We challenge ourselves to transform human understanding of the changing Earth by enabling the integration of innovative technologies, open geodetic observations, and research, from pole to pole.
Our sponsors challenged us to diversify both the UNAVCO community and its revenue streams through a strategic planning process. This offered us the opportunity to revisit our goals in light of recent successes: the completion of the Plate Boundary Observatory including GeEarthScope; the full integration of Polar Programs science support into core facility activities and funding; the hosting of the WMSTAR consortium under the UNAVCO community umbrella; and the international recognition of UNAVCO as a model for geodesy community collaboration and open data archiving.

A FLOURISHING UNIVERSITY CONSORTIUM

We believe that the university consortium is uniquely positioned to advance and support the science community goals articulated here. Our effective management of community interests is affirmed in the extraordinarily positive reviews of recent proposals to support EarthScope Operations and Maintenance and the UNAVCO Community and Facility.

A VIBRANT SCIENCE COMMUNITY

Our plan provides a road map for how we will support community-driven initiatives that advance science through geodesy across a number of disciplines. It is both a management and communication tool, designed to support community work in ongoing and emerging science areas.

A WORLD-CLASS GEODESY FACILITY

We face opportunity at every turn: to support EarthScope science as data sets mature, to advance community interests in expanded LiDAR and InSAR data acquisition; to influence monumentation standards and open data protocols as civic and commercial real-time GPS networks proliferate around the world; to support a burgeoning demand for TLS technology; to improve data access and analysis with web services and cyberinfrastructure; to expand the use of autonomous integrated, geodetic networks to new scientific targets, new geographic settings, and new science disciplines; and to bring emerging data sets and technologies to the attention of investigators in many research areas such as atmospheric science and hydrology. In a climate that requires efficient and effective use of human and fiscal resources, this landscape of opportunity challenges us to be disciplined, selective, and focused in advancing science through geodesy.

As a community, we must set priority among these opportunities and then measure our progress. The strategic plan provides a foundation for an implementation plan that will detail actions, timelines, and specific metrics, and will be undertaken through UNAVCO governance, by the investigator community, and by facility staff.

Thank you for your hard work as a community in developing this plan. It will help guide our future through the support of both legacy and emerging science initiatives.

M. Meghan Miller, Ph.D.
President, UNAVCO
We challenge ourselves to transform human understanding of the changing Earth by enabling the integration of innovative technologies, open geodetic observations, and research, from pole to pole.

In order to advance understanding of Earth processes, two major scientific challenges face UNAVCO’s research and education community:

To understand the dynamic evolution of the lithosphere, cryosphere, hydrosphere, and atmosphere on temporal scales spanning seconds to millennia.

To investigate the processes that control natural hazards, including earthquakes, tsunamis, volcanic eruptions, and long term changes in climate, ice mass, global sea level, and coastal subsidence.

Meeting these challenges will advance discovery of the processes that underlie Earth dynamics because of fundamental application to hazards science. Dissemination of these advances informs education and decision-making, and carries great economic, political, and societal importance. We aspire to global mapping of the kinematics of the solid Earth and its fluid envelope across the temporal spectrum. This objective can be achieved through application of the most powerful geodetic observational tools available.

UNAVCO commits its energies and resources to achieving these ends in three areas. We will support integrative scientific studies that link kinematics to dynamics, process-based science, and hazards through the collection of geodetic data and the facilities to support the research. We will build and sustain partnerships to share the scientific benefits to society through Education and Outreach.

In pursuit of these science goals, investigators rely on UNAVCO as the world’s premier organization for the collection and stewardship of geodetic data and products. The UNAVCO Facility provides science support through community coordination, field engineering, data services, technology innovation, and instrument testing, acquisition, and deployment. Further, it supports state-of-the-art global geodetic infrastructure that is developed and operated through international collaborations. GeoEarthScope provides integrated geophysical observations that support investigation of the entire temporal spectrum of Earth deformation processes. In particular, the Plate Boundary Observatory (PBO) including GeoEarthScope provides unprecedented geodetic imaging of plate boundary deformation. Together, the UNAVCO Facility and PBO are committed to enabling efficient testing, adoption, and implementation of rapidly evolving geodetic technologies needed to support cutting edge geodynamics research.

Our long-term success depends on development of a forward-looking, diversified workforce that draws on and cultivates talent across the demographic spectrum of gender and ethnicity, across international boundaries, and across scientific disciplines. The UNAVCO community further relies on the Education and Outreach program to inform the public interest and to support the development of partnerships, collaborations, curricula, and student opportunities.
In order to accomplish our mission of research and education, as a community and science support organization, we hold these values:

- Advancement of community science goals
- Excellence in science, service, and education
- Open access to data products and scientific exchange
- Data preservation and stewardship
- Efficient and effective use of resources
- Strong service ethic and “can do” attitude
- Transparent community governance
- Scientific and professional integrity
- Diversity of scientific, educational, and social perspectives

Based on its core values, UNAVCO will pursue six strategies to deliver on its mission and vision. This set of strategies is the heart of “Positioning UNAVCO—Advancing Science through Geodesy” and, taken with actions for each strategy, provides the road map to guide UNAVCO in creating its future during the next five years.

