

# UNAVCO Facility Interim Report, January – March 2005

## EAR-0321760: Support of UNAVCO Community and Facility Activities

### 1.0 Quarterly Summary

UNAVCO Facility activities for the January-March 2005, quarter continued at a steady pace in all three of the key support areas of engineering, data, and equipment. For this quarterly report we are placing a focus on data, data archiving and related Information Technology (IT). The Facility completed the first phase of a significant upgrade and enhancement of its archive infrastructure. A new EMC2 mass storage system was commissioned and will greatly increase the reliability and capacity of the archive and other Facility computer systems. The implementation of an associated Storage Area Network (SAN) will simplify systems administration. The new system is the featured highlight for this quarter. The second phase of the update will include acquisition and installation of a new multi-drive tape backup system that will help us ensure the long-term preservation of the communities GPS data.



**Figure 1.** Project engineer Beth Bartel installing a GPS antenna on the rim of Mt. Erebus Volcano, Antarctica. Twenty-five individual projects were supported during the 2004-2005 Antarctic field season, which came to a successful close in March. More photographs of Erebus GPS monitoring can be found on the Erebus Volcano Observatory web site <http://www.ees.nmt.edu/Geop/mevo/mevomm/imagepages/gps/index.html>.

The new mass storage system is only one part of a wide range of Information Technology developments that the Facility develops and supports. At one end of the spectrum are data systems for equipment management, shipping and inventory, all critical components for property management, tracking and handling of thousands of pieces of equipment and purchases that add up to millions of dollars per year. These recent enhancements were essential as the Facility Equipment Group finished outfitting the UNAVCO warehouse to assemble, test and ship 200+ systems for PBO this year as well as handling on-going PI project support. At the core of UNAVCO's IT efforts are the archive data management system and Oracle database that are described in the highlight. At the science and cyberinfrastructure end, the Facility develops and supports the "Voyager" Internet mapping tool and participates in the GEON ITR project. The Voyager map server computer cluster received a major upgrade this quarter that resulted in a more than tripling of the speed of map generation. Voyager recently received nationwide attention from a number of on-line journals and is used for scientific as well as education and outreach purposes. Chuck Meertens and GEON colleagues Ramon Arrowsmith (ASU) and Chaitan Baru (SDSC) also organized a successful GEON 3-D, 4-D Visualization workshop held 1-2 March at SDSC that addressed state-of-the-art visualization and associated data and metadata delivery systems. The workshop website is at <http://www.geongrid.org/workshops/geonvis2005/>.

As detailed in this report, the Facility provided engineering support to a number of projects around the globe. A significant new activity was the newly funded Mauna Loa project (U. Hawaii) that was started this quarter and installation of 12 permanent stations is underway with UNAVCO field engineering support. The Western U.S. Existing Networks project wrapped up this quarter and it being followed-up by the newly funded EarthScope PBO Nucleus project. PBO Nucleus and continuing PBO support will be major UNAVCO Facility activities for the next few years. This quarter significant effort was placed on development and testing related to implementation of new GPS systems for PBO permanent stations and campaign surveys. Ongoing operation and maintenance support to the NASA Global GPS Network was provided in conjunction with JPL, with over 300 trouble or maintenance issues addressed in the quarter. Antarctic season was brought to successful conclusion with major support provided to 25 projects using 80 GPS receivers. The Facility permanent station support role continues to expand on NSF's request for UNAVCO to provide technology for multiple projects. Arctic season schedule developing with 15+ projects to be supported in this field season. Approximately 169 GPS receivers were purchases by UNAVCO projects or members on the semi-annual group order.

Community feedback and interaction is an essential component of any facility. To help with this process, the UNAVCO Board of Directors formed a new UNAVCO Facility Standing Committee that met at UNAVCO in Boulder 15 February 2005. The committee consists of Tim Dixon, Chair, U. of Miami; Simon McClusky, MIT; Carol Raymond, JPL; Jeanne Sauber, NASA Goddard; Glen Mattioli, U. of Arkansas; Tim Ahern, IRIS; and UNAVCO Board Liaison: Kristine Larson, U. of Colorado, Boulder. During the site visit and with subsequent discussions, UNAVCO staff and the Standing Committee outlined short and long term concerns and started the process of prioritizing them. The Committee will consider them over the next months and deliver a preliminary report to the Board in June.

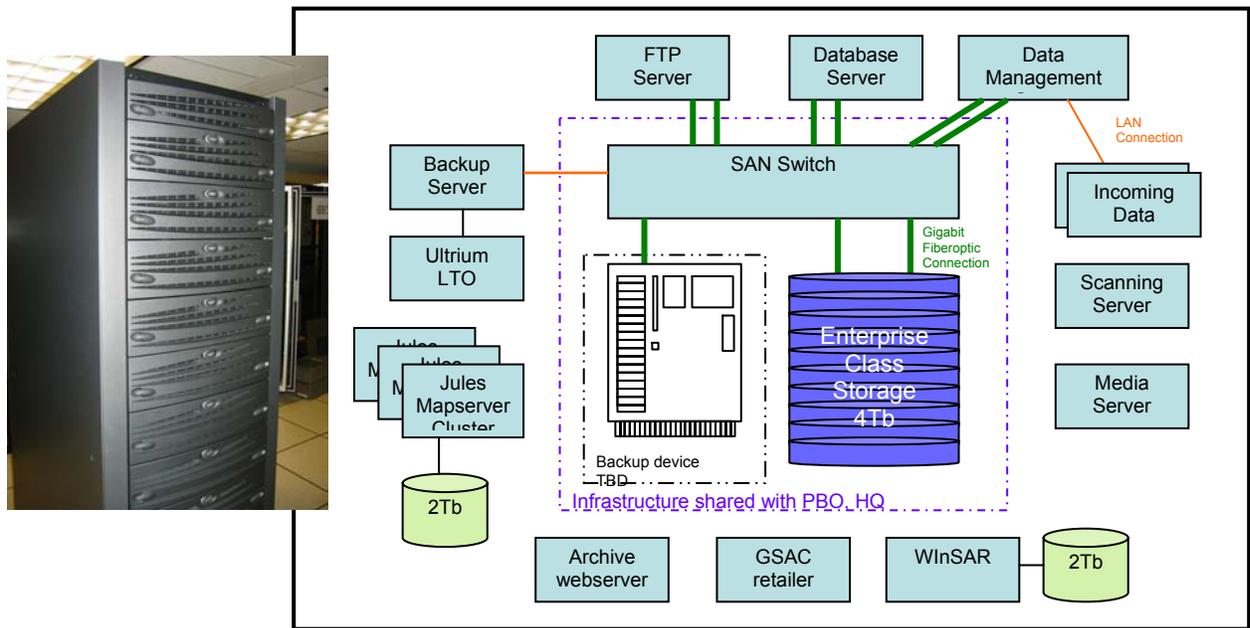
Also during this quarter, the 2005 funding commitment from NSF was received. At NSF request, the budget was reformulated and programmed into the UNAVCO accounting system.

We present below a series of highlights for the quarter, our featured Quarterly Highlight on recent archive system upgrades and detailed monthly reports for January, February and March, 2005.

### 1.1 Quarterly Featured Project

Project: UNAVCO Archive Moves to High-end Data Storage System  
 Principal Investigators: UNAVCO, Inc. (Will Prescott, Chuck Meertens)  
 Funding Source: NSF EAR Instrumentation and Facilities  
 UNAVCO Staff: Fran Boler, Jeff Braucher, Myron McCallum  
 Dates: October 1, 2003 to September 30, 2007

The UNACO Boulder Facility Archive manages, stores, and provides access to high-precision GPS geodetic data. These data are primarily collected on research projects sponsored by NSF and NASA.



