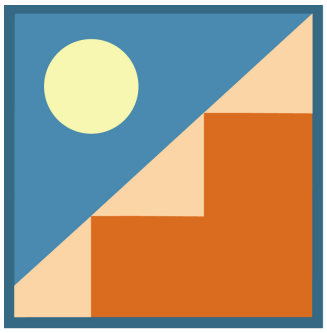

New Mexico EPSCoR

C2: Improving Broadband Connectivity for Tribal and Regional Colleges in New Mexico

Year One Annual Report
September 1, 2010-August 31, 2011

Award Number: 1005886

Submitted by:

William K. Michener, Project Director

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Executive Summary

Vision, Mission and Goals

Cyberinfrastructure (CI) planning within New Mexico, coupled with past NSF EPSCoR investments, has enhanced research opportunities by improving connectivity to the major research institutions, increasing high performance computing capacity, and adding visualization and collaboration technologies. Significant challenges remain, particularly with respect to increasing connectivity to and within the smaller and more remote institutions, supporting data and model interoperability, and training a CI-literate work force.

The vision for this project is to *enable small and rural institutions to employ improved cyberinfrastructure to enhance education and research, increase diverse participation in research and learning at all levels, and advance external engagement, workforce and economic development, and collaboration.*

The goal of this project is to *improve bandwidth and cyber connectivity for three rural higher education institutions in New Mexico*. Two are Hispanic Serving institutions - Western New Mexico University and Northern New Mexico College - and one is a Tribal College – Navajo Tech.

Key Accomplishments in Year One

Intellectual Merit
All of the CI upgrades implemented at each institution will increase students' access to collaboration technologies, online research tools and online courses. Once fully implemented, the CI enhancements will allow each campus to increase on-line course offerings as well as more effectively utilize the Education Gateways that have been installed by the NM Computing Applications Center (NMCAC).

Broader Impacts
Each campus directly involved in this project has a large population of students generally underrepresented in science, technology, engineering and mathematics (STEM) education and research. The enhanced CI resulting from this award will provide additional opportunities for URM students and women to engage in STEM courses and related opportunities. Through its connection to EPSCoR Track 1 and Track 2, this project will make high-quality environmental data, information, and models available for STEM education and outreach, including classroom and laboratory use and student research. The project's outreach activities to K-12 students in these same communities will help prepare the future scientific workforce with better-developed quantitative reasoning, data analysis, and modeling skills.

Specific accomplishments to date include:

- WNMU purchased and installed equipment to upgrade the Silver City campus network.
- WNMU bandwidth of the network backbone was increased from 100MHz to 1GHz.
- Bandwidth of WNMU Internet access has increased from 30Mbps to 40Mbps.
- NNMC has purchased and begun installation of appropriate equipment to upgrade the campus to gigabit speeds.
- NTC developed detailed project implementation plans and has worked to establish collaborations necessary for enhancing the Internet to the Hogan network.
- Faculty and staff from 6 institutions attended a workshop on how to effectively use the NMCAC Education Gateways in their courses.
- Two projects to develop course material using 3-D visualization capabilities of the Education Gateways have begun.
- Teachers to lead new high school Supercomputing Challenge teams have been recruited and engaged in professional development activities.

Response to EAC Recommendations

The External Advisory Committee provided several recommendations for project improvement; they are provided in the Management section of this report. Each campus lead has received the EAC's report and is working to address the recommendations specific to their campus; their responses will be discussed at the upcoming Management Team meeting. The Management Team meeting itself provides a venue to address the EAC's first recommendation to continue collaboration and discussion between the three campuses involved in this project. In addition, those recommendations concerning the project's evaluation plan have been communicated to the external evaluator; he is working with project leadership to develop a response to those specific recommendations.

Of note, the EAC provided one recommendation to NSF:

> We strongly encourage NSF to continue to support the C2 program to allow campuses to update and replace all legacy equipment to continue to address the rapidly evolving needs of faculty, students and the community. It is obvious that this C2 project has been very successful, but the current level of funding is not sufficient to address the existing needs, let alone the future CI requirements.

Detailed Report

Participants and Participating Institutions

"C2: Improving Broadband Connectivity for Tribal and Regional Colleges in New Mexico" focuses on improving the cyberinfrastructure at three NM institutions:

- Western NM University (WNMU) in Silver City, NM
- Navajo Technical College (NTC) in Crownpoint, NM
- Northern NM College (NNMC) in Espanola, NM

WNMU is a Hispanic-Serving university located in Silver City in the sparsely populated southwestern corner of NM. The university enrolls approximately 2,900 students on the main campus and, using on-line and ITV technologies, delivers an expanding number of distance learning courses to its extended university sites and several regional end-user sites. WNMU serves as a comprehensive, regional, rural, public and coeducational institution and offers 41 baccalaureate degrees, ten masters degrees, associate degrees, and certificate programs. WNMU provides pre-university adult education services (GED, ESL, Citizenship Training, etc.) to students and it provides education and training to more than 1,000 welfare recipients under the WNMU works program sponsored by the NM Department of Labor. As part of its commitment to economic development, the university houses the local economic development agency and one of NM's Small Business Development Centers is located on campus.