Strategy and Actions

**Community**
- Continue to build the UNAVCO scientific community that uses geodesy by further developing core strengths in solid Earth science, while responding to emerging community needs and enhancing UNAVCO's visibility at home and abroad

**Scientific Diversity**
- Support expanded use of geodesy and integration of new communities across science disciplines

**Support Services**
- Provide effective and efficient support to the scientific community—through community planning, equipment acquisition and sharing, engineering and data services, and education and outreach activities

**Technology**
- Support innovative application of existing and novel technologies for the investigator community in funded science projects, education, and outreach

**Resources**
- Diversify the resource base in support of the science community

**Leadership**
- Continuously improve the leadership role and effectiveness of UNAVCO management and governance to support future growth
UNAVCO, originally the University NAVSTAR Consortium, was created to support the application of GPS geodesy to geoscience problems. It was named for the satellites that make up the NAVSTAR Global Positioning System constellation. The National Science Foundation (NSF) funded UNAVCO under the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado. UNAVCO had seven founding member universities.

The Global Strain Rate Map, determined by GPS, seismic and Quaternary fault slip rates from over 100 international studies, shows motions of rigid plates with respect to North American and other deforming plate boundary zones. Map produced on the Jules Verne Voyager (JVV) from the model of C. Kreemer, W. Holt, and A. Haines, 2003.

Continue to build the UNAVCO scientific community that uses geodesy by further developing core strengths in solid Earth science, while responding to emerging community needs and enhancing UNAVCO’s visibility at home and abroad.

**Actions Needed**

- Core Strengths and Emerging Needs
  - Educate the science community, sponsors, and public on the accomplishments of the Plate Boundary Observatory and EarthScope
  - Encourage and explore opportunities for international/global applications that build on the Plate Boundary Observatory and EarthScope capabilities
  - Increase the visibility of NASA-funded science

- Enhance UNAVCO’s Visibility
  - Improve communication with sponsors
  - Promote geodesy and community science among stakeholders
  - Communicate UNAVCO’s research support role and available services within the science community
  - Increase awareness and visibility of UNAVCO within the international scientific community to support and seed collaboration and the development of global data sets
Support expanded use of geodesy and integration of new communities across science disciplines

**Actions Needed**

01 Strengthen relationships with scientific communities beyond solid Earth science — including atmospheric science and hydrology

02 Explore connections with new educational institutions — including primarily undergraduate institutions and minority serving institutions

03 Explore industry opportunities for student internships

04 Re-engage the neotectonics and paleoseismology communities

05 Continue integration and strengthening of InSAR and LiDAR communities

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**SCIENTIFIC DIVERSITY**

1991

The promise of atmospheric science applications, improved physical facilities, and the potential for multi-agency international science projects prompted UNAVCO to move to the University Corporation for Atmospheric Research (UCAR).
Strategy Number Three

Provide effective and efficient support to the scientific community — through community planning, equipment acquisition and sharing, engineering and data services, and education and outreach activities

**Actions Needed**

**Planning**

01 Provide coordination and support for nascent, regionally focused, community-driven collaborations

**Equipment Acquisition and Equipment Pool**

02 Continue to exploit community leverage for equipment specifications and cost through centrally negotiated vendor agreements

03 Increase visibility of Terrestrial Laser Scanner technology and its applications

04 Optimize use of UNAVCO campaign receiver pools to meet investigator demand

05 Plan for renewal of UNAVCO receiver pools in the GNSS era

**Support Services**

06 Enhance user support through the web interface

07 Enhance archive services

08 Continue development and distribution of software tools for data processing and display

09 Identify community needs for Information Technology solutions and seek funding opportunities to support them through Cyberinfrastructure and other sources

10 Offer technical support and seek funding to upgrade monumentation for the global GPS network

11 Work with foreign universities and agencies to establish open data practices

12 Initiate discussions with NASA and others (including UNAVCO community) regarding an enhanced UNAVCO role in space missions

**Education and Outreach**

13 Provide community training for equipment use and data analysis

14 Lead community development of a coherent, modern geodesy curriculum

15 Explore opportunities to develop an equipment pool for undergraduate instructional programs

16 Explicitly address the connection between geodesy fundamentals and scientific advances within web content and other outreach materials