**Figure 2.** UNAVCO's new CLARiiON mass storage system (left) and schematic of the system architecture.

The UNAVCO Archive data volume currently exceeds 1 terabyte (Tb), and is expected to grow by 1-2 Tb per year in the next several years. High data volumes and the need for scalable, long-term, high-availability, secure, rapid-access storage dictates that a high-end enterprise storage solution be employed. High-end storage systems can operate as direct attached storage, like any RAID or hard disk. But to take full advantage of the capabilities of a high-end storage system, they are typically deployed as the basis for a storage area network

(SAN). SANs provide significant advantages in storage-intensive enterprises, most notably, readily expandable enterprise quality storage on a single device that can be shared or partitioned among servers. Storage is accessed over fast fibre channels, with redundant cabling, switches, controllers, and server connections, leading to extremely high reliability and availability. SAN software allows snapshot backups to take place while ongoing writes are cached until the backup completes. SAN systems can also be synchronized over the internet to an offsite SAN system for ultimate data safety. UNAVCO has purchased a state-of-the-art, high-end storage device, with fibre channel disks, SATA disks, and SAN software. All of the Facility Data Archive holdings are currently stored on the EMC<sup>2</sup> CLARiiON CX500 system, depicted in the photo. UNAVCO Headquarters and PBO are scheduled to deploy their critical storage on the CLARiiON in the coming months.

The National Science Foundation's significant investment in GPS data collection reaps its full benefit over time, as new data reveal long-term position changes and velocity trends as well as short-term anomalies. The UNAVCO Archive plays a key role in long-term GPS data and data product safe storage and accessibility. For PBO, the UNAVCO Archive provides the long-term primary archive, and will soon deploy PBO's long-term secondary archive offsite at IRIS. Both the primary and the secondary PBO Archives will utilize high-end storage. In its role as the PBO Archive, and for all other NSF-funded Data Archiving, the CLARiiON storage and SAN are expected to provide significant benefits to the UNAVCO Community of investigators, as well as other researchers, educators and the public.

## 1.2 Facility Highlights

### NSF/EAR Program Support

*University PI Project Support.* Fourteen UNAVCO member projects were provided engineering and equipment support during the quarter. The project mix included two campaign or mixed-mode projects involving episodic deployment of personnel and equipment, nine permanent networks involving new station installations or upgrade or maintenance of existing stations, one training session at the UNAVCO Facility and one support for two long-term receiver tests. Ongoing operations and maintenance support was provided to 271 permanent GPS stations in support of various projects (excluding PBO and Nucleus, which are reported separately below), with approximately 50 trouble or maintenance interventions required during the quarter. Proposal planning and budget development support was provided for 4 new projects proposed under NSF programs that are pending funding. Fifteen new support requests by members were accepted and are being scheduled throughout the year. A number of smaller projects were provided technical support or equipment.



**Figure 3.** Engineering support section manager Jim Greenberg mapping marine stromatolites using real-time kinematic GPS at Highbourne Cay, Bahamas. This work was conducted for PI PamReid of U. Miami in support of a joint EAR/BIO initiative.

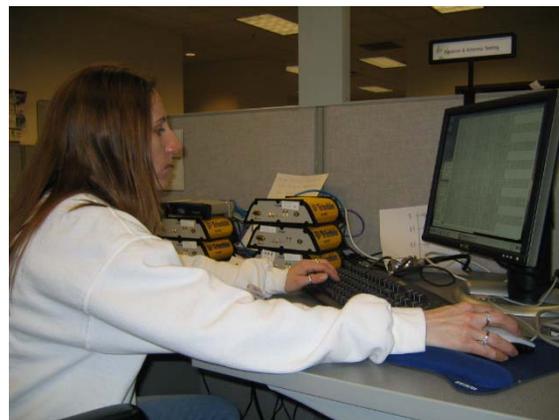
A summary of the quarterly activities is included in Table 1.

| <b>Project</b>                              | <b>PI</b>   | <b>Type</b>       | <b>Support Provided</b>   |
|---|-------------|-------------------|---|
| Highbourne Cay                              | Reid        | Campaign          | RTK training and survey field support.  |
| Saudi Arabia                                | Reilinger   | Mixed Mode        | Campaign and permanent station technical and equipment support.   |
| DIVE  | Miller      | Permanent Network | Permanent station upgrade.  |
| Guerrero Coast                              | Larson      | Permanent Network | Troubleshooting and maintenance of the Guerrero network.  |
| Mauna Loa                                   | Brooks      | Permanent Network | Install 12 NetRS GPS stations and communications on Mauna Loa volcano, Hawaii.  |
| Sierra Negra Volcano                        | Geist       | Permanent Network | Replace two malfunctioning receivers in Galapagos Dual/L1 network.  |
| Southern Salton Trough                      | Bennett     | Permanent Network | Supported establishing two new continuous GPS stations in northern Mexico to complement PBO south of the US border.                       |
| Yucca Mountain Expansion                    | Wernicke    | Permanent Network | Equipment purchasing, configuration, testing in progress, installation of 18 stations in summer.  |
| Mid-America GPS Network                     | Smalley     | Permanent Network | Establish automated downloading of 11 permanent GPS stations in the central USA   |
| Andaman, Islands                            | Smalley     | Permanent Network | Technical support with new permanent station installed in response to great earthquake.   |
| Southern Miss CORS                          | Mooneyhan   | Permanent Network | Technical support in implementing 10 permanent stations in southern Mississippi using NetRS receivers.                                    |
| Hydrological Linkages                       | McGlynn     | Training          | GPS training session in Boulder.  |
| Calibration Experiment for Pseudorange Data | Larson      | Testing           | Support controlled experiment in UNAVCO laboratory for high-precision receiver testing.   |
| Receiver Calibrations                       | P. Elosegui | Testing           | Equipment and technical support to receiver testing.  |
| Permanent Network O&M                       | Multiple    | Permanent O&M     | Remote maintenance was performed on approximately 50 continuous GPS stations of 271 monitored.  |
| Proposal Planning and Budget Development    | Multiple    | Multiple          | Planning and budgeting support for 4 proposals submitted to EAR programs.   |
| New Support Requests                        | Multiple    | Multiple          | Fifteen new support requests were evaluated and accepted for UNAVCO member projects in 2005.  |
| Equipment Loans and Technical Support       | Multiple    | Multiple          | Provided technical support to a number of smaller projects Equipment loans were provided to 9 projects not requiring engineering support. |

**Table 1.** UNAVCO Member Projects Supported During the January – March Quarter

*Earthscope PBO Permanent GPS Network Support.* The Facility continued working with PBO and Trimble staff on version testing of the NetRS firmware. Multiple issues were uncovered in v1.1-1, a list of which was circulated to UNAVCO member customers by Trimble, and mitigated in v1.1-2. Rotation tests were conducted on all in-stock choke ring antennas to assure phase center offsets are in compliance with contracted specification. Approximately 15 percent of affected antennas were returned to Trimble for replacement, which has the compounding effect of delaying delivery of new units. As a result, PBO project managers may decide to temporarily deploy Zephyr Geodetic antennas at some sites until choke ring antennas become available to replace them. A shim was designed to place the center of curvature of the standard SCIGN dome at the average (absolute) phase center height and presented to PBO staff. Station reconnaissance was performed for multiple new stations in the Southern California region. Continued technical and equipment support was provided to IRIS in implementing co-located GPS at US Seismic Array locations with continued planning, assembly of equipment and delivery of monument materials to ASL. A contract with IRIS to fund this effort was initiated, with funds programmed into the UNAVCO accounting system.

*Earthscope PBO GPS Campaigns Support.* Design, development, and purchasing of the PBO campaign boxes, including custom built solar modules, foam inserts, and security enclosures is now complete; delivery and assembly of the first 28 units will be done by late April. Evaluation of the of the Topcon GB-1000 GPS receiver continues, with new receiver board and controlled unit firmware versions having been received from the manufacturer. A newer version incorporating BINEX and internet security capabilities is currently in the final stages of development with our group having extensive input in the process. The final configuration of the campaign system was demonstrated to the community at the EarthScope National meeting in conjunction with a GPS mini-class provided by UNAVCO staff. Although no portable deployments have yet been funded by the EarthScope panel, at least one proposal from last year's submittals is still under consideration. In the meantime, plans are being developed for prototype campaigns with Geoff Blewitt in Nevada, Rick Bennett in southern California, and Dan Johnson in Cascadia using outside funding. GB-1000 receivers have been sent to various community members for demonstration and familiarization.



