

UNAVCO 2005-2009

Strategic Plan



15 July 2005

UNAVCO Strategic Planning Committee

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Cover photo courtesy of Meghan Miller. A view of the SCIGN-Dome covered GPS receiver in the Olympic Mountains in the northwest corner of Washington State.

INTRODUCTION

UNAVCO has recently undergone some major changes. It has changed its status, from a program within the University Corporation for Atmospheric Research (UCAR) to an independent entity. Administratively, UNAVCO has moved to a new physical location and the number of employees at UNAVCO has tripled in the past year. UNAVCO has entered into a cooperative effort with Stanford University and the Incorporated Research Institutions for Seismology (IRIS) to construct the largest ever solid Earth science facility, EarthScope. Construction of the EarthScope Plate Boundary Observatory has made UNAVCO responsible for strainmeters, seismometers and remotely sensed data sets in addition to the Global Positioning System (GPS) technology that has formed the core of UNAVCO activities in the past.

A Global Navigation Satellite System (GNSS) is a network of satellites that transmits ranging signals used for positioning and navigation anywhere around the globe; on land, in the air or at sea. The US Global Positioning System (GPS), the Russian GLObal NAVigation Satellite System (GLONASS) and the upcoming European GALILEO system are examples of GNSS. GNSS/GPS is being used in new ways as people apply GPS to non-traditional areas such as seismology and meteorology. The deployment of large numbers of continuous GPS sites has led to the identification of transient deformation, often accompanied by seismic activity. It has provided evidence that such transient deformation may be much more common than previously realized. Since currently available GPS receivers can operate at higher sampling rates, GPS investigators are utilizing these data in new applications such as seismology. Interferometric Synthetic Aperture Radar (InSAR) and Light Detection And Ranging (LIDAR) observations form exciting complementary data sets for the study of solid earth deformation. All these changes make this an exciting time for the UNAVCO Community. However, it is also a challenging time, one requiring a clear sense of direction. The purpose of this document is to provide some of that direction. Initial discussions of this plan took place during a Strategic Planning meeting held at Aspen Lodge, Estes Park, Colorado on the 28th and 29th of April 2004.

EXECUTIVE SUMMARY

The UNAVCO Facility and the PBO Project, with support and guidance from Headquarters and the Board of Directors, are meeting numerous, far-reaching requirements through current activities. With a broadened focus, the following actions are required to address additional scientific needs and opportunities over the next two years:

Goals

Goal 1. Provide effective support of investigations funded by NSF and NASA

- *Support PBO construction, operation and maintenance*
- *Continue support of NSF-GEO-EAR investigators*
- *Continue support of the NASA Global GNSS/GPS Network*

- *Continue and enhance support of NSF-GEO-OPP investigators*
- *Assure that the data acquired for these projects are made available for current and future scientific use*
- *Continue UNAVCO's traditional role in instrument and technique development*

Goal 2: Add new capabilities required to support geophysical research

- *Develop UNAVCO capability to support strainmeter investigations*
- *Develop UNAVCO capability to support LIDAR investigations*
- *Investigate ways in which UNAVCO can support InSAR investigations*

Goal 3: Expand and improve Education and Outreach (E&O)

- *Increase the diversity of scientists applying geodetic techniques to solve earth science problems, thereby increasing the pool of potential geodynamic scientists.*
- *Increase the level of understanding of deformation processes among students, politicians, members of the public, and other scientists*
- *Implement an Education and Outreach Standing Committee*

Goal 4: Develop a stronger UNAVCO scientific community

- *Formalize a Visiting Scientist Program*
- *Formalize a Student Intern Program*
- *Formalize summer training courses*
- *Increase UNAVCO membership*

Goal 5: Develop long-term plans

- *Explore options for follow-on programs to EarthScope*
- *Explore possibilities for a Global PBO*
- *Undertake broader working relationships with international scientific organizations to strengthen international collaboration*

Planning committees and advisory committees

The UNAVCO Board of Directors and President comprise the primary long-range planning group. With the President's input, the Board will review the Strategic Plan document, facilitate consultation with members of the community, periodically clarify and sharpen the proposed actions, and support the President in their implementation.

The UNAVCO Board has appointed a UNAVCO Facility Standing Committee and an Education & Outreach Standing Committee. UNAVCO may also implement an InSAR Applications Working Group and/or an Information Technology Working Group if it appears that these are required.

This strategic plan will provide guidance to UNAVCO for the period 2005-2009 and will be used to guide the budget and activity development for the years 2005 and 2006. Activities in these years will lay the groundwork for the future of UNAVCO, and strategic planning will be an ongoing activity.