SUPPORT SERVICES

An equipment grant that funded community institutions to purchase GPS systems provided an unprecedented availability of mobile, high-precision receivers tailored for global geodetic studies. The resulting community projects spanned the globe, and continuous GPS networks began to demonstrate the wealth of time-dependent deformation resolved by GPS. Some of these networks went on to become the nucleus of the EarthScope Plate Boundary Observatory.
Support innovative application of existing and novel technologies for the investigator community in funded science projects, education, and outreach

**Actions Needed**

**Requirements**

01. With users and agencies, define the requirements for and explore implementation of a global telemetry system

02. Develop a plan for integration of new GNSS technologies and InSAR missions to enhance geodetic observations

03. Explore further applications of autonomous sensor networks to geodesy

**Integrated Networks and New Techniques**

04. Provide development and testing of receivers, antennas, domes, and monuments to ensure 1-mm global geodesy as GNSS instrumentation evolves

05. Seek support for expanded geodetic networks to support community-driven science opportunities (e.g. polar networks, hurricane tracking, high-rate and real-time networks)

06. Support development of the next generation NASA observing system with site vector co-location

07. Explore acquisition of a ground-based portable radar interferometer

08. Develop natural hazard event scenarios and plans for responsive instrument deployments and data acquisition

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**Technology**

2001 Building on the scientific gains of existing continuous GPS networks, EarthScope was conceived and shaped by the community, and ultimately funded by the National Science Board. In 2002, with the charge of constructing the EarthScope Plate Boundary Observatory (EPO), a five-year community project, UNAVCO, Inc. became an independent, non-profit organization of 23 founding university members. Originally an acronym, the word 'UNAVCO' became the official name of the consortium.
Diversify the resource base in support of the science community

Actions Needed

01 Cultivate new funding sources in support of UNAVCO’s mission, including federal, foreign, and private sources
02 Work creatively with sponsors in finding support for interdisciplinary initiatives and new science areas
03 Explore pathways to support Education and Outreach and other activities that are critical to UNAVCO’s mission
04 Explore the boundary conditions and pilot a plan under which UNAVCO can participate in commercial activities while maintaining its core values
05 Explore ways of expanding the NASA funding base in support of community science
Continuous improvement of the leadership role and effectiveness of UNAVCO management and governance to support future growth.

**Actions Needed**

01. Cultivate broad use of geodesy across science disciplines
02. Set an international standard for data sharing in the geodesy community
03. Review membership by-laws for currency in light of expanded activities since inception
04. Ensure efficient and effective management of UNAVCO to meet community and sponsor needs
05. Establish a business development plan to keep UNAVCO viable on behalf of the membership
06. Encourage diversity of science and cultural perspectives in governance
07. Ensure active and effective governance by the Board of Directors

2008

The UNAVCO community continues its science successes with a vitality that is reflected in support for community science and the facility from numerous directorates and programs within NSF and NASA. 2008 marks the completion of the Plate Boundary Observatory, the world’s most ambitious integrated geodetic observatory to date. Cryospheric sciences are now fully integrated into core activities, providing a model for serving new sub-disciplines. The geodetic toolbox has expanded to include iGPS, LIDAR, and TLS. The consortium now comprises 81 member institutions and 53 associate members.

Geodetic velocity image in a North American reference frame based on data from the Global Strain Rate Map project; C. Kreemer, W. Holt, and A. Haines, 2003.
Critical Success Factors are key areas in which UNAVCO must perform well on a consistent basis in order to achieve its mission and vision within fiscal constraints.

Metrics gauge progress on the Critical Success Factors and are linked to the strategies noted in brackets below. These metrics will be linked to specific actions in the implementation plan.

Publication of high impact science that uses UNAVCO resources
- [Community, Scientific Diversity, Support Services, Technology]
  - Number of papers that acknowledge UNAVCO support
  - Number of papers with results that rely on UNAVCO resources
  - Impact factor of these publications

Funding of research that uses UNAVCO resources
- [Community, Scientific Diversity, Support Services, Technology, Resources]
  - Profile of funded projects in the sponsor database
  - Profile of non-sponsor funded projects

Diverse involvement in UNAVCO activities and projects
- [Community, Scientific Diversity, Leadership]
  - Composition of UNAVCO community members attending meetings, workshops and short courses
  - Number of journals represented in the publication database
  - Degree and research profile (Carnegie classification) and minority-serving status of member institutions
  - Profile of Associate Membership

Archive for data preservation, stewardship, and open access
- [Support Services, Technology]
  - Number of data products in and out of the archive by type
  - Number of unique users and domains by technique
  - Number of software downloads

Community use of state-of-the-art geodetic technology
- [Support Services, Technology]
  - Number and diversity of users drawing on the equipment pool
  - Sufficiency of the equipment pool to meet investigator demand
  - Community equipment acquisition

Community involvement in and use of Education and Outreach programs and products
- [Community, Scientific Diversity, Support Services, Technology, Resources]
  - Workshop and short course participation
  - Number of interns each year
  - Web site use
  - Number of principal investigator projects that include Education and Outreach resources

