Community governance: UNAVCO Facility models for EarthCube implementation

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Introduction

The variety of multi-user facilities that are supported by NSF's Directorate of Geosciences provides a spectrum of models for community governance. In this contribution, we describe UNAVCO governance with an emphasis on some aspects that have proven particularly effective and flexible in directing NSF resources in support of large or rapidly evolving projects. UNAVCO is NSF's national geodesy facility for the Division of Earth Sciences; its membership comprises 98 university members and 71 international and other organizations.

The Consortium, its Governance and Accountability

UNAVCO governance and management provide the interface between the scientific community, funding agencies, and UNAVCO programs. A community engaged in governance ensures close involvement of investigators in the development of UNAVCO facilities, focusing science talent on common objectives. Community involvement supports broad participation and effective oversight of UNAVCO programs. Each year, more than 50 scientists, primarily drawn from the 91 Member institutions, participate in the governance and oversight of UNAVCO management through its standing and advisory committees, plus *ad hoc* advisory groups. These scientists work with a professional staff of Program Directors and Project Managers to administer UNAVCO programs. Program advisory committees also work closely with the project management staff within their areas of responsibility.

As an academic consortium, UNAVCO Member institutions provide advice and direction on UNAVCO activities. Through ongoing interactions with scientists at member institutions as well as workshops, annual meetings, symposia, and short courses, the research community interacts with UNAVCO and, through the Consortium, articulates its evolving science agenda and the consequent needs and opportunities. From the strengths and passions of its members, UNAVCO sets direction for its support of transformative geoscience research using geodesy and serves as the conduit for the community science agenda.

The key to effectiveness of a community governance structure is clear articulation of community mission[1], vision[2], and strategic goals. For UNAVCO, this was achieved through a formal process of strategic planning by the board and other key community stakeholders: *Positioning UNAVCO – Advancing Science through Geodesy (UNAVCO Strategic Plan 2011 – 2015).* This community plan guides the activities of the Facility and Consortium on behalf of the science community.

As the National Earth Science Geodetic Support Facility, UNAVCO works closely with the Division of Earth Sciences to develop a program focused on the support of facilities on which NSF-funded geodetic

[1] MISSION
UNAVCO, a non-profit university-governed consortium, facilitates geoscience research and education using geodesy.

[2] VISION
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

research is based. Through Cooperative Agreement, NSF provides funding with which UNAVCO operates the UNAVCO Facility with program several program elements: NSF Earth Sciences, NSF Polar Programs, NASA IGS and GGN, and support from other agencies such as the USGS for acquisition of InSAR data sets and similar efforts. UNAVCO programs also include the Plate Boundary Observatory (under a separate award from EAR EarthScope program) and UNAVCO Education and Outreach (with a hybrid of direct and indirect-funded program elements). From time to time, NSF, NASA, USGS, and NOAA augment certain core-funded program activities, when the reach of a particular program or resource can be expanded through a well-defined enhancement. Under the Cooperative Agreement, UNAVCO programs are first and foremost accountable to NSF's Earth Sciences Directorate; augmentations are most commonly funded as supplements to the Cooperative Agreement. In some cases, work is augmented through related awards, and this is carefully coordinated with the cognizant NSF program officer.

As a corporation, UNAVCO provides NSF the fiscal, compliance, and legal structures for stable operation of UNAVCO facilities and programs, and a mechanism for developing programs and facilities to support the science vision of its community. Through its professional staff and governance structure, UNAVCO provides continuity in institutional and personnel resources for operational and developmental activities.

3.1 Consortium Membership

UNAVCO is an academic consortium constituted of member institutions that share its purpose:

"….to support and promote scholarly research involving the application of high precision geodetic and strain techniques such as the Global Positioning System (GPS) to Earth science and other related fields of study."

There are two classes of membership: fully vested Member institutions[3] that participate in all aspects of UNAVCO governance, and Associate Member institutions that share UNAVCO's purpose but do not qualify as an educational or nonprofit institution chartered in the United States and its Territories. The Associate Membership constitutes a global geodesy community, but with limited roles in formal governance. In practice, this division invests the NSF investigator community with the powers of consortium governance.

