earthscope

April 1, 2004 - March 31, 2005
Annual Report

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Submitted to the National Science Foundation, June 1, 2005
By the Project Director and the members of the EarthScope Facilities Executive Committee

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Preface

Each EarthScope Project Annual Report is designed as a self-contained document that presents the basic project execution plan and allows the reader to assess the extent to which EarthScope is on schedule, on budget, and moving towards its scientific and educational goals.

The Annual Report summarizes: (a) program activities, (b) progress towards quarterly milestones, (c) cost schedule status report (CSSR) with explanations of variances of 10% or greater, (d) cost schedule performance, (e) contingency funds, and (f) change orders. It also includes a list of project concerns and action plans.

We use scheduled milestones to report technical progress in terms of stations being installed, data becoming available, and progress in drilling and monitoring. We use Earned Value Management to correlate progress made with funds spent, and through variances, to identify quickly areas that may need corrective action.

Change suggestions (both internal and external) are welcome at all levels of EarthScope, and a change request form is available on the EarthScope website. Change suggestions are evaluated through a formal process that weighs scope, schedule, cost, risk, and gain against the program's scientific objectives. All changes are formally recorded in the EarthScope Change Control Log, a summary of which is contained within this report.

EarthScope is committed to a responsive and transparent management structure. Our progress reports are published, posted on the EarthScope website, and submitted to the National Science Foundation under the terms of the EarthScope Project Execution Plan. Additional information can be found on the EarthScope website (www.earthscope.org) and by directly contacting the EarthScope office (earthscope_info@earthscope.org).

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EarthScope Status at a Glance

Overall Project Numbers

- 5-year work completed: 21%
- Cumulative overall schedule variance: -9%
- Cumulative overall cost variance: 6%
- Change requests this quarter: 8

Data Resources Available

- SAFOD seismic data from Pilot Hole; SAFOD Physical Samples
- GPS stations: Alaska (13), California (58), Colorado (4), New Mexico (6), Oregon (1), Utah (6), Washington (15), Wyoming (1)
- ANSS Backbone stations: Wyoming (1), Nevada (1), Texas (2), Alaska (1), Virginia (1), Oklahoma (1), Arizona (1), Utah (1), Washington (1), Colorado (1), Georgia (1), Arkansas (1)
- Transportable Array stations: California (72), Oregon (2), New Mexico (1), Washington (2)

Major Year 1 Accomplishments

- EarthScope National Meeting
- Operations & Maintenance Proposal submitted to NSF
- SAFOD Pilot Hole data available online
- EarthScope data used in analysis of Sumatra-Andaman Earthquake
- Strainmeter drilling and coring complete
- EarthScope-SAFOD Phase 1 drilling complete and Stage 2 instrumentation installed
- EarthScope-PBO mentors student in an NSF outreach program
- Outreach to Geoscience community
- Transportable Array station installed near school

Major Technical Concerns

- Operations & Maintenance contingency funds
- Completion of strainmeter for Stage 1 sonde
- Borehole strainmeter delivery and costs
- Delivery of RefTek “Texan” data recorders for Flexible Array

PART I: Activities

HIGHLIGHTS

San Andreas Fault Drilling

EarthScope began drilling towards the San Andreas Fault during the summer of 2004 with Phase 1 completing on September 16, 2004. The borehole reached a measured depth (length of the borehole) of 3 km 13 days ahead of schedule. During drilling, the borehole passed from fractured granite into a complex sequence of both granitic and sedimentary rock about 213 m northeast of the drill site. The borehole is currently angled 54 degrees from vertical and is 1.1 km towards the San Andreas Fault. After the conclusion of drilling, a suite of geophysical measurements were performed, the deviated part of the borehole was cased and cemented, and coring operations began. Phase 2 activities are scheduled to begin in June 2005.

EarthScope drill rig in Parkfield, CA.

EarthScope and CISN Form Partnership

As part of EarthScope's commitment to form partnerships with regional networks, EarthScope and the California Integrated Seismic Network (CISN) collaborated in April 2004 to enhance seismic networks in California. CISN is contributing 58 stations to the EarthScope's 84 Transportable Array stations in California. The stations were successfully reconfigured to EarthScope specifications and began transmitting seismic data in real-time. Data from the EarthScope stations are also being made available to the CISN earthquake processing centers in order to enhance their monitoring capabilities. Four additional stations are being provided by contributing partners to CISN: 2 stations from the University of California San Diego and 2 stations from the University of Nevada, Reno.

Students at the EarthScope Exhibit Booth.

Outreach to the Geoscience Community

EarthScope continued to develop its outreach mechanisms by consulting scientists and educators at numerous professional meetings throughout the year, including the Seismological Society of America Annual Meeting, the American Geophysical Union Fall Meeting, and the Geological Society of America Rocky Mountain and Cordilleran Section Meeting. While the specific interests of participants at these meetings vary, they are all consumers of EarthScope data, products, and research. EarthScope was represented at the meetings through the EarthScope exhibit booth and oral and poster presentations, including an EarthScope-specific session. The large EarthScope presence at the meetings expanded awareness of the project and answered questions for those interested in using EarthScope data or instrumentation. Many of the questions focused on when and where instrumentation would be deployed, and when and how data will be accessible.

Engaging K-12 Teachers

At the National Science Teachers Association National Convention, EarthScope asked K-12 teachers how an active research project would engage their students in the Geosciences. Teachers expressed their need for hands-on, interactive exercises with access to real-time data. They also requested articles on research results, participating scientists, and regional tectonics. The teachers' requests were consistent with one of the primary goals of EarthScope's Education and Outreach Program Plan — "to advance a formal Earth science education by promoting inquiry-based classroom investigations that focus on understanding Earth and the interdisciplinary nature of the EarthScope experiment." As EarthScope moves forward, it is the need of scientists, educators, and the general public that will form the basis of its data portal, products, and tools.

Top Responses	Number Responded	Grades Taught											
		1	2	3	4	5	6	7	8	9	10	11	12
Information on plate tectonics: emphasis on regional tectonics, visual aids, online activities, interactive, simulation, earthquakes	21	1	2	2	2	2	2	3	10	6	7	6	5
Real-time data access: interactive, virtual lab, plotting and analysis software, lesson plans	16	0	0	0	0	1	2	1	6	6	7	7	7
Articles: what EarthScope is doing and why, research updates, "real life" applications, instrumentation, career information with scientist biographies and interviews	13	0	0	0	0	3	5	2	9	1	3	3	3
Active participation in the project: student participation in field work, summer internships, after school activities, adopt/host a station	8	0	0	0	0	1	2	1	4	4	3	4	4

NSTA Questionnaire Results: In addition to the above, teachers emphasized the need for hands-on and interactive activities. They prefer activities that are inter-disciplinary (e.g., geology and math, physics, or chemistry) and that can be geared towards different student levels in one classroom.

First EarthScope Operations Meeting

In May 2004 EarthScope held its first Operations Meeting. The meeting reviewed EarthScope operations and sought methods to improve synergy among all elements of EarthScope. The meeting identified 17 items for improved cooperation. In the area of program management, there has been strong and successful synergy. Within the technical operations, however, synergy among the various EarthScope components needs improvement. Several topics were identified where there is duplication of effort including: meetings, quality assurance, archiving, permitting, communication systems, purchasing, outreach efforts, seismic data acquisition systems, subawards, etc. Several other topics were identified as "falling through the cracks" due to either the barriers between projects or poor communications, including: interoperability among EarthScope data sets, data products, operations and maintenance, data portal, education and outreach, and strategic planning on both large and small scales. Of particular concern is the absence of any EarthScope-wide system to minimize repair, maintenance, and operations in the out years.

Attendees at the EarthScope synergy meeting held in Socorro, NM. From left to right: G. Anderson, R. Morris, M. Jackson, K. Feaux, F. Vernon, and C. Shin.

NSF Director Bement on the drill rig.

EarthScope Hosts Tour in Parkfield, CA

EarthScope in partnership with the US Geological Survey invited Congress, the National Science Foundation, and the media to Parkfield, CA on September 2, 2004. The participants toured the San Andreas Fault and the drill site, met the scientists and engineers, saw demonstrations of geodetic and seismic stations, learned about EarthScope's progress and plans, and heard how scientists and educators will use the data. Over 80 people participated in the event, including NSF Director Arden Bement, Congressman Sam Farr, and national and international press. In his opening remarks, Director Bement praised the event, stating that it exemplifies how "to keep policymakers and the general public informed of what we are learning and its relevance." The event resulted in an increased awareness of EarthScope, over a dozen articles in the media, and footage for two documentaries that are in production.

NSF Participates in Installations on Augustine Volcano

In September, seven short-drilled braced GPS stations were installed in and around Augustine Volcano, Alaska, to better characterize magma plumbing systems, the dynamics of intrusive and eruptive processes, and volcanic unrest. Station installation on Augustine Volcano, like many other parts of Alaska, requires weeks of planning due to the remote location and unpredictable weather. A crew of 10 engineers and support personnel spent three weeks mobilizing, installing stations, and demobilizing. Mark Coles and Jim Whitcomb from the National Science Foundation spent 4 days with the crew in the Cook Inlet to participate in the installations, to learn about the challenges of working in remote locations, and to gain first-hand experience with the EarthScope project. NSF also sent a film crew to collect B-roll footage of the installations for documentary film makers.

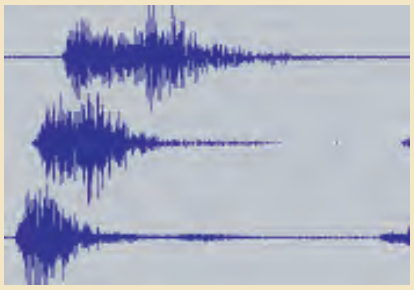
J. Whitcomb and M. Coles discuss station installation with B. Pauk on Augustine Volcano.

Students participating in Transportable Array installation.

Transportable Array Station Installed Near a School

Integrating research and education, a Transportable Array station was installed near the Wishkah Valley School in Aberdeen, WA. This is the first Transportable Array station to be installed in conjunction with a school. The K-12 students participated in the station installation and learned how seismometers measure earthquakes. For classroom use, the school also received an AS1 seismograph to give students hands-on experience in how seismometers record earthquakes. Soon after the installation, the Transportable Array station began recording the largest of the events occurring at Mt. St. Helens (M_L 3.5 - 3.6) 75 miles to the southeast. The students are using the recorded data to learn more about the local geology and natural hazards.

Parkfield 6.0 Earthquake Response

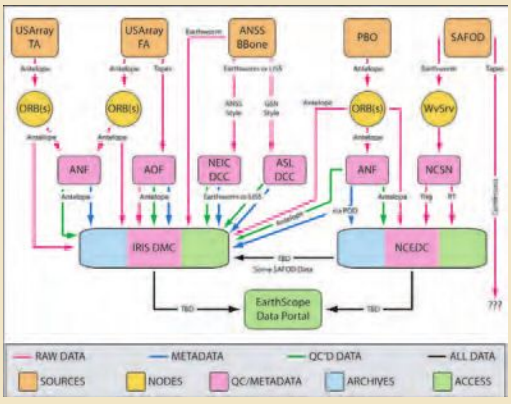


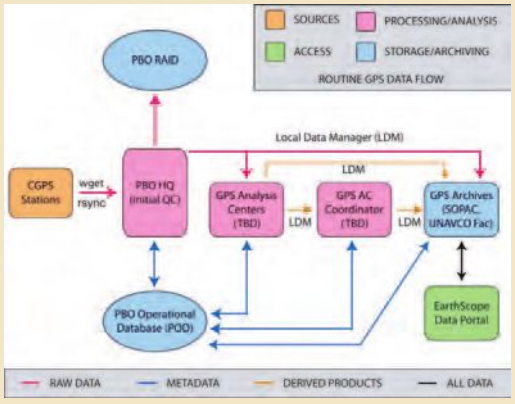
Ground motions from 6.0 Parkfield Earthquake.

On September 28, 2004 a 6.0 earthquake struck Parkfield, California. This was the sixth in a series of moderate-sized earthquakes to have ruptured the San Andreas Fault in Parkfield, an area that the US Geological Survey has been monitoring for over 20 years. The mainshock rattled EarthScope's SAFOD drill site approximately 24 km (15 miles) north of the epicenter. Although shaken, nobody was hurt and the rig did not incur any significant damage. Instrumentation already installed as part of the EarthScope project recorded the event. The EarthScope USArray seismic stations -- many of them operated with the California Integrated Seismic Network -- recorded the earthquake in California, Washington, Oregon, and New Mexico. Data from the EarthScope PBO GPS stations in the San Simeon area, which were installed immediately after the earthquake last December, are being analyzed for ground movement associated with the Parkfield earthquake. Crews also quickly mobilized to install five new GPS stations in the Parkfield area and to accelerate the start dates of two seismic experiments using the Flexible Array seismic equipment.

Preliminary Internal EarthScope Data Products and Portal Meeting

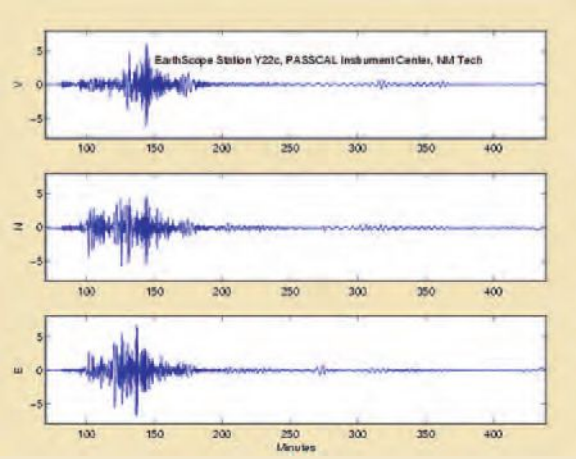
With over one hundred EarthScope stations recording seismic and geodetic data nine months into the first year of EarthScope funding, a data products and portal working group convened at EarthScope headquarters in Washington, DC to open discussions on how EarthScope can best provide access to the data and metadata for the broad scientific community, the educational community, and the public. The working group included data managers and educators from Stanford University, the US Geological Survey, UNAVCO, and IRIS. The goal of the meeting was to develop an integrated model for all EarthScope seismic, geodetic, and strain data, map data flow and data repositories, and to start developing a structure for single point access to all EarthScope data in a seamless fashion. Results from this meeting include the EarthScope integrated seismic and geodetic data models indicating data sources, data flow, and full data access through the EarthScope Data Portal shown here (compiled by G. Anderson and based on results from a pre-data products and portal meeting with T. Ahern, W. Ellsworth, and C. Weiland) and two draft documents on EarthScope data management: EarthScope Data and Sample Policy, and EarthScope Data Product Levels and Definitions.





EarthScope Data Used in Analysis of Sumatra-Andaman Earthquake

High-resolution data from EarthScope USArray seismometers are contributing to the analysis of the 9.0 M Sumatra-Andaman Earthquake. The December 26, 2004 earthquake was the largest seismic event on Earth in 40 years. Based on preliminary locations of larger aftershocks, approximately 1,200 kilometers of the boundary between the India and Burma tectonic plates slipped as a result of the earthquake. From the size of the earthquake it is likely that the average displacement on the fault plane was about 15 meters. The plots in the figure show the vertical (V), north-south (N), and east-west (E) displacement of the Earth's surface in Socorro, NM from the earthquake's first seismic waves. Recorded by the EarthScope USArray station at the PASSCAL Instrument Center on the New Mexico Tech campus, the ground in Socorro moved about 10 mm, which is more movement than most of the local earthquakes produce.



The first seismic waves from the Sumatra-Andaman Earthquake moved the ground in Socorro about 10 mm, which is more movement than most local earthquakes produce.

EarthScope PBO Mentors Student with NSF's MS PHD Program

EarthScope Plate Boundary Observatory (PBO) Director Mike Jackson participated in the Minorities Serving and Pursuing Higher Degrees of Success (MS PHD) in Earth System Science Professional Development Program at the 2004 American Geophysical Union Fall Meeting in San Francisco, CA. Mentoring Eddie Flores, a student studying Environmental Science at the University of South Florida, College of Marine Science, Jackson facilitated networking with individuals in the science community and in Flores's research area, and offered academic and career advice relevant to Flores's career goals.

From left to right: Chuck Meertens (UNAVCO and GEON), Eddie Flores (MS. PHD, University of South Florida), Ben Domenico (Unidata), Cliff Jacobs (NSF), Mohan Ramamurthy (Unidata), and Steve Miller (Scripps).

EarthScope's Plate Boundary Observatory Wins Technology Award

EarthScope Plate Boundary Observatory (PBO) won the QUALCOMM 3G cdmA-List Award for Innovation. The award honors organizations for their creativity and innovation, overall business impact, and quantifiable return-on-investment. By using their wireless technology, EarthScope PBO was recognized for avoiding expenses of nearly $1 million per year by eliminating the need for multiple modems and accounts, for providing faster turnaround of data and analysis to member organizations, and for increasing the data sampling rates at sites to improve further modeling, analysis, and prediction of seismic activity.

D. Mencin (center) receiving the 3G cdmA-List Award for Innovation.

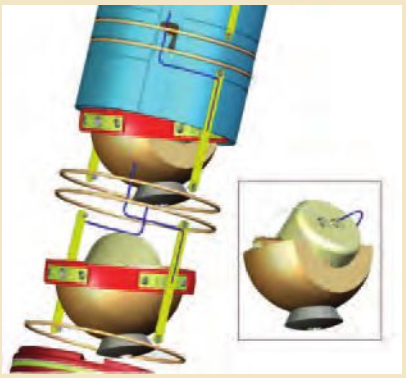
Installing a GPS antenna on the north-west flank of Mt. St. Helens.

Response to Increased Seismic Activity on Mt. St. Helens

In response to the increased seismic activity at Mt. St. Helens, EarthScope Plate Boundary Observatory (PBO) re-prioritized their planned installation of five GPS stations on and around the flanks of the volcano. The stations were originally planned to be installed next summer. Fortunately, site reconnaissance for these stations was completed over the summer. The crews worked closely with the National Forest Service and the US Geological Survey to secure permits and permission to install the stations rapidly. Within two weeks of the increased seismic activity, helicopters were slinging solar panels and equipment enclosures to each site. Four sites were completed in two days and the fifth site was completed on October 28, 2004. Data downloads are occurring once every hour with sampling occurring once every 15 seconds. Both the hourly and daily data files are available through the UNAVCO Archive.

Stage 2 Instruments Installed

During November 2004, the Stage 2 instrument package, which includes a self-leveling seismometer and a non-self-leveling accelerometer, was installed in the EarthScope San Andreas Fault Observatory at Depth (SAFOD) Main Hole. During installation it was discovered that the accelerometers were not properly operating and that vibrations from the cable holding the sonde were interfering with the seismic signals being recorded. The accelerometers were replaced and a mechanical casing clamp was added to the sonde, which decreased tension on the wire. The Stage 2 instrumentation are being used with EarthScope USArray Flexible Array seismometers at the surface (PASO TRES) and charges detonated by the US Geological Survey to further refine the locations of the borehole's target earthquakes. The instrument package will be removed in mid-April when drilling activities resume and will be replaced for the next monitoring stage.



Schematic of Stage 2 instrumentation.

EarthScope Briefs Congress

At a briefing hosted by the House Committee on Science, Mark Zoback (EarthScope and Stanford University) and John Pallister (US Geological Survey) presented emerging results from the recent Parkfield 6.0 Earthquake and the Mount St. Helens eruption. They displayed data collected from EarthScope and USGS instrumentation and explained how these opportunities are improving our understanding of earthquakes and volcanoes. EarthScope is currently operating GPS receivers on the flanks of Mount St. Helens, seismometers and GPS receivers near Parkfield, CA, and seismometers and strainmeters in the EarthScope San Andreas Fault Observatory at Depth's Pilot Hole and Main Holes.

M. Zoback describing EarthScope activities in Parkfield, CA to Congressional staff.

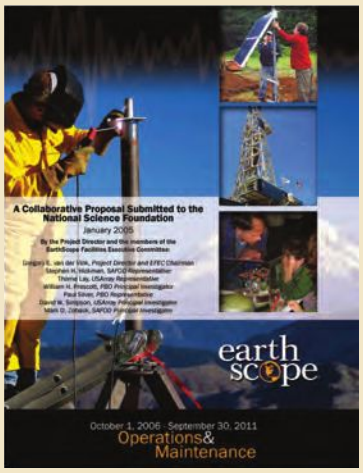
EarthScope National Meeting field trip to the Jemez Mountains area of northern New Mexico.

EarthScope National Meeting

The first EarthScope National Meeting was attended by over 300 faculty, researchers, and students March 29-31, 2005 on the Santa Ana Pueblo, NM. Through plenary and poster sessions, mini-courses, and a field trip, the meeting synthesized results from EarthScope workshops, served as a forum for discussions on EarthScope science and education progress, promoted cross-cutting science and interdisciplinary research, and explored the view forward for the next decade of EarthScope science and education. Surveying a third of the participants afterwards, the meeting received extremely high reviews with 91% considering the meeting successful and 96% planning to attend the next EarthScope National Meeting.

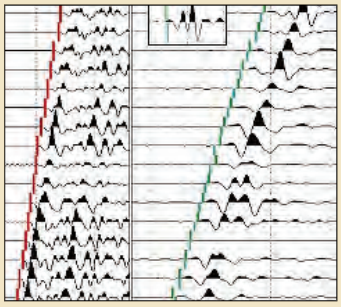
EarthScope Submits Operations and Maintenance Proposal to NSF

In January 2005, EarthScope submitted a proposal for its operations and maintenance to the National Science Foundation. At 530 pages, the proposal provides a highly detailed budget analysis that focuses on meeting the requirements of EarthScope's scientific and educational users through performance goals and single-point, integrated data access. EarthScope worked extensive hours through the holidays to ensure an accurate, comprehensive, and realistic budget that will meet the scientific objectives of the project. The proposal is being reviewed by 1) NSF mail review, 2) an independent cost contractor, and 3) a special emphasis panel. Once reviewed, the proposal will go to the National Science Board for approval. EarthScope remains committed to working with NSF to develop a facility that will meet its scientific goals and that will be sustainable within the current budgetary environment.

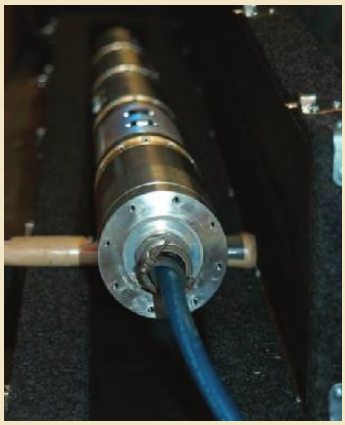


Pilot Hole Data Available Online

Seismic data from the SAFOD Pilot Hole became available through the EarthScope website and the Northern California Earthquake Data Center (NCEDC) in January 2005. Initially instrumented with a seismic string containing 32 levels of 3-component 15 Hz geophones, the data include waveforms of approximately 5,600 events from September 2002 through May 2004 and October 2004. The data are available in SEED format, and have been quality assured and quality controlled for basic parameters such as timing errors and instrument response by NCEDC. Despite incurring damage during drilling last summer, the array continued to operate in the Pilot Hole.



The magnitude 2.1 SAFOD drilling target earthquake as recorded on the Pilot Hole seismic array (Oye et al., 2004).



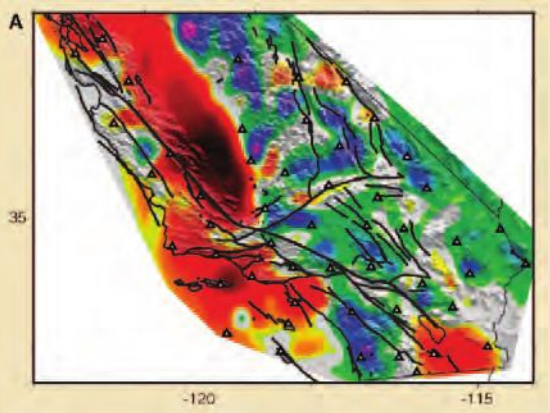
In preparation for the first EarthScope strainmeter installation, the instrument is carefully packaged for its shipment from Australia.

Strainmeter Drilling & Coring Complete

The EarthScope Plate Boundary Observatory completed coring the strainmeter boreholes in the Pacific Northwest. The cores were compared to geophysical logs to assure the suitability of the borehole. Of the 8 holes drilled, 7 were cored and 6 were determined acceptable. Due to the sensitivity of the strainmeters, the rock surrounding the instrumentation must be homogenous and unfractured. Preparations are now underway for the first installation in Sekiu, WA. Following performance testing, installations will take place this summer. The seismometer and the power system components that will accompany the strainmeter are also being prepared.

Crustal Images from Noise

Just 15 months into EarthScope construction, data recorded from 62 EarthScope Transportable Array stations were published in *Science*. Nikolai Shapiro, Michel Campillo, Laurent Stehly, and Michael Ritzwoller discussed in the March 11, 2005 issue how seismic noise recorded at EarthScope stations were used to produce high-resolution images of the Earth's crust. The technique diminishes the need for earthquakes to produce tomograms, which could lead to continued new discoveries as the array moves towards the less seismically active east. Commenting on the research, James Whitcomb of NSF said "This innovative research foretells what's to come from EarthScope."

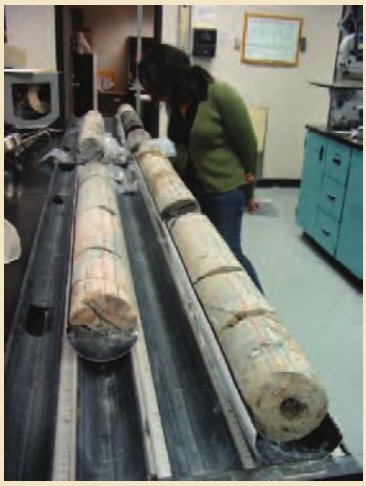


Group-speed maps constructed using data recorded at EarthScope Transportable Array station (Shapiro et al., 2005).

Heavy Rains in California

Southern California was hit with one of the wettest winters on record, causing mudslides and flooding throughout the region. The unusual deluge of water hampered some EarthScope activities, but management teams were able to quickly respond, keeping delays to a minimum. For the GPS installations, staff from Alaska, where installations do not occur in the winter months, were temporarily relocated to help the California teams recover the lost work. For the Transportable Array, the unusual rain flooded some of the sites. The engineers responded by changing the vault designs, adding a plastic liner to prevent water infiltration. Four vaults were retrofitted and no flooding problems have occurred at sites built with the new design.

A plastic liner was added to Transportable Array vaults to avoid flooding from California's unusually wet winter.



At the Phase 1 Sampling Party, 30 scientists examined 38 feet of core from the SAFOD Main Hole. The researches then submitted requests for subsamples to use in their investigations.

Phase 1 Sampling Party

Scientists interested in analyzing the physical samples extracted from the SAFOD Main Hole gathered in College Station, TX to attend the Phase 1 Sampling Party. The samples are stored at the Integrated Ocean Drilling Program's Gulf Coast Repository at Texas A&M University. The 30 scientists attending the meeting pored over the 38 feet of core that was publicly displayed for the first time. Following oral presentations on research plans and sample needs by scientists already funded by the National Science Foundation and US Geological Survey, the participants examined the samples in detail and then submitted requests for core and cuttings subsamples. Comprehensive structural and petrographic studies of the cores are now underway, after which subsampling of the cores will begin.