NNMC is also a Hispanic-Serving, rural institution and began as a teacher training school for the State's Spanish-speaking population. In the 1960s, the school began offering two-year degree programs with an emphasis on technical-vocational degrees. For the next 40 years, the mission of the school evolved and expanded until legislation in 2005 changed the institution's name to Northern New Mexico College and permitted it to offer four-year programs. Today, NNMC is a comprehensive regional public college enrolling approximately 2,100 students across 40 associate degree and ten baccalaureate degree programs as well as certificate programs. The college's service area is primarily rural or semi-rural and encompasses an area larger than Massachusetts. Its main campus is in Espanola (population ~ 10,000), and its second campus is in El Rito, nestled in the Carson National Forest. NNMU

operates ten off-site attendance centers in schools and other public facilities in rural communities and an environmental science lab in Santa Fe.

NTC, a Tribal College, previously named Crownpoint Institute of Technology, is located on the Navajo Nation in Crownpoint, approximately 125 miles west of Albuquerque. The Navajo Nation and a Board of Trustees appointed by the tribe administer the college, which offers approximately 570 Navajo students a range of certificate and associate degree programs accredited by the North Central Association of Colleges. NTC serves 30 Navajo Chapters whose 56,542 people live in remote, rural areas encompassing more than 4,396,734 acres of land. The college has open admission, meaning that any member of the Navajo Nation may attend courses tuition-free. The mission of the college expresses a commitment to nurture intellectual growth with an emphasis on the Diné philosophy of education, and it encourages integration of traditional Navajo culture and language into all learning experiences on campus.

In addition, the New Mexico Computer Applications Center (NMCAC) and the Supercomputing Challenge (SCC) are providing educational outreach activities for this project. Through their participation, they are working to broaden participation to other community colleges in the state as well as to the K-12 education community. Their activities are detailed later in this report.

See Fastlane entries for participant information for this award. In Year One, there were a total of 23 participants in the award. Of the total, 43% were underrepresented minorities (URM) and 35% were female. See Table 1 below.

Institution	Male	Female	Total	URM	Disability
WNMU	2		2		
NNMC	4		4	4	
NTC	3		3	3	
UNM	2	5	7	2	1
NMCAC		1	1		
SCC	1	2	3		
EAC (Advisors)	3		3	1	
Totals	15 (65%)	8 (35%)	23	10(43%)	1 (4%)

Table 1. Demographics of NM EPSCoR C2 Participants, Year 1

Program/Project Description

Project Accomplishments

Year One activities have focused on acquiring equipment appropriate for each campus based their needs for improving their bandwidth and cyber connectivity. The general focus of each campus' CI enhancements did not change from those included in the proposal, but changes in equipment availability and small changes in campus status in the interim warranted a review of equipment purchases. The list of equipment purchased is provided in the Equipment section at the end of this report.

Western NM University (WNMU) efforts are focused on enhancing access to broadband communication for WNMU's students and other members of the regional community. The equipment outlined in the grant proposal has been purchased. Through negotiation and competitive proposals, WNMU was able to save $16,000 on the purchase of this equipment with which they purchased additional broadband switching equipment, which has arrived at WNMU. At this time, all grant monies have been expended.

All of the equipment has been installed except those components designated for three campus buildings currently undergoing renovation (Castorena, Juan Chacon, and Chino) in order to protect that equipment from the construction environment. These final pieces of equipment will be installed as part of the final renovation efforts when major construction has been completed. The current estimate for installation of this equipment is January 2012.

The upgrades at Western have allowed them to raise the bandwidth of the WNMU network backbone from 100MHz to 1GHz and the bandwidth of WNMU Internet access from 30Mbps to 40Mbps. They have also implemented an OC3 network connection at the Silver City main campus and DS3 network access at the Deming Mimbres Valley Learning Center.

In the time between submission of the proposal and receipt of funding, some of *Northern NM College (NNMC)'s* specific needs for improved connectivity changed with respect to a newly constructed building. The slightly revised plan maintains the focus of upgrading switches and routers to provide gigabit speeds throughout the campus, but a new building connection was no longer needed, which allowed them to purchase more routers and switches for the college network. Network switches have been purchased and installed; additional routers are expected to be received and installed by the end of summer 2011. Fiber connection to a new building (SERPA) has been postponed to Year Two of this award.