Sustainability/viability of the funding sources
- [Community, Resources, Leadership]
  - Profile of funding sources and amounts
  - Optimal overhead rate

A well-functioning corporation with informed community governance
- [Community, Leadership]
  - Attendance at the business meeting
  - Election participation by member representatives
  - Composition and balance of the Board of Directors and governance committees
  - Governance committee attendance and regular reporting to the Board of Directors
  - Board of Directors’ training and assessment; management performance review
  - Sponsor, community, and employee satisfaction
  - Audit outcomes and findings; federal compliance
UNAVCO MEMBERS

Appalachian State University
Baylor University
Boise State University
California Institute of Technology
California State University, Fullerton
California State University, Stanislaus
Carnegie Institution of Washington – founding member
Central Washington University – founding member
Columbia University
Cornell University
Georgia Institute of Technology
Grand Valley State University
Hamard University – founding member
Hawaii State University
Indiana University – founding member
Jet Propulsion Laboratory – founding member
Los Alamos National Laboratory
Louisiana State University
Macalester College
Massachusetts Institute of Technology – founding member
Michigan Technological University
Missouri State University
New Mexico Institute of Mining and Technology
New York University
North Carolina State University
Northwestern University – founding member
Ohio State University
Pennsylvania State University
Purdue University
Rensselaer Polytechnic Institute – founding member
Saint Olaf College
Smithsonian Astrophysical Observatory – founding member
Southern Methodist University
Stanford University – founding member
Stony Brook University – founding member
Texas A&M University, Corpus Christi
University Corporation for Atmospheric Research
University of Alaska, Fairbanks – founding member
University of Arizona
University of Arkansas – founding member
University of California, Berkeley – founding member
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, Riverside
University of California, San Diego – founding member
University of California, Santa Cruz
University of Chicago
University of Colorado, Boulder – founding member
University of Hawaii
University of Idaho – founding member
University of Illinois, Urbana-Champaign
University of Kentucky
University of Maine
University of Maryland
University of Memphis – founding member
University of Miami – founding member
University of Michigan
University of Minnesota
University of Missouri, Columbia – founding member
University of Montana
University of Nevada, Las Vegas
University of Nevada, Reno – founding member
University of New Hampshire
University of Oklahoma
University of Oregon
University of Puerto Rico, Mayagüez
University of Rochester
University of South Carolina
University of Southern California
University of Southern Mississippi
University of Texas, Austin – founding member
University of Texas, Dallas
University of Texas, El Paso
University of Utah – founding member
University of Wisconsin, Madison
University of Wisconsin, Milwaukee
University of Wyoming
Utah State University
Virginia Polytechnic Institute and State University
Woods Hole Oceanographic Institution

UNAVCO ASSOCIATE MEMBERS

Academia Sinica, Taiwan
Bulgarian Academy of Sciences
Cascade Volcano Observatory, United States
Geological Survey Centre National de la Recherche Scientifique, France
CICESE – Centro de Investigación Científica y de Educación Superior de Ensenada, Mexico
Danish National Space Center
Escuela Politécnica Nacional, Ecuador
European Center for Geodynamics and Seismology, Luxembourg
Earth System Research Laboratory / OAR / NOAA, USA
Geoforschungszentrum Potsdam, Germany
Geological Survey of Canada
Geophysical Service of Russian Academy of Sciences
Global Hydrology and Climate Center, USA
Hamburgsche Radio-Astronomy Observatory, South Africa
Instituto Nacional de Meteorologia
Måns National Laboratory, USA
INGOMINAS – Geological Survey, Columbia
Institute of Geological and Nuclear Sciences, New Zealand
Instituto de Geofísica, Mexico
Instituto Nazionale di Geofisica e Vulcanoscienza, Italy
Istituto Nazionale di Oceanografia e Geofisica Sperimentale, Italy
Ludwig-Maximilians Universitat, Germany
Observatório Nacional, Ministério da Ciência e Tecnologia, Brazil
Montevideo Volcano Observatory, West Indies
Natural Resources Canada
San Fernando Naval Observatory, Spain
Simon Fraser University, Canada
Southern California Earthquake Center, USA
Technische Universität Darmstadt, Germany
The University of the West Indies
Universidad de Chile
Universidad Nacional Autonomo de Mexico
Universidade Federal de Rio Grande do Norte, Brazil
Université de Québec à Montréal, Canada
University of Alberta, Canada
University of Barcelona, Spain
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University of Luxembourg
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University of Northern British Columbia, Canada
University of Nottingham, United Kingdom
University of Ottawa, Canada
University of Oxford, United Kingdom
University of Patras, Greece
University of Rennes, India
University of Porto, Portugal
University of Western Ontario, Canada