SITE REVIEWS

USArray

A review of USArray was conducted on May 11, 2004 in conjunction with the 2nd Quarter EarthScope Facility Executive Committee (EFEC) Meeting at the Array Operations Facility in Socorro, NM. The site review included a tour of the facility, introductions to USArray staff, and briefings on USArray operations, data and data products, data communications, database development activities, power and construction plans, and reconnaissance and permitting activities.

Key Findings of the USArray Site Review:

- USArray is being carried by talented scientists, engineers and administrators with many years of relevant experience
- IRIS is an ideal organization to operate USArray because of its excellent track record of operating large scale seismic programs and strong community support
- Equipment acquisition proceeding according to plan
- New facility construction promises adequate housing and technical support for required activities
- Modification and upgrade of IRIS Data Management Center seems to be on track for accepting USArray data
- Conversion of pre-existing stations to USArray stations is a good ramp-up mechanism and should benefit the overall deployment schedule
- EFEC has concerns about pre-existing demands on key management personnel, the lack of a dedicated USArray advisory mechanism and the lack of adequate staff to meet NSF's project tracking and reporting requirements

Positive Findings of the EFEC:

- USArray is being managed and executed by a talented group of scientists, engineers, administrators, and technicians with the knowledge and experience to implement the varied components of USArray
- USArray is taking full advantage of existing infrastructure and experience within IRIS. For example, the experience obtained through operating PASSCAL over the past 15 years is essential in implementing the Transportable and Flexible Arrays. Similarly, Global Seismological Network experience is important for installing the ANSS Backbone and the ability to expand and modify the IRIS Data Management Center is important to accommodate USArray data and is very important for EarthScope.
- Cooperating effectively with organizations such as the US Geological Survey's Albuquerque Seismic Laboratory for the ANSS Backbone, the California Integrated Seismic Network for the Transportable Array, and the NASA/IAGT program for GIS support applications
- Institutional support from New Mexico Tech is very important to the success of USArray
- Increases in staffing at the technical and middle-management level are on track and appropriate
- Station conversion in the early years appears to be an effective mechanism for quickly ramping up
- USArray is cooperating well with existing regional seismic networks

Concerns that should be addressed in time for review and comment from EFEC prior to preparation of the 3rd Quarterly Report:

- In general, EFEC has expressed concern about the evolution of the USArray management structure from the pre-existing IRIS structure. These concerns are being dealt with by IRIS in a manner to be described in the next Quarterly report as part of the overall USArray site review.
- EFEC has concerns about the demands on key management personnel due to their pre-existing job responsibilities associated with other IRIS activities
- EFEC is concerned about the apparent absence of a comprehensive organizational structure with lines of authority and reporting responsibilities clearly defined

USArray Response: As part of the budget structure included in the EarthScope MREFC proposal, salary support is included for IRIS Program Managers to provide oversight and management of the major USArray and ensure full and effective integration between the IRIS core programs and USArray. The level of effort charged to the EarthScope award was included in the EarthScope proposal and Project Execution Plan and reflects the relative extent of responsibilities of Program Managers for each of the program components under USArray (30% for PASSCAL for management of the Transportable and

Flexible Arrays; 20% for DMS for USArray data management activities; 10% for GSN for management of the Backbone Network; and 10% for E&O for management of siting outreach activities). These changes in level of effort under the core IRIS award (NSF/EAR-0004370) were submitted to NSF on September 17, 2003 and approved. To compensate for the decreased level of effort from the Program Managers and ensure the full performance of activities under EAR-0004370, each of the IRIS programs has re-directed the funds, made available by the changes in level of effort, to new support staff. The current status of personnel changes as they relate to the IRIS core programs and hiring of new staff for USArray is described in the figure below.

> IRIS-USArray Staffing - August 2004

IRIS Program Managers are supported by EarthScope at the following levels to provide oversight and management of the major USArray and ensure full and effective integration between the IRIS core programs and USArray:

James Fowler, PASSCAL Program Manager	3.6 months
Rhett Butler, GSN Program Manager	1.2 months
Tim Ahern, DMS Program Manager	2.4 months
John Taber, E&O Program Manager	1.2 months

The level of effort charged to the EarthScope award was included in the EarthScope proposal and Project Execution Plan and reflects the relative extent of responsibilities of Program Managers for each of the program components under USArray (30% for PASSCAL for management of the Transportable and Flexible Arrays; 20% for DMS for USArray data management activities; 10% for Global Seismographic Network for management of the Backbone Network; and 10% for Education and Outreach for management of siting outreach activities).

To compensate for the decreased level of effort from the Program Managers and ensure the full performance of activities under EAR-0004370, each of the IRIS programs has re-directed the funds, made available by the changes in level of effort, to new support staff. The current status of personnel changes as they relate to the IRIS core programs and USArray is described below:

PASSCAL

Marcos Alvarez was hired as Deputy Program Manager for PASSCAL in Socorro as of January 15, 2004. He reports directly to the PASSCAL Program Manager and is responsible for oversight of field and lab duties at the PASSCAL Instrument Center in Socorro. His salary is split 50/50 between the IRIS core budget and USArray.

Data Management System

Mari Francissen was hired as Executive Assistant at the Data Management Center in Seattle as of May 17, 2004. 7.2 months (60%) of her salary is budgeted in the core DMS budget. She reports directly to the DMS Program Manager and is responsible for administrative duties, generation of reports, and other support activities.

Global Seismographic Network

Kent Anderson has been hired as Operations Manager for the Global Seismographic Network (GSN) effective January 4, 2005. In addition to changes in effort related to USArray, the creation of this position is also in response to the recommendations of the NSF-mandated review of the Global Seismographic Network carried out in 2003. The report of the Review Panel submitted to I&F in April 2003

stated that "GSN should consider hiring an Assistant Program Manager, to assist in the management of the network O&M, so that longer range issues affecting the GSN can be regularly and carefully addressed."

Education and Outreach

Gayle Levy was hired as the IRIS Outreach Specialist for Education and Outreach (E&O) in the Washington, DC office as of May 13, 2004. She reports directly to the IRIS E&O Program Manager and is responsible for IRIS E&O Outreach activities with a special emphasis on informal education and museum displays. She is also assisting in the coordination of siting and outreach at member institutions related to the development of potential sites for USArray stations.

Additional Hires

To provide support for project management and reporting required under the EarthScope award, a Director of Project Administration (Robert Woolley) was hired as of July 1, 2004. His initial effort will be on the refinement of EarthScope/USArray budget controls and project management.

Additional IRIS staff supported through EarthScope/USArray include a USArray Operations Manager (R. Busby) and new hires for programming and technical support staff at the Data Management Centre in Seattle. Additions to the headquarters and business office staff are budgeted within the general and administrative indirect cost pool.

Increased personnel support for USArray operations has been primarily funded through new subawards as documented in the EarthScope proposal and reports.

The following are new USArray staff position under the New Mexico Tech subaward at the Array Operations Facility in Socorro:

Data Specialist	May 1, 2004
Hardware Engineer	May 1, 2004
Field Engineer	May 1, 2004
Software Engineer.	June 18, 2004
USArray Coordinator	Aug. 2, 2004
Office Coordinator	Aug. 16, 2004
Instrumentation Tech	May 12, 2004
Transportable Array Site Coordinator	Apr. 26, 2004

The following USArray positions at New Mexico Tech are projected for hiring for the next year:

Field Engineer	Sept. 1, 2004
Maintenance Engineer	Jan. 1, 2005
Field Engineer	Jan. 1, 2005
Shipping & Receiving	Jan. 1, 2005
Maintenance Engineer	Apr. 1, 2005
Maintenance Engineer	Oct. 1, 2005

In addition, Don Lippert has been hired mid-June as a consultant to work on site location/permitting in Central and Northern California.

- **Concern:** EFEC sees an immediate need for USArray to establish a dedicated advisory group to provide a mechanism for input from the outside scientific community. EFEC has been advised that establishment of such an advisory committee is underway.

  USArray Response: The IRIS Executive Committee has approved the formation of a USArray Advisory Committee. The charge to the committee is included in following figure.

> USArray Advisory Committee Charge - August 6, 2004

The USArray Advisory Committee is charged with providing advice to the IRIS Board of Directors and IRIS President on the performance of the USArray component of EarthScope. The Committee will monitor the development and operation of the USArray facility, and review the contributions of IRIS core programs (DMS, PASSCAL, GSN, E&O) to the successful implementation of USArray and the science goals of EarthScope. The Committee is neither a science planning nor operations committee, but should review USArray operations in the context of the science framework for USArray and EarthScope.

The Committee will meet as needed, but no less than twice per year, and will provide semi-annual written reports to the IRIS President and Board of Directors. Additionally, the Committee may be charged with reviewing special topics and questions requiring prompt action.

Members of the Committee are appointed by the Board of Directors and serve renewable two-year terms.

Background

IRIS is responsible for the development and operation of the USArray component of EarthScope. Within IRIS, the USArray project is implemented through coordinated activities in the core IRIS programs (PASSCAL, GSN, DMS, E&O). The Transportable and Flexible Arrays are implemented through PASSCAL. The Backbone Array is being established through the GSN as part of the USGS Advanced National Seismic System (ANSS), in collaboration with USGS/ASL. All data from USArray flow through the IRIS Data Management System (DMS) and are provided to users through existing IRIS data management structures and an evolving EarthScope data portal.

The program Standing Committees (PASSCALSC, GSNSC, DMCSC, E&OSC) are focused on the development of their respective core IRIS programs, including activities related to USArray.

The Coordinating Committee of IRIS (CoCom) oversees the operational coordination among IRIS core programs, including the development and operation of USArray. CoCom provides programmatic and budgetary advice to the IRIS Board of Directors, which has the ultimate responsibility for approval of program plans and budget allocations.

Considering the large scope, the long-term commitment, and the well-developed scientific objectives of USArray and EarthScope, the IRIS Board of Directors has determined that it is in the best interest of IRIS and of the community to establish a USArray Advisory Committee. This committee will review the development and operation of USArray and provide advice to the IRIS Board of Directors on ways to maximize IRIS participation in USArray and EarthScope, to the overall benefit of Earth science research.

- **Concern:** EFEC is concerned that there are inadequate staff for USArray to meet NSF's project tracking and reporting requirements. EFEC encourages USArray to proceed rapidly with plans for hiring a Cost and Schedule Coordinator to assist in meeting these requirements.

  USArray Response: To provide support for project management and reporting required under the EarthScope award, a Director of Project Administration (Robert Woolley) was hired as of July 1, 2004. His initial effort will be on the refinement of EarthScope/USArray budget controls and project management.

- **Concern:** What does conversion mean for an ANSS Backbone station? Does it mean new sensors, electronics and/or data telemetry at every site? What does conversion mean for an existing regional station such as TriNet or a short-period network station?

  USArray Response: Backbone stations. The EarthScope MREFC Proposal (pp. 35-37) provides a description of the conversions and new installations to be made as part of the USArray contribution to the backbone network:

  - 4 existing US Atomic Energy Detection System stations will be included in the backbone
  - 5 existing National Seismic Network stations will be upgraded with Global Seismographic Network quality sensors
  - 4 new Global Seismographic Network quality stations will be installed
  - 14 existing National Seismic Network stations will be upgraded with improved sensors
  - 13 new National Seismic Network quality stations will be installed

  Transportable Array.

  > In areas where there are existing regional networks for earthquake monitoring, USArray will collaborate closely with regional network operators in site selection and installation, and the regional networks will have high priority access to all data.
  >
  > *— EarthScope MREFC Proposal*

  > The USArray/Bigfoot deployment in California will be designed so as to optimize the use of existing CISN broadband sites while retaining the array design called for by the USArray plan. If technically and logistically feasible, these sites will be contributed by CISN to be part of the Transportable Array. Where necessary and technically and logistically feasible, existing instrumentation may be temporarily upgraded or augmented with equipment provided by IRIS to meet USArray/Bigfoot standards.
  >
  > *— Agreement between IRIS and the California Integrated Seismic Network (CISN)*

  The upgrades to regional stations required to meet USArray/Bigfoot standards varies depending on the existing instrumentation and communications capability. For most of the CISN broadband stations incorporated to date into the Transportable Array, the seismometers, data loggers and communication systems were equal to USArray quality and the primary modifications required were to increase the continuous sample rate to 40 sps and provide for dataflow into the USArray data collection system. Upgrade of components and improvements in site conditions were required at some CISN sites. If future collaborative sites have equipment that does not conform to USArray standards (e.g. short period sensors, analog telemetry) USArray equipment will be provided for temporary upgrade during the Transportable Array deployment. The regional network operators will have the option of continuing parallel operation of their existing equipment or utilizing the USArray channels.

A description of the collaborative efforts between USArray and CISN is included in figure below.

> Collaboration with CISN Generates First EarthScope Seismic Data in California

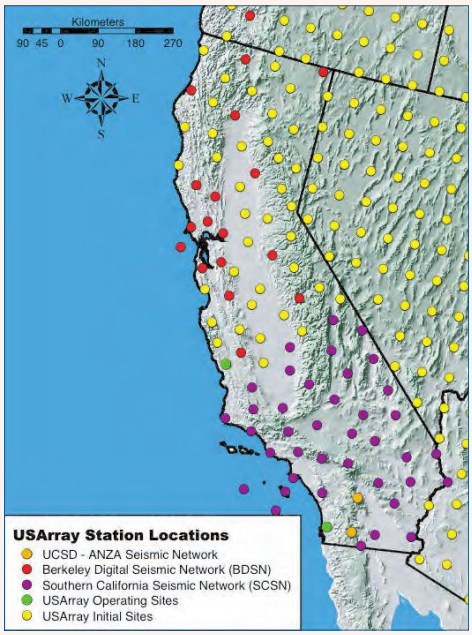
CGS USGS OES Caltech UC Berkeley IRIS

earthscope

The Incorporated Research Institutions for Seismology (IRIS) has been selected by the National Science Foundation to implement the USArray component of the EarthScope program. The USArray program calls for the deployment of a temporary digital broadband seismic array, the Transportable Array or Bigfoot, with an approximate spacing of 70km, in support of studies of the deep structure of the North American continent.

To coordinate the implementation of USArray with the earthquake monitoring infrastructure in the United States, IRIS has established partnerships with regional seismic networks. In late 2003, the California Integrated Seismic Network (CISN) and IRIS agreed to coordinate their operations for the duration of EarthScope's USArray Transportable Array deployment in California. The benefits to the CISN and USArray are cost savings through dual use of monitoring equipment and improved performance through exchange of field expertise and new technology.

The CISN operates seismic stations, analysis centers and data centers across the State of California in support of real-time earthquake monitoring and earthquake hazard mitigation at both the state and national level, the latter as the regional organization of the Advanced National Seismic System. CISN is recognized as the authoritative source of earthquake information in California. As such, CISN has the primary responsibility for routinely distributing hypocenters, magnitudes, mechanisms, and other standard products through Web sites and other electronic means.



As part of the agreement with IRIS, the CISN is contributing 60 stations (41 from Caltech/USGS Pasadena, 19 from University of California Berkeley) to the 84 Transportable Array stations that will be operating in California. In late April 2004, the Caltech/USGS Pasadena stations were successfully reconfigured to USArray specifications and started transmitting seismic data in real-time to the EarthScope Array Network Facility (ANF) in San Diego, CA, and also to the IRIS Data Management Center (DMC) in Seattle, WA. Reconfiguration of the University of California Berkeley stations commenced in May 2004, and these data are also transmitted in real time to both the ANF and DMC. University of California Berkeley will also assist USArray by reconnaissance and installing eight new Bigfoot stations that will become a part of the CISN. Four additional stations are being provided by contributing partners to CISN; University of California San Diego (two stations) and University of Nevada, Reno (two stations). Data from all USArray stations are being made available to the

CISN earthquake processing centers in order to enhance their monitoring capabilities, in addition to the sharing of modern seismic network technologies and software.

All USArray data from Transportable Array stations undergo quality assurance at both the ANF and at the DMC. These data are freely available from the DMC in near real-time through automated delivery mechanisms. Data from the CISN stations are also available from the Northern California Earthquake Data Center (NCEDC) and the Southern California Earthquake Data Center (SCEDC).

- **Concern:** Are the baselines in the Quarter 2 Report going to remain constant and used to define variances, change orders, etc. for the remainder of Year 1? If not, why not?

  USArray Response: Yes, the baselines in the Quarter 2 Report represent the approved baselines for USArray. Any adjustments to this baseline will be made in accordance with the EarthScope change control procedure.

SAFOD

A review of the San Andreas Fault Observatory at Depth (SAFOD) was conducted in conjunction with the 3rd Quarter EarthScope Facility Executive Committee (EFEC) Meeting. The site review began in Parkfield, CA with a tour of the drill site and then moved to Paso Robles, CA for technical presentations.

EFEC touring drill site in Parkfield, CA.

Overall

Drilling and on-site activities are proceeding well. As of the end of July, SAFOD is on schedule and on budget. The downhole measurements and coring have been successful. The fluid sampling has not been successful due to the low permeability of the granite. The development of the facility is also going well, but some planned activities, such as the Stage 1 instrumentation, are behind schedule. SAFOD has a strong plan, yet retains flexibility to account for unexpected opportunities and/or challenges.

The technical team, overall management, and project execution for drilling activities is impressive. The EFEC is confident (accepting the inevitable uncertainties associated with drilling), that SAFOD will successfully complete the technical drilling objectives. They have had a very successful execution of their plan to date. They have strong international links and collaboration. The partnership between the US Geological Survey supported and National Science Foundation funded parts of EarthScope is impressive and serves as a model for scientific collaboration between federal agencies. In addition, we feel similarly confident that Phase 1 will be accomplished both within the proposed budget and schedule. The swift and skillful handling of the potential setback that could have occurred from the intersection of the main and pilot holes demonstrated the capabilities and resilience of the management and technical plan.

The individual Principal Investigators are highly knowledgeable about drilling and the teams they have put together represent the appropriate cross-section of scientific and engineering expertise. The long-standing relationship with ThermaSource has been especially important for the project's success.

Reaching the Target Earthquakes

SAFOD drilling is targeting three locations of frequent earthquakes. The current level of confidence of the absolute location is within 100 to 200 meters. SAFOD needs locations that are accurate within a few tens of meters relative to the borehole. While this may not be possible with current data, data collected within the next two years should allow it to be done. SAFOD's approach is to use application of multiple algorithms by different groups and comparison of results afterwards, which tests the inevitable effects of weighting, outlier identification, etc. SAFOD plans for simultaneous recording from both surface and in-hole sensors during Phase 2. During stage three these data will provide ray paths within the target zone, thus reducing travel-time errors, and allow for the use of 3-sided geometry. SAFOD is confident that the application of these techniques will allow for the desired accuracy of a few tens of meters. In the event that the target locations are missed, the multi-lateral cores will allow for correction during Phase 3. Given the central importance of intersecting the location of specific repeating earthquakes, EFEC encourages the continuation of an aggressive approach to continually refining the locations of the target earthquakes.

The EarthScope San Andreas Fault Observatory at Depth is drilling 3.2km into the fault near Parkfield, CA.

Intersection with Pilot Hole

Due to a calibration error in the gyroscopic survey, the main drill hole intersected with the previously-drilled Pilot Hole. Upon discovering this error, SAFOD was able to withdraw from Main Hole, plug the Main Hole above the intersection with the Pilot Hole, and redirect the Main Hole away from the Pilot Hole. The company that conducted the gyroscopic survey has agreed to reimburse the project in services for any costs they may have incurred due to the error. EFEC was impressed that despite this potential setback, the team was able to overcome this incident and get quickly back to being on budget and on schedule.

Seismic Data

Over the life of the project, we can expect that SAFOD will record on the order of tens of thousands of earthquakes. Magnitude 1 events are recorded each day, and the seismic instrumentation will be recording down to below magnitude -1.0. The continuous data will be on order of 50-100 sensors capable of producing 100 to 200 gigabytes per day. A component of 5 to 10 channels of continuous data will be flowing in real time to Berkeley and IRIS DMC. Sampling rates, data collection methods, archiving and distribution have not yet been clearly defined. EFEC is concerned that plans have not been made for how this substantial data set will be stored and how it will be accessed by interested researchers. It is essential that a clear data management plan similar to that of USArray and PBO be produced for SAFOD as soon as possible.

SAFOD Response: The plans for telemetry and storage of SAFOD data are being finalized. With respect to the continuous data being sampled at extremely high rates, it has been decided that only a subset of these channels will be telemetered and stored at the IRIS and Northern California Earthquake Data Center data bases. The remainder will be recorded on tape, on site, and stored by the US Geological Survey.

Physical Samples, Core and Fluid Samples

Cores will be curated at the Integrated Ocean Drilling Project core facility at Texas A&M. Protocols for handling these samples have been established by the Integrated Ocean Drilling Project and will be reviewed and overseen by the established SAFOD technical panels. Protocols for priority of access to core samples still need to be worked out. SAFOD is well aware of the need to develop a system for the distribution of core and fluid samples. Such a system needs to be developed as part of an overall EarthScope policy. In particular, SAFOD has identified the need for 1)

Principal Investigators on-site to do preliminary analysis, etc., 2) establishing a priority system for samples, and 3) protecting the interests of American Principal Investigators. EFEC is concerned that the cost basis for both the Integrated Ocean Drilling Project responsibilities and Principal Investigator involvement have not been described. SAFOD is well aware of the need to identify science teams to help handle core and fluid samples as they are recorded from the hole during the summer of 2005 and especially during the summer of 2007. In addition, they have accurately identified the possible conflicts that might arise from scientists funded by the National Science Foundation, US Geological Survey, and foreign science organizations. The EFEC is committed to working with them to develop policies within the general EarthScope data and sample policy that can be presented to the National Science Foundation.

P. Silver and N. Boness conferring at the SAFOD site review.

SAFOD Response: A recent workshop was held among scientists interested in working on SAFOD core and the draft policy prepared by NSF for core handling was discussed. This draft policy was also discussed at the SAFOD Advisory Board meeting in September. As a result of these discussions, the Principal Investigators and EarthScope Project Director look forward to discussing modifications of the draft policy in the near future.

Education and Outreach

SAFOD should consider a simplified sample collecting effort for cuttings that might be useful in the future for education and outreach purposes.

SAFOD Response: Such samples are already available to anyone interested in them.

General Data Availability

Considerable work still needs to be done in formulating procedures for making data available to interested researchers. For example, strain and seismic data will be openly available, while other SAFOD-specific data will be under password protection following International Continental Drilling Program protocols. The EFEC feels that these data should be openly available.

SAFOD Response: The password protection policy is a relic of that used for data collected in the SAFOD Pilot Hole, largely funded by ICDP. This policy will be abandoned and data will be released in accordance with policies developed for EarthScope data of different levels.

It is not obvious how data collected from associated data collection activities at the SAFOD site (for example the recent US Geological Survey thermal log and the GeoForschungs Zentrum Potsdam gas sampling) will be made openly available. In addition, there needs a plan for the event that activity increases at Parkfield, and data must be quickly disseminated to the broad community.

SAFOD Response: These data will be subject to the same EarthScope policies.

Perception

There still exists the perception that SAFOD has an “insider track”. We need to more clearly and publicly declare the pathways for interested scientists to become involved in SAFOD.

SAFOD Response: The PI's are doing everything possible to allay this perception, in numerous talks, workshops and private meetings. It is easy to see why this perception exists as the SAFOD project was developed from a comprehensive proposal for scientific drilling into the San Andreas Fault submitted to NSF in 1998. This proposal included a fairly comprehensive science team. Nevertheless, it is clear that the PI's need to continue to communicate the fact that SAFOD is an open experiment.

Budget Impacts

The budget impact of changing the drilling plan from 4.0 km to 3.2 km has not been fully documented, and the relatively minor savings indicated in the Change Order seem inconsistent with this decrease in depth. SAFOD needs to more accurately describe the budget benefits of the decrease in depth determinations of the target earthquakes.

SAFOD Response: There are two issues that are relevant with respect to the depth of drilling and the budget. First, the budget included in the Project Execution Plan was based on the 3.2 km total depth. Hence, no Change Order was necessary. However, an incorrect graphic used in the Project Execution Plan gave the impression that the planned depth had not changed. Second, after preparation of the initial SAFOD budget in January 2002, one major cost item was added as a result of the feedback the PI's got from the review. A full-time Data Manager was hired, Charley Weiland. The cost of hiring this person more than offset the savings associated with changing the depth of the hole. This too was included in the budget in the Project Execution Plan. The duties of the Data Manager have been split between data management issues and meeting National Science Foundation's reporting requirements, especially the use of Earned Value Management, which was unknown at the time the January 2002 budget was prepared.

Undefined Aspects

EFEC is concerned that several of the long-term plans (Stage 3) have not been developed in terms of the exact type of instrumentation that will be used and how it will be selected and developed. These plans need to be finalized.

SAFOD Response: Detailed planning for Stage 3 is currently underway. The PI's are receiving input and advice on Stage 3 instrumentation from both the Downhole Monitoring Technical Panel and Sandia National Labs.

■ EarthScope Management

A review of EarthScope Management was conducted as part of the Year 1 Quarter 4 EarthScope Facility Executive Committee (EFEC) Meeting. The meeting was held at EarthScope Headquarters in Washington, DC.

Statement of EFEC:

Under Greg van der Vink's leadership, EarthScope has a strong positive identity in the Geoscience community as well as in Congress, NSF, and other federal agencies. In addition, Greg has helped to provide a broad-based vision for the EarthScope facility in the context of EarthScope science and for the solid Earth sciences in general. He has consequently helped to elevate the stature and visibility of the solid Earth sciences within the broader scientific community, government agencies, Congress, and the public at large.

The EFEC finds that the EarthScope Office has skillfully implemented a suite of management tools that have streamlined the management of EarthScope. The EFEC continues to be very impressed by the skill, energy level, and motivation of the EarthScope staff. Reporting requirements are being met in a comprehensive and timely manner (EVM, development of PEP, structure of Quarterly Reports). Outreach to the Geoscience community has been very successful, which has led to the development of a broad base of support (for example, the recent GSA meeting with a major science session devoted to EarthScope). We note that Greg and staff are responding well to the increasing demands on the EarthScope office, such as E&O, the EarthScope National Meeting, and a comprehensive PEP. The EarthScope Office has provided the leadership for the development of

a comprehensive and well-integrated data management plan as the basis for the EarthScope data portal. The EarthScope Office has been effective in establishing the identity of EarthScope as an integrated Geoscience program built on the strengths of preexisting consortia. Overall, the EFEC is very impressed with the wide range of tasks undertaken by the EarthScope Office.

- **Concern:** First, the EFEC is concerned that the staff is overworked. There do not appear to be mechanisms in place to address this problem over the next 2 years. We perceive this state to be a risk to the program, since it may lead to employee burnout, or to other negative consequences if one or more of the employees leaves. We see a need to either reduce the workload of the Office or to increase the staff.