Navajo Technical College (NTC) also revisited their plans in order to take advantage of equipment advances that had occurred in the interim between proposal submission and award. NTC continues to focus on enhancing the Internet to the Hogan initiative, extending its wireless transmission network to better serve the Navajo Nation as well as connect to the University of New Mexico (Gallup) GigaPoP. They have opted to connect NTC and the University of New Mexico with a Motorola PTP800 Microwave Solution, using different equipment than was proposed but achieving the same objective. This will provide a 355MBPS Wireless Backhaul from Navajo Technical College Campus to UNM Gallup Campus. The proposed system will consist of three separate Motorola PTP800 Microwave Links. The system will provide a wireless Ethernet path from the UNM Gallup Campus to the Navajo Technical College Campus through two remote radio tower locations (Gibson and Dezza Bluff). All paths are licensed, operate in a 1 + 0 configuration and will provide 354 Mbps aggregate Ethernet throughput at 99.999% availability. NTC's current plans to connect through UNM will provide NTC access to the Western Regional Network. The Western Regional Network is a multi-state partnership to provide advanced, robust high-speed networking for research, education, and related uses.

Diversity

Each of the institutions involved in this award have large populations of minority students, as seen in Table 2 below. Therefore, the connectivity improvements resulting from this award will serve to enhance the educational experiences of students who are generally underrepresented in STEM fields. As these institutions are often the community's center of educational, social and cultural experiences, enhancements to their cyberinfrastructure will benefit the entire community and contribute towards economic development.

Institution	Undergraduate Enrollment	Hispanic	Native American	Female
NNMC	2,139	70%	8%	62%
Navajo Tech	567	0%	99%	49%
WNMU	2,882	45%	3%	66%

Table 2. Demographics of C2 Institutions; data from Fall 2009

The educational outreach activities (described later in this report) will broaden the impact of the cyberinfrastructure enhancements to students at the K-12 level and to students at other campuses in New Mexico. Specifically, the Supercomputing Challenge is adding three new high school teams, one in each community served by WNMU, NNMC, and NTC. As part of the development of the teams, high school teachers have been recruited and will receive professional development that will prepare them to guide their students in conducting projects that use computing to solve engaging problems.

At the post-secondary level, the NM Computing Applications Center has partnered with NM EPSCoR to offer a workshop for community college faculty and staff on how to use the NMCAC Education Gateways to enhance instruction on their campuses. There were 10 participants from six institutions—two research universities and four primarily undergraduate institutions—at the initial workshop. Following the workshop, proposals were solicited for development of course materials that will make use of CI enhancements, including 3-D visualizations. Two projects at non-research institutions have been selected and are under development (described below).

Institutional Collaborations
Each of the institutions has established collaborations with other institutions and service providers in their efforts to improve connectivity.

WNMU is working with NM State University to share applications and anticipates that NMSU will host WNMU's learning management system. WNMU is also part of the regional team negotiating franchise licensing with ComCast for the Grant County area.

Northern NM College has established collaborations with the Regional Development Corporation, a regional economic development organization in Northern NM (www.rdcnm.org), the NM Dept. of Information Technology (www.doit.state.nm.us), Kit Carson Electrical Cooperative (www.kitcarson.com), and the University of New Mexico IT Department. They are working with Advanced Network Management on the design and installation of their network upgrade.

In order to enhance the Internet to the Hogan (ITTH) project by providing a secured redundant backhaul to the Albuquerque Giga-PoP and extend services to the meet bandwidth demands of the Zuni Pueblo, *Navajo Tech* has held numerous planning meetings with representatives from the UNM Main Campus IT Department, UNM-Gallup (branch), and Zuni Public Schools. Advance Communications is providing expertise for the upgrades.

Workforce Development

The educational programs at WNMU, NNMC, and NTC are geared toward workforce development. The broadband and cyber connectivity improvements resulting from project activities will enable each institution to enrich course content, expand the delivery area, and strengthen programs focused on workforce and economic development in their respective service areas.

The investments in education outreach provided in this award also contribute to workforce development in STEM areas. The Supercomputing Challenge (SCC) is a yearlong experience that provides CI training for teachers as well as high school students. Challenge teams of up to five students and a sponsoring teacher define and work on a single computational project of its own choosing. Throughout the

program, help and support are given to the teams by their project advisors and the Supercomputing Challenge organizers and sponsors. The SCC is establishing three new teams, one in each community served by WNMU, NNMC, and NTC. As part of starting the teams, funding is used to send teachers to the Summer Teachers' Institute (STI), which provides professional development in computer modeling and project-based learning that enables the teachers to support a challenge team in the coming year. In Espanola, the community served by NNMC, SCC is joining forces with NNMC to provide a four-week June mathematics and computing course for high school students in Rio Arriba County. In Silver City (WNMU), the SCC will be holding a summer "Round-Up"—an event for students and teachers that gives them an introduction to the types of projects and activities carried out through the Supercomputing Challenge competition.

In April 2011, NM EPSCoR partnered with the New Mexico Computing Applications Center (NMCAC) in offering a training session to help faculty use their NMCAC Education Gateway equipment more effectively. Each Gateway provides 3-D visualization capability and video conferencing that can be used for distance education. Faculty from Luna Community College led the workshop; half of the participants joined the workshop using their Gateway and half attended in person. Subsequent to the workshop, NM EPSCoR invited faculty to participate in "Using Cyberinfrastructure for Education Project" (UCIE), through which they would develop course materials that make use of the Gateway technology. Two projects from non-research institutions are under development:

Eastern NM University: Computer and Network Security Fundamentals
The scope of this project will focus on the content improvement of the IS 131 Computer and Network Security Course by incorporating and demonstrating the use of 3d graphics modeling of cyber terrorists' threats. The project will also implement interactive blackboard integrated labs, using the LabSim Testout products.