**Figure 4.** Development and test engineer Victoria Andreatta checks output from receiver power cycle testing being conducted to evaluate a firmware fix to solve receiver boot failures that have been found problematic with some NetRS receivers. Extensive testing to validate functionality of Trimble NetRS firmware was conducted by Facility and PBO project staff.

*Western U.S. Existing Networks/PBO Nucleus.* We were notified by NSF in early January that the \$4.5M, three and a half year proposal "PBO Nucleus: Support for an Integrated Existing Geodetic Network in the Western U.S." would be funded. Submitted last August by

UNAVCO on behalf of the community, the project will upgrade, standardize, and integrate into PBO 209 existing GPS stations that were supported by the predecessor "Existing Networks" project. A one-year, no-cost extension to the Existing Networks funding, which was scheduled to end on February 28, 2005, was granted by NSF to allow the seamless transition between the two projects. The project budget was reformulated on NSF direction and funds were programmed into the UNAVCO accounting system.

Only three stations in the Nucleus network were upgraded during the quarter as issues relating to the performance and supply of Trimble receivers and antennas used by the project were investigated and resolved. An order for 60 units was placed, which will allow the rate of upgrades to increase to 10-15 per month in the near future. Several station upgrades are planned for the spring timeframe, including major communications system upgrade in basin and range region in cooperation with PBO staff. Issues relating to the performance of CDMA modems currently in use are also being investigated and should be resolved shortly. A key project milestone was reached this quarter as data flow and archiving for all 209 stations was established at the UNAVCO Facility; integration of the data into the PBO data products flow has just commenced and will be complete by the end of Q3.

### **NASA/SENH Program Support**

Ongoing network monitoring, operation and maintenance were provided for 75 GGN stations under the UNAVCO Facility's responsibility. Highlights include the following:

- A site visit was conducted at Cordoba, Argentina to re-establish the station.
- Support was given to a PI site visit to Saudi Arabia to restore operations at three stations.
- A detailed plan for decommissioning of the VSAT system and a budget for station reconfiguration at Guadalupe, Island was coordinated with SCIGN staff at USGS.
- Planning for a potential new installation at Nairobi, Kenya was begun as well as a plan to reestablish Riobamba, Colombia.
- Tracking issues were resolved at 6 GGN stations.
- Ongoing O&M of seventy-five GPS stations with approximately 300 trouble incidents handled during the quarter.
- Approximately 300 individual trouble and maintenance issues were responded to during this fiscal quarter, including equipment, computer and communications upgrades at several GGN stations

Warranty repairs of Thales uZ receivers exhibiting (or in the serial number range of affected receivers) poor tracking performance are ongoing and being performed by the manufacturer in a timely manner. So far six receivers have been repaired and two more are at the repair center. It should be mentioned that there is significant effort and cost associated with retrieving and replacing receivers at installed locations around the world. A total of 15 receivers require this repair.

The FY2005 NASA statement of work was developed in conjunction the relevant JPL staff members. New tasks will include planning for enhancements to IGS reference frame stations to improve the stability of time-series observations at core locations, performance and functional evaluation of GPS receivers that could be adopted within the GGN in the future, establishment of operating agreements at new station locations and increased support to the IGS Central Bureau. Also, a new equipment test station is being planned in Boulder for investigation of receiver and antenna performance, equipment mixing, and new GPS observables issues. New L2C-capable receivers have been purchased to support testing of this new observable at existing global stations.

### **NSF OPP Project Support**

The Antarctic season was brought to successful conclusion with major support provided to 25 projects using 80 GPS receivers, permanent station support role continues to expand at NSF's request for UNAVCO to provide technology for multiple projects. The Arctic season schedule is developing with 15 projects to be supported in this field season. Infrastructure support activities continue with Iridium communications development and weather station testing. A remote, extreme environment test platform was set up at the University of Colorado Mountain Research Station, and an environmental test chamber was purchased for cold testing of electronics and will initially be used to test battery performance at -50C cold chamber testing. The OPP equipment pool was expanded with the purchase of 17 new GPS receivers for long-term (months and years) continuous data application.

### **Archiving and Data Management**

*Permanent Stations.* Currently, 572 active global permanent stations are being archived at UNAVCO. This is a 33% increase over last quarter. Over one hundred sites were added as part of the NSF Nucleus project, including 98 SCIGN sites. Thirty-four new PBO sites were added this quarter. The remaining six added sites were from a variety of global networks

*Campaigns.* Archiving of seven campaigns was completed this quarter: Central America 2003/2004, Hanford 2002, Kupařuk 2004, Morocco 2002, Parkfield Emergency Response 2004, RETREAT – Italy 2004, San Simeon Earthquake Response 2004. Archiving is in progress for several large campaign projects.

*Data Access.* A new tool for viewing site positions in map format was installed within the Archive web pages (<http://jules.unavco.org/SiteViewerDocs/worldmap.html>). This tool employs a variety of selection criteria for sites shown on a map. Links to data available on the Archive ftp server are accessible via the map.

*Infrastructure.* A new high-end Storage Area Network (SAN) RAID device (EMC CLARiiON) was purchased, configured, and placed in service for Data Group data storage. The SAN provides readily expandable storage that features high reliability and high availability along with flexible backup configurations.

## General Support and Infrastructure Development



**Figure 5.** Equipment technician Effendi Sihombing demonstrating the Facility's new temperature test chamber, which was acquired to support highly controlled receiver data quality testing for various investigations.

*Technical Equipment Support, Development and Testing.* Internal training on Topcon equipment was conducted at the UNAVCO Facility by Topcon staff. Testing of iridium satellite communication system continued--an interference issue with some GPS receivers was discovered and mitigation is being evaluated. Several staff members helped interface with Trimble on NetRS hardware firmware issues and influenced Trimble to distribute an "issues list" to UNAVCO members who may have purchased affected receivers. Several receivers in stock at UNAVCO were evaluated for potential issues and repaired as necessary for deployments. A new temperature test chamber (Figure 5) was acquired by the Facility to support highly controlled receiver data quality testing for various investigations.

*GPS Receiver Purchases.* The semiannual UNAVCO member receiver purchase was coordinated with Trimble and Topcon. Approximately 169 GPS receivers were purchased by the UNAVCO Facility and members. Twenty-six of those are available in the UNAVCO Facility pool, including 17 NetRS receivers purchased by OPP and 6 by EAR. The remaining receivers were purchased for specific projects, or by members.

*Equipment Grant Report.* The 2004 annual NSF equipment grant report was completed and submitted to NSF. 2005 funds were received by UNAVCO.

*Facility Equipment Handling.* Two large shipments have been received from Antarctica this past quarter, with the balance due in early April. Fourteen NSF and thirteen NASA projects have shipped this quarter. The new "UNAVCO Property" type is being implemented on Facility Pool Equipment as the large Antarctic shipment is verified and unpacked. The tracking category of each piece of equipment is being verified and reclassified according to the new policy.



**Figure 6.** Boulder Warehouse

*PBO/Warehouse Activity.* Preparations are being made for the PBO third quarter shipment to each of the regions. Forecasts of monument, communications, and power are being developed with each region. Cost savings in communication equipment procurement has been identified. In the past, the Boulder Warehouse has maintained an inventory of CDMA modems and VSAT terminals. Going forward, these units will be ordered from the supplier and shipped to the regions on a “just-in-time” basis according to weekly installation schedules. UNAVCO receives a monthly bill from the time the unit is turned on and shipped from the supplier. With no inventory, monthly communication charges are levied only on units that are installed in the field.