  EarthScope Management Response: The main areas where the EarthScope Office is overworked are a) in the production of materials for program management and oversight, and b) in monitoring cost and schedules to insure high-level compliance with NSF procedures and policies across multiple awards and agreements. The EarthScope Office is currently in the process of hiring a Publications and Design Specialist. The position of EarthScope Business Analyst has been included in the O&M Proposal beginning in Year 3. (Both of these positions were in the original EarthScope proposal, but have not been filled due to budget limitations and changing priorities in the evolving EarthScope landscape.)

- **Concern:** Second, there is a need for more effective interaction between the EarthScope Project Director and the EFEC regarding setting project priorities and long-term planning. The EFEC would like to be informed earlier in the process when issues arise both at the office level and in the various EarthScope subcommittees.

  EarthScope Management Response: The Project Director would also like to see the EFEC engaged more in the overall activities of EarthScope and assume additional responsibilities across EarthScope elements. In response to this concern, the following procedures were developed and adopted by the EFEC on December 9, 2004:

  1) EFEC members will receive the agendas for both the Operations and EFEC Conference Calls, and EFEC members are strongly encouraged to join the Operations Conference Calls.
  2) Each EarthScope element has a designated representative on the ES-Ops: Charley Weiland for SAFOD, Shane Ingate for USArray, and Mike Jackson for PBO. As the designated “single point of contact” for the EarthScope Office, it is their responsibility to keep their respective EFEC members informed about the operations activities. If a single point of contact for the Operations Call can not make the call, it is his or her responsibility to appoint a substitute who in turn will assume the responsibilities.
  3) If any EFEC member finds that communication between the EFEC and their ES-Ops representatives does not occur, any EFEC member may request to begin the EFEC Conference Call with a summary of the previous Operations Call.
  4) The EFEC is invited and encouraged to appoint an EFEC representative to any of the EarthScope committees or working groups.
  5) Any EFEC member can request for any item to be added to the weekly conference call agendas at any time. EFEC members are encouraged to be the leader of the discussion of that agenda item.
  6) Abbreviated “minutes” of action items and decisions from the EFEC Conference Calls and the Operations Calls will be taken. The “minutes” will be posted on the management website and approved as part of the following meeting or conference call.

  In addition, the EFEC is now being briefed on all EarthScope meetings as part of the weekly conference calls, with minutes appended to the agenda whenever possible. The EarthScope Office has also requested that SAFOD, PBO, and USArray supply the EarthScope Office with the minutes and findings of their advisory panels and working groups so they may be posted on the EarthScope website and shared with the EFEC.

  An EarthScope Planning Committee is being developed which will include the chairs of the SAFOD, PBO, and USArray Advisory Committees. We anticipate that this Committee will provide a forum for EarthScope to move forward as a more integrated project and to improve communication across EarthScope elements in the area of long-term planning and priorities.

- **Concern:** The EFEC would also like to see the time during conference calls and quarterly meetings used in a more effective manner.

  EarthScope Management Response: The changes included in the previous response are meant to improve the effectiveness of the conference calls. The Quarterly Meetings were developed to review EarthScope status, undertake an annual site review, and to formally discuss, modify, and approve the Quarterly Reports submitted to NSF. As a result of the already demanding agenda for these meetings, there is little time for committee discussions outside the scope of their original intent. The Project Director recommends that if concerns can not be addressed in the weekly conference calls or the committee structures that are being developed, that the EFEC consider holding additional meetings devoted to general agenda items. In terms of the efficiency of the meetings, the site reviews are now being organized around specific questions submitted by EFEC members. In addition, each EarthScope element is now presenting their progress and concerns during the quarterly meetings.

- **Concern:** Regarding the EarthScope Portal, there has been a large amount of work done in defining the structure of the Portal, but it was done in the absence of a well-established framework for what the Portal is designed to achieve. There is a need for an extensive discussion of Portal goals with the EFEC.

  EarthScope Management Response: The EarthScope Portal(s) will be defined by the community through the submission of proposals to NSF and peer-review. The EarthScope Data Access Working Group, which includes data managers from each EarthScope element plus an EFEC representative, is charged with developing common data access capabilities that will be used by portal developers and scientists and educators who are interested in developing higher-order integrated data products and tools. This work is not dependent on any specific definition of portal goals.

- **Concern:** Regarding communication, we suggest the following recommendations: There is a need to more clearly define the charges of the various EarthScope subcommittees and the means by which these committees interact with the EFEC. There needs to be minutes taken and approved of the EFEC meetings (telecoms and quarterly meetings) documenting decisions made and insuring corporate memory.

  EarthScope Management Response: The role of each EarthScope committee and working group has been defined in the EarthScope O&M Proposal. An EFEC member will be invited to participate in each committee and working group. All minutes and recommendations will be presented to the EFEC and posted on the EarthScope website, including those committees that are contained within the individual EarthScope elements.

PBO

A review of the Plate Boundary Observatory was conducted by the EarthScope Facility Executive Committee (EFEC) as part of the Year 2-Quarter 1 meeting. The meeting was held at UNAVCO headquarters in Boulder, CO.

Statement of EFEC:

PBO has a highly effective management system with clear lines of authority and responsibility. The EFEC continues to be impressed with the development and the operation of the management structure developed under Mike Jackson and supported by Will Prescott. The delegation of responsibilities and the clear definition of goals have lead to an enthusiastic, energetic, and committed PBO team that has taken full ownership for the success of both the PBO program in specific and EarthScope in general. The EFEC once again commends both PBO and UNAVCO, Inc. for their effective program and for their overall commitment to the success of EarthScope.

PBO management has done an excellent job in developing a fully-populated management structure. The staff charged with executing their responsibilities now have experience in executing all aspects of their project – GPS, strainmeters, long-baseline strainmeters, permitting, and installation on public lands (BLM, NFS, etc.). As a result, they are better able to make accurate estimates of the efforts and feasibility of their installation plans.

Borehole Strainmeters

The global experience for installing PBO-type borehole strainmeters is highly limited and there is little precedent upon which to base cost estimates. The EFEC recognizes that borehole strainmeters are a high-risk undertaking, one that has been identified as high risk in both the EarthScope Proposal and EarthScope Project Execution Plan. The EFEC also recognizes that PBO has been updating their assessment of the risk as a concern in each of the Quarterly Reports. On the other hand, the scientific rationale for the deployment of these instruments on active faults may be stronger than previously thought, especially for detecting signals associated with aseismic slip events at depth.

The EFEC recognizes that operations and budget considerations require re-thinking the deployment plans for strainmeters on volcanoes. The PBO Standing Committee and Strainmeter Working Group have been installing strainmeters using a priority system based on scientific value. The EFEC supports this approach.

As strainmeters are deployed in Cascadia and more experience is gained about the value of these data, the relative importance of the strainmeters will become more clear. The EFEC confirms the need to continuously re-evaluate the needs to install strainmeters. In the meantime, changes in the schedule and cost of the deployment of the installation of strainmeters should continue to be accounted for as variances.

Strainmeter equipments costs have increased from $45,000 to $56,500. Preliminary experience has been that only three of the first five holes drilled were found suitable for strainmeter installation. To date, this success rate translates into approximately $95,000 per drilling cost per useable hole, compared to an original budget estimate of $40,000 per hole. The EFEC recommends that PBO review alternatives for the procedures associated with drilling, logging, and instrumentation of the holes for the borehole strainmeters. In particular, PBO should consider if logging would be adequate to evaluate the quality of the hole without undertaking the additional cost of coring.

The EFEC agrees that it is appropriate to evaluate the possible replacement of some borehole strainmeters in volcanic areas with tiltmeters. We encourage PBO to ask their advisory committees to evaluate the trade off between scientific return and operational advantages, and to inform the EFEC of their assessment.

Maintenance Goals

PBO maintenance goals are well-defined: scheduled maintenance is set to once every 3 years, and unscheduled maintenance is set to one-month response time, either in replacement or evaluation. Exceptions apply to Alaska and helicopter access stations. Expectation is 95% data return, 99% data product generation, and 100% data product archiving. EFEC approves these goals and considers them to be appropriate for the operations stage of EarthScope.

Synergy

EFEC appreciates the synergy between UNAVCO and IRIS data management systems, which are now serving as mutual backups.

The PBO management team deserves much of the credit for developing the overall EarthScope reporting/management system and for the skillful application of appropriate management tools to the special nature of EarthScope and the various reporting requirements of NSF. The EarthScope Office greatly appreciates the time and effort contributed to the overall EarthScope management system and in developing a reporting structure that meets all NSF requirements while minimizing the additional workload placed on the various elements of EarthScope.

To further improve synergy, the EFEC supports involving PBO personnel more in the general EarthScope activities such as EarthScope booth and Washington D.C. activities. The EFEC also supports further information exchange between PBO and USArray on installation plans.

Geospatial Applications to Station Siting

PBO is making sophisticated use of IAGT's Graphic Information Systems capabilities by integrating (among other things) landownership, communication coverage, and view-shed angle to horizon within the PBO siting tolerance buffers to refine locations for siting PBO stations. The use of IAGT's capabilities and the location of an IAGT

employee at PBO headquarters who is directly integrated in the stations siting and permitting operations represents an effective leveraging of NASA's contribution to EarthScope, estimated at considerable savings to EarthScope.

The EFEC encourages the continuation of this collaboration and the transition of IAGT capabilities from siting to other geospatial work once siting needs lessen. In particular, there is opportunity for collaboration between the geospatial display systems that will be developed for PBO program status and the geospatial display and access capabilities that are being developed at EarthScope Headquarters.

Program Status Reporting

The design and development of reporting systems within PBO to maintain station, communication, and data status information needs to be tightly coordinated with the EarthScope Senior IT Engineer and the EarthScope Senior Analyst. Otherwise, the lack of such coordination will lead to unnecessary duplication of effort and redundant reporting activities that will place needless additional burdens on field engineers and data managers.

Seamless Single Point Access

The EFEC greatly appreciates the efforts of the PBO Data Manager with the EarthScope Data Access Working Group. PBO has worked closely with the other elements of EarthScope to develop plans for the integration of all EarthScope data, identify areas of duplication and inefficiencies, and contribute to EarthScope's goal to improve overall data flow, data archiving, and achieve seamless data access.

Hosting of EarthScope Website and Server

UNAVCO, Inc. is generously hosting the EarthScope Office's web and e-mail server. The EarthScope Office, however, requests the development of a structure for improved coordination.

Education and Outreach

Through overhead, PBO supports the education and outreach efforts of UNAVCO. PBO personnel mentor students from underrepresented groups. UNAVCO has a policy of advertising positions to underrepresented groups. PBO has sited approximately 20 stations on native lands. The UNAVCO intern program, which contains diversity as a core value driving their program, will make use of PBO.

PBO Advisory Committee

At present, the PBO Standing Committee advises the UNAVCO, Inc. Board of Directors and has three meetings per year and monthly conference calls. PBO, however, is reminded that EarthScope relies on the advisory structures organized within the structure of the various elements for community input, oversight, and recommendation. PBO is reminded that the requirement of the Memorandum of Understanding (MOU) contractually formalized within the Cooperative Agreements III.2.b states:

> *Each of the EarthScope project components (USArray, SAFOD, and PBO) will appoint an advisory committee. The recommendations of these advisory committees will be transmitted both to the Principal Investigator of the respective EarthScope component and to the Project Director. The purpose of the advisory committees will be both to franchise the broader community and to bring ideas, suggestions, concerns, and criticisms from the broad EarthScope community to the attention of the Project Director and the EFEC. The Project Director and representatives of federal agencies or other organizations may be invited to participate as non-voting liaisons.*

The EFEC is concerned that this responsibility is not clearly recognized by either PBO nor the Advisory Committee. The EarthScope Office would like to formalize the advisory process by asking that minutes and recommendations of these meetings be formally kept and approved; and that such minutes and recommendations be transmitted to the EarthScope Project Director in a timely manner.

Change Control Process

PBO has pointed out that the threshold for approval of the change control system going to NSF may be too low ($250,000). The EFEC supports a re-evaluation of the Change Control Process.

Risks

Permitting continues to be a major hurdle for the installation of stations. In particular, the unexpected lack of cooperation on the part of BLM which is charging up to $8,500 per site to start the process as cost-recovery to expedite the issuance of permits on BLM lands. The de-centralized structure of BLM prohibits a single solution to this problem and requires considerable investment of both time and money. The EFEC recommends that the EarthScope Office approach the NSF Director's Office and explore agency-to-agency approaches to addressing this problem.

PBO Response:

The PBO Project Investigators appreciate the continued oversight and support of the EFEC. PBO management acknowledges and appreciates the positive comments regarding our highly effective management system, clear lines of authority and responsibility, effective Earned Value Management cost and schedule management structure, overall project synergy with respect to data management, and the feeling that the project is moving forward on schedule and budget in all components. We look forward to clear and straightforward recommendations from the EFEC on how PBO can better integrate our field operations programs with the USArray Transportable and Permanent Arrays; assistance in Washington at NSF and the Departments of Agriculture and Interior on reducing our permitting burden; guidance on borehole strainmeter implementation including tradeoffs between additional sensors or measurements requested by the Standing Committee and the impact on the overall budget and numbers of stations installed; and how the PBO project can better work with all components to yield a stronger and more integrated EarthScope project.

Borehole Strainmeters

PBO Management will continue to evaluate the cost implications associated with borehole instrumentation and installation and apprise the EFEC on issues of negative cost and schedule variance. Once approximately 15-20 systems are deployed, we will be better able to make forward budget predictions and thus estimate the total number of strainmeters that can be installed. We will continue to explore mechanisms to reduce costs, such as rotary drilling accompanied by logging rather than coring. We must however point out that given the heterogeneity of lithologies and lack of experience of PBO crews in interpreting logs, this could result in the installation of borehole strainmeters in less than scientifically ideal locations. We will continue to evaluate the tradeoff between scientific return and operational advantages of tiltmeters versus strainmeters on volcanoes. It must be noted that irrespective of these tradeoffs, PBO may not be able to install tiltmeters let alone strainmeters due to highly restrictive permitting processes on Fish and Wildlife, National Park, and Forest Service lands. We look to the EFEC for help in solving our long-term and potentially project limiting permitting problem.

Geospatial Applications to Station Siting

Our understanding is that IAGT committed to housing an employee at PBO for a 3-year period which ends in October 2006. We would be happy to utilize IAGT for other geospatial work once siting needs lessen. We encourage the EFEC to discuss with NASA and IAGT the extension of support through the construction phase and into the EarthScope O&M phase.

Program Status Reporting

PBO understands the need for a tightly coordinated effort between PBO development staff and the EarthScope Senior IT Engineer and Senior Analyst while maintaining our commitment to rapid system development for focused PBO construction and operations and maintenance support, and data and data products delivery to the broader EarthScope and focused geodetic community. Soon after the PBO site review, we hosted the EarthScope Senior IT Engineer for a discussion of development issues. We encourage continuing this dialogue with quarterly IT meetings with a development focus hosted at the IRIS Data Management Center, PBO Boulder, and EarthScope Headquarters.

Hosting of EarthScope Website and Server

PBO will continue to host the EarthScope Office's web and e-mail server as long as it does not unduly impact our existing staff. The PBO System Administrator is on call for EarthScope staff and we encourage the Headquarters Office to contact him as issues arise. We would encourage the EarthScope Office to partially fund a student intern at PBO to assist the PBO System Administrator and to act as a dedicated resource for EarthScope web and e-mail server issues.

PBO Advisory Committee

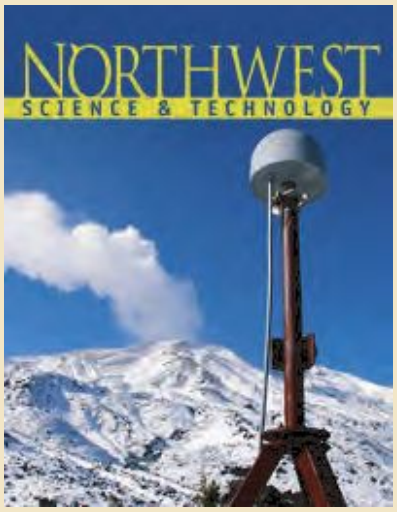
PBO Management understands the issue and the wording of the MOU. The EarthScope Project Director is invited to all Standing Committee meetings and conference calls, receives all Standing Committee notes and recommendations, and we now formally approve all committee notes and archive them in the PBO Document Management System. We assume the Project Director updates the EFEC members on critical issues.

Change Control Process

We look forward to the EFEC engaging the NSF Program Director on this issue and gaining approval to increase the threshold for approval of the change control system to greater than $250,000.

ACTIVITY DETAILS

The success of EarthScope requires strong involvement and outreach with the scientific community and the public. The mechanisms for community interfaces include: EarthScope publications; an EarthScope presence at professional meetings through talks, posters, and the EarthScope booth; listening sessions and workshops; a current, comprehensive, and authoritative website; and participation by the EarthScope Project Director in the meetings of the EarthScope Science and Education Committee.



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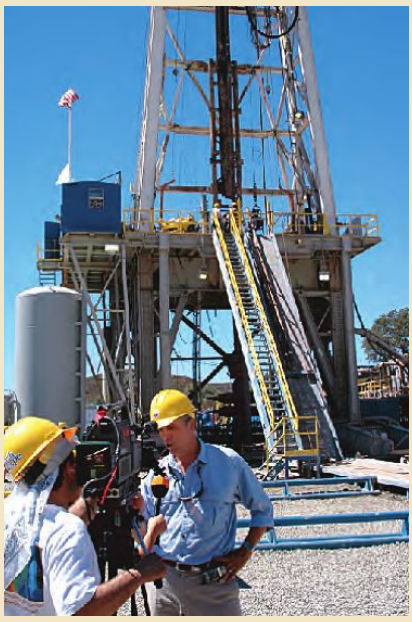

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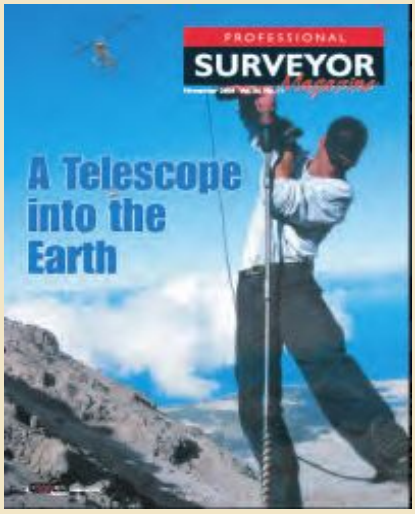

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Presentations and Talks:

- Southern California League of Surveyors at Riverside County Flood Control (Riverside, CA): "Southern California PBO San Simeon earthquake response: Current status in production goals". April 1, 2004. M. Jackson and C. Walls.
- California League of Surveyors Meeting (Las Vegas, NV): "PBO component of EarthScope project". April 5-6, 2004. C. Walls, B. Coyle, and G. Hilker.
- Urban and Regional Information Systems Association (Tukwila, WA): "Datums and projections: What you need to know by 2005". April 6, 2004. K. Hafner and P. Gray.
- Alaska Miner Association (Anchorage, AK): "Broad overview of PBO & PBO's plans for Alaska". April 14, 2004. B. Pauk.
- Seismological Society of America Annual Meeting (Palm Springs, CA):
  - "EarthScope in the western US: Current plans, goals and opportunities". April 15, 2004. G. van der Vink, and R. Smith.
  - "EarthScope and USArray - The first six months and the year ahead". April 15, 2004. S. Ingate, T. Ahern, R. Butler, J. Fowler, and J. Taber.
  - "The nature and promise of broad-band surface-wave measurements from the random wavefield". April 15, 2004. N. Shapiro, M. Campillo, and M. Ritzwoller.
  - "The proposed Southern California Imaging Project (SCIP): Targeting structure of the transverse ranges". April 15, 2004. G. Fuis, S. Baher, J. Murphy, V. Langenheim, K. Howard, R. Catchings, M.. Fisher, J. Matti, D. Okaya, T. Henyey, R. Clayton, P. Davis, C. Nicholson, and M. Oskin.
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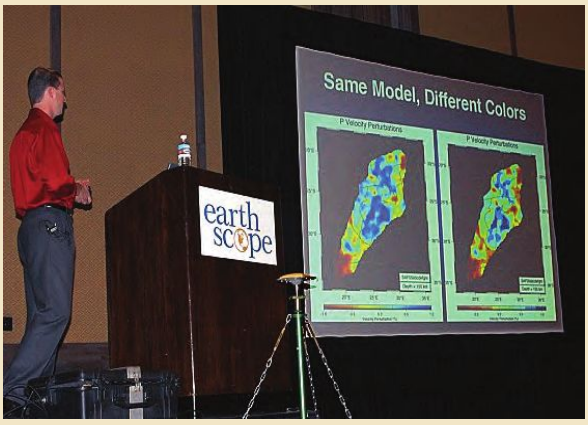
  - "Plate Boundary Observatory response to the December 22, 2003 M6.5 San Simeon earthquake". April 16, 2004. C. Walls, E. Arnitz, M. Jackson, K. Feaux, D. Mencin, S. Borenstein, B. Coyle, and T. Williams.
- Anchorage Arc Users Group (Anchorage, AK): "Broad overview of PBO & PBO's plans for Alaska". April 21, 2004. B. Pauk.
- SCIGN (Southern California Integrated Geodetic Network) Coordinating Board (Los Angeles, CA): "PBO response to the San Simeon earthquake and southern California status and production goals". April 26, 2004. C. Walls, G. Anderson, and F. Blume.
- Colfax County Commission (Angel Fire, NM): "The PBO component of EarthScope." May 3-4, 2004. D. Mencin.
- Geological Society of America Rocky Mountain and Cordilleran Joint Meeting (Boise, ID): "Exploring western North America with EarthScope: The best place to study plate boundary processes." May 5, 2004. R. Smith and G. van der Vink.
- Swiss Wrestling Society (Lebam, WA): "PBO activities – Pacific Northwest focus." May 12, 2004. K. Hafner. The purpose of the presentation was to gain approval for a permit to install a GPS monument at the proposed P416 location.
- The 2004 Joint Assembly of the American Geophysical Union, Canadian Geophysical Union, Society of Exploration Geophysicists, and Environmental and Engineering Geophysical Society Meetings (Montreal, Canada):
  - "Fault interactions and large complex earthquakes in the Los Angeles area." May 17, 2004. G. Anderson, B. Aagaard, and K. Hudnut.



M. Fouch teaching a mini-course on tomograms for non-seismologists at the EarthScope National Meeting.

  - "The Plate Boundary Observatory: Operational status and data plans." May 20, 2004. G. Anderson.
- Oregon GPS User's Group (Bend, Oregon): "PBO activities – Pacific Northwest focus." May 21, 2004. K. Hafner.
- IRIS Annual Meeting (Tucson, AZ):
  - "EarthScope underway: Progress, goals, and emerging opportunities." June 10-12, 2004. G. van der Vink, R. Smith, C. Hennet, and C. Meth.
  - "PBO: The toddler year." June 10-12, 2004. M. Jackson.
- Association of Certified Engineers and Surveyors Annual Meeting (Redmond, Oregon): "PBO activities in the Pacific Northwest." June 15, 2004. K. Hafner.
- NSF supported Center for Airborne Laser Mapping Steering Committee Meeting (St. Augustine, FL): "EarthScope and GeoEarthScope." June 16-18, 2004. G. Anderson.

M. Alvarez installing the STS-2 sensor in the Transportable Array site at Socorro, NM.

- GreatBREAK Workshop (Tahoe City, CA): "EarthScope underway: Progress, goals, and emerging opportunities." June 21, 2004. G. van der Vink and R. Smith.
- Digital Library for Earth Systems Education Annual Meeting (Madison, WI): "Voyager interactive web interface to EarthScope." July 10-13, 2004. L. Estey and S. Eriksson.
- 4-D Framework of the Continental Crust-Integrating Crustal Processes through Time (Oak Ridge, TN): "EarthScope underway: Progress, goals, and emerging opportunities." July 1, 2004. G. van der Vink and R. Smith.
- UNAVCO Board of Directors Meeting (Boulder, CO): "PBO summary Q3, 2004." July 22, 2004. M. Jackson.
- Mid-America Workshop (August 20, 2004: Memphis, TN): "Strategies for using EarthScope to advance Earth sciences in mid-America." G. van der Vink.
- ESRI (Environmental Systems Research Institute) International User Group Meeting (August 10, 2004; San Diego, CA.): "EarthScope and PBO: An opportunity for cooperation." K. Bohnenstiehl and T. Reynolds.
- Skamania County Board of Commissioners Meeting (August 17, 2004; Stevenson, WA): "Project PBO in Washington." K. Hafner.
- City of Delta, UT, City Council (August 19, 2004; Delta, UT): "Permitting for PBO in Utah." G. Hilker.
- Research Frontiers in Appalachian Geology and Tectonics: An EarthScope Perspective (Arlington, VA): "EarthScope underway: Progress, goals, and emerging opportunities." September 10, 2004. G. van der Vink.
- Southern California Earthquake Center Annual Meeting (Palm Springs, CA): "Plate Boundary Observatory: Operational status and data plans." September 19-20, 2004. G. Anderson and C. Walls.
- Continuously Operating Reference Station Users Forum at Civil GPS System Interface Committee Meeting (Long Beach, CA): "Plate Boundary Observatory: Operational status and data plans." September 21, 2004. G. Anderson.
- Southern California Earthquake Center Annual Meeting (Palm Springs, CA): "Update on the San Andreas Fault Observatory at Depth." September 22, 2004. W. Ellsworth.
- ConocoPhillips Fracture Colloquium (Calgary, AB): "Determination of the full stress tensor and application to assessment of fractured reservoirs and fault seal." October 4, 2004. M. Zoback.
- NSF Project Science Workshop (Aspen, CO): "EarthScope." October 6, 2004. G. van der Vink.
- PBO Standing Committee Meeting (Palo Alto, CA): "PBO Data Management System review." October 7-8, 2004. M. Jackson, G. Anderson, K. Bohnenstiehl, K. Feaux, and B. Stephanus.
- California Water Colloquium (Berkeley, CA): "Fluids and faulting: Water and earthquakes in California." October 12, 2004. M. Zoback.
- US-Japan Natural Resources Meeting on Earthquake Research (Asilommar, CA): "Preparing for the San Andreas Fault Observatory at Depth: Results from site characterization studies and the SAFOD Pilot Hole." October 14, 2004. S. Hickman, M. Zoback, and W. Ellsworth.
- US-Japan Natural Resources Meeting on Earthquake Research (Asilommar, CA): "SAFOD – Phase 1 status and looking ahead to Phases 2 and 3." October 14, 2004. M. Zoback, S. Hickman, and W. Ellsworth.