NMSU-Grants: 3-D Visualization Tools: Procedures and Methods for Introductory Engineering Analysis and Problem Solving
This course module will help modernize the curricular approach to teaching computer-aided problem solving by introducing students to the latest computational techniques in distributed computing and 3-D visualization early on in their studies. The framework established in this module, utilizing the NMCAC Gateway Network, will facilitate student collaboration and interaction across the NMSU branch campuses, and potentially other New Mexico colleges.

As part of the UCIE project, the course materials developed will be field-tested with selected students in the fall and then disseminated through workshops to other faculty throughout New Mexico. Both projects will produce materials that will enhance educational programs that are directly focused on workforce development.

Evaluation and Assessment

The Evaluation plan for the C2 award combines qualitative and quantitative metrics by the external evaluator as well as review and feedback from the External Advisory Committee.

While each C2 institution has its own objectives to accomplish using the increased cyberinfrastructure, there are common milestones and metrics to measure the impact of the C2 project as a whole that will be assessed by the external evaluator. These are:

- Technology/Infrastructure Capability: installation and use of equipment and cyberinfrastructure;
- Increase in availability of broadband on and off campus; increase in reliability of networks;
- Cyberinfrastructure Workforce: increase in number of students enrolled in and/or graduating with emphasis in technology related careers; increase in reported career interest in STEM/cyberinfrastructure related fields;
- Research Capacity and Competitiveness: increase in STEM faculty reported research collaborations outside the institution resulting from broadband availability, increase in number of proposals submitted by STEM faculty;
- Education/Institution capability: increase in use of technology in STEM courses and e-learning courses offered and number of students enrolled in STEM e-learning courses;
- STEM Pipeline Enhancement: increase in number of high school students concurrently enrolled in college courses, especially in STEM courses.

In order to measure the impact of the enhanced cyberinfrastructure using the metrics above, the external evaluator developed and administered an online survey to students and faculty at each of the institutions. Preliminary results of the survey were shared with the Management Team and the External Advisory Committee at their April 2011 meeting. The EAC suggested that the proposed evaluation plan includes overly ambitious outcomes and encouraged each campus review the initial evaluation results and provide feedback for modifications that would better assist them in their planning. These suggestions have been communicated to the external evaluator.

The external evaluator also conducted campus visits to each of the C2 institutions during the first year of the award. The purpose was to obtain a better understanding of the challenges facing the C2 institutions and collect baseline data onsite. The campus visits included meeting with the IT director, interviewing faculty and administrators, measuring wireless speed/connectively around the campus, and observing the geographical and physical challenges posed for each institution.

Sustainability

The administration at each institution has committed to maintain and upgrade equipment installed through the C2 award. The technology being installed is an extension of the connectivity infrastructure in place and integrates into or is compatible with existing systems. Sustaining the new C2 investments will be absorbed into existing management and maintenance activities. The NM Computer Applications Center maintains the Education Gateways at each campus.

New course materials that use the 3-D capabilities of the Education Gateways will be disseminated to institutions throughout the state through workshops for faculty. The NM EPSCoR program website will publicize the workshops and provide links to access the newly developed course materials. Participants in the UCIE program (described above) will collaborate with RII Track 2 colleagues in Nevada and Idaho who are developing 3-D visualizations. The External Advisory Committee has also suggested connecting with relevant programs at Indiana University and the Texas Advanced Computing Center; initial contacts have been made.

Leveraging NSF Programs

NM EPSCoR has worked strategically to connect the C2 program to NM's other NSF EPSCoR programs in several ways. Faculty from the C2 institutions have been invited to participate in Track 1 opportunities for faculty development, including the Junior Faculty Leadership Workshop, CI trainings and outreach activities. Faculty from WNMU, NNMC and NMT have participated in several of these opportunities, including NSF Day which provided information that will improve their chances for securing additional funding. In addition, the data being collected by NM EPSCoR researchers and other related sources are being made available through a project data portal. The enhanced CI at WNMU, NNMC and NMT will allow students and faculty better connectivity to access and download these data so they can be used in courses and for student projects. The RII Track 1 program also provides statewide mechanisms for communication and collaboration through its website and social networking tools from which the C2 institutions can benefit.

The NMCAC Education Gateways were NM's contribution to improved statewide connectivity in the RII Track 2 project, a consortium with Nevada and Idaho EPSCoR programs. Additionally, the Track 2 cyberlearning activities are providing educational materials and training opportunities that will benefit the C2 participants and the materials developed through C2 will be added to the Track 2 website. The Supercomputing Challenge is also providing education outreach through the Track 2 awards and is another intersection and leveraging of resources between C2 and Track 2. The RII Track 2 award is connecting statewide CI to small businesses by via Fast Forward NM trainings for small business entrepreneurs in

rural communities. The communities targeted for these workshops in the Track 2 award are those surrounding WNMU, NNMC and NTC.