The consortium functions first and foremost as a professional community committed to transformative science and education involving geodesy. Faculty, researchers, and students participate in (1) developing and executing community science proposals and awards, (2) sharing results through the biennial UNAVCO Science Workshop, in topical sessions in other professional venues, by publication, and through interactions with policy makers and emergency response professionals; (3) frequent workshops for geodesy science planning and advancement, (4) short courses for professional development, (5) curriculum innovation, mentored student internships, and other educational programs that support national workforce development, and (6) collaboration among members and with the UNAVCO facilities for application of new geodetic technologies.

UNAVCO was incorporated as a 501 (c) (3) in the State of Colorado in 2001, and received its first direct Cooperative Agreement in 2003. Elections for the Board of Directors are held at the Annual Meeting of the Members, typically in December of each year at the American Geophysical Union Meeting in San Francisco.

Member powers include Board nominations and elections, revisions to the by-laws, and calling of special meetings. The Board of Directors reviews and develops UNAVCO programs and activities, appoints members to the standing and advisory committees, approve community policies, provide oversight of fiscal matters and corporate management, participate in the development and review of new

[3] Membership. An educational or nonprofit institution (or a department or other division of such an institution) chartered in the United States and its Territories may become a Member of the Corporation if it has a continuing commitment to scholarly research involving the application of high precision geodetic and strain techniques to Earth science or other related fields of study. Such institution must be willing to make a clear and continuing commitment to active participation in the activities of the Corporation, including governance, and its programs and facilities. Before an institution may be selected to membership in the Corporation, it must have filed an application for membership with the Board of Directors, in accordance with the procedures and the schedule established by the Board of Directors from time to time.

proposals, guide annual program plans and budgets, and transact other business of the Board.

3.2 Consortium Governance & Accountability

UNAVCO is governed by a Board of Directors, with an advisory committee structure that provides for oversight of key programmatic and organizational issues.

The seven-member UNAVCO Board of Directors provides governance and oversight of the corporation on behalf of the 91 Member institutions. Board members may serve up to two successive two-year terms. Five Institutional Directors come from Member institutions – either as a Member Representative or otherwise formally affiliated with the Member; two At-large Directors may be affiliated with a Member (although not as the Member Representative) or may be nominated to bring outside organizational, management, or other needed perspectives to the board.

The board sets organizational goals and approves community policies, reviews proposals, proposal budgets, and annual indirect budget plans; appoints members to advisory and standing committees and directs the work of the President, who in turn manages UNAVCO's staff on behalf of the consortium. It meets face-to-face three or four times each year, and more frequently by teleconference. The Board undertakes regular professional development activities at each regular meeting in order to ensure best practices in its oversight role.

Committees are established and charged in the bylaws, by action of the board or, in some cases, by management. The Nominating Committee – a committee of the members – develops the ballot for board and nominating committee elections. The Audit and Finance Committee oversees corporate financial management functions and advises the board on these matters. The Membership Committee advises the board on issues pertaining to membership. These committees are all named in the bylaws.

The board has established program oversight through advisory committees for each of the three major programs: UNAVCO Facility, Plate Boundary Observatory, and Education and Outreach Advisory Committees. These committees review policies and effectiveness of each program in meeting its commitments to the user community and achieving the goals set in the UNAVCO Strategic Plan. Each committee is established by and formally reports to the board, but also advises UNAVCO management.

Other committees of the board reflect special initiatives or program needs: the WInSAR Executive Committee (WInSAR chose UNAVCO as its umbrella organization, and is working towards integration of its activities in UNAVCO awards), the SAFOD Advisory Committee oversees SAFOD O&M subawards (currently managed by UNAVCO), and the Polar Networks Science Committee which is a joint committee of the boards of UNAVCO and IRIS (Incorporated Research Institutions of Seismology; a sister facility).

Consortium governance strengthens the community and the purpose of the organization. Further documents on these structures and the history of committee and board membership since incorporation in 2001, and attests to the breadth of participatory governance are available at:

http://www.unavco.org/pubs_reports/pubs_reports.html

Relevance to NSF – GEO EarthCube

In summary, geodesy community advisory roles exploit a number of flexible organizational structures, optimized to the needs of different subdisciplines or projects, technical programs, and the board in its oversight role. Similarly, facility managers respond to community needs using methods and frequency tailored to specific programs or projects and to specific science requirements within the community.