Several items have been designed for PBO Operations:

- AK Hut redesign: The new design will virtually eliminate the need for an additional solar panel mount.
- Universal U-bolt with saddle: this u-bolt is used for hanging the GPS equipment enclosure and will fit on 2-2.5” pipe. It will eliminate the need to maintain additional part numbers, and is less expensive than the current equivalent items.
- External RTK connection box: As a condition for permitting in some locations, some host organizations request RTK signals from the NetRS. A weather-proof box has been developed and installed at some sites in the Rocky Mountain region. The new box will be used for this purpose throughout PBO.

*Health and Safety.* Forklift Safety Training Course was provided to key personnel by a certified instructor. The PBO Health and Safety Plan was modified and distributed to PBO personnel. The bi-annual warehouse safety inspection was conducted by Owen and Kurnik. Occupational medicine clinic was selected and information provided to employees. The annual fire safety inspection was conducted by the building owner and Owen with subsequent test of system conducted. The Quarterly ERT/Safety meeting was held. An automated defibrillator device was procured and staff training was scheduled.

*Building/Facility Activity.* A plan for building modification to add offices in Facility area was approved by management, NSF and the building owner, the contractor was selected and work began. The new security card access system was installed.

## **2.0 UNAVCO Facility January – March 2005 Monthly Reports**

### **2.1 January 2005**

#### **Facility Data Group (Fran Boler)**

##### **NSF/EAR Data Support**

- Routine archiving of permanent stations proceeded with 37 Gb archived.
- Three new permanent stations (Suominet-A: SA37, SA43; TransAntarctic Mountains: FTP1) were added for ongoing data management and archiving. Currently, data from 452 sites are actively managed and archived.
- Manual intervention was required to support data management and archiving for 45 sites during the month due to communications problems, metadata problems, file misnaming, and other issues.
- Archiving was completed for five campaigns (Kuparuk 2004, Hanford 2002, Morocco 2002, San Simeon Earthquake Response 2004, Central America 2003/2004) this month. New data and documentation for one campaign was received.
- 104,000 files (30 Gb) of data were picked up from the ftp area during the previous month.
- Data requests for three campaigns were filled.

##### **NSF WInSAR Archive Support**

- Following discussions with Howard Zebker (Stanford) plans are underway to operate a WInSAR archive at UNAVCO. UNAVCO will support obtaining, archiving, and making available InSAR scenes to be used by investigators with EarthScope funding.
- In support of InSAR archiving plans, WInSAR software was obtained from Howard Zebker and a system and RAID storage for WInSAR archiving were designated.

##### **NSF/EAR NUCLEUS Data Support**

- Metadata for 125 SCIGN Nucleus sites was entered via IGS log ingestion, in preparation for next phase of Nucleus data archiving.
- Discussions were held with SCEC representatives on possible plans for archiving of SCIGN data at UNAVCO.

### **NSF/EAR Plate Boundary Observatory Data Support**

- Thirteen sites (AB07, P086, P242, P301, P302, P319, P421, P451, P470, P472, P473, P588, P589) were added for interim automated data management and archiving.
- Consistency and completeness checks were performed on all PBO data archived for 2004.
- A process for site-tie archiving was developed with PBO staff and a set of site-tie data was archived.
- Planning and implementation was initiated for data mirroring using GPS Seamless Archive software for initial phase of mirroring archived PBO data holdings to the PBO secondary archive system at IRIS.
- Assisted PBO data flow staff with resolving metadata errors that led to data file misnaming and misarchiving for two sites at Mount Saint Helens. Re-archived the data to affect needed corrections.

### **NASA/SENH Data Support**

- An automated systems backup mechanism was set up for the two systems used for pulling data in GGN backup mode.
- The daily data report was reorganized according to the specifications of the NASA Network Engineer.

### **Infrastructure**

- Fibre channel interface cards were installed in three hosts in preparation for integration of storage area network (SAN) RAID into the Archive's data management, database, and data products storage systems.
- To increase the response speed of the Jules web mapserver system, 64-bit AMD Opteron systems were configured as replacements for the current Jules mapserver systems. When the upgrade is completed, a three- to six-fold increase in performance is expected.

### **Software Development**

- Steps for releasing an open-source version of TEQC were taken including a meeting with interested parties within UNAVCO, an announcement to the TEQC mailing list, and communication with receiver manufacturers on the plan.
- TEQC enhancements to read Vaisala metpack records were made.
- Scripts for automated ingestion of metadata from IGS-style text and XML format logs into SQLServer and Oracle databases were developed.

### **Database Services to Headquarters, Facility, and PBO**

- Inventory database development is nearly complete, with valuation report functionality recently added. User tools are still under development. Documentation of the database and information entry systems has been prepared.

- The US Government Property report detailing property locations based on the inventory database was enhanced.
- Customization of Solomon screens and troubleshooting of Solomon applications was provided to headquarters.
- A new model for internal access to inventory, equipment, budget and permanent station databases is under development.

#### **Education and Outreach**

- Earthquake and volcano datasets were enhanced in the EarthScope Voyager Jr. edition as well as the Jules Verne Voyager web mapservers.
- Staff attended DLESE planning meeting for the DLESE annual meeting to be held in July.

### **Engineering Group (Steve Fisher)**

#### **General**

- Helped formulate community correspondence regarding available resources for Sumatra earthquake response
- Developed key activity matrix for group at request of HQ
- Hosted visit by Topcon technical support to acquaint UNAVCO field engineers with functionality of the production GB-1000 GPS receiver
- Continued testing for Iridium SATCOM system
- Continued acceptance testing of Trimble choke ring antennas and NetRS firmware
- PC104 system testing continues
- Developed FAQ for downloading data from serial bridged wireless IP network
- Continued coordinating February UNAVCO member GPS receiver purchase
- Finalized ne R7 pricing with Trimble
- Evaluating Facility equipment needs for February purchase
- Migrated [support@unavco.org](mailto:support@unavco.org) to mailman list server application and updated recipient list
- Several group members attained OSHA forklift operator certification.

#### **NSF-EAR University PI Project Support**

- Mauna Loa 2005 (B. Brooks): Supported design of 12 station semi-permanent network using Trimble NetRS receivers and IP radio network, addressed communications and networking requirements with USGS, all equipment has been specified and in the process of being purchased and tested in the Boulder facility for deployment in February
- Andaman Islands (R. Smalley): Provided technical support to new permanent station installation

- Guerrero CPDP (K. Larson): Permanent station maintenance. We are attempting to solve the problem remotely with a site visit by the local collaborator. If this does not solve the problem an Engineer will visit the site in Mid February.
- Psuedorange Bias Testing (K. Larson): Project setup and last-minute receiver repairs were conducted to support early-February start of data collection
- Highbourne Cay Bahamas (P. Reid): One week of RTK surveying and training took place on Highbourne Cay. The PI, Pamela Reid from the University of Miami is interested in utilizing GPS for modeling coastal dynamic as part of a study of stromatolites.
- DIVE (M. Miller): A NetRS was supplied to Meghan Miller to replace a Trimble 4000 and computer at the station
- Southern Miss CORS 2005 (D. Mooneyhan): Technical support in implementing 10 permanent stations in southern Mississippi using NetRS receivers
- Permanent station/network O&M
  - BARGEN Network: 14 stations were managed remotely.
  - All sites were maintained for the year roll-over downloading and processing issues at Harvard CFA.
  - Galapagos: GV01 continuing problems.
  - Antarctica: support for FTP1
  - SuomiNet-C GPS Network : SC01
  - Eastern Mediterranean: IFRN
  - Central Asia: SUMK
  - Las Vegas: UNR1 and UNR2
  - EarthScope / PBO USSarray - WMOK,MAIR,JCTX
  - Arenal Cost Rica - CX01
  - Saudi Arabia - SOLA,NAMA
  - Bhutan- RBIT
  - Guerrero Coast – CPDP
  - Philippines - TV09
- Support requests accepted
  - Station WMOK, Wichita Mountains, OK (K. Persefield): Assist with installation of Short Drill Brace monument.
  - Station MIAR, Mount Ida, AR (K. Persefield): Assist with installation of deep-drill-brace monument.
  - Station JCT, Junction, TX (K. Persefield): Assist with installation of Short Drill Brace monument.
  - RETREAT 2005 (R. Bennett): 16 5700 GPS receivers have been scheduled to continue the RETREAT Project in 2005.
  - Andaman Islands 2005 (R. Smalley): Establish and operate a continuously operating GPS receiver in the Andaman Islands in support of post seismic deformation measurements following the December 2004 Sumatra Earthquake