Both NNMC and NTC have other NSF-funded programs that are linked to C2 programs. NTC has a TCUP award (NSF award # 1023461) through which they are launching new engineering programs and supporting Native American students to graduate in STEM disciplines. The improved connectivity achieved through the C2 award will provide better Internet access and connect the NTC to the UNM Albuquerque GigaPoP, which will support the TCUP project's goals. NNMC has a STEM Talent Expansion Program (NSF award #757088) that provides summer math instruction for high school students. With C2 support, the SCC is contributing instructors to integrate computing into the summer program.

Management Structure

There are four primary elements of the C2 management structure: 1) NM State Committee, 2) NM EPSCoR program staff, 3) C2 Management Team, and 4) External Advisory Team. In addition, the management and coordination structure includes an external evaluator. The project's structure is shown in Figure 1 below.

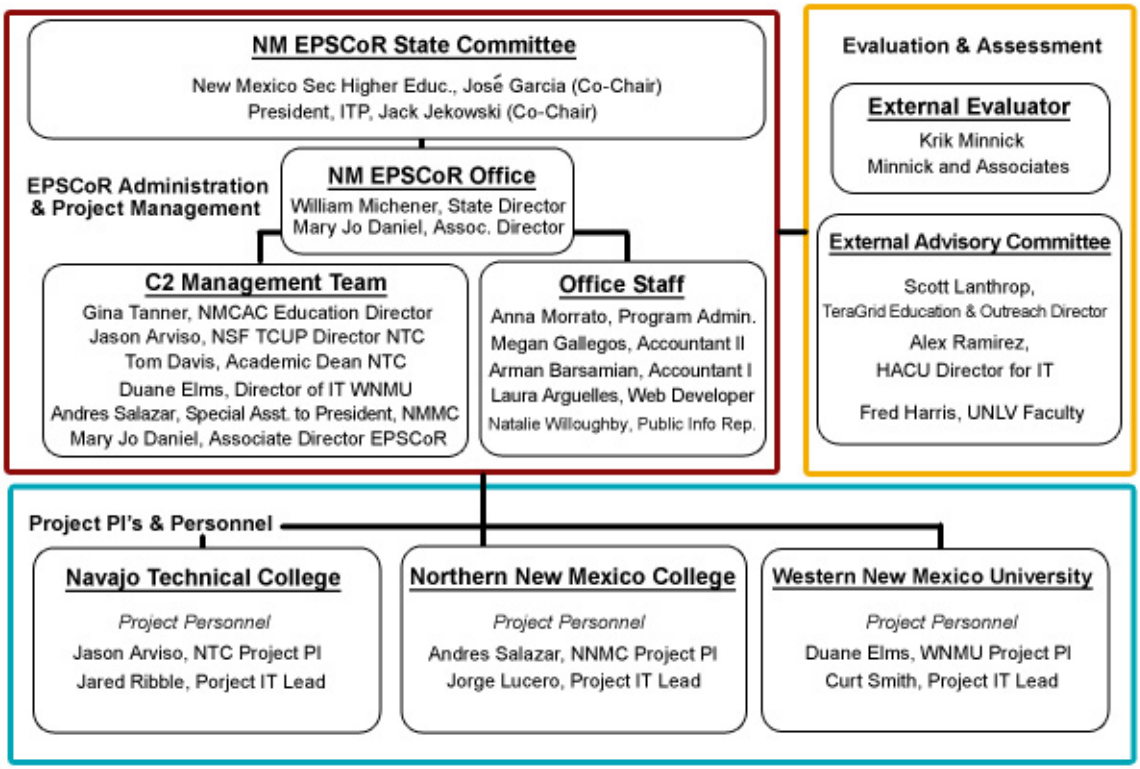


Figure 1: C2 Management Structure

The Project PI at Northern NM College resigned from the project effective May 31, 2011. Upon receipt of approval from the NSF Program Officer, Dr. Jorge Crichigno will assume the duties of the NNMC Project PI.

NM EPSCoR State Committee: The New Mexico EPSCoR State Committee is the primary governing body for NM EPSCoR. The Committee, which oversees the EPSCoR program, includes members of the community, government, private, and academic sectors from all regions of the state. The New Mexico State EPSCoR Committee met in September 2010 and April 2011. At both meetings they reviewed C2 progress to date as well as available feedback from external advisory and evaluation reports. No actions relevant to C2 were taken.