Two examples – perhaps end members – are particularly germane to the scope, complexity, and evolution of activities that are likely to emerge under EarthCube: (1) the highly structured governance bodies of the Plate Boundary Observatory (PBO) in the context of NSF's EarthScope management and advisory structure, and (2) the more fluid "adaptive management" structures exploited during rapid response to geophysical events under a broad umbrella of community-vetted policy.

The EarthScope Facilities are collectively managed through NSF-established structures that provide for project-wide coordination and synergies. For PBO, as the geodesy component of EarthScope, the

UNAVCO Board seeks guidance and exercises oversight through the PBO Advisory Committee and working groups that are convened (and sometimes disbanded) as project needs evolve: PBO Data Products Working Group, and the working groups that provided community guidance for siting when the network's design specifications could not be implemented within a certain footprint. The PBO Advisory Committee reports to the Board and advises UNAVCO management.[4]

In contrast, for event response, the Board has enacted a broad policy[5] that guides the facility in responding to community requests for assistance during significant geophysical events such as earthquakes, volcanic activity, landslides, glacial and ice-sheet movements, unusual uplift or subsidence, extreme meteorological events, or other hazards. The procedures for such responses are maintained within the support organization and are refined in response to "lessons learned" after each unique event, and optimized for management of future response efforts. This is similar to a process known as adaptive management in the management literature. This model provides for rapid decision-making in close consultation with community scientists and sponsors, as circumstances evolve during each event response. This methodology was developed as part of the 2008 and 2009 Shake Out earthquake drills in southern California.

These provide successful examples of how flexible governance structures can be optimized to project needs and science requirements using science community oversight. As EarthCube takes shape, the successes of the NSF – GEO facilities provide useful models to inform governance and community advisory structures.

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[4] The PBO Advisory Committee (PBO AC) is appointed by and reports to the UNAVCO Board of Directors, and provides recommendations (1) to the Board, on issues of governance, policy, oversight, resource allocation, or strategic direction and (2) to UNAVCO Management, on issues pertaining to PBO management. Recommendations to management are conveyed to the board by the board liaison and through distribution of the minutes. The PBO Advisory Committee reviews the policies and effectiveness of the UNAVCO PBO in meeting its commitments to its user community and in achieving the goals set in the UNAVCO Strategic Plan. The PBO Advisory Committee will meet at least once a year, review PBO operations every year prior to the Annual Meeting, and make a report to the Board at least once a year, no later than the Board meeting prior to the UNAVCO Annual Meeting. The PBO Advisory Committee interacts closely with the PBO Director and the UNAVCO President.
PBO Advisory Committee responsibilities include:
* Reviewing the accordance of PBO resource allocation with the priorities established by the UNAVCO Strategic Plan.
*Advising on the performance of PBO with respect to program planning, yearly budgets and resource allocation
* Recommending guidelines for the use of PBO resources, including both equipment and engineering resources as set out in the Cooperative Agreement
* Developing new initiatives to enhance the effectiveness of PBO in meeting the demands of the UNAVCO Members

[5] UNAVCO responds to community requests for assistance during significant geophysical events such as earthquakes, volcanic activity, landslides, glacial and ice-sheet movements, unusual uplift or subsidence, extreme meteorological events, or other hazards.

UNAVCO resources for event response may include:

- personnel
- permanent, real-time/high rate, and campaign GPS deployment
- data communications and power systems
- tiltmeter, strainmeter, and borehole seismometer deployments
- ground-based LiDAR measurements
- airborne LiDAR project management
- InSAR data acquisition
- Education and Outreach assistance or products
- data processing services

UNAVCO also acts as a focal point for UNAVCO community activities and communication during an event.

If UNAVCO's assistance is requested and appropriate, UNAVCO will respond within the bounds of available resources, and in consultation with community members and sponsors. Unless specified by funding agency, all data collected during an emergency response event will be made publicly available without delay.