- Southern Salton Trough 2005: (R. Bennett) Establish two new continuous GPS stations in northern Mexico to complement PBO south of the US border
- Provided proposal planning and budgeting support to one new project being proposed under EAR programs
- Equipment loans
  - PBO/Rocky Mountain Recon
  - MIT Field Camp

### **NSF-EAR Plate Boundary Observatory Project Support**

- Assigned project management responsibilities for the PBO campaigns to F. Blume
- Eastern US Seismic Array: Continued coordinating station installation, equipment purchasing continues
- Contributed to development of the PBO Operations & Maintenance proposal submitted to NSF
- Continued development of final PBO Campaign system packaging: new solar panel prototype purchased and tested, new security system designed and fabricated, final foam insert configuration designed
- Evaluated Topcon equipment with company representatives and made suggestions for increased functionality and usability
- Extensive contacts with several PIs and potential PIs regarding use of PBO campaign pool and development of future proposals (R. Bennett, D. Johnson, A. Qamar, T. Melbourne, R. Smith, M. Murray)
- Coordination of requests by PI's Bevis and McCluskey for evaluation units. Projects were approved and units shipped.
- Approved requests for PBO campaign equipment loan by two PBO regional engineers for recon and pre-installation campaign surveys in RM and PNW
- Continued provisional planning for MAGENT campaign, which is on indefinite hold due to weather and field conditions

### **Nucleus Project Support**

- Extensive troubleshooting of EBRY, PANGA, and BARGEN stations.
- Planned upgrades for SCIGN, BARD, EBRY, and PANGA stations for early February. Tested, configured and shipped equipment to PANGA and SCIGN operators.
- Reformulated Nucleus project budget at the request of the NSF program manager as a condition for final approval, which has since been unofficially given.
- Continued testing of Nucleus stock of Trimble choke rings.
- Continued evaluation of NetRS firmware.

- Purchased quantity of CDMA modems and IP radios, and planned final purchases of NetRS receivers for ExNet project which expires in February

### **NSF OPP Support**

- Set up Extreme Environment test site at the University of Colorado Mountain Research Station at 11,600 feet on Niwot Ridge
- Field testing met pack/anemometer for polar applications at the Niwot Ridge test site
- Began cold-chamber (-50C) testing of GPS system batteries for engineering evaluation of remote Polar GPS systems
- Performed cost/benefit analysis of Iridium data retrieval vs. physical data retrieval for remote GPS sites
- Initiated collaboration with Vexcel Corp. (R. Fatland) to apply 802.11 technology to remote GPS data downloading
- Contributed to Expression of Interest for International Polar Year "Polar Earth Observing Network" Polar regions GPS and seismic network.

### *Antarctic Projects*

- Field season continues through January, with recent engineering support to several projects in the McMurdo Dry Valleys region including Commonwealth glacier (A. Fountain), Lake Fryxell (M. Gooseff), Lake Hoare (P. Doran), Taylor glacier (E. Pettit), and Garwood valley (M. Uhle). Began the process of shipping equipment back to UNAVCO
- Successfully tested Iridium modem for GPS data downloads at McMurdo Station, and system is slated for deployment to remote TransAntarctic Deformation Network site Fishtail Point on Southern Victoria Land Coast (T. Wilson). Hourly data files will be transferred to the UNAVCO data archive.

### *Arctic Projects*

- Provided letters of support for two NSF-OPP Arctic projects submitted for the January 24 proposal deadline
- Scheduling and planning for approximately 15-20 (dependent on successful proposal reviews) projects between March and October 2005
- Provided GPS data processing software loan for Bench Glacier project (J. Harper)

### **NASA Program Support**

- Ashtech MicroZ "recall" repairs ongoing – many network sites effected and will be repaired over the next several months
- Shoring up details on FY2005 work statement and resource allocation
- New computer system for Diyarbikir, Turkey, being finished (new installation). New rackmount computers shipped/installed at CRO1, CORD (not installed yet)
- Evaluated options for alternate communications at Guadalupe island and began coordinating with interested parties

- Site highlights:
  - AMC2: Configured USNO rack mount and returned to site.
  - AREQ: New IP for our computer, operations restored.
  - BREW: Site private. Needs new uZ receiver.
  - BOGT: Two data interruptions due to antenna cable problems.
  - CHPI: New uZ rx arrived at INPE, to be installed ASAP.
  - CORD: Shipment in Argentina. Trip tentatively planned for mid-February.
  - CRO1: Poor tracking. Swapped rx+ant. Need new antenna cable, and possible H-Maser problems?
  - GUAM: Computer access problem resolved. Trying to sort out invoices with Marianas I-net provider
  - MCM4: Firmware upgrade of ACT TR.
  - MKEA: Computer access denied. Unknown reason/source. RTNT stream coming back out OK
  - SEY1 ISP I-net connection still down. No word from locals
  - Helped support Saudi Arabia station maintenance
  - Approximately 100 individual NASA trouble or maintenance issues were handled during this month.

## Equipment Group (Chuck Kurnik)

### Equipment Support

- The Equipment Group is beginning to configure and prep Topcon systems. Three have been sent out for PBO-related use.
- Additionally, twelve Trimble NetRS have returned from Antarctic, and three NSF and four NASA projects were shipped in January.

### PBO/Warehouse Activity

- Physical inventory at the Boulder Warehouse has been completed and loaded into the new Inventory Database tool. Transfers since the beginning of the month are being back-filled, and bugs are being documented and fixed.
- Quarterly shipments for Basin and Range and Pacific Northwest PBO regions are being completed. Solar panel mounts are being expedited from the supplier. The Facility Equipment Tech is being trained on PBO kit assembly procedures.
- PBO installation schedules are being examined and coordinated with the next quarter's shipping schedule.
- The template used for procurement earned-value reporting has been completed this month.

## 2.2 February 2005

### Facility Data Group (Fran Boler)

#### Facility Standing Committee

- Presentations and tours were prepared for the Facility Standing Committee visit on February 15.
- A summary write-up of issues and actions brought up in discussion with the Standing Committee was prepared.

#### NSF/EAR Data Support

- Routine archiving of permanent stations proceeded with 34 Gb archived.
- One new permanent station (Socorro: CARB) added for ongoing data management and archiving. Currently, data from 464 sites are actively managed and archived.
- Communications problems resulting in data quality issues were identified for Akutan and Okmok Networks; the PI is looking into possible fixes.
- Archiving was completed for one campaign (Parkfield Emergency Response 2004) this month. Archiving of two large projects, Antarctica Support 2004/2005 and RETREAT Italy 2004, are underway. New data and documentation for one campaign was received.
- 113,000 files (43 Gb) of data were picked up from the ftp area during the previous month.
- Data requests for five campaigns were filled.

#### NSF WInSAR Archive Support

- Plans to use a system retired from the mapserver cluster for WInSAR archiving were held up. A new system was ordered instead.

#### NSF/EAR NUCLEUS Data Support

- Further testing of connections for SCIGN Nucleus data pulling was completed. Archiving is set to begin on March 1.

#### NSF/EAR Plate Boundary Observatory Data Support

- Eleven sites (P066, P158, P164, P181, P225, P284, P287, P486, P594, P690, P699) were added for interim automated data management and archiving.
- Consistency and completeness checks were performed for all PBO GSAC published holdings.
- Staff provided input to the PBO Data Products Manager on the Archive Statement of Work.
- Data Group and Engineering Group personnel performed tests to validate NetRS firmware for BINEX generation at high sample rates (up to 10 Hz).