Management Team

The C2 Management Team is comprised of representatives from each of the three institutions, from the NMCAC, and from the EPSCoR office. The C2 Management Team had its initial "Kick-off" meeting in September 2010 in Albuquerque and a virtual meeting in December 2010. Each campus reviewed its plans and determined there would be some minor changes of equipment anticipated due to changes in campus resources in the time between proposal submission and the start of the award, but there would be no significant changes in scope of the activities. A timeline for activities was developed; attached as an Appendix to this report. The third Management Team meeting was combined with the External Advisory Committee meeting in April 2011 on the campus of WNMU, described below. The Management Team will meet again using distance technology in summer 2011.

External Advisory Committee:

The External Advisory Committee is comprised of nationally recognized experts in cyberinfrastructure and education. They met in April 2011 on the campus of WNMU in Silver City with the project's leadership. Representatives of each campus reviewed their plans and progress for enhancing connectivity; C2 educational plans were also presented. The committee provided a report, which included several recommendations for program improvement that the C2 Management Team is using to guide future activities.

In their report, the EAC noted:

> All three campus IT groups have demonstrated an excellent understanding of the issues they are facing, have proposed deployment plans to directly address those issues, are tracking the impact of their implementations, and have plans to accomplish tasks with existing small numbers of staff. Each campus has demonstrated efforts in securing leveraged funding to augment the C2 resources. We applaud this and encourage continued efforts in this area.

Below are key recommendations from the EAC; each campus is working on plans in response to these recommendations. Collaboration between campuses will be facilitated by EPSCoR leadership through quarterly Management Team meetings as well as interim discussions on issues as they arise.

Recommendations:

- We strongly encourage the three campuses to continue discussions that have started with this meeting in order to share challenges, opportunities and diverse perspectives.
- We recommend that each campus continue to develop and/or update their long-term strategic cyberinfrastructure plans.
- We encourage promotional efforts to engage faculty and students in utilizing the enhanced capacity, and work with select faculty and students to realize the enhanced capabilities within the timeframe of this project that can be shared with the rest of the campus.
- We strongly encourage each campus to collect highlights of impact among faculty, students, IT staff, and the community.
- We strongly recommend that NNMC explore opportunities to leverage the enhanced IT infrastructure with the current distance learning initiative to improve distance learning and to avoid duplication of effort and expense.
- We encourage that the impact of the Gateways successes and materials be shared with the larger community.
- We encourage the investigation of Navajo culture courses (e.g. Navajo language) being developed and delivered (through the new infrastructure across the Navajo Nation and beyond) to meet general education requirements at NTC, UNM Gallup, and other campuses.
- We encourage continued engagement of K-12 teachers for the broadest impact over the long-term.
- We were pleased to see some student involvement in the C2 project, and encourage each campus to engage more students in the project activities.
- The project team needs to review and revise the evaluation metrics in the proposal plan as the proposed outcomes seem overly ambitious.
- We recommend that the team begin to develop a plan for what would be proposed to build upon this initial two-year effort.
- We recommend working now with faculty and the community in developing the applications (courses, modules) that can utilize the infrastructure and enhance research and education.
- We strongly encourage NSF to continue to support the C2 program to allow campuses to update and replace all legacy equipment to continue to address the rapidly evolving needs of faculty, students and the community. It is obvious that this C2 project has been very successful, but the current level of funding is not sufficient to address the existing needs, let alone the future CI requirements.

Jurisdictional and Other Support

The State Office provides meeting and collaboration space, including access to video and web conferencing facilities. The New Mexico Computing Applications Center has purchased, installed, and maintains the Education Gateways on each campus.

Unobligated Funds

Year One Budget	Obligated	Unobligated	%Unobligated
$978,304	$872,272	$106,032	11%

Equipment

The table below lists equipment purchased in Year One of this award. Items in *italics* have not yet been received, but are expected before the end of Year One.