UNAVCO Strategic PLAN FOR 2005-2009

About UNAVCO

UNAVCO provides community-based planning and management of activities benefiting geodesists in the solid Earth research community. Activities under the direction of UNAVCO include working groups, scientific/engineering meetings and workshops, and field, equipment and data support to Principal Investigators. UNAVCO is also part of the team constructing EarthScope (<http://www.earthscope.org>), a major new solid Earth science initiative of the National Science Foundation.

The UNAVCO Facility in Boulder, Colorado (<http://www.unavco.org/facility>) is the primary operational arm of UNAVCO. The UNAVCO Facility exists to support university and other research investigators in their use of GPS technology for Earth sciences research. The Facility performs this task by providing state-of-the-art GPS equipment and field engineering support for projects, by installing, operating and maintaining continuous GPS networks globally, by undertaking new technology development and evaluating commercially available products for research applications, by archiving GPS data and data products for future applications, and contributing educational and outreach activities to our community.

UNAVCO was founded in 1984 as The University NAVSTAR Consortium under the auspices of the Cooperative Institute for Research in Environmental Sciences at the University of Colorado. In 1992, UNAVCO became a part of the University Corporation for Atmospheric Research. On 24 April 2001, UNAVCO was created as an independent, non-profit Colorado, 501(c)(3) corporation.

UNAVCO Members are educational or nonprofit institutions chartered in the United States (US) or its Territories.

UNAVCO Associate Members are institutions engaged in research that advances the mission of UNAVCO, but that otherwise do not qualify for membership (e.g., non-US educational or research institutions).

As of June 2005, UNAVCO had 48 Members and 16 Associate Members.

UNAVCO is governed by a seven member Board of Directors. Five Board positions are selected from among the member institutions and two positions are at-large. Board members are elected by a vote of the Members of UNAVCO. Board members serve two-year terms and can serve a maximum of two consecutive terms. The terms are staggered so that each year three or four positions come up for election.

UNAVCO is funded by the National Science Foundation (NSF) and National Aeronautics and Space Administration (NASA).

UNAVCO's Role

Initially, UNAVCO was formed when GPS receivers cost over \$150,000 each. The intent was to create a pool of receivers that could be used by many universities, allowing them to apply this new technology to research problems. Although the cost of receivers has decreased by a factor of 25, the sharing of receivers continues to be a part of UNAVCO's role. However, UNAVCO's work has expanded to include data retrieval, archiving and distribution, construction, operation and maintenance of continuous GPS stations, hardware testing, software development, training, and engineering support for all of these functions. In addition, UNAVCO supports communication within the scientific community through its annual membership meeting, workshops, and working groups. UNAVCO is also involved in Education and Outreach efforts through student intern programs, through the development of web-based learning tools and through the development of classroom materials.

The start of EarthScope in 2003 has led to a major increment in UNAVCO activities. EarthScope is a major solid Earth science facility. The borehole, seismic and geodetic components are funded by the National Science Foundation (NSF). The National Aeronautics and Space Administration (NASA) and the US Geological Survey (USGS) are cooperating in the development of EarthScope. UNAVCO has responsibility for construction of the Plate Boundary Observatory (PBO) component of EarthScope. Although this effort is, in theory, simply another project much like other continuous station construction projects, the scope of the effort has led to a major shift in UNAVCO's organization and staffing level. UNAVCO now has a separate division and staff devoted to the implementation of PBO. The construction phase, funded by NSF's Major Research Equipment Facility Construction (MREFC) appropriation will progress through Year 5 in 2007/2008. The Operations and Maintenance Program, funded by NSF-EAR, will phase in starting in Year 2 and proceed for at least five years beyond the MREFC phase, to 2013.

UNAVCO Mission

With the adoption of this Strategic Plan, UNAVCO is revising its Mission Statement.

New Mission Statement

UNAVCO, a non-profit, membership-governed consortium, supports and promotes Earth science by advancing high-precision techniques for the measurement and understanding of deformation. UNAVCO also supports education to meet the needs of the community and the public.

UNAVCO-supported investigators and students include those interested in studying deformation associated with earthquakes, volcanoes, glaciers, ice sheets, continents, plate motion, and related phenomena. To carry out its mission, UNAVCO provides equipment, engineering, and data handling and storage capabilities. UNAVCO provides support for all techniques that have application to detecting and measuring changes in the surface of the earth, including surveying techniques such as GPS, imaging techniques such as InSAR and LIDAR, and point observations such as strain. UNAVCO also supports its

investigator community by serving as a focal point for interaction through meetings, workshops and other cooperative efforts, including community planning.