### **Infrastructure**

- EMC, the vendor for the UNAVCO SAN, came onsite to install software and test connectivity of the newly installed SAN hardware.
- Configuration of RAID groups, file system partitions and LUNs proceeded for the CLARiiON SAN system.
- Progress was made on replacing two of the Jules mapserver computational nodes with 64-bit dual processor Opterons.

### **Software Development**

- Discussions are ongoing with receiver manufacturers having concerns about releasing an open-source version of the TEQC software.
- SiteViewer, a GMT-based Javascript web mapping system has been deployed for viewing for sites with data in the UNAVCO Archive; site metadata and available data is summarized by clicking on the map.
- TEQC modifications to provide the capability to read some fraction of partially corrupted CMC data were made.

### **Database Services to Headquarters, Facility, and PBO**

- A front-end Access application for obtaining permanent station metadata, maintenance, and site information was developed.
- Adjustments were made to travel request software.
- The inventory database is in production; some refinements to the database and tools are ongoing.

## **Engineering Group (Steve Fisher)**

### **General**

- Several group members participated in the Facility standing committee meeting.
- Prepared and submitted annual report to NSF for Facility equipment pool grant
- Continued acceptance testing of Trimble choke ring antennas.
- Continued testing NetRS receivers and participated in resolving remaining hardware/firmware issues and communication.
- Continued testing of Iridium SATCOM system, currently looking at RFI issues
- PC104 long-term system testing continues.
- Helped coordinate new membership application for CICESE
- Continued coordinating February UNAVCO member GPS receiver purchase -- approximately 61 receivers anticipated to be ordered by members.
- Ordered 102 receivers for Facility use on various projects and for community pool.
- Reviewed several sections of Facility web site for stale and broken links, found and fixed several.

- Performed personnel action to reclassify one employee.
- Suggested several improvements to project planning database, which were implemented by S. Jeffries.
- Produced a program to replace schedg for automated downloading.
- Produced a Topcon GB1000 quick-ref guide for inclusion with the GB-1000 campaign systems.

### **NSF-EAR University PI Project Support**

#### *Projects*

- Mauna Loa 2005 (B. Brooks): Equipment has been purchased, configured, tested and shipped to Hawaii for installation of a 12-station network. Engineer to be deployed in March.
- Sierra Negra Volcano (Galapagos) 2004 (D. Geist): Replaced two malfunctioning receivers in Galapagos network.
- Saudi Arabia Permanent Stations 2005 (R. Reilinger): This project reestablished communications with problematic stations in Saudi Arabia.
- Provided technical support and equipment to Acceleration *Calibration* 2005 project (P. Elosegui): Assess the GPS capability for detecting short-term transient motions.
- Provided proposal planning and budgeting support to one new project being proposed under EAR programs.

#### *Permanent station/network O&M activities:*

- Antarctica: FTP1
- Saudi Arabia; SOLA,NAMA, HALY
- Socorro Network: CARB
- Guerro Coast :CPDP
- Easter Mediterranean sites: IFRN
- Galapagos: GV01
- Philippines: KATY
- SuomiNetC Net : SC01
- Alaska : ATWC
- Andaman Islands :CARI

#### *Additional Support requests accepted:*

- Nairobi GGN 2005 (M. Kamamia): We are investigating the possibility of installing an IGS station in Kenya
- DISCoVER-cGPS (A. Dennis): We are discussing the design and implementation of a combined GPS and seismometer network with the intention of submitting a budget to DOS Savanna River.

- Pico del Aguila anticline 2005: Field Project scheduled for May.
- PBO Northern CA March 2005: Deep-drill installation scheduled for March
- Guerrero – CPDP: Working with local collaborators to get the station transferring data to the UANVCO archive

### **NSF-EAR Plate Boundary Observatory Project Support**

- Finalized design of foam inserts for GB-1000 campaign systems in Pelican 1600 boxes, ordered 28 of same.
- Ordered 20 Tech2000 antenna masts for April delivery.
- Continued evaluation of GB-1000 firmware and usability and coordinated features and delivery of future firmware updates.
- Tested and configured 2 GB-1000 systems for networked deployment in PBO/USGS Mt. St. Helens network, the first such use of the PBO campaign pool.
- Eastern US Seismic Array: Continued coordinating station installation, equipment purchasing, supported site work at WMOK, MAIR, JCTX.
- Continued provisional planning for MAGENT campaign, which is on indefinite hold due to weather and field conditions.

### **Nucleus Project Support**

- Extensive troubleshooting of EBRY, PANGA, and BARGEN stations.
- Planned upgrades for SCIGN, BARD, EBRY, and PANGA stations for early February. Tested, configured and shipped equipment to PANGA and SCIGN operators
- Reformulated Nucleus project budget at the request of the NSF program manager as a condition for final approval, which has since been unofficially given
- Continued testing of Nucleus stock of Trimble choke rings
- Continued evaluation of NetRS firmware
- Purchased quantity of CDMA modems and IP radios, and planned final purchases of NetRS receivers for ExNet project which expires in February

### **NSF OPP Support**

- Requested Polar Special Interest Group forum at UNAVCO/IRIS Annual Meeting.
- Completed field testing met pack/anemometer for polar applications at the Niwot Ridge test site.
- Continued cold chamber (-50C) testing of GPS system batteries for engineering evaluation of remote Polar GPS systems.
- Initiated "Remote IPY GPS Site" development .

### *Antarctic Projects*

- Field season completed, and seven systems left out for over-winter data collection, remaining equipment shipped back to UNAVCO.
- Performed failure analysis for Iridium modem communication problem from site Fishtail Point.
- Updated Raytheon Support Information Packet (SIP) to include expanded UNAVCO support for Antarctic continuous station.
- Set up remote Iridium system for field validation at the Niwot Ridge test site.
- Provided equipment support for USAP Patagonia glaciology project (B. Hallet).

### *Arctic Projects*

- Provided GPS data processing training for Bench Glacier project (J. Harper)
- Planning GPS and RTK training course to be held at the University of Alaska, Fairbanks (A. Balsler)
- Preliminary planning for GPS component of High Arctic Field Course in Thule, Greenland (R. Sletten)

### *Additional Support requests accepted*

- Columbia Glacier 2005 (T. Pfeffer): Equipment request.
- Arctic Hyporheic Zone: Field Support request at the Toolik research Station, AK.
- Kuparuk 2005: Equipment request
- McCall2005: Equipment request

### *Equipment loan*

- Patagonia 2005: kinematic surveying.

### *General Support and Infrastructure Development*

- Completed field testing met pack/anemometer for polar applications at the Niwot Ridge test site
- Set up remote Iridium system for field validation at the Niwot Ridge test site
- Continued cold chamber (-50C) testing of GPS system batteries for engineering evaluation of remote Polar GPS systems
- Initiated "Remote IPY GPS Site" development

### **NASA Program Support**

- Ashtech MicroZ capacitor "recall" repairs ongoing.
- New computer system for Diyarbikir, Turkey, being finished (new installation).
- Made final preparations and cleared equipment through customs in Argentina for GGN Site visit to Cordoba. Coordinated site visit for early March to reestablish the station.