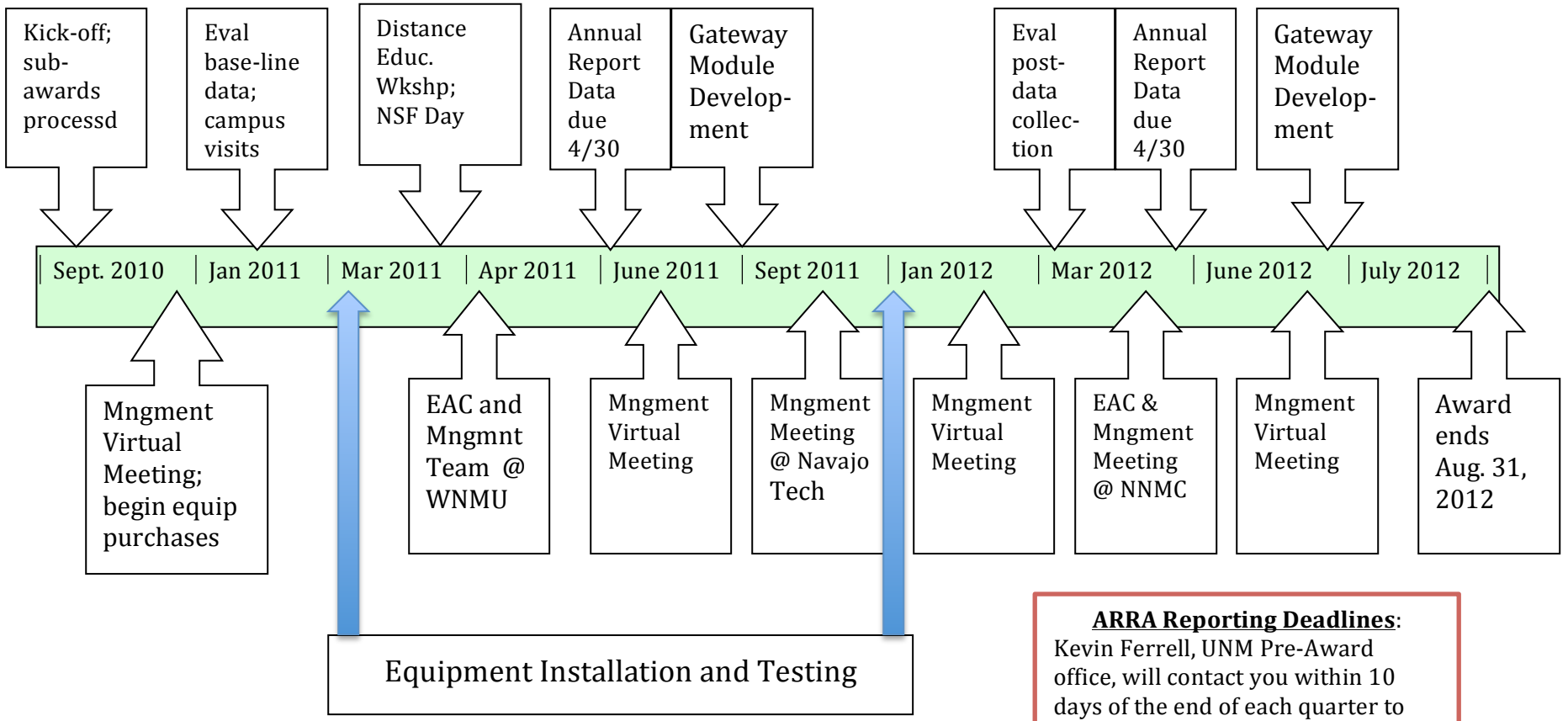
Inst.	**Equipment**	**Brief Description**	**Location Installed**
WNMU	Qty 3 - Cisco WS-C4506E	6 slot modular switch chassis	WNMU Silver City Campus
WNMU	Qty 4 - Cisco WS-x45-SUP6L-E	10 Gb Ethernet switch card	WNMU Silver City Campus
WNMU	Qty 1 - Cisco WS-X4596	Fan array	WNMU Silver City Campus
WNMU	Qty 1 - Cisco WS-X4418-GB=	18 port Gigabit fiber module	WNMU Silver City Campus
WNMU	Qty 6 - Cisco WS-X4648-RJ45V+E	48 port PoE Gigabit switch card	WNMU Silver City Campus
WNMU	Qty 7 - Cisco WS-X4648-RJ45V-E=	48 port Gigabit switch card	WNMU Silver City Campus
WNMU	Qty 1 - Cisco WS-X4124-FX-MT=	24 port 100-FX fiber module	WNMU Silver City Campus
WNMU	Qty 6 - Cisco PWR-C45-1300AC=	Power Supply	WNMU Silver City Campus
WNMU	Qty 9 - Cisco WS-G5486=	Gigabit single mode transceiver module	WNMU Silver City Campus
WNMU	Qty 12 - Cisco WS-G5484=	Gigabit multi mode transceiver module	WNMU Silver City Campus
WNMU	Qty 3 - Cisco CON-SNTP-C4506E	SMARTNET 6 slot switch chassis	WNMU Silver City Campus
WNMU	Qty 3 - Cisco APC SAU2200RM2U	Rackmount Uninterruptable Power Supplu (UPS)	WNMU Silver City Campus
WNMU	Qty 18 - Cisco WS-C3560V2-48PS-S	48 port PoE switch	WNMU Silver City Campus
WNMU	Qty 10 - Cisco WS-C3560V2-24PS-S	24 port PoE switch	WNMU Silver City Campus
WNMU	Qty 30 - Cisco GLC-SX-MM=	Multimode SFP transceiver module	WNMU Silver City Campus
WNMU	Qty 15 - Cisco GLC-LH-SM=	SingleMode SFP transceiver module	WNMU Silver City Campus
WNMU	Qty 10 - Cisco GLC-T	Twisted-pair SfP transceiver module	WNMU Silver City Campus
WNMU	Qty 1 - Cisco WS-X6724-SFP	24 port Gigabit fiber module	WNMU Silver City Campus
WNMU	Qty 1 - Cisco WS-X6724-100FX-MM	24 port Gigabit 100-FX module	WNMU Silver City Campus