- UC Riverside Extension Spatial Reference Systems Seminar (Riverside, CA): "EarthScope Plate Boundary Observatory." October 21, 2004. W. Prescott.
- California Spatial Reference Center Coordinating Committee Fall Meeting (San Diego, CA): "PBO Year 1 in Review." October 22, 2004. M. Jackson and G. Anderson.
- California Spatial Reference Center Coordinating Committee Fall Meeting (San Diego, CA): "PBO GPS Data Management System." October 22, 2004. M. Jackson and G. Anderson.
- UNAVCO Board Meeting (Washington, DC): "PBO Year 1 review and plans for Year 2." October 27, 2004. M. Jackson.
- Global Seismic Network Standing Committee Backbone Working Group (Albuquerque NM): "Semi-annual ANSS status report." K. Anderson.
- USGS Western Earthquake Hazards Team Seminar (Menlo Park, CA): "The Plate Boundary Observatory: Purpose, progress, and plans." November 3, 2004. G. Anderson.
- Geological Society of America Annual Meeting (Denver, CO): "The Plate Boundary Observatory: Data management plans and status." November 7, 2004. G. Anderson, K. Feaux, M. Jackson, and W. Prescott.
- Geological Society of America Annual Meeting (Denver, CO): "PBO facility construction: Year 1 accomplishments." November 7, 2004. K. Feaux.
- Geological Society of America Annual Meeting (Denver, CO): Pre-EarthScope synthesis of the Rocky Mountains I and II: Surface processes, geodynamics, and the roles of neotectonics and climate in development of modern topography. November 7, 2004:
  - "EarthScope underway: Progress, goals, and emerging opportunities for the Rocky Mountains." G. van der Vink and R. Smith.
  - "4-D images of the lithosphere beneath the Rocky Mountains and challenges for understanding the evolution of continental lithosphere." K. Karlstrom and S. Whitmeyer.
  - "Geochronological and thermochronological constraints on proterozoic lithospheric evolution, southwestern United States." S. Bowring, R. Flowers, J. Crowley, B. Schoene, K. Karlstrom, and M. Williams.
  - "Current problems in basement-involved Laramide foreland deformation, Rocky Mountains, USA: 3D structural evolution and connections to plate processes." E. Erslev.
  - "Coupling between crustal flow and detachment tectonics during exhumation of the northern Cordilleran metamorphic core complexes." C. Teyssier, D. Whitney, S. Kruckenberg, E. Ferré, and O. Vanderhaeghe.
  - "Paleo-subduction and modern basalt extraction structures in the southern Rocky Mountains: Multi-band images from the CD-ROM experiment." A. Levander, M. Magnani, K. Dueker, and K. Miller.
  - "Surface wave tomography of the Yellowstone hotspot and Wyoming craton." D. Schutt and K. Dueker.
  - "Neogene faulting in Colorado's high plains." V. Matthews and M. Morgan.
  - "Determining paleoelevation of the Rocky Mountains and Colorado Plateau: A challenge for paleogeography." D. Sahagian.
  - "How high was the Cordillera? Eocene elevation of the North American Cordillera recorded in stable isotope composition of detachment mylonites." A. Mulch, C. Teyssier, P. Chamberlain, T. Vennemann, M. Cosca, and M. Wells.
  - "Laramide uplift, orographic precipitation, and basin-margin rainforests: An early Paleocene test case from the Colorado Front Range." K. Johnson, B. Ellis, R. Barclay, and M. Reynolds.

GPS station P532, a deep drilled-braced monument, located southeast of the Parkfield earthquake hypocenter.

- "Testing the impact of late Cenozoic rock uplift on the topography of the Rocky Mountains." C. Riihimaki, R. Anderson, and E. Safran.
- "Drainage integration as a first-order control on the erosional exhumation of the interior west — The example of the Green River and the Uinta Mountains." J. Pederson.
- "Gravity models of the Albuquerque Basin and Tularosa Basin in the Rio Grande Rift, New Mexico." C. Peterson and M. Roy.
- "Middle Tertiary buoyancy modification and its relationship to rock exhumation, cooling, and subsequent extension at the eastern margin of the Colorado Plateau." M. Roy, S. Kelley, F. Pazzaglia, and M. House.

STS-2HG ridged base plate experiment.

- Geological Society of America Annual Meeting (Denver, CO): Pre-EarthScope synthesis of the Rocky Mountains III: New advances in Laramide deformation and tectonics of Rocky Mountains. November 8, 2004:
  - "Laramide-style backthrusts and triangle zones in the U.S. Rockies and Sierras Pampeanas, Argentina." D. Lageson and C. Costa.
  - "Rift and grain (microjointing) in basement as thermally-triggered records of transient Laramide stress fields during unroffing of the middle Rocky Mountains." D. Wise.
  - "3-D characterization and analysis of fold-fracture relationships with application to Raplee Monocline, Utah." I. Mynatt and D. Pollard.
  - "The role of fractures in the structural interpretation of Sheep Mountain Anticline, Wyoming." N. Bellahsen, P. Fiore, and D. Pollard.
  - "Three-dimensional studies of oblique deformation within Laramide folds." J. Tétreault and C. Jones.
  - "Using close-range photogrammetry to analyze physical models of basement uplifts." M. Fischer.
  - "The structure of monoclinal folds resulting from variable amounts of oblique slip along basement-involved faults: Results of physical modeling." D. Keating and M. Fischer.
  - "Foreland basement involvement in sinistral transpression along the Lewis and Clark Shear Zone, Montana-Wyoming Rocky Mountains." J. Sears.
  - "Reconstructing the timing and structural evolution of the eastern Beartooth uplift using paleoseismites and synkinematic alluvial fans." K. Stewart, M. Bartholomew, and H. Ballantyne.
  - "Structural refinement of the northeastern corner of the Laramide Beartooth Uplift, Montana." M. Bartholomew and K. Stewart.
  - "Structural analysis of a Laramide-age, basement-involved, foreland fault zone, Rawlins Uplift, south-central Wyoming." A. Otteman and A. Snoke.
  - "Sedimentation and offset of the Picuris-Pecos Fault system of northern New Mexico constrains late Laramide models proposing significant right-lateral displacements." D. McDonald.
  - "Comparative stratigraphy of the Dakota sandstone across the Picuris-Pecos Fault system south of Lamy, New Mexico: Definitive evidence of Laramide strike-slip." S. Cather and S. Lucas.
  - "Limits to Laramide strike-slip displacements in the southern Rocky Mountains, USA: Implications of Precambrian pinning lines and Precambrian faulting on the Picuris-Pecos Fault." E. Erslev and S. Fankhauser.
  - "The continuous rock springs – Douglas Creek Uplift and a folding mechanism for large-scale control of Rocky Mountain Uplifts." B. Tikoff and S. Mederos.
- Geological Society of America Annual Meeting (Denver, CO): "Geochemical probing of continental dynamics." November 9, 2004. R. Rudnick.
- Geological Society of America Annual Meeting (Denver, CO): "Using internet map server technology to assist with the siting, permitting, and building of the Plate Boundary Observatory GPS network." November 9, 2004. K. Bohnenstiehl.

- Geological Society of America Annual Meeting (Denver, CO): "Opportunities and challenges for strong geoscience departments: Results of a national survey." November 9, 2004. R. Richardson and S. Beck.
- Geological Society of America Annual Meeting (Denver, CO): Pre-EarthScope synthesis of the Rocky Mountains V: New insights in basement tectonics, deep crustal structure and Precambrian tectonic evolution. November 9, 2004:
  - "Basement accretionary processes – precursor to the tectonic reactivation history of the Rockies and adjoining regions." M. Carlson.
  - "Tectonic heredity in the Grand Canyon and implications for Tibetan-scale Mesoproterozoic intra-continental deformation in the southwestern United States." G. Dumond, M. Williams, K. Mahan, K. Karlstrom, and M. Heizler.
  - "Metamorphic history of the upper Granite Gorge, Grand Canyon, Arizona, and implications for the significance of domain boundaries in the Yavapai/Mazatzal Orogen." K. Mahan, G. Dumond, M. Williams, M. Jercinovic, and K. Karlstrom.
  - "Adding "time" to the EarthScope image: Petrologic analysis, structural analysis, and monazite geochronology of the Proterozoic crust." M. Williams, M. Jercinovic, K. Karlstrom, K. Mahan, and G. Dumond.
  - "Progressive Proterozoic growth of southern Laurentia by magmatic stabilization of lithosphere." S. Whitmeyer and K. Karlstrom.
  - "New insights into the proterozoic evolution of the western margin of Laurentia and their tectonic implications." P. Mueller, D. Foster, D. Mogk, and J. Wooden.
  - "New U-Pb dates of syn-deformational minerals that directly date multiple tectonic events at 1.75 and 1.62 Ga along the Cheyenne Belt Suture Zone, southeastern Wyoming." D. Strickland, K. Chamberlain, and E. Duebendorfer.
  - "Structural and thermochronologic evidence for a ca. 1.6 Ga contractional event in southern Wyoming." E. Duebendorfer, K. Chamberlain, M. Heizler, and K. Harper.
  - "Brittle and plastic deformation in the Homestake Shear Zone, Colorado: Implications for deformation processes in the middle crust and the evolution of the Colorado mineral belt." C. Shaw and J. Allen.
  - "Circa 1.4 Ga penetrative deformation in the southern Wet Mountains, Colorado: Implications for Mesoproterozoic intracontinental tectonism across the southern Rocky Mountains." J. Jones, C. Siddoway, J. Connelly, G. Perkins, and O. Callahan.
  - "Aureole structure of 1.4 Ga plutons and their tectonic significance." R. Dean and C. Andronicos.
  - "The evolution of Laurentia as documented by $^{40}Ar/^{39}Ar$ thermochronology studies." M. Heizler, K. Karlstrom, C. Shaw, J. Timmons, and R. Sanders.
  - "Provenance and geochronology of mesoproterozoic sedimentary rocks from across the southwest United States revealed by $^{40}Ar/^{39}Ar$ dating of detrital muscovites." K. Fletcher, M. Heizler, K. Karlstrom, J. Timmons, L. Crossey, and J. Bloch.
  - "Basement exhumation, fault reactivation, and K-metasomatism in the southern Sangre de Cristo Range, New Mexico: $^{40}Ar/^{39}Ar$ insights into Neoproterozoic tectonism and crustal fluid flow." R. Sanders, E. Melis, M. Heizler, L. Goodwin, and K. Chamberlain.
- Geological Society of America Annual Meeting (Denver, CO): Pre-EarthScope synthesis of the Rocky Mountains IV (Posters). November 10, 2004.
  - "Tectonic implications of late Archean-early Proterozoic supracrustal rocks in the Gravelly Range, SW Montana." D. Mogk and P. Mueller.
  - "Paleoproterozoic suturing of the Wyoming Craton and Medicine Hat Block and its influence on Phanerozoic crustal evolution." J. Vogl, D. Foster, P. Mueller, and J. Wooden.

S. Roberts adjusts VSAT antenna at ANSS Backbone station near Dugway, UT.

- "Timing of Proterozoic thermal events in the Poudre Canyon, Colorado Front Range: Constraints from microprobe monazite U-Th-Pb dating." M. Hudson, R. Tracy, and P. Dahl.
- "Shear zone roots in the middle crust: The transition from partitioned deformation to penetrative ductile flow in the northern Wet Mountains, CO." T. Collins, C. Siddoway, J. Jones, and C. Tellio.
- "Insights on the kinematic evolution of the Ute Pass Fault Zone from investigation of mesoscopic brittle faults." E. Fay and C. Siddoway.
- "U-Pb zircon geochronology of Proterozoic granites of the Taylor River area, SW Sawatch Range, Gunnison County, central Colorado." S. Rogers, J. Connelly, J. Jones, and C. Rhea.
- "Re-Os systematics in Fe-Ti oxides from Proterozoic anorthosite complexes." N. Loeppke and J. Hannah.
- "Petrologic comparison of Precambrian rocks in the Las Vegas and Santa Fe areas, southern Sangre de Cristo Mountains, New Mexico." T. Evans and J. Lindline.
- "Geochronological evidence for Meso- and Neoproterozoic mafic magmatism along the western margin of the Wyoming Craton." S. Harlan, W. Premo, D. Unruh, L. Snee, and J. Geissman.
- "Cordilleran tectonics: The roles of lithoplate and mesoplate boundaries." R. Pilger

Operations and performance testing on borehole strainmeter in preparation for installation.

- "Alluvial architecture of a distal ancestral Rocky Mountains fluvial system, Permain Hermit Formation, Sedona, Arizona." E. Eastwood and R. Blakey.
- "The southern Oklahoma and Dniepr-Donets Aulacogens: A comparative analysis." R. Keller and R. Stephenson.
- "Late Paleozoic deformation of the Permain basin region and other parts of the Marathon-Ouachita Foreland." S. Dorobek.
- "Eustasy and tectonism in the ancestral Rocky Mountains, eastern Paradox Basin, CO." G. Lianniny.
- "Final movements associated with late ancestral Rockies deformation." M. Gilbert
- "Neogene development of the Pleasant Valley Graben (Howard, CO) based on the study of mesoscopic faults." R. Henderson and C. Siddoway.
- "Mantle source for CO^2-rich springs in the southwestern U.S.: Links between mantle tomography, neotectonics and water quality." D. Newell, L. Crossey, T. Fishher, K. Karlstrom, and M. Kennedy.

- Congressional Briefing (Washington, DC): "The Magnitude 6 Parkfield earthquake of September 28, 2004." November 17, 2001. M. Zoback.
- PBO Operations Meeting (Riverside, CA): "PBO Data Management System review." December 3, 2004. G. Anderson, E. Lee, E. Persson, and J. Wright.
- National Science Foundation (Arlington, VA): "EarthScope's first year — Progress made and lessons learned." December 9, 2004. G. van der Vink.
- Integrated Solid Earth Science Workshop (San Francisco, CA): "EarthScope update." December 12, 2004. G. van der Vink.
- Integrated Solid Earth Science Workshop (San Francisco, CA): "SAFOD – Phase 1 status and looking ahead to Phases 2 and 3." December 12, 2004. M. Zoback.
- International Continental Drilling Program, Assembly of Governors Meeting (San Francisco, CA): "SAFOD – Phase 1 status and looking ahead to Phases 2 and 3." December 12, 2004. M. Zoback.
- American Geophysical Union Fall Meeting (San Francisco, CA): SAFOD Site Characterization. December 13, 2004.
  - "Site characterization for the San Andreas Fault Observatory at Depth." S. Hickman, M. Zoback, and W. Ellsworth.

- "Seismic velocity structure from a refraction-reflection survey across the San Andreas Fault at SAFOD." J. Hole, T. Ryberg, A. Sharma, and G. Fuis.
- "SAFOD site characterization using the Pilot Hole seismic array." P. Malin, J. Chavarria, E. Shalev, and L. Walter.
- "Defining the SAFOD drilling trajectory: Locating the target earthquakes." C. Thurber, S. Roecker, and H. Zhang.
- "Multi-scale crustal seismic anisotropy in the region surrounding the San Andreas Fault near Parkfield, CA." N. Boness and M. Zoback.
- "Characterization of fault zone structure at the SAFOD site with magnetotelluric exploration." M. Unsworth, and P. Bedrosian.
- "Crustal structure across the San Andreas Fault at the SAFOD site, California, from gravity and magnetic studies." D. McPhee, J. Tilden, R. Jachens, and C. Wentworth.
- "Structure of the San Andreas fault zone and SAFOD drill site as revealed by surface geologic mapping and seismic profiling near Parkfield, California." M. Rymer, R. Catchings, M. Thayer, and J. Arrowsmith.

- American Geophysical Union Fall Meeting (San Francisco, CA): SAFOD site characterization II. December 13, 2004.
  - "Geologic structure of Middle Mountain within the San Andreas Fault Zone near Parkfield, California." M. Thayer, R. Arrowsmith, J. Young, A. Fayon, and M. Rymer.
  - "Paleoseismology and tectonic geomorphology: Results from the Parkfield, CA segment of the San Andreas Fault." N. Tok, J. Arrowsmith, C. Crosby, and J. Young.
  - "Microstrutural analyses of an exhumed part of the San Andreas Fault near the SAFOD site, California." J. Evans, M. Rymer, and D. Moore
  - "Parkfield Unified Visualization Project: A repository of geospatial data and portable toolset for its visualization." G. Wurman, J. Arrowsmith, and J. Conner.
  - "Structure, kinematics, and recurrence of microseismicity in the SAFOD target region." R. Uhrhammer, R. Nadeau, D. Dolenc, A. Michelini, and T. McEvilly.
  - "Scattered wavefield within the San Andreas Fault system, California." T. Taira, P. Silver, F. Niu, and R. Nadeau.
  - "A Search for temporal variations in the scattered wavefield associated with the 1993 Parkfield aseismic transient event: A calibration between borehole and surface instruments." X. Cheng, F. Niu, P. Silver, and R. Nadeau.
  - "Combined teleseismic and local earthquake tomography of the SAFOD drill site." J. Krajewski, S. Roecker, and C. Thurber.
  - "Controlled source P and S wave tomography at SAFOD." T. Ryberg, J. Hole, and G. Fuis.
  - "Depth-dependent low-velocity structure of the San Andreas Fault near the SAFOD drilling site at Parkfield from fault-zone seismic waves." M. Alvarez, Y. Li, J. Vidale, and E. Cochran.
  - "The drill bit seismic project at SAFOD." S. Taylor, C. Stolte, J. Haldorsen, B. Moyano, and P. Malin.
  - "High-resolution fault zone monitoring and imaging using long borehole arrays." B. Paulsson, M. Karrenbach, A. Goertz, and P. Milligan.
  - "Accurate measurement of P and S wave travel times under controlled laboratory conditions over long time scales." D. Loggia, D. Mainprice, P. Silver, and G. Bokelmann.

EarthScope GPS station at Canyon de Chelly National Monument on the Navajo Nation.

- "1348 airborne gravity gradiometer survey over the San Andreas Fault." M. Talwani.
- "Imaging the deep roots of the San Andreas Fault and the Dead Sea Fault with magnetotelluric measurements." O. Ritter, S. Park, P. Bedrosian, U. Weckmann, and M. Weber.
- "Determination of thermal properties at the SAFOD site through cross-hole temperature monitoring." C. Williams, F. Grubb, S. and Galanis.
- "Frictional heterogeneity and heat flow." M. d'Alessio, R. Burgmann, and C. Williams.
- "Rock deformability, brittle fracture, and strength criteria in and adjacent to the San Andreas Fault zone; applications to tectonic stress estimation." B. Haimson.
- "Dynamics of Chi-Chi earthquake rupture: Discovery from seismological modeling and Taiwan Chelungpu-fault drilling project (TCDP)." K. Ma, C. Wang, J. Hung, S. Song, H. Tanaka, E. Yeh, and Y. Tsai.
- "Preliminary summary of current fault zones in the hole-A of TCDP." E. Yeh, H. Sone, T. Nakaya, K. Ian, S. Song, and J. Hung.

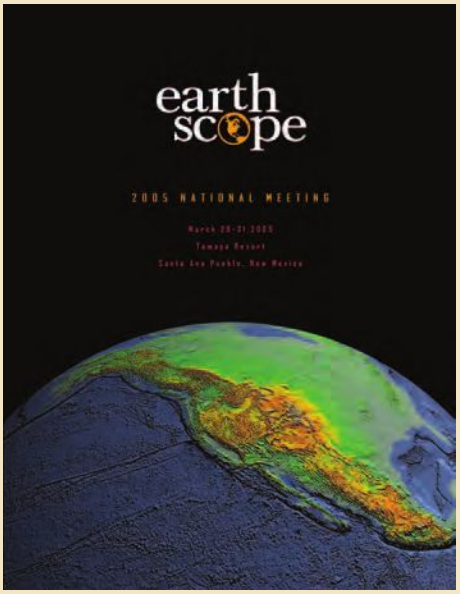
Mitigating against water intrusion at a Transportable Array station using a thick pond liner as a water barrier.

- American Geophysical Union Fall Meeting (San Francisco, CA). December 13, 2004.
  - "Low-velocity damaged structure on the San Andreas Fault at seismogenic depths near the SAFOD drilling site, Parkfield, CA from fault-zone trapped waves." Y. Li, E. Cochran, J. Vidale.
  - "High-resolution visualization of USArray data on a 50 megapixel display using OptIPuter Technologies." A. Nayak, F. Vernon, G. Kent, J. Orcutt, D. Kilb, R. Newman, L. Smarr, T. DeFanti, J. Leigh, L. Renambot, and A. Johnson.
  - "Voyager interactive web interface to EarthScope." S. Eriksson, C. Meertens, L. Estey, M. Weingroff, M. Hamburger, W. Holt, and G. Richard.
  - "Preliminary results of seismic refraction/reflection experiment in Northwestern Nevada and Northeastern California." J. Colgan, D. Lerch, E. Gashawbeza, C. Wilson, S. Klemperer, and E. Miller.
  - "Developing a methodology for measuring stress transients at seismogenic depth." P. Silver, F. Niu, T. Daley, and E. Majer.
  - "Development of nested modeling in the Modular Electromagnetic Modeling and Inversion Software (MEMIS) System: A new software tool for EarthScope." K. Tandon, G. Egbert, and W. Siripunvaraporn.
- American Geophysical Union Seismology Tectonics Luncheon (San Francisco, CA): "EarthScope: Current accomplishments and future challenges." December 14, 2004. G. van der Vink.
- American Geophysical Union Fall Meeting (San Francisco, CA). December 14, 2004.
  - "The Plate Boundary Observatory: Operational status and data plans." G. Anderson, K. Feaux, M. Jackson, W. Prescott, C. Stolte, and J. Wright.
  - "Isla Guadalupe, Mexico (GUAX, SCIGN/PBO) a relative constraint for California borderland and northern Gulf of California motions." J. Gonzalez-Garcia.
  - "PBO strainmeters: Distribution, design and data products." K. Hodgkinson, G. Anderson, M. Hasting, and B. Mueller.
  - "The PBO Nucleus: Integration of the existing continuous GPS networks in the western U.S." F. Blume, G. Anderson, J. Freymueller, T. Herring, T. Melbourne, M. Murray, W. Prescott, R. Smith, and B. Wernicke.
  - "Tensor strain seismograms: A new tool for earthquake science." M. Gladwin, and P. Malin.
- American Geophysical Union Fall Meeting (San Francisco, CA). December 15, 2004.
  - "The role of grid computing in the geosciences: Developing a 3D seismic waveform propagation tool for seismologists and EarthScope research." D. Seber, T. Kaiser, C. Youn, C. Santini, D. Greer, S. Larsen, and B. Glassley.

  - "Illumination assessment for the seismic-array, applications to the USArray project." X. Xie, R. Wu, and T. Lay.
  - "Teacher directed design: Content knowledge, pedagogy, and assessment under the Nevada K-12 Real-Time Seismic Network." P. Cantrell, J. Ewing-Taylor, K. Crippen, K. Smith, and C. Snelson.
  - "The Denali Earth Science Education Project." R. Hansen, J. Stachnik, J. Roush, K. Siemann, and I. Nixon.
- American Geophysical Union Fall Meeting (San Francisco, CA). December 16, 2004.
  - "Web-based data mining to systematically determine data quality from the EarthScope USArray seismic observatory project." R. Newman, K. Lindquist, T. Hansen, F. Vernon, J. Eakins, and S. Foley.
  - "Moving mountains and deep crustal earthquakes: Evidence for deep magma injection beneath Lake Tahoe, Nevada-California." G. Blewitt, K. Smith, and D. von Seggern.
- American Geophysical Union Fall Meeting (San Francisco, CA). December 17, 2004.
  - "The Campaign GPS Component of the Plate Boundary Observatory (PBO): New tools, new strategies and new opportunities to support EarthScope investigations." D. Phillips, J. Greenberg, J. Sklar, C. Meertens, V. Andreatta, and K. Feaux.
  - "The EarthScope Plate Boundary Observatory (PBO) response to the September 28, 2004 Parkfield earthquake." B. Coyle, E. Arnitz, A. Basset, G. Bawden, G. Anderson, K. Feaux, M. Jackson, W. Prescott, C. Walls, and T. Williams.
  - "High frequency recordings of the Parkfield M=6 and its aftershocks in the 1.1 km deep SAFOD Pilot Hole." P. Malin, E. Shalev, and A. Chavarria.
  - "Volcano-tectonic deformation at Mount Shasta and Medicine Lake volcanoes, northern California, from GPS: 1996-2004." M. Lisowski, M. Poland, D. Dzurisin, and S. Owen.
  - "USArray Array Network Facility (ANF): Metadata, network and data monitoring, and quality assurance during the first year of operations." J. Eakins, F. Vernon, V. Martynov, R. Newman, and S. Foley.
  - "The EarthScope Plate Boundary Observatory (PBO) response to Mt. St. Helens' 2004 volcanic crisis." S. Borenstein, G. Anderson, K. Bohnenstiehl, K. Feaux, B. Friesen, P. Gray, K. Hafner, G. Hilker, M. Jackson, M. Lisowski, D. Mencin, and E. Roeloffs.
- Magmatic Systems Siting Committee (Vancouver, WA): "Progress of the PBO." January 18, 2005. M. Jackson, K. Hafner, B. Coyle, T. Corbett, C. Walls, and S. Borenstein.
- Annual PANGA meeting (Vancouver, WA): "Status of PBO/PNW activities." January 20-21, 2005. K. Hafner.
- Annual Pacific Northwest Geodetic Array Meeting (Vancouver, WA): "Status of EarthScope." January 20-21, 2005. W. Prescott.
- Consortium of Universities for the Advancement of Hydrologic Science, Inc (teleconference with internet presentation): "UNAVCO, EarthScope, and hydrology." January 25, 2005. W. Prescott.
- Gifford Pinchot Forest Service (Troutdale, WA): "Proposed PBO GPS, tiltmeter, and strainmeter installations." February 2, 2005. K. Hafner, D. Miller, and K. MacKinnon.
- PBO Extension Working Group Meeting (Tucson, AZ): "Progress of PBO in the Rocky Mountain and Basin & Range regions." February 3, 2005. S. Borenstein and B. Friesen.
- Sandia National Laboratory Distinguished Lecture Series (Albuquerque, NM): "Testing fundamental theories of earthquakes and faulting: The San Andreas Observatory at Depth." February 9, 2005. M. Zoback.
- City of Willits Airport Commissioners (Willits, CA): "PBO GPS stations in Northern California." February 15, 2005. T. Williams.
- Elma School Board Facilities Group (Elma, WA): "PBO in the Pacific Northwest." February 16, 2005. K. Hafner.

Approximate location of ANSS Backbone station in the Konza Prairie Reserve in KS.

- Humboldt Chapter of the California Land Surveyors Association (Eureka, CA): "PBO GPS stations in Northern California." February 16, 2005. T. Williams.
- Oregon GPS User Group Workshop (Vancouver, WA): "Plate Boundary Observatory component of the EarthScope project." February 18, 2005. K. Hafner.
- International Ocean Drilling Program Board of Directors (Washington, DC): "Testing fundamental theories of earthquakes and faulting: The San Andreas Observatory at Depth." February 18, 2005. M. Zoback.
- PBO Transform Siting Committee Meeting (Sacramento, CA): "Progress of PBO in Northern and Southern California and Alaska." February 18, 2005. B. Coyle, C. Walls, and T. Corbett.
- USGS Geologic Hazards Team Seminar (Golden, CO): "The Plate Boundary Observatory: Purpose, progress, and plans." February 24, 2005. G. Anderson.
- Alaska Survey and Mapping Conference Technical Meeting (Anchorage, AK): "The PBO project in Alaska." February 25, 2005. B. Pauk.
- Pit River Tribal Council Meeting (Burney, CA): "Proposal to host EarthScope/PBO GPS stations." March 8, 2005. B. Coyle, K. Bohnenstiehl, and E. Itswabo.
- US Geological Survey (Menlo Park, CA): "Multi-scale crustal seismic anisotropy in the crust surrounding the SAFOD drill site near Parkfield, CA." March 15, 2005. N. Boness.