- Developed plan and budget options for follow-on operations at Guadalupe Island after VSAT is decommissioned. Coordinating plan with SCIGN staff at USGS, Pasadena.
- Started discussing possibility for new station in Nairobi, Kenya, and corresponded with potential collaborator.
- Began planning for re-installation of RIOP, Colombia.
- Site O&M highlights:
  - AREQ: Gilat payment outstanding. No connection. Awaiting authorized personnel to arrange payment locally. Discussed situation at Tracking Station with D. Carter.
  - BREW: New uZ receiver installed with repaired capacitor. Station back operational.
  - BOGT: Hector will prepare current Ashtech equipment return shipment (Colombian customs regulations).
  - CHPI: New uZ rx installed. Old data re-transferred from CHPI computer due to ASCII xfers caused data problems. Old data going back to August 2004 re-rinex'd and re-published. Lightning strike at station in late Feb, receiver only tracking L1 ... still investigating, site private again.
  - CORD: Site visit started end of Feb.
  - CRO1: Determined antenna cable problem. New LMR600 (100m) cable ordered.
  - FAIR: Shipped and installed Rubidium in place of H-Maser.
  - GUAM: Upgrading current (slow) Internet connection to Cable modem. Intermittent connection problems all month. Paid Marianas Internet charges for all of 2005.
  - ISPA: Faulty VSAT satellite transponder. Swap in progress. Sent out IGSSTATION email.
  - MKEA: Computer access restored after UNAVCO/JPL IP's were added to NRAO router. Original rack mount in place, new will be returned to UNAVCO.
  - QUIN: Some tracking problems w/ uZ, recommend swap when unit becomes available.
  - SEY1: ISP I-net connection back up, files being pushed to UNAVCO. Still no access back into the computer from outside.
  - SHAO: Updated log/IGSSTATION email with correct firmware dates, data file recoveries, etc. Phone lines still down, local contact is out of the office.
  - YKRO: Connection back up! Data flowing.
  - ZAMB: Network connection down this whole month. In progress.
  - Saudi Arabia: Remote support to PI visit in February, 2005. HALY, NAMA, SOLA connection restored data being sent to UNAVCO. Ashtech offload software re-written to support local conditions.
  - Approximately 120 individual NASA trouble or maintenance issues were handled during this month.

## Equipment Group (Chuck Kurnik)

### Facility Equipment Support

- Four NASA and four NSF projects were shipped in February.

### PBO/Warehouse Activity

- The Inventory Database has been implemented, and all transfers are being tracked from the Boulder Warehouse to the regional offices.
- The next steps are to implement the Deployment module, and quarterly counts at regional offices.

### Property Management:

- A new category of trackable equipment has been implemented, “UNAVCO Property”.
- A procedure for the physical inventory of trackable equipment has been developed in preparation for the JDS audit at the end of March.

## 2.3 March 2005

### Facility (Chuck Meertens)

- Chuck Meertens, Ramon Arrowsmith (ASU) and Chaitan Baru (SDSC) organized the GEON Visualization Workshop at the San Diego Supercomputer Center, 1-2 March 2005.
- The workshop was attended by 25 geo- and computer scientists to address issues and advances in 3D and 4D visualization.
- The workshop website contains links to presentations and visualization resources: <http://www.geongrid.org/workshops/geonvis2005/index.html>.

## Facility Data Group (Fran Boler)

### NSF/EAR Data Support

- Routine archiving of permanent stations proceeded with 38 Gb archived.
- Two new permanent stations were added for ongoing data management and archiving (SAGE: BNET, Andaman Islands: CARI). Currently, data from 562 sites are actively managed and archived.
- Communications problems resulting in data quality issues within the Akutan and Okmok networks were solved and retransmitted data were manually archived.
- Manual intervention was required to support data management and archiving for sixteen sites during the month due to communications problems, metadata problems, file misnaming, and other issues.

- Archiving was completed for one campaign (RETREAT-Italy 2004) this month. Data for one new campaign was received.
- 189,000 files (61 Gb) of data were picked up from the ftp area during the previous month.
- Data requests for eleven campaigns were filled.

#### **NSF WinSAR Archive Support**

- A Sunfire v20z was purchased to serve as the WinSAR system.
- WinSAR software installation was initiated NSF/EAR NUCLEUS Data Support

#### **NSF/EAR NUCLEUS Data Support**

- Routine archiving of 95 SCIGN Nucleus sites began on March 1. Four sites are currently not operational. Twenty-five sites will have RINEX files pulled and archived in the near future.
- Routine archiving of six BARD Nucleus sites began late last month.

#### **NSF/EAR Plate Boundary Observatory Data Support**

- Nine sites (P035, P038, P039, P224, P229, P230, P300, P560, P577) were added for interim automated data management and archiving, for a total of 98 sites.
- A final budget was provided to the PBO Data Products Manager for the Archive Statement of Work.
- The Archive Statement of Work was finalized.

#### **NASA/SENH Data Support**

- Handling of hourly files from CHPI was incorporated into archiving.

#### **Infrastructure**

- The EMC CLARiiON was put in production for storage of all archived GPS data.
- Two 64-bit dual-processor Opterons were put into production in the Jules mapserver compute cluster; map generation speeds are now 3-6 times faster.
- Specifications for a tape backup system were completed and final quotes were obtained.

#### **Software Development**

- Discussions are ongoing with receiver manufacturers having concerns about releasing an open-source version of the TEQC software Database Services to Headquarters, Facility, and PBO

#### **Database Services to Headquarters, Facility, and PBO**

- The backup strategy for the financial information database server was evaluated and revised.

- A front-end Access application for obtaining permanent station metadata, maintenance, and site information was developed.
- Adjustments were made to travel request software.
- The inventory database is in production; some refinements to the database and front end are in progress.

#### **Education and Outreach**

- Data Group staff met with Marianne Weingroff of UCAR, a group of University of Colorado student evaluators, and the UNAVCO E&O coordinator to receive the report from the evaluators and to formulate a plan for enhancements to the Jules Verne Voyager GMT map tool.

### **Engineering Group (Steve Fisher)**

#### **General**

- NetRS firmware version 1.1-2 was delivered and acceptance testing begun.
- Reviewed Trimble release notes and customer correspondence about general NetRS issues and resolution.
- Continued Topcon GB1000 functional evaluation and coordination of improvements with manufacturer. Extensive field testing and coordination has been required to understand functionality. Several issues have been uncovered and addressed.
- Continued testing of Iridium SATCOM system – still investigating RFI issues and mitigation.
- PC104 long-term system testing continues in communication laboratory.
- Continued various cold-response tests of batteries for use in extreme environments.
- Improved online support request form and began evaluating backend functionality of project-planning database. Will coordinate implementing improvements with S. Jeffries over next few months.
- Opened new project engineer position in engineering support section. Primary duty is to help with Nucleus project implementation and PBO campaign coordination.
- Several group members participated in internal financial system training for project budget monitoring and reporting.

#### **NSF-EAR University PI Project Support**

- Mauna Loa 2005 (B. Brooks): Installation of 12 station network in progress. Last-minute advisory from Trimble regarding potential faulty NetRS hardware was responded to. All twelve receivers were evaluated and several needed repair just prior to deployment.

- Saudi Arabia (R. Reilinger): Helped PI establish station communications and automated download at stations HALY, SOLA, NAMA. Provided technical support to campaign, supplied two receivers, handhelds and misc. other equipment.
- Calibration Experiment for Pseudorange Data (K. Larson): Relocated temperature chamber to permanent location, identified and currently preparing receivers for expanded request, all components of experiment will be ready for PI to begin collecting data by end of month.
- Mid-America Network (R. Smalley): Established automated downloading of all 12 sites, supporting ongoing O&M.
- BARGEN (Wernicke): Continued monitoring, O&M activities.
- Yucca Mountain Network Expansion (B. Wernicke): All NetRS receivers have been checked for faulty diode and several were returned for repair. Remaining equipment is being purchased, assembled and tested at UNAVCO.
- Guerrero Coast (K. Larsen): Working with local collaborator to reestablish routine download of station data at CPDP.
- Adaman Islands (R. Smalley): Working with collaborator to establish download at new site CARI.
- Polar/SCAR Network: Supporting PI Peter Morgan with Ashtech download issues at several stations.
- Approximately 25 troubleshooting incidents were responded to on the 271+ stations monitored for EAR PIs.
- Proposal planning and budgeting: Provided proposal planning and budgeting support to two new projects being proposed under EAR programs.

*New Support Requests Accepted*

- K2 2005 (Shroder): Campaign equipment loan for surveying on the Baltoro Glacier, Pakistan.
- Oregon Coast 2005 (Schmidt): Campaign equipment loan of 5-10 receivers in conjunction with leveling survey on Oregon coast.
- Hydrological Linkages 2005 (McGlynn): Campaign equipment loan and training.