UNAVCO Goals and Activities

Goal 1. Provide effective support of investigations funded by NSF and NASA

UNAVCO currently has five major commitments: Community and Facility Support from NSF/GEO/EAR/IF, Earthscope/PBO from NSF/MREFC, Existing Networks, Global GPS network support from NASA, and Arctic/Antarctic support from NSF/OPP. UNAVCO's highest priority is the effective execution of current responsibilities under these projects.

- *Support PBO construction, operation and maintenance*
- *Continue support of NSF-GEO-EAR investigators*
- *Continue support of the NASA Global GPS Network*
- *Continue support of NSF-OPP investigators*
- *Continue integration of existing GPS networks with PBO*
- *Implement a complete complement of Standing Committees by adding Facility and Education and Outreach Standing Committees*
- *Assure that the data acquired for these projects are made available for current and future scientific use*
- *Continue UNAVCO's traditional role in instrument and technique developments*

UNAVCO has established standing committees of the Board of Directors to advise the Board and staff on Facility issues and on Education and Outreach issues. These committees will complement the existing PBO Standing Committee.

Goal 2. New capabilities required to support geophysical research

In the past UNAVCO has primarily supported GPS investigators. UNAVCO is responsible for installing strainmeters as part of the EarthScope PBO project. Also as part of the PBO project, UNAVCO is responsible for acquiring, archiving, and distributing LIDAR data. InSAR interferograms constitute a complementary data set to the GPS observations currently supported by UNAVCO. The interferograms provide detailed spatial coverage that cannot be achieved by GPS: GPS provides temporal sampling and precision that cannot be attained by InSAR. Together, the two techniques are powerful tools for observing and understanding deformation. In order to carry out the PBO project, several new activities are required.

- *Develop UNAVCO capability to support strainmeter investigations*

The full success of EarthScope PBO requires expansion of the community of investigators using strainmeter observations to study solid earth deformation problems. UNAVCO will encourage an increase in the number of scientists using strainmeter

observations by: making the data and data processing software more accessible; by offering short courses in strainmeter data processing; and by providing installation and maintenance engineering support to investigators.

- *Develop UNAVCO capability to support LIDAR investigations*

As part of PBO, UNAVCO will acquire, archive and distribute LIDAR data.

- *Investigate ways in which UNAVCO can support InSAR investigations*

InSAR data complements GPS data. Many of the GPS investigators who are part of the UNAVCO community also utilize InSAR observations. EarthScope planning included an InSAR satellite that would be built and launched by NASA. This portion of EarthScope has not been funded. Nevertheless, existing InSAR sources provide valuable data to a large InSAR community, one that has a large overlap with the UNAVCO. Expansion of UNAVCO activities to include InSAR will strengthen both groups. Activities that UNAVCO will explore include: InSAR data archiving, short courses in InSAR processing, and a role in data acquisition.

Goal 3. Expand and improve Education and Outreach (E&O)

UNAVCO has carried out an effective Education and Outreach program through the efforts of a few key staff and community members. With the recent addition of a full-time Education and Outreach Coordinator, UNAVCO has an opportunity to build on the past Education and Outreach activities to reach a broader audience. UNAVCO is also developing a detailed strategic plan for Education and Outreach that will expand upon the activities described here.

- *Increase the diversity of scientists applying geodetic techniques to solve earth science problems, thereby increasing the pool of potential geodynamic scientists.*

UNAVCO's educational effort will be aimed at increasing the diversity of the geodynamics research community by developing programs that encourage students to consider careers in solid earth science. The focus will be on quality rather than quantity, i.e., UNAVCO will develop programs that make a big impact on the participants, rather than programs that provide a brief exposure to large numbers of participants. Diversity, broader participation/ and equal access will be embedded in all UNAVCO activities and will be explicit and will be evaluated.

- *Increase the level of understanding of deformation processes among students, decision makers, members of the public, and other scientists*

UNAVCO will revise existing pamphlets and will remodel the exhibit booth to reflect recent changes in its organization and activities and will develop new materials with the same aim. UNAVCO already has a well-developed web-based visualization effort centered around the Jules Verne Voyager web tools. UNAVCO will build and enhance these tools to incorporate additional data sets and to make them more useful to educators and students.