WNMU	Qty 20 - Belkin F2F402L7-02M	SC/LC multimode fiber jumper	WNMU Silver City Campus
WNMU	Qty 30 - Belkin F2F802L7-02M	SC/LC single mode fiber jumper	WNMU Silver City Campus
WNMU	Qty 20 - Belkin F2F402L0-02M	ST/LC multimode fiber jumper	WNMU Silver City Campus
WNMU	Qty 10 - Belkin F2F802L0-02M	ST/LC single mode fiber jumper	WNMU Silver City Campus
WNMU	Qty 6 - Cisco CAB-SFP-50CM	SFP interconnect cable	WNMU Silver City Campus
NNMC	2 Cisco 2960's with Smartnet, Stacking Modules, Power Injectors	Part of campus upgrade	NNMC Teacher Education Building.
NNMC	*5 Cisco Catalyst WS-C3750X 48 port switch with redundant power supplies, network modules and all the necessary fiber optic interface for Interconnectivity with the existing equipment.*	Switches needed to upgrade the main IDF room as well as our data center in the administration and VOC area. This is where our Data center and Core routing equipment resides	Switches are in Back Order until 6-13.
NNMC	*Cisco Catalyst 2960S-48TS-L Ethernet Switch, Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; stacking module, cables*	Total campus upgrade to Gigabit speeds.	MDF Admin Level 2
NNMC	*Cisco Catalyst 2960S-48TS-L Ethernet Switch, Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; stacking module, cables*	Total campus upgrade to Gigabit speeds.	Student Success Center
NNMC	*Cisco Catalyst 2960S-48TS-L Ethernet Switch, Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; stacking module, cables*	Total campus upgrade to Gigabit speeds.	Business Admin and Economics
NNMC	*Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base*	Total campus upgrade to Gigabit speeds.	Fine Arts
NNMC	*Cisco Catalyst 2960S-48TS-L Ethernet Switch, Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; stacking module, cables*	Total campus upgrade to Gigabit speeds.	Biology
NNMC	*Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base*	Total campus upgrade to Gigabit speeds.	Library
NNMC	*Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; transceiver, cables*	Total campus upgrade to Gigabit speeds.	Gym
NNMC	*Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; transceiver*	Total campus upgrade to Gigabit speeds.	Facilities Bldg.

NNMC	*Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base, transceiver, cables; Cisco Catalyst WS-C3750X-48P-S Ethernet switch, cables*	Total campus upgrade to Gigabit speeds.	High Tech Building--old and new parts
NNMC	*Catalyst 2960S Stack 48 GigEPoE 740W, 4x SFP Lan Base; transceiver, stacking module*	Total campus upgrade to Gigabit speeds.	SERPA
NNMC	*Cisco Catalyst 3560-12PC-S Gigabit Ethernet switch with PoE, transceiver*	Total campus upgrade to Gigabit speeds.	Portable A--Cosmetology
NNMC	*Cisco Catalyst 3560-12PC-S Gigabit Ethernet switch w PoE*	Total campus upgrade to Gigabit speeds.	Portable B
Navajo Tech	*Motorola PTP 800 Point to Point Microwave System, PTP Indoor unit with a 200 Mbps capacity license, PTP Outdoor unit operating in the 11 GHz Licensed Frequency Band,2.5' High Performance Dish pointed a the Gibson Radio Site NewMar Battery Back-up System, 115 VAC to -48 VDC 10 amp redundant rectifier with 72 hr battery backup.*	UNM Gallup System Architecture	UNM Gallup
Navajo Tech	*Motorola PTP 800 Point to Point Microwave System, 2 ea PTP indoor units with a 200 Mbps capacity licenses, 1 ea PTP Outdoor units operating in the 11 GHzz Licensed Frequency Band, 1 ea PTP Outdoor units operating in the 6 GHz Licensed Frequency Band, 1 ea 2.5' High Performance Dish pointed at the Gallup Campus, 1 ea 6' High Performance Dish Pointed at the Black Rock Radio Site NewMar Battery Back-up system, 115 VAC to -48 VDC 10 amp redundant rectifier with 72 hr battery*	Gibson Radio Site System Architecture	Gallup New Mexico/Gibson Peak

Navajo Tech	*Motorola PTP 800 Point to Point Microwave System, 2 ea PTP indoor units with a 200 Mbps capacity licenses, 1 ea PTP Outdoor units operating in the 11 GHzz Licensed Frequency Band, 1 ea PTP Outdoor units operating in the 6 GHz Licensed Frequency Band, 1 ea 2.5' High Performance Dish pointed at the Navajo Technical College Campus, 1 ea 6' High Performance Dish Pointed at the Black Rock Radio Site NewMar Battery Back-up system, 115 VAC to -48 VDC 10 amp redundant rectifier with 72 hr battery backup*	Dezza Bluff Radio Site System Architecture	Dezza Bluff/Navajo Nation

C2 Timeline



ARRA Reporting Deadlines: Kevin Ferrell, UNM Pre-Award office, will contact you within 10 days of the end of each quarter to provide required documentation for ARRA reporting.

Draft 11/30/10