**NSF-EAR Plate Boundary Observatory Project Support**

*PBO Permanent GPS Network*

- PBO Zephyr Antenna Mount (Jackson): Calculated vertical offset to make center of curvature of SCIGN raydome coincide with the average absolute phase center, designed adapter to realign dome to this height if deemed necessary by PBO personnel.
- Antenna Rotation Testing (Jackson): Completed collecting rotation test data with all Trimble choke rings in stock to test compliance with specification of phase center offset.

- Provided engineering group staff member for Southern California region station reconnaissance for two week field trip, plus reporting time.
- US Seismic Array: Continued assembly and testing of equipment and consulting on site selection and installation with IRIS staff.

#### *Earthscope Campaign Projects Support*

- Received and began evaluation of new GB-1000 version 2.5 receiver board firmware release.
- Received, evaluated and rejected GB-1000 version 2.11UB (beta) controller firmware, which disabled CF card functionality rather than enhancing it.
- Participated in extensive discussions with Topcon in planning next firmware release for BINEX and SSL capabilities, user interface and usability concerns.
- Met with Allen Dennis of S. Carolina to begin development of EarthScope proposal.
- Clarified UNAVCO's PBO campaign support procedures for Earthscope program manager K. Shedlock.
- Developed custom solar module design with CT Solar, order pending final details from manufacturer.
- Demonstrated PBO portable GPS campaign system at EarthScope national meeting and held multiple discussions with potential users for feedback and advice on how we may help support their use of this equipment.

#### **NSF EAR PBO Nucleus Project Support**

- Received official notification of funding and award letter for PBO Nucleus proposal, along with excellent reviews, which were distributed to the project participants.
- Placed order for 60 NetRS/Zephyr systems from Trimble.
- Completed testing of NetRS - USGS VSAT communication interface.
- Supported extensive troubleshooting and diagnostic testing of Proxicast CDMA problems with Verizon network in NV, UT and WA, including coordination and support of site visits in all three states. Investigated new options for cellular internet service PBO wide - hardware (DIGI and Junxion) and service providers (CellularOne, Cingular)
- Participated in resolution of multiple NetRS issues: Met with Trimble personnel to coordinate response and action resulting from receiver and antenna performance and supply issues. Worked with Brian Frohring of Trimble to verify performance of NetRS's that have been deployed by Existing Networks project. No obvious problems found. Supported rotation testing of choke ring antenna stock. Began testing of beta NetRS firmware release 0.3-7.
- Continued joint planning of upgraded Nevada IP communication network with PBO regional engineer B. Friesen.
- Investigated and tested DC timers for use with CDMA modems.
- Troubleshooting of stations in UT, WY, WA, OR, and NV.

- Began planning of Parkfield IP communication network.
- Upgraded Corvallis, Oregon station with NetRS/CDMA, although it is not yet online.
- Presented poster of PBO Nucleus project at EarthScope national meeting.

### **NSF OPP Support**

#### *Antarctic*

- Prepared field season report draft.
- Attended and presented at Geospatial Solutions for Antarctic Research workshop hosted by USGS in Baltimore.
- Polar/SCAR Network: Supporting PI Peter Morgan with Ashtech download issues at several stations.
- Prepared Support Information Package for Raytheon logistics support for 2005/06 field season

#### *Arctic*

- Preparing GPS and RTK training course to be held at the University of Alaska, Fairbanks (A. Balsler).
- Planning support for GPS on Odin icebreaker cruise (C. Tweedie).
- Planning support for Barrow Biocomplexity project (C. Tweedie) and DGPS system support.

#### *General Support and Infrastructure Development*

- Continued cold chamber (-50C) testing of GPS system batteries for engineering evaluation of remote Polar GPS systems
- Continued Iridium system field validation at the Niwot Ridge test site.

#### *Equipment loan*

- USAP Patagonia glaciology project in progress (B. Hallet).
- Equipment sent out for Iceland Breidamerkurjokull project (S. Tulaczyk).
- Bench Glacier data processing software loan (J. Harper).

### **NASA Program Support**

- Ashtech MicroZ capacitor "recall" -- repairs of 26 GGN receivers ongoing and will be completed next month.
- Site visit to Cordoba, Argentina to re-establish station CORD and Internet communications was completed. Station is operational
- Purchase of 6 NetRS receivers for L2C tests at GGN sites to be conducted in June time frame.
- Plan and diagram for Marshall test site is in progress – prototype station to be deployed at several GGN sites for future equipment testing purposes.
- Budget and plan for Guadalupe upgrade w/ SCIGN was finalized. SCIGN will purchase a NetRS receiver for the site and fund travel for site work.

- Continued refining FY05 NASA SOW. Setting quarterly meeting w/ JPL PEM in April.
- GGN site O&M highlights:
  - AREQ Gilat payment still outstanding. No connection. Awaiting authorized personnel to arrange payment locally.
  - CHPI Site private (no data publishing). Lightning strike at station in late Feb, receiver only tracking L1. Removing battery back-up restored L2, but clock jumping around and still L2 outages at times. Preparing replacement equipment shipment.
  - CORD Site visit to install new computer, Ashtech eqp. and wireless Internet link done. Site operational w/ RTNT stream.
  - CRO1 New LMR600 (100m) cable installed. Tracking OK. H-Maser/receiver lock problems. Need comparison data w/ and w/o dome. Reconfigured UPS sw. Site still private.
  - FAIR Receiver running off Rubidium. Old Ashtech uZ returned and shipped to Thales for repair.
  - GUAM Internet connection upgraded to Cable modem connection. Link stable.
  - HRAO ntp (123) service problems. Tracking restored by Ludwig, working on MET-data. Site private still.
  - ISPA VSAT satellite transponder swap done. Link throughput improving towards end of month.
  - NLIB Poor tracking. No apparent problems at site except possible cable damage (in conduit) due to rodents. Awaiting info on replacement cable length, possible NOAA uZ additional rx, etc. Site private.
  - RABT Changed offload (GNEX) to hourly files. Hourly (and daily) now published.
  - RBAY Ludwig installed new Debian computer. GNEX offloads back up. IGSSTATION notification.
  - SANT Tracking problems, site private. Poor clock performance.
  - SEY1 ISP I-net connection back up, files being pushed to UNAVCO. Link interrupted again, locals are checking. Still no access back into the computer from outside.
  - SHAO Phone line connection to TR restored, data publishing back on.
  - YKRO Internet connection is still good, but poor tracking (intermittent), trying to locate replacement TR. Site private.
  - ZAMB Network connection restored. Ludwig installed in-line pre-amp and lightning protector. Tracking improving. Data published.
  - S.Arabia Some connection problems to SOLA still, but data coming in. Need to install simple timer on modem power source to ensure modem is power cycled and not gets hung.
  - Eight long-problematic GPS stations were restored to operation in the month.
  - Approximately 130 individual NASA trouble or maintenance issues were handled during this month.

## Equipment Group (Chuck Kurnik)

### Facility Equipment Support

- Five NASA and three NSF projects were shipped in March
- The primary return shipment has been received from Antarctica. A final shipment is expected in early April.
- The new “UNAVCO Property” classification of equipment is being implemented as the Antarctic shipment is being unpacked and verified. This involves adding a red sticker with the words “Property of UNAVCO, Inc.” to specific pieces of equipment, and changing its status in the Facility Equipment Database.

### PBO/Warehouse Activity

- The Deployment module is being added to the Inventory Database. This will allow Boulder warehouse personnel to remove items from inventory at the regional offices as PBO stations are installed.
- The third quarter shipment to the regional offices is being prepared this month. The mix is determined from a rough forecast and refined during conversations with each of the regions.
- Quarterly counts at regional offices are beginning at the end of this month. These counts will establish the accuracy of the Inventory Database during this period of startup. These counts will be performed for at least the next 3 quarters.