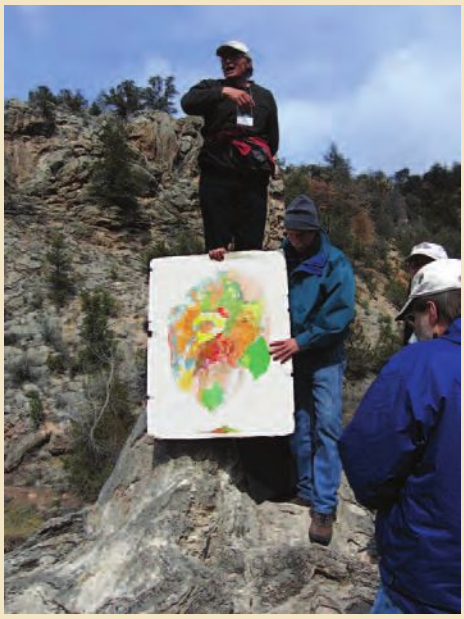
EarthScope National Meeting program book cover.

- Adeleide Farm Community Meeting (Adeleide, CA): "PBO on the San Simeon and Parkfield earthquakes." March 18, 2005. C. Walls.
- International Continental Drilling Program Association of Governors (Potsdam, Germany): "Testing fundamental theories of earthquakes and faulting: The San Andreas Observatory at Depth." March 29, 2005. M. Zoback.
- International Continental Drilling Program Association of Governors (Potsdam, Germany): "Seismic velocity anisotropy in the crust surrounding the San Andreas Fault near Parkfield, California: Observations from the SAFOD borehole." March 30, 2005. N. Boness.
- EarthScope National Meeting (Santa Ana, NM; March 29-31, 2005):
  - "Imaging subduction with EarthScope." G. Abers.
  - "The management of USArray data and the EarthScope IDAS system." T. Ahern, C. Trabant, and L. Kamb.
  - "USArray Transportable Array installations; from concept to practice." M. Alvarez, J. Fowler, R. Busby, and B. Beaudoin.
  - "The Plate Boundary Observatory: Data management status and plans." G. Anderson, K. Hodgkinson, M. Jackson, E. Lee, E. Persson, W. Prescott, and J. Wright.
  - "InSAR Working Group report: Education and outreach." J. Andrews.
  - "Characterization of continental mantel in an active rift zone: Kilbourne Hole, New Mexico." E. Anthony.
  - "Integrated studies of fault zone structure and earthquake geology along the San Andreas Fault at Parkfield." R. Arrowsmith, Members ASU Team, and M. Rymer.
  - "Geophysical constraints on compositional variations in the continental upper mantle." I. Artemieva.
  - "Increasing Geoscience literacy and public support for the EarthScope national science initiative: Museum exhibits, educational programming, and public outreach." J. Aubele.
  - "Moho topography and lower crustal density in southern Ontario from linearized gravity inversion." C. Bank, D. Eaton, and K. Aktas.
  - "BACKPAC: BAsin & range–Cascade–Klamath–PACific geoscience transect – The accreted crustal section." C. Barnes, H. Gurrola, R. Keller, and A. Snoke.
  - "EarthScope interpretive environment: Designing portals for scientific research and education." C. Baru, R. Arrowsmith, R. Keller, and D. Seber.

- "Using InSAR in the Plate Boundary Observatory site selection process." G. Bawden, C. Walls, and B. Coyle.
- "The USArray Array Operations Facility at the PASSCAL Instrument Center, New Mexico Tech." B. Beaudoin, R. Aster, J. Fowler, and M. Alvarez.
- "The Sierras Pampeanas of Argentina: A modern analog for the Laramide Rocky Mountains in the western U.S." S. Beck, H. Gilbert, L. Wagner, and P. Alvarado.
- "Imaging upper mantle structure beneath the Illinois Basin." H. Bedle and S. van der Lee.
- "Seismic anisotropy and flow across continental North America." M. Behn, C. Conrad, and P. Silver.
- "SCEC communication, education, and outreach 'frameworks.'" M. Benthien.
- "Seismic reflection/refraction-imaging at the San Andreas Fault." F. Bleibinhaus, J. Hole, and T. Ryberg.
- "Workshops for establishing a Stable North American Reference Frame (SNARF) to enable geophysical and geodetic studies with EarthScope: Annual report 2004-2005." G. Blewitt and SNARF Working Group.
- "PBO Nucleus: Support for an integrated existing geodetic network in the western U.S." F. Blume and W. Prescott.
- "Why very high rate (10-50 Hz) GPS data is useful for EarthScope." Y. Bock and J. Genrich.
- "EarthScope science for mid-America: Onward!" P. Bodin, M. Withers, J. Gomberg, C. Langston, C. Powell, and G. Patterson.
- "Plate Boundary Observatory GPS and strainmeter site permitting update, obstacles, and plans for Years 2-5 of network buildout." K. Bohnenstiehl.
- "Understanding physical properties and seismic anisotropy in the crust adjacent to the San Andreas Fault using observations from SAFOD." N. Boness and M. Zoback.
- "New insights into lithospheric evolution by linking lower crustal and mantle xenolith records with surface exposures." S. Bowring, R. Flowers, J. Crowley, B. Schoene, M. Williams, and K. Karlstrom.
- "Signals from the Earth's deep plumbing." K. Brown, M. Tryon, S. Schwartz, and D. LeRoy.
- "Seismic bright spots, magmatism, and fluids in the deep crust." L. Brown and L. Cathles.
- "The continental U.S., secular variation in metamorphic regimes and EarthScope." M. Brown.
- "Investigation of crustal structure in the New Madrid seismic zone using industry reflection data." S. Browning, C. Langston, and R. Van Arsdale.
- "A pilot study of continental lithosphere beneath the New Madrid seismic zone with a broadband seismic array." M. Brudzinski, W. Chen, and C. Thurber.
- "Towards a community fault model for the Great Basin." R. Bruhn.
- "USArray: Preparing Arizona for Bigfoot's deployment." N. Bueno, S. Semken, and M. Fouch.
- "Tertiary to quaternary history of the central Sierran frontal fault system." C. Busby, D. Rood, and S. DeOreo.
- "Contemporary tectonic motion of the Eastern Snake River Plain, Idaho: A campaign GPS study, 1995-2004." J. Chadwick, S. Payne, D. Rodgers, and T. Van Hove.
- "1.60 Ga megashear and remnant ocean basins: Redrawing the basement map of the western U.S." K. Chamberlain and E. Duebendorfer.
- "Postseismic and interseismic deformation of large normal-faulting earthquakes in the Basin-Range." W. Chang, and R. Smith.
- "Looking deeper into the landscape: Topography and tectonic inheritance in the western U.S." D. Coblentz and A. Sussman.

Pre-meeting activities at the EarthScope National Meeting included eight workshops.

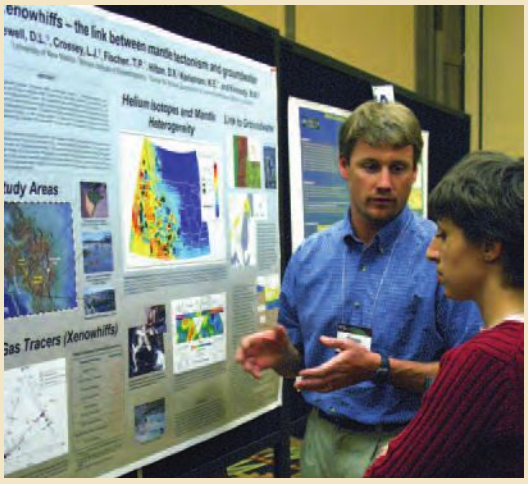
- "The EarthScope Plate Boundary Observatory (PBO) response to the September 28, 2004 Parkfield earthquake." B. Coyle, T. Williams, A. Basset, and E. Arnitz.
- "Quaternary travertine-depositing systems: A geologic record of mantle degassing." L. Crossey, K. Karlstrom, D. Newell, T. Fischer, D. Hilton, and P. Patchett.
- "Automated EarthScope Receiver Surveying (EARS): A prototype for USArray data product generation." P. Crotwell and T. Owens.
- "Frictional strength heterogeneity and surface heat flow; implications for the strength of the creeping San Andreas Fault." M. d'Alessio, C. Williams, and R. Bürgmann.
- "Transient crustal motion in the Northern Basin and Range from GPS." J. Davis, B. Wernicke, S. Bisnath, and P. Elosegui.
- "Scaling properties and mechanisms of stress heterogeneity in the San Andreas Fault Observatory at Depth (SAFOD), Parkfield, California." A. Day-Lewis, M. Zoback, and S. Hickman.
- "Observational strategies related to EarthScope for an InSAR mission." A. Donnellan.
- "Recent observations of episodic tremor and slip along the Northern Cascadia margin." H. Dragert, H. Kao, and G. Rogers.



K. Karlstrom leading the EarthScope National Meeting field trip to the Jemez Mountains.

- "Filling the North American Proterozoic tectonic gap: Structural and thermochronological evidence for ca. 1.6 Ga deformation and orogenesis in southern Wyoming, U.S." E. Duebendorfer, K. Chamberlain, M. Heizler, and K. Harper.
- "ELF/ULF magnetic field monitoring of the California fault system." C. Dunson.
- "Incorporating Plate Boundary Observatory and other EarthScope data products in broader objectives for Geoscience education and outreach: 2005 Activities." S. Eriksson and G. Anderson.
- "Composition of rocks near and within the San Andreas Fault zone as determined from SAFOD Pilot Hole mineralogy and analysis of exhumed parts of the San Andreas Fault." J. Evans, M. Rymer, D. Moore, and S. Hickman.
- "Imaging the b-value distribution beneath the Yellowstone hydrothermal system." J. Farrell, S. Husen, and R. Smith.
- "PBO facility construction: GPS network status." K. Feaux, M. Jackson, G. Anderson, and D. Mencin.
- "Paleomagnetic and rock magnetic record of transient co-seismic electric currents in fault-rocks." E. Ferre and J. Geissman.
- "SAR interferometry of the 2004 Parkfield Earthquake zone: Using WInSAR Envisat and Radarsat data to measure co-seismic and post-seismic deformation." E. Fielding, I. Johanson, and R. Bürgmann.
- "EarthScope possibilities for understanding lithospheric processes in eastern North America." K. Fischer, A. Li, M. Wysession, and K. Sinha.
- "EarthScope workshop for the northern Rocky Mountains." D. Foster, P. Mueller, and D. Mogk.
- "Crust and uppermost mantle structure beneath the southern Basin and Range/Colorado Plateau: Results from the COARSE broadband seismometer array and goals for regional USArray studies." M. Fouch, H. Gilbert, G. Zandt, S. Beck, A. Frassetto, J. Yoburn, T. Owens, and E. Garnero.
- "Stratigraphy of the Arizona lithosphere and evidence of remnant partial melt beneath the Colorado Plateau: Project COARSE." A. Frassetto, H. Gilbert, G. Zandt, and M. Fouch.
- "A transect across Alaska, from Pacific to Arctic margins." G. Fuis, T. Brocher, G. Plafker, T. Moore, M. Fisher, W. Nokleberg, R. Page, and N. Christensen.
- "Fluid overpressures on the San Andreas Fault following the passage of the Mendocino Triple Junction." P. Fulton, D. Saffer, and B. Bekins.

- "Mapping upper-mantle anisotropy in western U.S.: Constraints on crust-mantle coupling." J. Gaherty, L. Zhao, and M. Roy.
- "Two-dimensional numerical modeling suggests that there is a preferred geometry of intersecting faults that favors intraplate earthquakes." A. Gangopadhyay and P. Talwani.
- "Poroelastic response in a marine sediment-hosted fault zone: Implications for stress dhange detection using seismic velocities." G. Gettemy and H. Tobin.
- "Preservation of Proterozoic terranes within the Colorado Plateau: A source of strength?" H. Gilbert, A. Velasco, and G. Zandt.
- "USMX and YESX: Continuation of United States's PBO into Mexico's mainland." J. Gonzalez-Garcia, R. Bennett, K. Hudnut, and C. Walls.
- "InSAR deformation map of the western Basin and Range." N. Gourmelen and F. Amelung.
- "Plan for a national volcano early warning system." M. Guffanti, J. Ewert, T. Murray, and J. Quick.
- "Reporting and presentation of EarthScope facilities information on EarthScope website." C. Guillemot.
- "Computational infrastructure for Geodynamics (CIG)." M. Gurnis.
- "Southern Laurentia – EarthScope investigation (SOEASI)." H. Gurrola, C. Barnes, R. Keller, and K. Miller.
- "Development and evolution of Y shears in simulated granite gouge." J. Hadizadeh, D. Goldsby, A. Konkachbaev, and T. Tullis.
- "GPS installation progress in the Pacific Northwest Region of the Plate Boundary Observatory." K. Hafner, P. Gray, A. Diefenbach, and K. Austin.
- "An interactive map tool for EarthScope education and outreach." M. Hamburger, A. Hereford, L. Estey, S. Eriksson, C. Meertens, M. Weingroff, W. Holt, and G. Richard.
- "Understanding northwest Basin and Range tectonics, from the northern Walker Lane to the central Nevada seismic belt, using EarthScope data." W. Hammond, C. Kreemer, and G. Blewitt.
- "Collaborative research: St. Eilias Erosional/Tectonics Project (STEEP)." R. Hansen, G. Pavlis, and N. Ratchkovski.
- "Thermal processes and EarthScope science." R. Harris, K. Furlong, C. Williams, and D. Saffer.
- "Thermal isostasy and the elevation of North America." D. Hasterok, D. Chapman, and R. Harris.
- "PBO facility construction: Borehole strainmeter network status." M. Hasting, B. Mueller, W. Johnson, and P. Gibicar.
- "Lithospheric structure of eastern North America: Unique EarthScope opportunities." B. Hatcher, W. Thomas, and K. Sinha.
- "EarthScope data generation and data flow." C. Hennet, T. Ahern, G. Anderson, W. Ellsworth, S. Eriksson, C. Guillemot, F. Pieper, J. Taber, C. Weiland.
- "The EarthScope Integrated Data Access System." C. Hennet, T. Ahern, G. Anderson, W. Ellsworth, S. Eriksson, C. Guillemot, F. Pieper, J. Taber, C. Weiland.
- "UAVSAR: An airborne SAR for differential radar interferometry." S. Hensley, P. Rosen, K. Wheeler, and H. Zebker.
- "Complementary Geophysics: Adding value to EarthScope science." T. Henyey.
- "Exploring our dynamic continent: Educational materials in support of the EarthScope Voyager map tools." A. Hereford, M. Hamburger, L. Estey, S. Eriksson, C. Meertens, M. Weingroff, W. Holt, and G. Richard.
- "The value of modern detrital samples for reconnaissance regional thermochronometry." K. Hodges.



Poster session at the EarthScope National Meeting.

- "PBO strainmeters on the Olympic Peninsula, installation and data products." K. Hodgkinson, G. Anderson, M. Hastings, and B. Mueller.
- "Stable Interior - Northern U.S. (SINUS) Region: Scoping out an EarthScope opportunity. D. Holm, V. Chandler, W. Cannon, D. Schneider." W. Van Schmus, J. Miller, and SINUS Working Group.
- "Finite strain movies in the Plate Boundary Zone of the western United States: A visualization tool for education and research." W. Holt, B. Birkes, and G. Richard.
- "A new method for measuring deformation in non-urban settings using InSAR persistent scatterers." A. Hooper, H. Zebker, P. Segall, and K. Bert.
- "Coseismic slip distribution of the 2002 M_w 7.9 Denali fault earthquake." S. Hreinsdottir, J. Freymueller, and R. Bürgmann.
- "USArray and the Great Plains: Summary of a pre-EarthScope workshop." M. Hubbard, S. Gao, K. Liu, J. Oviatt and K. Nicolaysen.
- "Extensional styles: Importance of evolving strength of the lithosphere and thermal structure." A. Huerta.
- "Delamination origin for Columbia River flood basalts and Wallowa Mountain uplift in NE Oregon." E. Humphreys.

G. van der Vink (left) receives tour of EarthScope drill site from L. Capuano (right).

- "USArray – Construction of a large seismological research facility." S. Ingate, T. Ahern, M. Alvarez, and K. Anderson.
- "Seasonal fariations in GPS site positions in a center of lateral figure (CL) reference frame." D. Johnson.
- "An integrative seismological and geodynamical approach to assess the mechanism underlying the Yellowstone Hotspot." M. Jordan, R. Smith, and Yellowstone Hotspot Team.
- "The North American upper mantle: Density, composition, and evolution." M. Kaban and W. Mooney.
- "Opportunities and challenges for EarthScope-leveraged 3D super-experiments to resolve the nature of mantle velocity domains and the heterogeneous structure and polyphase evolution of the continental lithosphere: Case study from the southern Rocky Mountains." K. Karlstrom and R. Aster.
- "Synergy between active and passive seismic techniques in integrated studies of lithospheric structure." R. Keller and A. Velasco.
- "Elevated regional heat flow during late Oligocene time on the southern high plains." S. Kelley.
- "Visualizing EarthScope data for all stakeholders." M. Kelly.
- "Seeing is believing: 3D interactive visualization tools that include the juxtaposition of multivariate data." D. Kilb, G. Kent, and A. Nayak.
- "Strategies for estimating coseismic displacements with GPS: Test cases from the southern California integrated GPS network." N. King, K. Stark, and D. Barseghian.
- "SAFOD-3D: A community initiative for 3D seismic reflection imaging of the San Andreas Fault: Report of a workshop at the EarthScope National Meeting." S. Klemperer, J. Hole, B. Biondi, and I. Matthias.
- "A new look at some old friends: A workshop to focus on the greater ancestral Rocky Mountains." C. Kluth, G. Soreghan, and R. Keller.
- "Preliminary analysis of data from the PASO TRES deployment: New wavespeed models and earthquake locations near SAFOD." J. Krajewski, S. Roecker, C. Thurber, and L. Powell.
- "A pre-PBO strain rate model for the Great Basin." C. Kreemer, W. Hammond, and G. Blewitt.
- "Seismic reflection crustal structure and 3D deometry of cordilleran metamorphic core complexes in southeast and West-central Arizona." J. Kruger, R. Johnson, J. Faulds, and S. Reynolds.
- "NASA's activities in support of the developing EarthScope program." J. LaBrecque and C. Dobson.

- "The science of intraplate earthquakes." C. Langston.
- "The increasing costs of natural disasters." R. Lease, L. Newman-Wise, M. Prat, and A. Prescott.
- "Trace-element evidence for hydrous metasomatism of North American lithosphere by the Farallon Slab." C. Lee.
- "Velocity model from the 2004 Stanford University seismic experiment: A 260 km refraction/reflection/ teleseismic survey in the northwestern Basin and Range." D. Lerch, S. Klemperer, E. Miller, and J. Colgan.
- "Images of the upper mantle: A cratonic root, a subducting slab, and basalt extraction structures." A. Levander, F. Niu, S. Ham, and M. Magnani.
- "USArray siting outreach and public access to data." G. Levy, J. Taber, and R. Welti.
- "A shallow low velocity zone beneath old continental lithosphere in southern Africa." A. Li and K. Burke.
- "Spatio-temporal characterization of damaged zone on the San Andreas Fault near the SAFOD drilling site, Parkfield from fault-zone trapped waves." Y. Li and J. Vidale.
- "The 2004-2005 eruption of Mount St. Helens, WA." M. Lisowski, M. Poland, D. Dzurisin, and R. LaHusen.
- "What is a "good" model? A comparison of regularization methods with examples using InSAR data." R. Lohman and M. Simons.
- "Towards a Geophysical investigation of Rio Grande Rift Extension." A. Lowry, A. Sheehan, M. Roy, and S. Nerem.
- "InSAR studies of Alaskan volcanoes." Z. Lu, C. Wicks, D. Dzurisin, and J. Power.
- "InSAR time series analysis of surface deformation for the metropolitan Los Angeles and San Francisco, California, areas." P. Lundgren, R. Lanari, M. Manzo, and F. Casu.
- "Dating sinter deposits in Dixie Valley, Nevada: A record of hot spring-fault interaction in the Great Basin." S. Lutz and S. Caskey.
- "EarthScope and National Park Service – Partners in education and outreach." L. Lutz-Ryan, J. Geniac, and P. Zichterman.
- "Computational infrastructure for Geophysical simulations – Building an EarthScope community modeling environment." P. Maechling, T. Jordan, and B. Minster.
- "Seismic and geomorphic evidences for rejuvenation of topography in the southern Rocky Mountains." M. Magnani, F. Pazzaglia, A. Levander, and M. Roy.
- "Secure Earth: A national cross-cutting initiative for the Geosciences." E. Majer, B. Bodvarsson, R. Colwell, and P. Long.
- "High-resolution 3D anisotropic structure of the North American upper mantle from inversion of body and surface waveform data." F. Marone and B. Romanowicz.
- "Resolving multiple simultaneous and continuous deep tremor sources using three small aperture seismic arrays." W. McCausland and S. Malone.
- "Principles of GPS and GPS-determined velocity fields for the non-geodesist – and a peek at the latest gear." C. Meertens, F. Blume, and M. Jackson.
- "Deformation in the western Salton Trough during 1992-2000 as observed by InSAR." R. Mellors and A. Van Zandt.
- "The PBO data communications network." D. Mencin, J. Wright, E. Persson, and G. Anderson.
- "L_g coda Q and the evolution of continents: New results for Eurasia." B. Mitchell and L. Cong.
- "Analysis of seismic data from the northern San Francisco Bay area." W. Mooney, M. Coble, S. Detweiler, and J. Fletcher.

The EarthScope PBO Transform Working Group met in Sacramento, CA on February 18, 2005.

- "Precambrian evolution of the northern Rocky Mountains: From Precambrian evolution of the northern Rocky Mountains: From Laurentia to North America." P. Mueller, D. Foster, D. Mogk, and J. Wooden.
- "Slip on the San Andreas Fault at Parkfield, CA through two earthquake cycles." J. Murray, J. Langbein, R. Simpson, and P. Segall.
- "Tomography of the North American upper mantle using global and regional datasets." M. Nettles and A. Dziewonski.
- "Xenowhiffs – The link between mantle tectonism and groundwater." D. Newell, L. Crossey, T. Fischer, D. Hilton, K. Karlstrom, and B. Kennedy.

Reconnaissance activity on Akutan, a stratovolcano in the Aleutian Chain of Alaska.

- "Temporal variations in the scattered wavefield associated with the 1993 Parkfield aseismic transient event: A comparison between borehole and surface instruments." F. Niu, X. Cheng, P. Silver, and R. Nadeau.
- "Finite frequency sensitivity in crustal environments." G. Nolet, S. Gautier, and J. Virieux.
- "The role of crustal anisotropy in the development of transtensional strain partitioning in the western Great Basin." J. Oldow.
- "Access to USArray data for education and public outreach." T. Owens and P. Crotwell.
- "Persistence of relief and erosion on the eastern passive margin." M. Pavich, J. Reuter, and P. Bierman.
- "Fundamental principles of seismic imaging with the USArray." G. Pavlis.
- "Detection of energy emission by micro-events." R. Phinney and M. Cromwell.
- "EarthScope Spatial Data Explorer." F. Pieper.
- "Central Utah's ancestral continental margin manifests shallow, complex geology conducive to previously unknown world-class petroleum reserves resulting in what may become the most scrutinized ancient continental margin in the world." M. Pinnell and F. Moulton.
- "A physical model of the western U.S. strain rate field." F. Pollitz and M. Vergnolle.
- "Anomalous V_p/V_s ratios and intraplate seismicity: An important target for USArray?" C. Powell, M. Withers, and G. Vlahovic.
- "Detecting magma reservoirs: What should we expect based on magmatic timescales?" M. Reid.
- "Borehole recordings of fluid pressure, strain, and microearthquakes at Long Valley Caldera, California, following the September, 2004, Adobe Hills earthquake swarm and the December 26, 2004, M9.0 Sumatra earthquake." E. Roeloffs, J. Chavarria, and C. Farrar.
- "Using USArray to study the spatial and temporal distribution of sources of the Earth's hum." B. Romanowicz, and J. Rhie.
- "Assembling virtual California." J. Rundle, P. Rundle, M. Gleb, and A. Donnellan.
- "Scattered wave imaging of the lithosphere and the asthenosphere beneath eastern North America." C. Rychert, K. Fischer, and S. Rondenay.
- "Structure of the San Andreas Fault zone in the vicinity of SAFOD – Evidence from surface geologic mapping and seismic profiling." M. Rymer and R. Catchings.
- "Heat flow data as an indicator of fault strength: Insights from a hydrologic perspective." D. Saffer, P. Fulton, and B. Bekins.
- "Strain accumulation across the central San Andreas Fault: Impact of laterally varying crustal properties." G. Schmalzle, T. Dixon, R. Malservisi, and R. Govers.

- "The role of supplementary data sets in EarthScope science." D. Seber and K. Sinha.
- "Direct constraints on Glacial Isostatic Adjustment (GIA) motion North American using GPS and implications for plate rigidity." G. Sella, S. Stein, S. Wdowinski, and T. Dixon.
- "Engaging Native American stakeholders in EarthScope." S. Semken, M. Fouch, and E. Garnero.
- "Fault zone guided waves observations in the SAFOD drill hole." E. Shalev and P. Malin.
- "Measuring finite-frequency amplitudes and travel times of teleseismic body waves." K. Sigloch and G. Nolet.
- "Developing a methodology for measuring stress transients at seismogenic depth." P. Silver, F. Niu, T. Daley, and E. Majer.
- "Surface latent heat flux associated with coastal earthquakes." R. Singh, G. Cervone, and M. Kafatos.
- "A community vision of EarthScope science frontiers in eastern North America." K. Sinha, R. Hatcher, K. Fischer, A. Forte, J. Ebel, M. Pavich, D. Seber, W. Thomas, L. Brown, A. Goldstein, L. Gundersen, and F. Read.
- "Yellowstone Hotspot: Integrative research and complimentary goals of EarthScope." R. Smith.
- "Some topics in lithospheric evolution." S. Smithson.
- "Relating tide gauge records of sea level change to local vertical motions." R. Snay, M. Cline, W. Dillinger, and T. Soler.
- "Imaging the Las Vegas Basin: Integration of basin scale and crustal scale data." C. Snelson, D. McEwan, A. Hirsch, and S. Zaragoza.
- "Extracting information on fault properties from the mineral assemblages of SAFOD." J. Solum, S. Hickman, D. Moore, and D. Lockner.
- "Mineral assemblages of SAFOD: Implications for fault properties." J. Solum and B. van der Pluijm.
- "Possible source of the Walker Lane anomaly." T. Song and D. Helmberger.
- "GeoSystems: Probing Earth's deep-time climate and linked systems." G. Soreghan.
- "Multi-facility approaches to solving problems in earthquake hazards." J. Steidl.
- "Slow slip in the December 2004 Sumatra earthquake and EarthScope implications." S. Stein and E. Okal.
- "EarthScope project management." B. Stephanus and R. Woolley.
- "Spatial and temporal sampling issues for characteristic earthquake and seismic hazard studies: Illustrations for the Wasatch, New Madrid, and other seismic zones." L. Swafford, S. Stein, A. Friedrich, and A. Newman.
- "Detection of a fault-zone heterogeneous structure of the San Andreas Fault, CA, using a multimode imaging of seismic coda waves." T. Taira, P. Silver, F. Niu, and R. Nadeau.
- "Insights into the mechanism of intraplate earthquakes and studies proposed to test them." P. Talwani, A. Gangopadhyay, I. Dura-Gomez, and R. Trenkamp.
- "Preliminary limages of subsurface structure at SAFOD using the drill bit seismic method." S. Taylor, J. Haldorsen, C. Stolte, and R. Coates.
- "The Cordilleran Orogen: An andean-type Eocene continental plateau?" C. Teyssier, A. Mulch, S. Kruckenberg, and R. Miller.
- "Present day continental block tectonics: New results from Tibet and the Aegean to the western United States." W. Thatcher.

