of that forest”

**Iisagvik College,** “Arctic Sea Ice: Condition and Extent”

**Southwest Polytechnic Institute,** “Correlations Between Climate and Tornadoes in the Choctaw Nation”

**White Earth Tribal and Community College,** “Wild Rice-Aquatic Vegetation: Lower Rice Lake”,

**Navajo Technical College**, “Using LandSAT 5TM Ration and Band Combination to FIND Eolian Sand Dune Deposits and Mobility on the Navajo Nation”

**Leech Lake Tribal College**, “Water Surface Level Project”

**Northwest Indian College**, “Portage Island Plant Survey”

**Dine College**, “Identifying a Decrease in Agriculture on the Navajo Nation over Past Years”

**Turtle Mountain Community College**,” Using Climate Moisture Indices to Predict Land Cover in the Turtle Mountains, North Dakota”

**White Earth Tribal and Community College**, “Lower Rice Lake, the major wild rice-producing lake on the White Earth Reservation: Historic to Present Water Levels”

**Sinte Gleska University**, “Water Resource Profile Project”

**Navajo Technical College**, “Analyzing medicinal plant stress from climate anomalies”

**Saginaw Chippewa Tribal College**, “Monitoring E. coli, Nitrate, and Phosphate levels in the Chippewa River”

**Haskell Indian Nations University**, “Traditional Connection Remain Despite Many Changes”

**Northwest Indian College**,” Lummi Nation Nooksack River Estuary Restoration: Smuggler's Slough”

**Northwest Indian College**, “At Sea Level- Yup'ik people and Salmon Living through Change”

**Nebraska Indian Community College**, “A geospatial look at the changes of the Niobrara Missouri River confluence and the sediment deposited in the Missouri River”

1.3: NASA Centers worked with students on a variety of projects under the 2011 TCUP NASA-AIHEC SRE Center internship program. This provided all participants valuable exposure to the realities of working with NASA and other scientists and engineers at tribal college training sessions.

**Examples of student projects carried out at the NASA Centers under the 2011 TCUP SRE Center Program:**

**Johnson Space Center**, 2 students, **Salish Kootenai College**, “Robotics Design and Engineering, and Development and Testing of Autonomous Flight Manger software in rapid prototyping flight software setting “

**Marshall Space Flight Center**, 2 students, **Blackfeet Community College**, **Salish Kootenai College**, “Florida wildfires and sea grass habitat and effects from storms”

**Kennedy Space Center**, 6 students, 1 faculty, **Institute of American Indian and Alaska Native Cultural College**, “Modeling and Simulation educational applications of NASA 3-D simulation system

**Ames Research Center**, 4 students, **Navajo Technical College**, **Haskell Indian Nations University**, “TCU focused studies on engineering-based problem solving”

**Dryden Flight Research Center**, 1 student, **United Tribes Technical College**, “Curriculum materials development using NASA Digital Learning Network resources”

**2. Initiate an enrichment grant program to build capacity in climate change research and education at TCUs through mini-grants coordinated by the AI AN CCWG (*Maps to APG 1 and Outcome 1: 1.1, 1.2, 1.4, 1.5*)**

1.1: Faculty received funding to conduct research projects related to climate change impacts, adaptation and mitigation that are relevant to their degree programs, course structure, or needs identified by their tribal entity .

1.2: Students were provided research opportunities and internship funding support.

1.4: Research projects were used to enhance or develop new course curriculum and laboratories in earth science classes.

1.5 Through a competitive proposal and review process, 3 colleges were selected for the AIAN CCWG Mini-Grant funding from the 2011 call for proposals:

- 1 “Native Youth Climate Action Project”, **Institute of American Indian Arts (IAIA)**,
2. “Measuring for Variance in Blooming of Wild Prairie Rose and Yellow Lady Slipper for Evidence of Climate Change”, **Turtle Mountain Community College**
3. “ Teaching Generational Climate Change through Traditional Cultural Knowledge ”, **Blackfeet Community College**

**3. Convene one Tribal College Conference (Maps to APG 2 and Outcome 1: 1.1, 1.2).**

NASA TCUP provided support for two workshops of the American Indian Alaska Native Climate Change Working Group. The first workshop, held in November at Northwest Indian College in Bellingham, WA, had more than 110 attendees with students and faculty from 15 TCUs and representatives from 8 tribal governments, 5 federal agencies, and 3 regional universities. The workshop provided an opportunity to network and share information about adaptation activities addressing climate change impacts being developed by tribes and tribal colleges in the Pacific Northwest. In addition, important information sessions about means by which Native peoples can participate in the current USGCRP National Climate Assessment were offered by federal agency partners. Twenty two student posters on undergraduate summer internship projects were displayed and presented.