- *Implement an Education and Outreach Standing Committee*

UNAVCO has established a standing committee of the Board of Directors to advise the Board and staff on E&O issues. The committee is charged with insuring that UNAVCO's E&O program meets these objectives and is a sustainable, E&O program that is in high demand and has broad participation of the UNAVCO science community. UNAVCO has received funding from NSF for Research Experiences in Solid Earth Science for Students (RESESS) an intern program patterned after and cooperating with SOARS but aimed at bringing students into solid earth studies.

Goal 4. Develop a stronger scientific community

One of UNAVCO's strengths has been community activities. The UNAVCO Annual Meeting has provided a forum for the community. UNAVCO has been a leader in testing and evaluating equipment and has facilitated group purchases of equipment. UNAVCO will seek to enhance the support it provides to the UNAVCO community by formalizing several activities that have been conducted on an ad-hoc basis in the past.

- *Formalize a Visiting Scientist Program*

In the past, UNAVCO has had great success with member scientists spending time at UNAVCO working with staff members on projects of interest to the scientist. UNAVCO will explore ways to formalize this program. UNAVCO's proximity to the University of Colorado, to the Digital Library of Earth System Education (DLESE), and its location in the Rocky Mountain Front Range make it an attractive location for visiting scientists.

- *Formalize a Student Intern Program*

UNAVCO has a long history of providing opportunities for student interns. This effort will be continued and expanded. UNAVCO has initiated RESESS (Research and Education in Solid Earth Science for Students), a program like SOARS (Significant Opportunities in Atmospheric Research and Science). In this program, students receive grants and mentoring over an extended time period that starts after the second year of college and supports them through an advanced degree.

- *Formalize Summer Training Courses*

UNAVCO has traditionally offered training in the use of GPS equipment. The community has identified a need to expand this training to related technologies such as strain and InSAR. UNAVCO will offer training courses in GPS, InSAR, and strain processing software with guest instructors. UNAVCO is well suited to expand this effort. It has the physical space; UNAVCO is centrally located with convenient access from anywhere in the contiguous US; and, UNAVCO has the staff to handle the logistics required.

- *Increase UNAVCO Membership*

While size is not a goal in and of itself, there are advantages to having more members. A larger community speaks with a bigger voice and can more effectively represent the interests of all members; and, it is clear that the number of members is viewed by funding agencies and reviewers as a measure of UNAVCO's success. In order to effectively meet the needs of the community, UNAVCO needs to continue to grow and include as

members all those institutions that are using UNAVCO technology to solve Earth science problems.

Goal 5. Develop long-term plans

In addition to the activities listed under Goals 1-4 above, UNAVCO will pursue two long-term efforts.

- *Explore options for follow-on programs to EarthScope*

The NSF EarthScope project is a phased effort with three currently identified phases: 2003-2007, a construction phase funded by the NSF Major Research Equipment Facility Construction (MREFC) account; 2008-2012, an operation and maintenance phase, and 2003-2017, a science investigation phase. However, interest in investigation of the North American continent will not end with the completion of EarthScope, nor will all the problems be solved. The community needs to begin thinking about what future Earth science projects are required to continue to make progress in understanding North America.

- *Explore possibilities for a Global PBO*

The United States is not alone in implementing a “Plate Boundary Observatory” including geodetic and seismic investigations. Other countries (e.g. Japan) have begun or completed similar observation networks. Understanding of the plate boundaries of the world would be enhanced by increasing communication between existing “Plate Boundary Observatories”, by developing similar networks along plate boundaries that do not currently have the spatially and temporally dense observation networks that characterize the US Plate Boundary Observatory, and by making all data sets easily accessible to the global scientific community. A first step will be to enhance the communication and data sharing between existing Plate-Boundary-like networks that exist in many countries today.

- *Undertake broader working relationships with international scientific organizations to strengthen international collaboration*

UNAVCO will increase its participation in activities of the International GPS Service (IGS), the International Association of Geodesy, the International Lithosphere Project and other international organizations.

Responsibilities, Timelines and Resources

With ongoing participation by the President and other UNAVCO managers, the Board of Directors will serve as a long range planning committee. Equal emphasis will be placed on implementation subsequent to planning. The following groups will contribute to the long range planning and implementation process:

UNAVCO Board of Directors
UNAVCO Facility Standing Committee
Education & Outreach Standing Committee
Plate Boundary Observatory Standing Committee
UNAVCO Senior Management Group

This strategic plan will provide guidance to UNAVCO for the period 2005-2009 and will be used to guide the budget and activity development for the years 2005 and 2006. Activities in these years will lay the groundwork for the future of UNAVCO and strategic planning will be an ongoing activity. It is anticipated that the Strategic Plan will be reviewed and updated in alternate years.