GPS installation at the Albuquerque Seismological Laboratory. Left to right: C. Hutt, K. Anderson, B. Friesen, K. Persefield, S. Borenstein.

- "EarthScope resolution of two complete cycles of supercontinent assembly and breakup." W. Thomas, R. Keller, R. Hatcher, and K. Sinha.
- "Evolution of an experiment: The PASO Array and SAFOD." C. Thurber and S. Roecker.
- "Calibration of small-to-intermediate aperture seismic arrays: Challenges, solutions, and possibilities for fine Earth structure investigations." I. Tibuleac, K. Lindquist, and R. Hansen.
- "The New Mexico Bureau of Geology and Mineral Resources' STATEMAP program: Detailed geologic mapping in New Mexico." J. Timmons and M. Mansell.
- "Drilling a subduction zone megathrust: The IODP NanTroSEIZE drilling project." H. Tobin and M. Kinoshita.
- "Magnetotelluric imaging of fault zone structure at the SAFOD site." M. Unsworth.
- "Subduction potential at the eastern margin of North America." S. van der Lee, K. Regenauer-Lieb, D. Yuen, and S. Wang.

Fred Jenkins drilling holes to install a short drill braced GPS monument located in Lakepoint, UT.

- "EarthScope and you: What is the EarthScope facility and how can researchers use it?" G. van der Vink.
- "GPS installation progress in the southern California region of the Plate Boundary Observatory." C. Walls, E. Arnitz, S. Bick, and S. Lawrence.
- "The electromagnetic view of continental dynamics: U.S. experience and the potential of EarthScope." P. Wannamaker, S. Park, J. Booker, G. Egbert, G. Jiracek, A. Chave, and M. Unsworth.
- "Increasing satellite monitoring of volcanic activity by achieving SO_2 flux measurements from small low-altitude volcanic gas plumes: Ambrym Volcano, Vanuatu as an initial case study." L. Wardell, M. Watson, V. Realmuto, and J. Stix.
- "Geodetic determination of the eastern terminus of the Pacific-North America plate boundary zone." S. Wdowinski and A. Newman.
- "SAFOD products: Monitoring data, downhole measurements and physical samples." C. Weiland, S. Hickman, W. Ellsworth, and M. Zoback.
- "Seismic wave-equation migration methods and EarthScope." L. Wen, L. Chen, and T. Zheng.
- "Proterozoic growth and stabilization of continental lithosphere: Southern Lautentia as a key type section." S. Whitmeyer and K. Karlstrom.
- "Enhancing the EarthScope image: A view of deep and middle crustal processes in isobarically cooled terranes." M. Williams, K. Mahan, M. Jercinovic, and K. Karlstrom.
- "Results from the LA RISTRA seismic array: Implications for the EarthScope flexible seismometer array." D. Wilson, R. Aster, S. Grand, and J. Ni.
- "Crustal-scale tectonic wedging in eastern New England: Target for the flexible array." R. Wintsch, J. Aleinikoff, D. Unruh, and G. Walsh.
- "Regional attenuation structure from surface wave tomography." Y. Yang and D. Forsyth.
- "Mechanical modeling of Sierra Negra Volcano, Galapagos Islands, based on InSAR observations." S. Yun, H. Zebker, and P. Segall.
- "Sierra Nevada EarthScope Project (SNEP): A study of active foundering of continental lithosphere beneath the Sierra Nevada, California." G. Zandt, H. Gilbert, T. Owens, and C. Jones.
- "Proterozoic rhyolite-quartzite syntectonic "cover" assemblages and their importance for understanding orogenic assembly of SW Laurentia." A. Zinsser, A. Luther, K. Karlstrom, and M. Williams.

EarthScope Outreach:

- National Science Teacher Association Annual Meeting (April 1-4, 2004; Atlanta, GA). EarthScope spoke with K-12 teachers about EarthScope and gathered teacher's suggestions through a questionnaire on how the EarthScope Education and Outreach Program can meet their needs: Over 130 teachers indicated they were interested in participating in EarthScope Education and Outreach Program, half of whom completed the questionnaire. Teachers requested articles on research results, participating scientists, and regional tectonics. They emphasized their continuing need for hands-on, interactive exercises with access to real-time data.
- EarthScope Exhibit Booth at:
  - Seismological Society of America Annual Meeting (April 14-16, 2004; Palm Springs, CA). EarthScope Exhibit Booth was featured on the local news and served as source of information about EarthScope's current status and activities.
  - Geological Society of America Rocky Mountain and Cordilleran Joint Meeting (May 3-5, 2004; Boise, Idaho).
  - Coalition for National Science Funding Meeting (June 22, 2004; Washington, DC). EarthScope was invited to attend by the American Geological Institute, the American Geophysical Union, and the Geological Society of America.
  - American Geophysical Union Fall Meeting (November 7-10, 2004; San Francisco, CA). Supported a Ph.D. student from Columbia University to attend the meeting and assist with the exhibit booth.
  - Geological Society of America Annual Meeting (December 13-17, 2004; Denver, CO). Supported a geodesy Ph.D. student from the University of Colorado, Boulder to attend the meeting and assist with the exhibit booth.
  - American Association for the Advancement of Science Annual Meeting (February 17-21, 2005; Washington, DC).
- EarthScope exhibit at Sunset Crater opened on June 7, 2004.
- EarthScope Exhibit at the Coalition for National Science Funding Meeting (June 22, 2004; Washington, DC). EarthScope was invited to attend by the American Geological Institute, the American Geophysical Union, and the Geological Society of America.
- Tour of EarthScope drill site given to:
  - Arizona State University Geomorphology team led by R. Arrowsmith, whose group is working in the surrounding Middle Mountain region (June 22, 2004).
  - Southern California Earthquake Center interns (July 29, 2004).
  - Parkfield residents (July 31, 2004).
  - Congressman Sam Farr (August 16, 2004).
  - National Science Foundation, US Geological Survey, and Congress (September 2, 2004).
  - Provided a tour of the SAFOD drill site to participants of the SAFOD Sample Analysis Workshop (October 8, 2004).
  - Provided a tour of the SAFOD drill site to participants of the US-Japan Earthquake Research Meeting (October 15, 2004).
  - Provided a tour of the SAFOD drill site to Parkfield and Shandon Elementary School students and Shandon 6th grade students.
- Developed materials for EarthScope VIP/Media Day in Parkfield, CA.
- Discussed outreach opportunities with the Pratt Museum in Homer, AK. Homer is near the Augustine Volcano where EarthScope installed 7 GPS stations. The museum staff is interested an evening talk to the general public.

From left to right: D. Simpson, J. Bordogna, C. Meth, Rep. V. Ehlers, J. Marburger, and K. Barbour.

- UNAVCO Education & Outreach Coordinator visited EarthScope Headquarters and IRIS to develop EarthScope Education & Outreach plans (August 23-24, 2004).
- Developed Media Guidelines.
- Developed VIP/Media announcement for Augustine Volcano and the EarthScope tour in Parkfield, CA.
- Created suite of 12 EarthScope one-pagers describing different aspects of the project:
  - EarthScope: Exploring the Structure and Evolution of the North American Continent
  - Instrumentation: Surveying the Continent
  - The United States: A Natural Geologic Laboratory
  - Outreach: Consulting the Geoscience Community
  - San Andreas Fault Observatory at Depth: Directly Measuring Earthquakes
  - Drill Site Selection: Why Parkfield?
  - Global Positioning System: Focused on Tectonic Regions
  - Borehole Strainmeters: Precisely Sensing Shape Changes
  - Long-baseline Laser Strainmeters: Combining Resolution and Stability
  - Transportable Seismic Network: Imaging the Earth's Interior
  - Permanent Seismic Network: An Integrated Resource
  - Campaign Instruments: A Community Resource & Magnetotelluric Observations: Electromagnetic Properties at Depth

EarthScope Exhibit at Sunset Crater

- Provided AS1 seismograph to Wishkah School (Aberdeen, WA) and worked with Wishkah School to discuss their educational interests.
- Produced "News: Response to Parkfield Earthquake" about EarthScope's response to the Parkfield Earthquake.
- Produced "News: Response to Mt. St. Helens" about EarthScope's response to Mt. St. Helens.
- Produced "Participating in EarthScope: Hosting a Transportable Array Station" for landowners.
- Produced "Borehole Strainmeters: Activities on the Olympic Peninsula" for press packets.
- Participated in Society of Exploration Geophysicists's Open House for Earth Science Teachers (October 10, 2004; Denver, CO).
- New Array Network Facility webpage to display events for each Transportable Array station in the last seven days. Added thumbnails to Array Network Facility web-site photo database.
- Participated in congressional briefing on results emerging from the Parkfield earthquake and Mt. St. Helens. Speakers: M. Zoback and J. Pallister.
- Hosted Open House at the EarthScope Office in Washington, DC.
- M. Jackson participated as a mentor in the 2004 MS PHD'S (Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science) Professional Development Program during the 2004 American Geophysical Union Fall Meeting.
- Candidates interviewed for open Summer Field Engineer and Intern positions at regional PBO. offices. Developed salary structure and began hiring process for the student intern program.
- 10 AS1 seismographs delivered to PASSCAL. The instruments will be distributed to schools that host Transportable Array stations.
- Began preparing newsletter and station monitoring website for landowners hosting EarthScope Transportable Array stations.
- Discussed potential of installing a Transportable Array station near a junior high school in Bothell, WA.
- Received proposal from Arizona State University to site Transportable Array stations in Arizona.

- Permitting document for the ANSS Backbone Station on the Navajo Reservation was put together and submitted to the US Geological Survey for legal processing. Negotiations with the Navajo Nation, US Geological Survey and Arizona State University are underway.
- Tested, with students from the Wishkah Valley School, a prototype data access page.
- Distributed outreach material at the grand opening (February 19, 2005) of the Pacific Science Center's "Forces of Nature" exhibit.
- PBO Data Products Manager advised a Caltech graduate student who is interested in PBO and data management activities.
- Supported documentary filmmaker to interview and take footage at EarthScope National Meeting.
- EarthScope National Meeting Mini-courses (March 30, 2005; Santa Ana Pueblo, NM):
  - "Geoscience E&O and 'edu-speak' for geoscience researchers." S. Semken.
  - "Principles of GPS and GPS-determined Velocity Fields for the Non-geodesist." C. Meertens.
  - "Understanding tomograms, receiver functions, and seismic anisotropy for the non-seismologist." M. Fouch.
  - "Topics in the earthquake process: Rock physics, fault mechanics, and rheology for the non-rock squeezer." C. Marone.

Meetings:

- Pacific Area Network GPS Array (PANGA) meeting at Central Washington University (April 5, 2004; Ellensburg, WA) focused on synergy between PBO staff and PANGA staff. Attended by: K. Hafner and P. Gray.
- House Science Committee staff briefed on EarthScope by the Project Director, informing them of program status and upcoming activities (April 5, 2004; Washington, DC).
- SAFOD Advisory Board Meeting (April 7, 2004; Washington, DC). Attended by: the Advisory Board, SAFOD PI's, C. Hennet, and D. Applegate. Introductory material presented by G. van der Vink. The role of the SAFOD Advisory Board was established and the SAFOD data policies for continuously recording instruments, downhole measurements, and PI-driven studies were established. Data policies were not established for core and fluid samples.
- Meeting to discuss PBO site selection and permitting in Salt Lake Bureau of Land Management (BLM) and Fillmore Bureau BLM Districts (April 13, 2004; Salt Lake City, UT). Attended by: G. Hilker, F. Jenkins, G. Jenson, G. Nebeker, P. Ainsworth, and C. Johnson.
- Seismological Society of America Annual Meeting (April 14-16, 2004; Palm Springs, CA). Attended by G. van der Vink, C. Meth, W. Ellsworth, P. Silver, C. Walls, M. Hasting, K. Barbour, D. Simpson, and S. Ingate. An EarthScope specific session included general overview presentations and presentations on EarthScope related research.
- Washington State GPS Users Group meeting (April 15, 2004; North Bend, WA) to discuss the Washington Spatial Reference System initiative. Attended by: K. Hafner and P. Gray.
- Meeting to coordinate field efforts (including installation schedule, current budget, and out-year budget) between the US Geological Survey Golden field office and those of Albuquerque Seismological Laboratory (April 21, 2004; Golden, CO). Attended by: R. Butler, A. Leeds and K. Anderson.
- IRIS/USArray Coordinating Committee Meeting (April 22-23, 2004; Boulder, CO). Attended by: T. Ahern, R. Aster, R. Butler, J. Fowler, S. Ingate, D. James, G. Nolet, T. Owens, B. Stump, T. Lay, C. Shin, D. Simpson, and J. Taber. USArray baseline, progress, and plans were discussed.
- Meeting to discuss siting stations on the Utah Test and Training Range South (April 26, 2004; northern Utah). Attended by: L. Johnson, G. Hilker, and F. Jenkins.

EarthScope one-pagers.

- Pre-application meetings with federal agencies to discuss the permitting process for working on federal lands in Alaska. Federal agencies included: the Fish and Wildlife Service (April 26, 2004; Juneau, AK), US Forest Service (April 27, 2004; Tongass and Chugach, AK), National Park Service and Bureau of Land Management (April 28, 2004; Anchorage, AK) and US Coast Guard (April 28, 2004; Anchorage, AK). Attended by: B. Pauk and K. Bohnenstiehl.
- Meeting with Institute for the Advancement of Geospatial Technology (IAGT) to establish IAGT's support for USArray (April 27-28, 2004; Seattle, WA). Attendees by: T. Ahern, R. Benson, F. Pieper, and M. Mercurio.
- Geological Society of America Rocky Mountain and Cordilleran Joint Meeting (May 3-5, 2004; Boise, ID). Attended by: R. Smith, G. van der Vink, C. Meth, and P. Sheatsley.
- Meeting with the South Pacific Applied Geoscience Commission and UNAVCO Facility GPS Archives to discuss draft statement of work for GPS Archives (May 6, 2004; Boulder, CO). Attended by: G. Anderson, E. Persson, W. Prescott, B. Stephanus, J. Wright, Y. Bock, M. Scharber, F. Boler, L. Estey, D. Maggert, C. Stolte, and D. Wilson.

Students learning about EarthScope at the American Association for the Advancement of Science Annual Meeting in Washington, DC.

- IRIS Executive Committee Meeting (May 6-7, 2004; Seattle WA).
- EarthScope Operations Synergy meeting (May 10, 2004; Socorro, NM). Attended by: G. van der Vink, C. Hennet, T. Ahern, G. Anderson, K. Anderson, B. Beaudoin, S. Bornstein, R. Busby, K. Feaux, J. Fowler, S. Ingate, M. Jackson, D. Mencin, C. Meth, R. Morris, C. Shin, B. Stephanus, J. Taber, F. Vernon, and C. Weiland. The meeting reviewed common activities among the EarthScope operational components and sought methods to improve synergy.
- Stage 2 equipment meetings at Sandia, NM (May 10, 2004), Houston, TX (May 18, 2004), Stanford, CA (May 19, 2004), and Sunnyvale, CA (May 20, 2004) Attended by: M. Zoback, B. Ellsworth, and S. Hickman.
- Pacific Area Network Geodetic Array meetings at Central Washington University (May 10 and 17, 2004; Ellensburg, WA) to discuss station siting issues and network collaboration. Attended by members of the PANGA staff, K. Hafner, and P. Gray.
- EFEC Meeting and USArray Site Review (May 11-12, 2004; Socorro, NM): Attended by: G. van der Vink, G. Ekstrom, S. Hickman, W. Prescott, P. Silver, D. Simpson, M. Zoback, C. Hennet, and C. Meth.
- Consortium of US Volcano Observatories Meeting (May 13, 2004; Portland, OR). Discussed creating and maintaining an inventory of geophysical instrumentation that are currently available or deployed for studying volcano hazards and deformation. Attended by representatives of the USGS Volcano Hazards management and observatories and M. Jackson.
- Semi-annual California Spatial Reference Center Meeting (May 14, 2004; San Francisco, CA). Discussions included close cooperation and coordination of PBO siting, reconnaissance, permitting, and installations activities. Also discussed EarthScope's near real-time needs (hours to days) versus the survey communities real-time (seconds) data needs. Attended by: B. Coyle, R. Mueller, and T. Williams.
- The 2004 Joint Assembly (American Geophysical Union, Canadian Geophysical Union, Society of Exploration Geophysicists, and the Environmental and Engineering Geophysical Society) (May 17-21, 2004; Montreal, Canada). Attended by: G. Anderson and S. Ingate.
- Meeting with US Forest Service Region 6 (May 19, 2004; Portland, OR) to discuss permitting on Mt. Hood, Mt. Olympic, and in the Gifford-Pinchot National Forest, which includes Mt. St. Helens. Attendees included J. Sauser, coordinators from each forest, M. Lisowski, K. Bohnenstiehl, and K. Hafner.
- Meeting with Northern California Earthquake Data Center staff in Berkeley to discuss long-term archive of SAFOD seismic and other data (May 19, 2004; Berkeley, CA). Attended by C. Weiland, B. Ellsworth, L. Gee, and D. Neuhauser.
- The 2004 Digital Library for Earth System Education (DELESE) Data Services Workshop (May 24-28, 2004; Durham, NH). G. van der Vink participated in the GEON workshop team to develop methods for making data and data analysis tools useful to educators.

- Meeting with US Fish and Wildlife Service (May 24, 2004; Homer, AK). Attended by G. Siekaniec, S. Schulmeister, K. Bohnenstiehl, T. Corbett, and B. Pauk. The meeting was held to discuss permitting issues in the Aleutian Islands. It was determined that EarthScope will need to do an Environmental Assessment of the sites after the initial permit application because many of the proposed installs on Fish and Wildlife Service land fall in wilderness areas where access is limited to non-motorized means of transportation and travel.
- Meeting with the Bureau of Land Management (May 24, 2004; Salt Lake City, UT) to discuss the BLM application process, cost recovery, map and documentation requirements. Attended by: G. Jensen, F. Jenkins, and G. Hilker.
- Meetings with ThermaSource and other subcontractors (May 25, 2004; Bakersfield, CA). Attended by M. Zoback and S. Hickman.
- Press planning teleconference (May 28, 2004). Attended by M. Zoback, S. Hickman, C. Weiland, S. Phillips-Moskowitz, S. Garcia, M. Shwartz, and C. Puckett.
- Meeting with Trimble (June 2, 2004; Boulder, CO) to discuss development status, to request changes to user interface and additional software for data retrieval, and to discuss the real-time software prototype system. Attended by B. Frohring, G. Anderson, D. Mencin, and J. Wright.
- Pre-spud Meeting (June 3, 2004; Parkfield, CA). Attended by S. Hickman, M. Zoback, and the drilling team.
- Meeting with Alaska Volcano Observatory (June 3, 2004; Fairbanks, AK) to discuss reconnaissance and installation activities on Unimak Island. Attended by: B. Pauk.
- Teleconference with the Institute for the Advancement of Geospatial Technology (June 4, 2004) to discuss summer interns.
- Pacific Northwest Geodetic Array Meeting at Central Washington University (June 7, 2004; Ellensburg, WA). Attended by: K. Hafner.
- IRIS Annual Workshop (June 10-12, 2004; Tucson, AZ). Attended by: C. Meth, M. Jackson, D. Simpson, G. Ekström, S. Ingate, R. Butler, J. Fowler, T. Ahern, and J. Taber.
- Northern California GPS Users Group Quarterly Meeting (June 11, 2004; Martinez, CA). Updated the local GPS community on the status and progress of EarthScope. Attended by: B. Coyle.
- Meeting with the Institute for the Advancement of Geospatial Technology (June 12, 2004) to identify activities to support USArray. Attended by T. Ahern, L. Kamb, C. Trabant, F. Pieper, M. Mercurio.
- GreatBREAK Workshop: Preparing for EarthScope in the Great Basin and its Margins (EAR-0346242) (June 21-23, 2004; Tahoe City, CA).
- Bureau of Land Management (BLM) briefing (June 23, 2004; Sacramento, CA). PBO will contact BLM districts prior to beginning fieldwork to screen sites for National Environmental Protection Act issues. Permits will fall under a categorical exclusion at the state level. Attended by: D. Marti, K. Bohnenstiehl, C. Walls, T. Williams, and B. Coyle.
- Magneto-telluric Instrumentation Planning Meeting (June 23, 2004; Corvallis, OR). A timeline was devised to prepare a strategic Project Execution Plan and budget for Magneto-telluric operations. Attended by: S. Ingate, J. Fowler, A. Schultz, G. Egbert, and S. Park.
- EarthScope Science and Education Committee Meeting (June 23-24, 2004; Tahoe City, CA). Attended by: G. van der Vink.
- 4-D Framework of the Continental Crust-Integrating Crustal Processes through Time (June 27-July 1, 2004; Oak Ridge, TN). Attended by G. van der Vink.
- Communication needs for the Transportable Array discussed with Hughes Satellite (June 28, 2004; San Diego, CA) and Quanterra and SpaceNet (June 29, 2004; Germantown, MD).
- Meeting of the Fluid Sampling Technical Panel (June 28, 2004; Parkfield, CA). Attend by: M. Zoback, S. Hickman, A.R. Bartley, M. Stute, M. Davidson, J. Thordsen, K. Thornton, M. Brennen, R. Valentine, L. Wohlgemuth, T. Wiersberg, M. Kennedy, and M. Pahler.

The PBO Magmatic Systems Working Group met in Vancouver on January 18, 2005.

- Teachers on the Leading Edge Workshop (June 28-29, 2004; Portland, OR). Attended by S. Eriksson.
- Teleconference with the Institute for the Advancement of Geospatial Technology (June 30, 2004). Attended by: F. Pieper, D. Piwinski, S. Ingate, and C. Meth.
- Meeting of the EarthScope Data Managers (June 30, 2004; Menlo Park, CA). Each EarthScope program presented a summary of their data management plan, particularly covering raw data (types, sample rates, data flow, etc.) and higher-level products (with similar information). The first comprehensive list of EarthScope raw digital data was also created. Attend by: T. Ahern, G. Anderson, B. Ellsworth, and C. Weiland.
- Meeting to discuss draft statement of work for PBO Strain/Seismic Data Archives (July 1, 2004; Berkeley, CA). Attended by: G. Anderson, T. Ahern, L. Gee, M. Murray, and D. Neuhauser.

24.4 cm casing for the borehole.

- PBO Operations Design Review Meeting (July 8-9, 2004; Boulder, CO) to review PBO GPS station design, documentation, and safety issues. Attended by: C. Walls, E. Arnitz, W. Johnson, K. Hafner, G. Hilker, B. Pauk, S. Borenstein, B. Friesen, M. Jackson, K. Feaux, and K. Barbour.
- PBO Standing Committee Meeting (July 12, 2004; Teleconference) to discuss PBO borehole strainmeter activities and published reports. Attended by: W. Prescott, M. Jackson, and K. Barbour.
- Preliminary Internal EarthScope Data Products and Portal Meeting (July 13-14, 2004; Washington, DC). Began development of data policy and data levels. Attended by: G. van der Vink, C. Hennet, W. Ellsworth, C. Weiland, M. Jackson, G. Anderson, T. Ahern, J. Taber, and F. Pieper.
- Meeting with the Utah Department of Transportation (UDOT) (July 13, 2004; Salt Lake City, UT) to discuss plans to install 57 permanent GPS stations in Utah. UDOT has agreed to host GPS sites using the standard right-of-way encroachment permit process. Attended by: D. Miller, K. Bohnenstiehl, and G. Hilker.
- Meeting with the Wyoming and Utah Bureau of Land Management (BLM) (July 14, 2004; Salt Lake City, UT) to discuss BLM applications and a statewide Environmental Assessment to cover PBO sites. Attended by: D. Miller, K. Bohnenstiehl, and G. Hilker.
- Teleconference with Skycaster.com (July 14, 2004) to discuss hardware needs, training and pricing structure for the Transportable and Flexible Arrays. Attended by J. Fowler and B. Busby.
- Meeting with Nevada Department of Transportation (NDOT) (July 15, 2004; Carson City, NV) to discuss location of PBO stations on Nevada DOT lands. PBO may try and locate at Sprint facilities along the I-50 corridor as there is power and internet there. They have provided information about those locations to us. Attended by: D. Miller and K. Bohnenstiehl.
- Site Visit to SAFOD to discuss VIP/Media Day (July 15, 2004; Parkfield, CA). Attended by: G. van der Vink, C. Meth, M. Zoback, S. Hickman, W. Ellsworth, M. Jackson, and J. Fowler.
- Meeting with Sid Hellman from Instrumental Software Technologies, Inc. (ISTI) (July 16, 2004; Boulder, CO) to discuss using their SeisNetWatch product for display of network state of health information.
- Meeting at the Array Network Facility (July 19-20, 2004: San Diego, CA) to discuss flow of data and information between the IRIS Data Management Center and the Array Network Facility. Attended by R. Benson, C. Trabant, F. Vernon and J. Eakins.
- Meeting with Southern California Integrated GPS Network Research, Education, and Applications Solutions Network Cooperative Agreement Notice Project Investigators (July 20, 2004; Los Angeles, CA) to get an update on project progress and possible linkages with PBO. Attended by: G. Anderson.
- Meeting with the Alaska Tsunami Warning Center (July 23, 2004; Palmer, AK) to discuss integration of their telemetry systems with PBO data streams. Attended by: B. Pauk, S. Friedly, and D. Mencin.
- Briefing with Kinemetrics (July 23, 2004: Pasadena, CA) regarding Transportable Array contractor pilot project for Fiscal Year 2004. Attended by O. Kuraica, M. Franke, M. Idrissi, J. Fowler and R. Busby.
- Transportable Array meeting with Caltech (July 23, 2004: Pasadena, CA). Discussion topics included procedure for fixing polarity, overall recommendations for data quality reporting, and communications link bandwidth questions possibly related to 40 samples per second increase at Transportable Array sites. Attended by R. Busby.
- Meeting with GladwinTensor Strainmeter (July 27, 2004; Boulder, CO) to discuss finalization of tensor strainmeter procurement issues. Attended by: M. Jackson, W. Prescott, D. Wilson, B. Stephanus, and M. Gladwin.