The second AIAN CCWG Working Group Meeting was held in April 2011 and hosted by Salish Kootenai College, Pablo, MT. The workshop included in-depth discussions about TCU campus initiatives on climate change, adaptation, sustainability, undergraduate research, and education from an indigenous perspective by tribal college students, faculty, federal and state agencies, university researchers, elders, and other organizations. Student and faculty presentations of some of the TCUP mini-grant research results were also presented..

**4. Continue and enhance engineering education to be taught at a Tribal College in order to enhance engineering education at the TCUs. (Maps to APG 3 and Outcome 1: 1.1, 1.2, 1.4)**

Salish Kootenai College has accomplished major progress in significantly increasing the participation of tribal college engineering and science students and faculty in NASA flight missions, and, hence, helping to motivate and prepare Native American students to go on to careers at NASA Centers, contractors or universities through activities at SKC in support of (1) designing, building, testing, and flying a CubeSat mission in Earth orbit, (2) participating in a major NASA flight mission, the 2011 Mars Science Laboratory rover mission, and (3) exploring new opportunities for SKC participation in future missions. Nine undergraduate tribal college students worked as student research interns, 7 from SKC, 1 from Stone Child College, and 1 from Southwest Indian Polytechnic Institute and all 9 students performed preliminary design of the SKC CubeSat. These students also participated in constructing a satellite communication ground station for downlink and uplink communications with the future CubeSat camera on NASA HASP flight, designed a stereo camera system for acquiring imagery under the mentoring of 4 SKC faculty members.

IMPROVEMENTS (e.g. project management, efficiencies, etc.) MADE IN THE PAST YEAR

- Implemented improved iteration of experimental “externship” program by new awardee, a Native-owned company, to accommodate participants who have family or personal obligations which would otherwise prevent them from participating in the standard NASA internship (such as single parents, parents of young children and/or heads of households). Number of students and faculty participating in the externship was doubled. The initial 3-week training was held at a tribal college in Indian Country to make it possible for students to travel home for domestic emergencies if necessary, after which they spent 7 weeks conducting project research at their home institutions. This arrangement minimized the need to be away from home for a significant length of time (often a barrier for many TCU students), while providing valuable research methods training and experience. Externship was managed by Native owned company (Kiksapa) at a new host TCU (Haskell Indian Nations University) with improved attention to the needs of the students culturally as well as institutionally.
- Externship also provided hosting/organizational experience to the new host tribal college (Haskell Indian Nations University) for the 3-week NASA introduction to STEM principles, GIS, & NASA remote sensing - providing the host institution valuable project management training and experience for NASA projects.
- Increased participation by students (now more familiar after a NASA internship) with STEM-related issues and Earth sciences issues about their own local region or tribe) in STEM-related TCU events/activities – e.g., , American Indian/Alaska Native Climate Change Working Group, AIHEC Student Conference, etc.
- Many NASA Externship/Internship program students gave successful power point presentations and presented a poster about their student project at the American Indian/Alaska Native Climate Change Working Group meetings or other meetings
- Significantly closer coordination and more efficient implementation of the TCUP internships/externships in all aspects was clearly evident especially in 2 of the new TCUP awardees - in the REU Externship Program as well as the Salish Kootenai College engineering program - with far greater attention paid to the details that help guarantee success of our students.

PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION *(THIS IS WHERE FURTHER FOLLOW-UP TO OCCUR FOR COLLECTING 2010 GRANTEE PERFORMANCE SUMMARIES FOR PUBLISHING TO OUR EDUCATION HOME PAGE)*

The following partners were instrumental in project execution: The American Indian/Alaska Native Climate Change Working Group (AI/AN CCWG), Kiksapa Consulting LLC, Salish Kootenai College, American Indian Science and Engineering Society (AISES), United States Geological Survey (USGS), U.S. Environmental Protection Agency (EPA), North Dakota Tribal College Association, American Indian Higher Education Consortium (AIHEC), University Corporation for Atmospheric Research (UCAR) and National Center for Atmospheric Research (NCAR), The Climate Institute, Native View Project, the Center for Remote Sensing of Ice Sheets (CRISIS) of the University of Kansas.