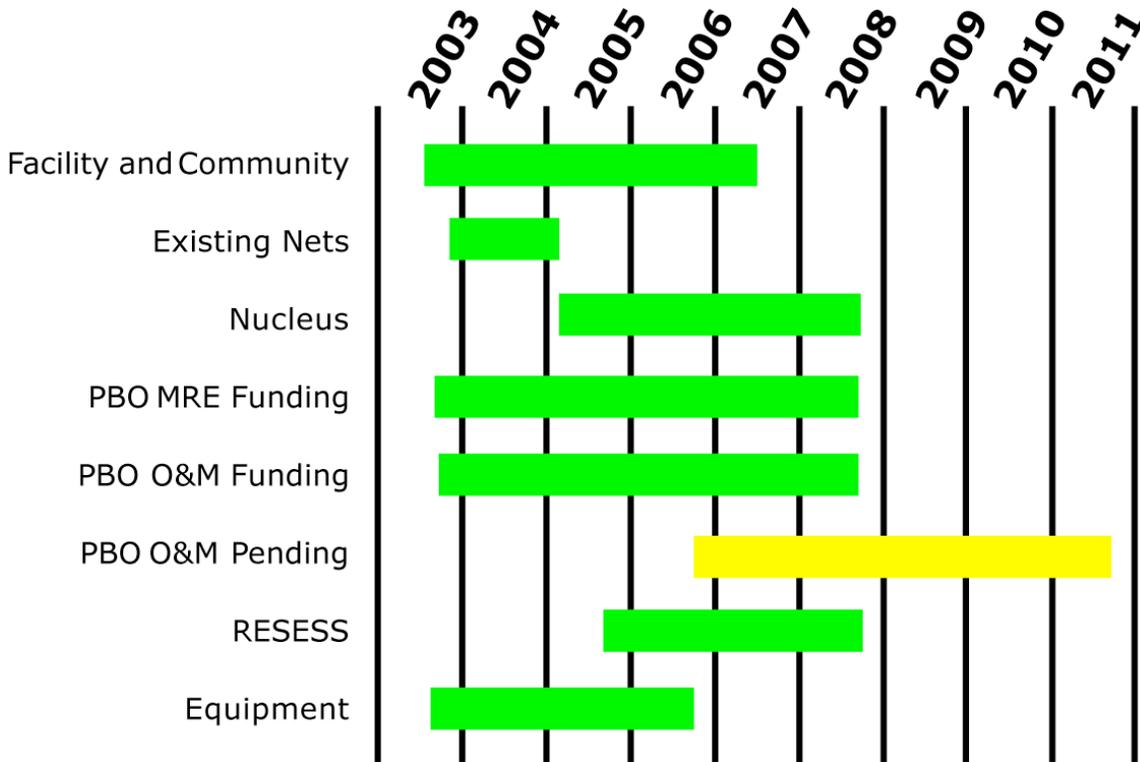


Figure. The green bars indicate the time span covered by the major existing UNAVCO funding agreements. The yellow bar is a pending funding request

Many of the activities specified in this plan can be carried out within the constraints of existing staffing and funding levels. These agreements provide constraints on current activities and their renewals provide opportunities to consider new directions. A few of the activities will require new resources. Timelines for existing funding sources are indicated in the above Figure. In particular, portions of Goals 1 and 2 (existing activities and new technologies) can be achieved with existing funding. New funding will be required should UNAVCO take a major role in InSAR data archiving and support. Regarding Goals 3 and 4 (E&O and Community development), UNAVCO added an Education and Outreach Coordinator last year and there is funding for small Visiting Scientist and Student Intern programs. New E&O programs or expansion of the Visiting Scientist and Intern programs will require identifying new sources of support. Significant new resources will be required for the programs discussed in Goal 5.

Glossary

E&O	Education and Outreach
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IGS	International GPS Service
InSAR	Interferometric Synthetic Aperture Radar

IRIS	Incorporated Research Institutions for Seismology
LIDAR	LIght Detection And Ranging
MREFC	Major Research Equipment Facility Construction
NASA	National Aeronautics and Space Administration
NSF	National Science Foundation
PBO	Plate Boundary Observatory
RESESS	Research Experiences in Solid Earth Science for Students
SCIGN	Southern California Integrated GPS Network
SOARS	Significant Opportunities in Atmospheric Research and Science
UCAR	University Corporation for Atmospheric Research
UNAVCO	Not an acronym, just a name (originally University Navstar Consortium)
USGS	US Geological Survey