- Strainmeter meeting with 33 participants from the EarthScope community (July 26-28; Boulder, CO) to discuss borehole logging techniques, characterization of the borehole environment, site selection and prioritization for year 3-5 borehole strainmeter systems, and site selection and prioritization for year 3-5 long-baseline strainmeter systems. Attended by: W. Prescott, M. Jackson, B. Stephanus, B. Mueller, M. Hasting, D. Mencin, K. Feaux, S. Smith, and K. Barbour.
- PBO Standing Committee Meeting (August 2, 2004; Teleconference). Discussion included borehole strainmeters and general management activities. Attended by: PBO Standing Committee, W. Prescott, M. Jackson, and K. Barbour.
- Meeting with wUtah Department of Transportation to discuss planned reconnaissance activities facilitated by the Utah Department of Transportation Aviation Department (August 3 and 20, 2004; Salt Lake City, UT). Attended by: G. Hilker and F. Jenkins.
- Meeting at the US Geological Survey Consortium of US Volcano Observatories to finalize the volcano threat ranking and identify monitoring gaps at particular volcanoes (August 10, 2004; Portland, OR).
- ESRI (Environmental Systems Research Institute) International User Group Meeting (August 10, 2004; San Diego, CA). Presented EarthScope to the GIS and survey communities and to solicit station sites. Over 250 flyers were distributed and a PBO poster was hung in the Map Gallery. Attended by: K. Bohnenstiehl and T. Reynolds.
- Meeting with HDR Engineering, Inc. to discuss reconnaissance within three Bureau of Land Management districts spanning eastern California (August 11, 2004: Riverside CA).
- Project Operations Interface requirements and design meeting (August 13, 2004; Boulder, CO). Attended by: G. Anderson, S. Borenstein, K. Feaux, D. Mencin, E. Persson, and J. Wright.
- Meeting with Pacific Northwest National Laboratory to discuss reconnaissance of a joint GPS/ANSS Backbone site (August 13, 2004; Richland, WA). Attended by: A. Rohay, K. Hafner.
- USArray website planning meeting to discuss content, look and feel of USArray website and relationship with websites organized by USArray subawards (August 18-19, 2004; Washington, DC). Attended by D. Barnes, G. Levy, J. Mallett, and J. Taber.
- Meeting with Bureau of Land Management (BLM) Hollister Region (August 26, 2004; Hollister, CA) to open discussions for GPS reconnaissance. Local BLM offices will review site locations prior to submitting permits. Attended by: B. Coyle and T. Williams.
- EarthScope Science for Mid-America Workshop (August 18-20, 2004; Memphis, TN). Attended by: G. van der Vink, D. Simpson.
- Meeting with US Geological Survey to discuss forming the Joint ANSS-EarthScope Working Group on Data Integration (August 24, 2004; Washington, DC). Attended by W. Leith, D. Applegate, G. van der Vink, and D. Simpson.
- Meeting with US Geological Survey/National Earthquake Information Center (August 24, 2004: Golden, CO) to discuss possible cooperation between US Geological Survey Geomagnetic Observatories and backbone magneto-telluric siting. Attended by S. Ingate, A. Schultz, S. Parkes, J. Love, and W. Leith.
- EFEC Quarterly Meeting and SAFOD Site Review (August 31-September 1, 2004; Paso Robles, CA).
- SAFOD Advisory Board (September 3, 2004; Paso Robles, CA). Attended by: J. Rice, T.-F. Wong, A. McGarr, and R. Hyndman.
- SAFOD Technical Panel Downhole Measurements (September 8, 2004; Paso Robles, CA). Attended by: G. Ugueto, H. Yin, M. Enderlin, D. Goldberg, and J. Erzinger.
- SAFOD Technical Panel on Drilling, Coring, and Safety (September 9, 2004; Paso Robles, CA). Attended by: P.J. Fox, E. van Oort, R. Ewy, L. Wohlgemuth, and A. Bartley.

Transportable Array (rear) and ANSS Backbone (front) vaults in parallel test at Albuquerque Seismological Lab.

- EarthScope Workshop: Research frontiers in Appalachian Geology and Tectonics: An EarthScope Perspective (September 10-11, 2004; Arlington, VA). Attended by: K. Shedlock, G. van der Vink, and D. Simpson.
- Discussed capabilities of the GeoRes Datalogger and data transmission requirements with Duke, US Geological Survey, and Stanford University (September 15, 2004; teleconference). Attended by: C. Weiland.
- SCIGN Coordinating Board Meeting (September 19, 2004; Palm Springs, CA). Attended by G. Anderson and W. Prescott.
- Meeting to refine plans for long-baseline laser strainmeter data and data management (September 19, 2004; Palm Springs, CA). Attended by: D. Agnew, F. Wyatt, and G. Anderson.
- Institute of Navigation Annual Meeting (September 21-23, 2004; Long Beach, CA). Attended several presentations and met with representatives from Trimble, Topcon, the National Geodetic Survey, and International GPS Service to discuss equipment requirements and collaborations. Attended by: G. Anderson.
- American Association for State Geologist Meeting (September 22, 2004; Washington, DC). Attended by: C. Hennet, G. van der Vink, S. Ingate, J. Taber, and D. Simpson.
- American Geological Institute's State Geologist Meeting (September 22, 2004; Washington, DC). Attended by: S. Ingate, J. Taber, and D. Simpson.

Coring strainmeter boreholes in the wet Pacific Northwest.

- ANSS National Implementation Committee Technical Integration Committee Meeting (September 26-27, 2004, St. Louis MO). Discussion included coordination between ANSS and Earthscope. Attended by T. Ahern.
- Data Portal Meeting (September 29, 2004, Seattle, WA).
- National Earthquake Conference (September 29, 2004; St. Louis, MO). Attended by: W. Ellsworth.
- NSF Project Science Workshop (October 3-7, 2004; Aspen, CO). Attended by: G. van der Vink, C. Meth, B. Stephanus, and R. Woolley.
- IRIS Global Seismic Network Standing Committee Meeting (October 5-6 2004; Albuquerque NM).
- SAFOD Strain Data Handling Meeting (October 6, 2004; Menlo Park CA). Attended by: G. Anderson, W. Ellsworth, and C. Weiland.
- Meeting to discuss data visualization and analysis software (October 6, 2004; Menlo Park CA). Attended by: G. Anderson, C. Weiland, and D. Cervelli.
- Meeting to discuss SAFOD strain and seismic data archiving and analysis (October 6, 2004; Menlo Park, CA). Attended by: G. Anderson, B. Ellsworth, S. Hickman, M. Zoback, and C. Weiland.
- IRIS Education and Outreach Steering Committee Meeting (October 7-8, 2004; Socorro, NM).
- PBO Standing Committee Meeting (October 7-8, 2004; Palo Alto, CA). Attended by: M. Jackson, G. Anderson, K. Barbour, K. Bohnenstiehl, K. Feaux, and B. Stephanus.
- SAFOD Sample Analysis Workshop (October 11-12, 2004; San Jose, CA). Attended by: M. Zoback and S. Hickman.
- USArray Data Products Workshop (October 11-12, 2004; Portland OR). Attended by: C. Hennet.
- IRIS PASSCAL Standing Committee Meeting (October 18-19, 2004; Woods Hole MA).
- Meeting between Array Network Facility, Array Operations Facility, Flexible Array, and Transportable Array personnel (October 19-20, 2004; Woods Hole MA) to discuss common issues regarding station installation, data flow, data communications, personnel for station construction, and station operations.
- California Spatial Reference Center Semi-annual Meeting (October 22, 2004; La Jolla, CA).
- Long-baseline Laser Strainmeter Analysis Center Meeting (October 26-27, 2004; San Diego, CA). Attended by K. Hodgkinson, D. Agnew, and F. Wyatt.
- EarthScope Data Access Meeting (October 27, 2004; Boulder, CO). Attended by: C. Hennet, T. Ahern, G. Anderson, W. Ellsworth, S. Eriksson, C. Guillemot, F. Pieper, J. Taber, and C. Weiland.

- UNAVCO Board Meeting (October 27, 2004; Washington, DC). Discussed PBO progress and plans. Attended by: UNAVCO Board members, D. Applegate, K. Shedlock, G. van der Vink, M. Jackson, C. Meth, and R. Price.
- Meeting to discuss SAFOD telemetry and surface seismic recorders (October 28, 2004; Menlo Park CA). Attended by: W. Ellsworth, D. Oppenheimer, L. Dietz, and S. Hickman.
- IRIS Data Management System Standing Committee Meeting (October 28-29, 2004; Boulder, CO). Meeting the BLM office in Ukiah to identify suitable locations for sites on BLM property and to discuss the permit submission procedures (November 1, 2004; Ukiah, CA). Attended by: B. Coyle and W. Dabs.
- Meeting with California Spatial Reference Center to discuss reconnaissance plan for BLM sites and stations in Imperial County and San Bernardino County (November 2, 2004; Riverside, CA). Attended by: C. Walls and R. Packard.
- EarthScope and USGS meeting to discuss seismic and strain data communications and archiving (November 3, 2004; Menlo Park, CA).
- SCIGN NASA REASoN project monthly meeting (November 4, 2004; La Jolla, CA). Attended by: G. Anderson, Y. Bock, M. Scharber, P. Jamason, L. Prawirodirdjo, P. Fang, F. Webb, S. Kedar, S. Owen, D. Dong, and K. Stark.
- IRIS Coordinating Committee Meeting (November 3-4 2004; Palisades, NY).
- IRIS Executive Committee Meeting (November 4-5, 2004; Palisades, NY).
- Geological Society of America Annual Meeting (November 7-10, 2004; Denver, CO). Four EarthScope sessions were featured at the meeting. Attended by: G. van der Vink, W. Prescott, C. Meth, G. Anderson, K. Bohnenstiehl, and K. Feaux.
- Meeting to discuss data downloads and analysis for Gladwin Tensor strainmeter stations (November 9, 2004; teleconference). Attended by: M. Jackson, G. Anderson, D. Wilson, K. Barbour, and M. Gladwin.
- IRIS Program Managers Retreat (November 11-12, 2004; Airlie, VA).
- Teleconference with Geospace Engineering Research Inc, USGS, Duke University, Stanford University (November 15, 2004). Attended by: C. Weiland, E. Shalev, D. Oppenheimer, L. Dietz, and L. Walter.
- EFEC Quarterly Meeting and review of EarthScope Management (November 15-16, 2004; Washington, DC). Attended by: EFEC and EarthScope Operations staff members.
- ESEC Meeting (November 16, 2004; Washington, DC). EarthScope was invited to brief the ESEC on activities from the past year and EarthScope's current status. Attended by: ESEC, EFEC, K. Shedlock, J. Jones, J. Villalpando, C. Hennet, M. Jackson, R. Woolley, and C. Meth.
- Congressional Briefing on Mt. St. Helens and Parkfield 6.0 Earthquake (November 17, 2004; Washington, DC). Attended by approximately 15 congressional staff members.
- Meeting to refine strain data archiving statement of work and develop preliminary budgets (November 17, 2004; teleconference). Attended by: G. Anderson, T. Ahern, D. Neuhauser, L. Gee, and M. Murray.
- Meeting with ThermaSource to discuss timetable and budget for monitoring installations, Pilot Hole cleanout operations, and EarthScope-SAFOD Phase 2 drilling in 2005 (November 19, 2004; Stanford, CA). Attended by: M. Zoback, C. Weiland, S. Hickman, L. Capuano, and J. Hanson.
- PBO Data Management/IT budget teleconference to develop and refine initial Operations & Maintenance budget numbers (November 19 & 22, 2004; Boulder, CO). Attended by: G. Anderson, K. Hodgkinson, E. Lee, D. Mencin, E. Persson, and J. Wright.
- Meeting to discuss reconnaissance in Riverside, San Bernardino, and Los Angeles (November 22, 2004; Riverside, CA). Attended by: C. Walls and K. Cato.
- Meeting with the Cull Canyon Park Manager to finalize details of an upcoming GPS installation in Northern California (November 24, 2004; Castro Valley, CA). Attended by: T. Williams.
- Meeting with Paulsson Geophysical Services regarding multilevel seismic array to be deployed in EarthScope SAFOD in April 2005 (November 30, 2004; Los Angeles, CA). Attended by: W. Ellsworth, M. Zoback, B. Paulsson, R. Normann, and S. Kuszmaul.

Fluid Sampling Technical Panel Meeting at the EarthScope drill site inside the science trailer.

Assembled the drilling rig (Nabor Drill Rig #633) in Parkfield, CA over a period of approximately 10 days.

- EarthScope Office and Facilities Outreach coordination. Attended by: S. Eriksson, G. Levy, C. Meth, J. Taber.
- Fall 2004 PBO Operations Meeting & First Aid Training (November 29 – December 4, 2004; Riverside, CA). Attended by: All of PBO staff.
- Strainmeter Data Archiving Meeting (December 2, 2004; teleconference). Attended by: T. Ahern, L. Gee, M. Murray, D. Neuhauser, and G. Anderson.
- PBO Standing Committee (December 6, 2004; teleconference). Attended by: M. Jackson and the PBO Standing Committee members.
- Meeting to plan for handling and long-term curation of SAFOD cores, cuttings, and fluid samples at the IODP Gulf Coast Core Repository (December 6-7, 2004; College Station, TX). Attended by: S. Hickman, J. Fox, P. Rumford, B Horan, M. Strickland, J. Beck, and J. Svitek.
- Meeting with Utah Bureau of Land Management regarding permitting of 14 sites and the preparation of a Utah-wide Environmental Assessment (December 9, 2004; Salt Lake City, UT). Attended by: K. Bohnenstiehl, B. Friesen, F. Jenkins, D. Wilson, and D. Miller.
- Meeting with Utah Department of Transportation regarding blanket permitting of GPS sites on Utah state highway Right-of-Way and facilities (December 9, 2004; Salt Lake City, UT). Attended by: K. Bohnenstiehl, B. Friesen, and D. Miller.
- Meeting with Trimble to discuss choke ring antennas (December 9, 2004; teleconference). Attended by: F. Manescalco, D. Muncy, and M. Jackson, and members of the UNAVCO Facility.
- Meeting with the Texas Bureau of Economic Geology's Houston Research Center to discuss standards, logistics, and costs for storage and curation of core samples, cutting samples, and geophysical logs from PBO borehole strainmeter installations (December 10, 2004; Houston, TX). Attended by: L. Zahm, B. DeJarnett, G. Anderson and R. Mueller.
- USArray Advisory Committee Meeting (December 11-12, 2004: San Francisco, CA). Attended by D. Simpson, G. Ekstrom, S. Ingate, R. Woolley, T. Ahern, R. Butler, J. Fowler, J. Taber, and USArray Advisory Committee members.
- SAFOD Technical Panel on Long-term Monitoring (December 12, 2004; San Francisco, CA). Attended by: M. Zoback, S. Hickman, W. Ellsworth, M. Zumberge, M. Fehler, L Gee, B. Langen, E. Major, H. Ito, P. Malin, and C. Weiland.
- ANSS Backbone Mangnetotelluric Meeting (December 12, 2004; San Francisco, CA). Attended by: S. Ingate, R. Butler, K. Anderson, A. Schultz, and R. Hutt.
- American Geophysical Union Annual Meeting (December 13-17, 2004; San Francisco, CA). Attended by: EFEC and EarthScope Operations Members.
- Electromagnetic Studies of Continents Consortium Meeting (December 13, 2004; San Francisco, CA). Discussed EarthScope mangetotelluric deployment issues within the Transportable Array footprint and further planning. Attended by: S. Ingate and R. Woolley.
- Joint EFEC/ES-Ops meeting to discuss Operations and Maintenance Proposal (December 14, 2004; Denver, CO).
- EarthScope Data Working Group Meeting (December 14, 2004; Denver, CO). Discussed EarthScope data management and projected data volumes.
- Meeting to discuss core and sample distribution (December 14, 2004; San Francisco, CA). Attended by: S. Hickman, M. Zoback, G. van der Vink, and K. Shedlock.

- Meeting to discuss GPS data analysis and processing plans (December 15, 2004; San Francisco, CA). Attended by: T. Herring, M. Miller, M. Murray, and G. Anderson.
- Meeting to discuss strainmeter data processing and calibration (December 15; 2004; San Francisco, CA). Attended by: J. Beavan, G. Anderson, and K. Hodgkinson.
- Strainmeter Data Archiving Meeting (December 15, 2004; San Francisco, CA). Attended by: T. Ahern, D. Neuhauser, G. Anderson, and K. Hodgkinson.
- Meeting with Alaska Volcano Observatory regarding permitting of GPS sites on Akutan and Unimak Islands (December 15, 2004; San Francisco, CA.). Attended by: K. Bohnenstiehl, M. Jackson, K. Feaux, D. Mencin, T. Murray, and J. Power.
- EarthScope Outreach Coordination Meeting (December 16, 2004; San Francisco, CA). Attended by: S. Eriksson, G. Levy, C. Meth, J. Taber, and C. Weiland.
- Santa Clara Valley Water District Meeting to discuss permitting (December 16, 2004; Santa Clara, CA). Attended by: D. Busalacci, B. Coyle, and K. Bohnenstiehl.
- Condor Reconnaissance and Permitting Subcontract Meeting (December 16, 2004; San Francisco CA). Attended by: C. Rutledge, B. Hillman, M. Jackson, K. Feaux, and B. Coyle.
- Meeting to discuss use of InSAR data to assist in PBO siting and reconnaissance activities (December 16, 2004; San Francisco, CA). Attended by: G. Bawden and B. Coyle.
- Transportable Array Siting Outreach Meeting (December 16, 2004; San Francisco, CA). Attended by: R. Aster, R. Busby, M. Fouch, J. Fowler, G. Levy, and J. Taber.
- Meeting to discuss permitting ANSS Backbone sites in southern Texas (December 16, 2004; Albuquerque, NM). Attended by: J. Pulliam and J. Derr.
- U.S. Coast Guard Meeting to discuss permitting options for six GPS sites that could be collocated with existing Coast Guard facilities and navigational beacons in Southeast and Southwest Alaska (December 20, 2004; teleconference). Attended by: R. Deering, B. Pauk, and S. Friedly.
- Meeting with the Navajo Nation Mineral Department to discuss permitting the ANSS Backbone site on the Navajo Nation (NNAZ) (December 21, 2004; teleconference). Attended by: J. Derr and B. Nesemeier.
- HDR Meeting to review reconnaissance and permitting results (December 28, 2004; Denver, CO). Attended by: D. Miller, K. McKinnon, K. Bohnenstiehl, and C. Jarvis.
- Meeting with Trinity County's Weaverville and Hayfork Airports to finalize siting and to submit permits to GPS stations (January 1, 2005; Trinity, CA). Attended by: T. Williams.
- Meeting with Humboldt State to finalize the location of a GPS stations and discuss details of the permitting process (January 5, 2005; Arcata, CA). Attended by: T. Williams.
- Meeting with officials from the Leggett County School District to discuss the timing and other details for installation a GPS station (January 6, 2005; Leggett County). Attended by: T. Williams.
- Meeting with Trimble to discuss GPS antenna testing and delivery schedule (January 6, 2005; teleconference). Attended by: M. Jackson, G. Anderson, K. Feaux, and B. Stephanus.
- Meeting with National Science Foundation (January 11, 2005; Arlington, VA). Attended by: D. Fortunata, J. Jones, J. Villalpando, W. Prescott, G. van der Vink, C. Jones, and D. Wilson.
- Meeting with Death Valley National Park regarding permitting 5-8 GPS sites (January 12, 2005; Death Valley, CA). Attended by: C. Walls.
- Meeting with Miller Knox Regional Shoreline to discuss installation schedule for a GPS station (January 12, 2005; Richmond, CA). Attended by: B. Coyle.
- Meeting with University of California Berkeley to refine details of strainmeter data archiving statement of work and draft budgets (January 12, 2005; teleconference). Attended by: G. Anderson, L. Gee, and D. Neuhauser.

EarthScope PBO Engineers E. Arnitz, S. Bick, and C. Walls at one of three GPS stations they installed in Southern California in January.

- Operations and Maintenance Proposal Meeting (January 13, 2005; Denver, CO) to discuss status and changes to the EarthScope O&M Proposal. Attended by: EFEC and EarthScope Operations Group.
- Meeting with an independent professional land surveyor to discuss the sites (mostly located near San Juan Bautista) and the requirements of the reconnaissance and permitting subcontract (January 13, 2005; Richmond, CA). Attended by: B. Coyle and T. Williams
- Meeting with Claremont Canyon Regional Park to discuss installation schedule of a GPS station (January 14, 2005; Berkeley, CA). Attended by: B. Coyle and E. Leong.
- Subduction Site Selection Working Group Meeting (January 14, 2005; teleconference). Reviewed the Pacific Northwest and Alaska GPS site status. Attended by: M. Jackson, K. Hafner, K. Feaux, K. Barbour, and B. Pauk.

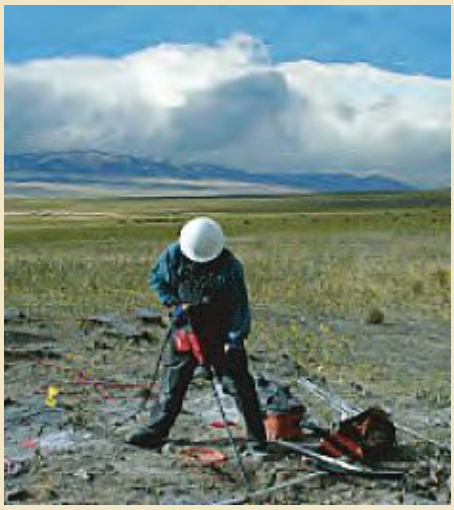
PBO station P170 in Northern California using a short-drilled braced monument style installation

- Meeting to refine draft Letter of Agreement between IRIS and UNAVCO to govern IRIS Data Management Center activities in archiving PBO strain data (January 14, 2005; teleconference). Attended by: G. Anderson and T. Ahern.
- Magmatic Systems Working Group Meeting to discuss scientific priorities for the upcoming strainmeter and GPS installations located on and around volcanoes and calderas (January 18, 2005; Vancouver, BC). Site selection and relocation issues were discussed for the Aleutian Islands, Yellowstone hotspot, Cascade volcanoes, Mt. Shasta volcano, Medicine Lake volcano, and Long Valley caldera. Committee members considered recent volcanic unrest with existing and planned infrastructure.
- Cascades Volcanic Observatory Meeting to discuss and test the equipment for two Mt. St. Helens installations scheduled for February (January 19, 2005; Vancouver, WA). Attended by: K. Hafner, P. Gray, and M. Lisowski.
- Meeting with Morgan Territory Regional Park to discuss installation schedule of a GPS station (January 20, 2005; Livermore, CA). Attended by: B. Coyle and R. Epperson.
- Meeting to develop draft technical plan for archiving and analysis of southern California GPS data (January 20, 2005; teleconference). Attended by: G. Anderson, F. Boler, F. Blume, and K. Stark.
- Meeting with Array Operations Center (January 20, 2005; Socorro, NM) to plan for the Sierra Nevada Experiment using Flexible Array equipment. Attended by: T. Owens and AOF Staff.
- Alaska Volcano Observatory Meeting to organize information and discuss permitting issues for Unimak Island (January 21, 2005; Fairbanks, AK). Attended by: B. Pauk, J. Power, T. Murray, and M. Coombs.
- Meetings with the Alaska Volcano Observatory and the US Fish and Wildlife Service to discuss future PBO installations and permitting issues for stations planned on Unimak Island (January 24, 2005; Anchorage, AK). Attended by: M. Jackson, K. Bohnenstiehl, and B. Pauk.
- Meeting with the US Forest Service and the Alaska Volcano Observatory to discuss how to proceed with permits in the Aleutians (January 24, 2005; Anchorage, AK). Attended by: D. Miller, M. Jackson, B. Pauk, T. Corbett, K. Bohnenstiehl, G. Siekaniek, S. Shuck, J. Stuart, S. Janis, S. Schulmeister, J. Brewer, B. Anderson, J. Power, and M. Coombs.
- Meeting with the Alaska Tsunami Warning Center to discuss joint installations in remote regions on the Alaskan Coast (January 25, 2005; Palmer, AK). Attended by: M. Jackson, B. Pauk, T. Corbett, and K. Bohnenstiehl.
- Meeting with the California Spatial Reference Center and the Southern California Earthquake Center to discuss archiving and analysis of southern California GPS data (January 26, 2005; Irvine, CA). Attended by: W. Prescott, G. Anderson, F. Boler, G. Helmer, W. Young, D. Agnew, and B. Minster.
- Meeting with Gladwin Tensor Strainmeter Technologies to discuss draft strainmeter processing and calibration plans (January 27, 2005; teleconference). Attended by: W. Prescott, M. Jackson, D. Wilson, G. Anderson, K. Hodgkinson, M. Gladwin, and M. Mee.
- Meeting to discuss Transportable Array station design and installation (January 18-21, 2005; Socorro, NM). Attended by: R. Busby, M. Alvarez, and J. Fowler.

- Meeting with the University of California San Diego to discuss communications, station installation schedules, and data flow for the Transportable Array (January 27-28, 2005; La Jolla, CA). Attended by: R. Busby, J. Fowler, D. Harvey, and the Array Network Facility Staff.
- PBO GPS Analysis Plan Meeting (February 1, 2005; Teleconference). Attended by: G. Anderson and T. Herring.
- Strainmeter Data Processing Workshop Planning Meeting (February 2, 2005; Teleconference). Attended by: S. Eriksson, E. Roeloffs, and K. Hodgkinson.
- IRIS Board of Directors Meeting (February 3-4, 2005, Washington, DC).
- Extension Working Group Siting Meeting (February 3-4, 2005; Tucson, AZ). Attended by: Working Group Members, M. Jackson, K. Feaux, K. Barbour, S. Borenstein, B. Friesen, C. Walls, and D. Mencin.
- Meeting with Gifford-Pinchot, HDR Consulting (February 3-4, 2005; Tucson, AZ). Attended by: K. Hafner.
- Meeting to discuss strainmeter data analysis methods (February 4 and 9, 2005; Teleconference). Attended by: K. Hodgkinson, and D. Agnew.
- California Spatial Reference Center Real-time GPS Networks Symposium (February 4, 2005; Irvine, CA). Meeting to discuss current developments in real-time GPS in the survey community and PBO's plans for real-time delivery of GPS data. Attended by: G. Anderson and K. Bohnenstiehl.
- Alaska Volcano Observatory (AVO) Geophysics Planning meeting (February 4, 2005; Anchorage, AK) to discuss joint activities for the 2005 field season. Attended by: M. Jackson and B. Pauk.
- Meeting with Alaska Department of Transportation (AKDOT) Northern Regional Design Office (February 8, 2005; Fairbanks, AK) to discuss GPS installations at AKDOT facilities and airports. Attended by: B. Pauk and R. Anderson.
- Meeting with NASA and IAGT (February 8, 2005; Washington, DC) to discuss EarthScope geospatial projects. Attended by: C. Hennet, G. van der Vink, F. Pieper, and J. Lebreque.
- Meeting with University of Alaska (February 9, 2005; Fairbanks, AK) to discuss GPS locations and priorities for Year 2 and Year 3. Attended by: B. Pauk and J. Freymueller.
- Meeting with private property owners (February 9, 2005; Valley Falls, OR) to discuss GPS installation. Attended by: K. Hafner.
- Meeting with the Olympic National Park Natural Resource Management Group (February 9, 2005; Port Angeles, WA) regarding permitting requirements for a GPS site at Hurricane Ridge and alternatives to a site at the Dosewallips Ranger Station. Attended by: K. Hafner and W. Bacchus.
- Meeting with Oregon Institute of Technology (February 10, 2005; Klamath Falls, OR) to finalize location for a GPS station. Attended by: K. Hafner.
- Meeting with Instrumental Software Technologies, Inc. (February 10, 2005; Boulder, CO) to discuss development of network status display tools. Attended by: G. Anderson, D. Mencin, and S. Hellman.
- Meeting with Gladwin Tensor Strainmeter Technologies (February 10, 2005; Teleconference) to discuss draft strainmeter processing and calibration plans. Attended by: K. Hodgkinson, M. Gladwin, and M. Mee.
- Meeting with Del Valle Regional Park (February 11, 2005; Del Valle, CA) to discuss installation schedule for GPS station. Attended by: B. Coyle.
- Meeting with Condor (February 14, 2005; Sonora, CA) to discuss reconnaissance and permitting subcontract requirements. Attended by: B. Coyle, A. Basset, and M. Crumm.
- Meeting with Park Supervisor for Coyote Creek Park (February 16, 2005; Coyote Creek, CA) to discuss installation schedule for GPS station. Attended by: B. Coyle.

Placing the weather-tight lid on the vault that holds the Transportable Array seismic instrumentation at Bend, OR. Installation of these sites often attracts the interest of local land owners and their animals.

- EFEC Quarterly Meeting and PBO Site Review (February 16-17, 2005; Boulder, CO). Attended by: EFEC, PBO Standing Committee, K. Shedlock, J. Whitcomb, C. Hennet, C. Meth, C. Guillemot, C. Weiland, M. Jackson, B. Stephanus, K. Feux, G. Anderson, S. Ingate, R. Woolley, D. Mencin, K. Barbour, K. Bohnenstiehl, and C. Shin.
- PBO Standing Committee Review of PBO (February 16, 2005; Boulder, CO). Attended by: M. Jackson, G. Anderson, and K. Barbour.
- Strainmeter Data Processing Workshop Planning Meeting (February 17, 2005; Teleconference). Attended by: S. Eriksson, E. Roeloffs, and K. Hodgkinson.
- Meeting with the Alaska Department of Transportation (February 17, 2005; Soldotna, AK) to discuss locating GPS stations at their maintenance facilities. Attended by: B. Pauk and S. Friedly.
- American Association for the Advancement of Science Annual Meeting (February 17-21, 2005; Washington, DC). Attended by: K. Kelly, C. Meth, and P. Sheatsley.
- Meeting with the Chugach Alaska Corporation (February 18, 2005; Ancorage, AK) to discuss siting requirements and permit needs. Attended by: T. Corbett, S. Friedly, and D. Phillips.



S. Borenstein trying to beat the storm in the Hansel Valley of Northern UT.

- PBO Transform Siting Committee Meeting (February 18, 2005; Sacramento, CA). Attended by: M. Jackson, K. Feaux, K. Bohnenstiehl, K. Barbour, B. Coyle, and C. Walls.
- Meeting with Sperry-Haliburton (February 20, 2005; Houston, TX). Attended by: M. Zoback, L. Capuano, J. Hanson, and Schlumberger Representatives.
- Meeting with Schlumberger regarding logging while drilling (February 21, 2005; Houston, TX). Attended by: M. Zoback, N. Boness, L. Capuano, J. Hanson, and Schlumberger Representatives.
- Meeting with Baker Hughes (February 21, 2005; Houston, TX). Attended by: M. Zoback, N Boness, C. Weiland, L. Capuano, J. Hanson, and Schlumberger Representatives.
- Meeting with California Spatial Reference Center and Imperial Irrigation District in Imperial Valley (February 22, 2005; Imperial Valley, CA) regarding potential siting of 3-5 GPS stations on Irrigation District property. Attended by: S. Lawrence and R. Packard.
- Meeting with the Spatial Reference Center of Washington to discuss possible collaboration of siting/permitting efforts in the region (February 22, 2005; teleconference). Attended by: M. Jackson, K. Bohnenstiehl, and K. Hafner.
- SAFOD Phase 1 Sampling Party at IODP Gulf Coast Repository (February 23, 2005; College Station, TX). Attended by: S. Hickman, M. Zoback, C. Weiland, N. Boness and 26 scientists from universities, the USGS, and private industry.
- Meeting with Northern California Earthquake Data Center (February 23, 2005; Berkeley, CA). Attended by: W. Ellsworth, D. Oppenheimer, D. Neuhauser, and L. Gee.
- Downhole Measurements Technical Panel Meeting (February 24, 2005; Houston, TX). Attended by: M. Zoback, S. Hickman, C. Weiland, N. Boness, A Day-Lewis, G. Ugueto, H. Yin, M. Enderlin, D. Goldberg, and D. Seeburger.
- Meeting with California Spatial Reference Center and Caltrans (February 24, 2005; San Bernardino, CA) to discuss potential siting of 2-7 GPS stations on Caltrans property. Attended by: S. Lawrence and R Packard.
- Meeting with the US Geological Survey (February 24, 2005; Golden, CO) to discuss use of USGS VSAT communication systems for GPS data. Attended by: G. Anderson, D. Ketchum, and H. Benz.
- IRIS Education and Outreach Standing Committee Meeting (February 24-25, 2005, Austin, TX).
- IRIS PASSCAL Strategic Planning Workshop (February 28, 2005, Boulder, CO).
- IRIS Data Management Center Meeting (February 23, 2005, Seattle, WA). Discussed quality assurance of ANSS Backbone data.
- Meeting with Sibley Volcanic Regional Park (March 3, 2005; Oakland, CA) to discuss installation location of GPS station P224. Attended by: B. Coyle, D. Marshall, and L. Craighill.

- Strainmeter data archiving meeting (March 4, 2005; teleconference). Attended by: G. Anderson, M. Hasting, K. Hodgkinson, J. Wright, and T. Ahern.
- Meeting to discuss borehole strainmeter data flow/processing (March 7-8. 2005; Riverside, CA). Attended by: G. Anderson, M. Gladwin, M. Hasting, K. Hodgkinson, D. Mencin, and J. Wright.
- Strainmeter data data archiving meeting (March 8, 2005; teleconference). Attended by: G.Anderson, L. Gee, M. Gladwin, K. Hodgkinson, D. Neuhauser, and J. Wright.
- Meeting to discuss management reserves and contingency (March 8, 2005; teleconference). Attended by: C. Weiland, R. Woolley, B. Stephanus, C. Hennet, C. Meth, G. van der Vink, and R. Morris.
- Alaska Volcano Observatory Annual Coordination Meeting (March 8-9, 2005; Fairbanks, AK). Discussed joint EarthScope/Alaska Volcano Observatory helicopter sharing and overlap of Aleutian installation and maintenance during the upcoming field season. Attended by: M. Jackson and B. Pauk.
- Meeting at Lava Beds National Monument (March 9, 2005; Tulelake, CA). Attended by: B. Coyle and K. Bohnenstiehl.
- Meeting at the Whiskeytown National Recreation Area (March 9, 2005; Redding, CA) to discuss GPS station P672. Attended by: B. Coyle, K. Bonenstiehl, and B. Rasmussen.
- Meeting with US Forest Service (March 10, 2005; Mare Island, CA). Attended by: B. Coyle, K. Bohnenstiehl, and R. Hawkins.
- Meeting with Geospace Engineering (March 11, 2005; Houston, TX). Attended by: W. Ellsworth, P. Malin, and Geospace Engineering representatives.
- Meeting with Sandia National Laboratory (March 14, 2005; teleconference). Attended by: M. Zoback, S. Hickman, W. Ellsworth, C. Weiland, S. Kuzsmaul, and R. Norman.
- Meeting with Olympic National Park (March 15, 2005; Port Angeles, WA) to discuss siting possible locations for a GPS monument. Attended by: K. Hafner.
- Meeting with Bureau of Land Management (March 18, 2005; Reno, NV) to discuss processing PBO applications. Attended by: K. Bohnenstiehl, B. Friesen, D. Miller, and D. Samuelson.
- Meeting with Oregon Department of Transportation (March 18, 2005; La Grande, OR) regarding a possible location for a GPS station. Attended by: K. Hafner.
- Meeting with Utah State Trust Lands (March 22, 2005; Salt Lake City, UT) to discuss archeological survey for permitting a GPS station. Attended by: C. Jarvis, B. Friesen, F. Jenkins, and G. Bagley.
- Meeting with Nevada Bureau of Land Management (March 23, 2005; Las Vegas, NV) to set course forward for processing of permits. Attended by: B. Friesen.
- Meeting at the Office of the Oregon Department of Aviation (March 23, 2005; Salem, OR) to discuss 7 GPS stations. Attended by: C. Riordan, T. Franklin, R. Leontiev, L. Maillet, and K. Hafner.
- Meeting with the Independent Cost Review team from LMI (March 23, 2005; Washington, DC). Attended by: G. van der Vink, C. Hennet, C. Meth, C. Weiland, S. Hickman, M. Zoback, W. Prescott, M. Jackson, B. Stephanus, D. Simpson, R. Woolley, R. Morris, and C. Shin.
- Meeting with Utah State Trust Lands (March 24, 2005; Salt Lake City, UT) to kick-off permitting first batch of four sites. Attended by: B. Friesen.
- Meeting with the City of Vernonia (March 24, 2005; Vernonia, WA) to discuss permitting requirements for a GPS installation at the airport. The city council has currently accepted the idea of the GPS monument, but their projected costs for power at the site are currently prohibitive. Attended by: K. Hafner.

Transportable Array station on Lummi Island, WA.

- EarthScope National Meeting 2005 (March 28-31, 2005, Santa Ana Pueblo, New Mexico). Attended by: EFEC, ESEC, and EarthScope Operations Group.
- Meeting with Yellowstone National Park (March 29, 2005; teleconference) regarding status of sites. Attended by: K. Bohnenstiehl and H. Heasler.
- Meeting with IAGT (March 29, 2005; Santa Ana Pueblo, NM) to discuss University Affiliate Siting Initiative, EarthScope Interactive Mapper, GlobeXplorer databases, and IAGT's potential involvement of the development of SeisNetWatch initiative within USArray. Attended by F. Pieper, S. Ingate, B. Busby, J. Fowler, and T. Ahern.
- Meeting with Harvard-Smithsonian Center for Astrophysics (March 29, 2005; Santa Ana Pueblo, NM) to discuss PBO Data Analysis Working Group status and plans. Attended by: G. Anderson and J. Davis.

Construction of the Array Operations Facility in Socorro, NM.

- Meeting with National Geodetic Survey (March 29, 2005; Santa Ana Pueblo, NM) to discuss incorporating continuous GPS stations into the Continuously Operating Reference Stations network. Attended by: G. Anderson and R. Snay.
- Meeting with University California San Diego (March 29, 2005; Santa Ana Pueblo, NM) to discuss borehole strainmeter station data loggers, data flow, and related issues. Attended by: M. Jackson, M. Hasting, G. Anderson, and Frank Vernon.
- Meeting with Yellowstone National Park (March 29, 2005; teleconference) regarding status of sites. Attended by: K. Bohnenstiehl and Hank Heasler.

Management Activities:

- Began development of partnership with Bureau of Land Management (BLM) to expedite permitting of EarthScope stations on BLM land.
- Submitted EarthScope Year 1-Quarter 2, Year 1-Quarter 3, Year 1-Quarter 4, Year 2-Quarter 1, and Year 1 Annual Reports to the National Science Foundation.
- EarthScope office supported summer interns from the State University of New York (June 8, 2004) and Princeton University (June 3, 2004) to work on GIS related projects.
- Submitted Education and Outreach Proposal to the National Science Foundation.
- Moved to new office space (1200 New York Ave, NW, Suite 700) on June 25, 2004.
- Submitted Government Performance and Results Act (GPRA) actuals to NSF.
- Marcos Alvarez temporarily relocated to California to oversee Transportable Array station construction efforts. The relocation will last approximately nine months until permanent crews can be brought on board and trained.
- PBO Standing Committee reviewed PBO. They were praised for having "accomplished a tremendous amount in its first year of operations."
- EarthScope trademark transferred from Kinemetrics, Inc. to the IRIS Consortium.
- Hosting of EarthScope website & email moved to UNAVCO.
- Expanded and renovated IRIS Data Management Center for additional EarthScope needs.
- Submitted Project Execution Plan version 2.0 to NSF on November 12, 2004.
- Hired PBO Pacific Northwest Field Assistant, Southern California Strainmeter Engineer, PBO Administrative Assistant I, PBO Depot Technician, ANSS Backbone Array Coordinator, PBO Pacific Northwest Field Engineer, PBO Southern California Field Engineer, PBO Data Management Database and Web Software Developer, PBO Data

Flow and Archiving Programmer, EarthScope Publications and Design Specialist, USArray Data Control Analyst, SAFOD Data Manager, and Transportable Array Coordinator at the Array Operations Center.

- Thorne Lay replaced Göran Ekström as the USArray representative on the EarthScope Facilities Executive Committee.
- Continued Operations and Maintenance planning, schedule and work breakdown development, and budget preparation and justification. Submitted the proposal to the National Science Foundation.
- Prepared proposal for EarthScope National Meeting.
- Trained new PBO Pacific Northwest Field Engineer and PBO Southern California Field Engineer on field operations.
- PBO Alaska regional staff assisted with installations in Northern California, Southern California, and the Basin and Range.
- Posted PBO Health and Safety Plan and Field Safety Procedures (February 24, 2005).
- Responded to permitting needs by temporarily reassigning the PBO Permitting Assistant to Northern California.
- Conducted Q330 training for three ANSS Backbone field engineers.
- Developed a staffing outline for the Transportable Array. The plan includes the MREFC phase and part of the O&M phase.
- Released a competitive request for quotes for a pilot Transportable Array installation project. This pilot project is projected to last 3 months for a private contractor to install the remaining Transportable Array stations in California. Experience gained from working with the contractor will help establish guidelines and standards for the more formal and larger RFP for Transportable Array operations to be released later this year.
- Continued training at PBO regional offices. Installation techniques for short-drilled braced monuments and CDMA communications modem were taught in the field. Current revision of NetRS GPS firmware and data communications strategies for Mt. St. Helens were discussed in Washington.
- VSAT training by Hues and Occupational Safety & Health Administration certified forklift training at the Southern California PBO office.
- Negotiated a pilot contract with Honeywell for construction and installation of Transportable Array stations during April, May, and June. The contract will act a prototype for the larger installation contract to be released later this summer.
- Negotiated with Arizona State University for reconnaissance and permitting support in Arizona and the University of Nevada Reno for reconnaissance and station specialists in Nevada.
- Answered questions for and provided supplemental information to NSF's independent cost reviewer LMI.
- EFEC Conference calls:
  - April 2, 2004: Discussed policies for using contingency funds and reporting variances, Education and Outreach Proposal, and Data Portal and Products.
  - April 9, 2004: Review of EarthScope progress via the February Monthly Report
  - April 23, 2004: Discussion of EarthScope reporting policies. Strainmeters will be installed as originally planed.
  - April 30, 2004: Discussed fiscal year 2004 possible budget revisions, the EarthScope reporting policy, and agenda items for the EFEC Quarterly Meeting.
  - May 21, 2004: Discussed Annual Report, GPRA Reporting, and EarthScope VIP/Media Day in Parkfield, CA. Reviewed Synergy Meeting recommendations, including the structure and participants for future EarthScope Operations Conference calls.

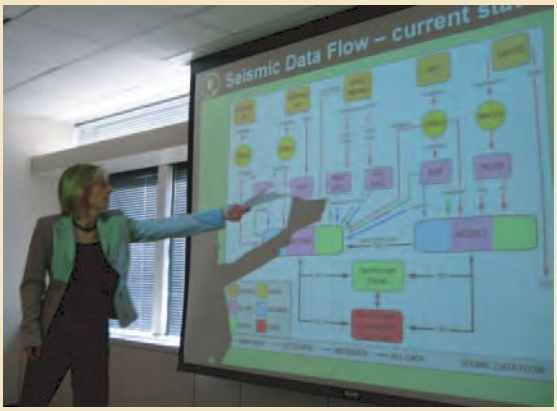
Unusually heavy rains affected EarthScope operations in California. Mitigation included assigning extra staff to California and modifying instrument installations.

- May 28, 2004: Discussed upcoming reports (Annual and GPRA), EarthScope request for proposals, and Coalition for National Science Funding Reception.
- June 4, 2004: Discussed R&RA Annual Report, Operations and Maintenance Funding, and information for NSF's request for proposals.
- June 17, 2004: Discussed conference call policies.
- July 2, 2004: Discussed VIP/Media Day
- July 9, 2004: Discussed the monthly report for May.
- July 23, 2004: Approved EarthScope Web Specialist candidate and the EarthScope Education and Outreach Manager advertisement, discussed itinerary for the VIP/Media Day and the SAFOD site review, and discussed the results of the recent data meetings.

Where the rubber meets the road. G. Hilker discussing EarthScope siting opportunities with a Utah land owner.

- July 30, 2004: Discussed recommended data policy, EarthScope data level definitions, EarthScope VIP/Media Day at Parkfield, CA and Augustine Volcano, and EarthScope Education and Outreach Manager search.
- August 20, 2004: Decided to approve NSF's "Additional Terms and Conditions" for the Education and Outreach Proposal with an attached list of concerns from the EFEC regarding interpretations of the Additional Terms. Discussed EarthScope Reporting System, the upcoming EFEC Quarterly Meeting, and VIP/Media Day in Parkfield.
- August 26, 2004: Reviewed agendas for EFEC Quarterly Meeting, SAFOD Site Review, and EarthScope VIP/Media Day in Parkfield.
- September 10, 2004: Discussed and approved EarthScope Data Level Definitions, and determined the next step in developing the EarthScope Data Management Plan.
- September 24, 2004: Approved joint ANSS-EarthScope Working Group on Seismic Data Integration and the plan to establish the EarthScope Education and Outreach Steering Committee.
- October 20, 2004: Discussed the current status of the project, upcoming schedule of events, and how EarthScope can respond to emerging scientific opportunities.
- November 12, 2004: Discussed agenda for EFEC Quarterly Meeting, agenda for EFEC/ESEC Joint Meeting, and GPRA numbers
- November 19, 2004: Discussed Quarterly Report and Operations and Maintenance Proposal
- December 3, 2004: Discussed Operation and Maintenance Proposal and Education and Outreach Manager Search Committee
- December 10, 2004: Discussed Operation and Maintenance Proposal and Education and Outreach Search Committee
- December 28, 2004: Discussed Operation and Maintenance Proposal and current status of EarthScope
- December 31, 2004: Discussed Operation and Maintenance Proposal and milestone reporting
- January 7, 2005: Discussed Operations and Maintenance Proposal and current status of EarthScope.
- January 21, 2005: Discussed Operations and Maintenance Proposal.
- February 11, 2005: Discussed quarterly meeting and EarthScope National Meeting.
- March 11, 2005: Discussed Independent Cost Review of Operations and Maintenance Proposal.
- March 17, 2005: Discussed NSF PBO Review and Independent Cost Review of Operations and Maintenance Proposal.
- March 25, 2005: Discussed handling of Project Concern Section from Quarterly Reports and Planning Committee.

- EarthScope Operations Conference calls:
  - April 21, 2004: Discussed negotiating an EarthScope price on VSAT equipment and bandwidth, and negotiating and EarthScope site license for Antelope software. Discussed GPS installations at Transportable Array sites, and developing a partnership between EarthScope and the Bureau of Land Management.
  - April 28, 2004: Discussed evolution of monthly reporting, monthly reporting templates, and outstanding questions from the previous monthly report.
  - May 19, 2004: Discussed structure and participants for future EarthScope Operations Conference calls, upcoming reports (Quarterly Report, Annual Report, and GPRA Report), and the Coalition for National Science Funding Reception.
  - May 26, 2004: Discussed upcoming reports, current status of project, and the next synergy meeting. Assigned deadlines and points of contact for Synergy Meeting action items.
  - June 2, 2004: Discussed EarthScope data policy, R&RA Annual Report, and upcoming meetings.
  - June 16, 2004: Discussed upcoming meetings.
  - June 26, 2004: Discussed current status of project, EarthScope National Meeting plans, and EarthScope Data Portal and Data Products
  - July 7, 2004: Reviewed current status of the project and discussed the monthly report for May.
  - July 21, 2004: Discussed current status of project, VIP/Media Day and the SAFOD site visit, and recent data meetings.
  - July 28, 2004: Discussed current status of project and VIP/Media Day, and suggested sessions for the National Meeting.
  - August 4, 2004: Discussed current status of project, upcoming change orders, and EarthScope VIP/Media Day in Parkfield.
  - August 18, 2004: Discussed current status of project, EarthScope VIP/Media Day in choreography and media packets.
  - August 25, 2004: Discussed current status of project, the EFEC Quarterly Meeting, EarthScope VIP/Media Day, and the NSF Management Review.
  - September 8, 2004: Discussed current status of project and the results of the EFEC Quarterly Meeting, SAFOD Site Review, and EarthScope VIP/Media Day.
  - October 13, 2004: Discussed revisions requested by the National Science Foundation for the Project Execution Plan.
  - October 19, 2004: Discussed current status of the project and revision requested by National Science Foundation for the Project Execution Plan.
  - November 3, 2004: Discussed Operation and Maintenance Proposal
  - November 24, 2004: Discussed Operations and Maintenance Proposal
  - December 1, 2004: Discussed Operation and Maintenance Proposal
  - December 8, 2004: Discussed Operation and Maintenance Proposal & change order procedures
  - December 20, 2004: Discussed current status of EarthScope and the Operation and Maintenance Proposal
  - December 29, 2004: Discussed current status of EarthScope and the Operation and Maintenance Proposal
  - January 5, 2005: Discussed current status of EarthScope and Operations and Maintenance Proposal.
  - January 10, 2005: Discussed EarthScope Operations and Maintenance Proposal.



C. Hennet at the EarthScope Management Review.

- January 27, 2005: Discussed current status of EarthScope and formed a subcommittee to determine EarthScope performance measures.
- February 2, 2005: Discussed current status of EarthScope.
- February 7, 2005: Discussed current status of EarthScope and NSF changes to the CSSR formulas.
- February 23, 2005: Discussed current status of EarthScope and PBO Site Review.
- March 2, 2005: Discussed current status of EarthScope and Independent Cost Review of Operations and Maintenance Proposal.
- March 9, 2005: Discussed current status of EarthScope and Independent Cost Review of Operations and Maintenance Proposal.

Installation of hybrid deep-short drilled braced monument in Sand Point Alaska.

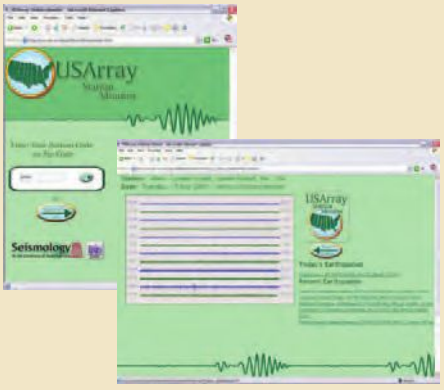
- Data Access Working Group Activities:
  - October 5, 2004: Discussed EarthScope Operations & Maintenance Proposal and agenda for meeting in Boulder end of October.
  - November 9, 2004: Discussed Operations and Maintenance Proposal and ArcIMS beta testing group.
  - November 23, 2004: Discussed Operations and Maintenance Proposal
  - December 7, 2004: Discussed the Operation and Maintenance Proposal and ArcIMS beta testing
  - January 13, 2005: Meeting to discuss Integrated Data Access System and the Operations & Maintenance Proposal.
  - February 8, 2005: Conference call to discuss performance measures for the operations and maintenance phase, and plans for the EarthScope National Meeting.
  - February 17, 2005: Meeting to discuss performance measures.
  - March 1, 2005: Conference call to discuss Integrated Data Access System development and access to current EarthScope data.
  - March 15, 2005: Conference call to discuss Integrated Data Access System development and access to current EarthScope data.
  - March 28, 2005: Workshop at EarthScope National Meeting
- Performance Metrics Working Group Activities:
  - February 16, 2005: Meeting to plan the schedule for development of the operations and maintenance performance metrics.
  - March 2, 2005: Conference call to identify performance measures to report on operations and maintenance funds.
  - March 9, 2005: Conference call to identify performance measures to report on operations and maintenance funds.
  - March 31, 2005: Conference call to identify performance measures to report on operations and maintenance funds.

Parkfield Response Activities:

- PBO Transform Site Selection Working Group requested response to M6.0 Parkfield earthquake.
- Verbal commitment for a GPS permit acquired within 24 hours of the earthquake.
- Permits are pending on three sites located on the Hearst Corporation property.
- Provided Flexible Array instrumentation in support of two new experiments (PASO TRES; C. Thurber and S. Roecker, and Parkfield Fault Zone Trapped Waves; Li and Vidale) near Parkfield.

Data Management Activities:

- Completed development of the IRIS Station Information System, including the station configuration interface, supporting database structures, and the extended markup language schema for messages and exported documents. Distributed for review and comment.
- Finalized membership of the PBO Data Products Working Group.
- Finalized the PBO Data Management Plan and released it to EarthScope community for comment. Feedback was provided by the EarthScope community through an email forum, and a second draft (written in concert with the PBO Data Products Working Group) was developed.
- Installed the USArray RAID for mission critical data storage. Integrated Veritas NetBackup for backing up data. Setup webmail so personnel can check their e-mail without a mail client. Finalized plans for Virtual Private Network access to remote offices for data flow, email, and web based services.
- Installed the USArray Real Time Computer System.
- Letter of Intent signed with California Integrated Seismic Networks for collaboration with regional networks in California.
- Installed Antelope 4.6 testing on the USArray servers, and installed second UPS system after failure of the first system. Configured the newly installed main processing unit.
- All channels from all USArray stations (ANSS Backbone and Transportable Array) that are being received at the IRIS Data Management Center are running through the Quality Assurance Framework.
- Data from the Transportable Array are now being processed in real-time at the Data Concentrating Nodes (University of California Berkeley and Caltech) using the Antelope software before it is quality controlled at the Array Network Facility.
- The BUD (Buffer of Uniform Data) to Archive Transfer System (BATS) is now operational and data are being transferred to the IRIS Data Management Center main archive.
- Started implementation of Virtual Networks at the IRIS Data Management Center.
- The Quality Analysis Control Toolkit, a software package under development at the IRIS Data Management Center for analyzing real-time seismic data, is now running on all Transportable Array data.
- Contacted several core repositories to begin discussions for long-term curation of SAFOD core.
- Contacted several vendors for 3-D geophysical modeling software to create interactive 3-D model of the SAFOD environment.
- Contracted Principle Investigators funded by the US Geological Survey and the National Science Foundation to work with cuttings, core, and fluid samples during Phase 1 drilling.
- Registered Federation of Digital Broad Band Seismic Networks code SAFOD on May 25, 2004.
- Begin set-up of science office and labs at drill site on May 26, 2004.
- Completed report “Review of Borehole Strainmeter Data Collected by the U.S. Geological Survey, 1985-2004.” E. Roeloffs, K. Hodgkinson, and C. Bryan. May 2004, 55-pages and 43 figures.
- Completed report: “Review of Borehole Tiltmeter Data Colleted by the U.S. Geological Survey.” K. Hodgkinson. May 2004, 24-pages and 19 figures.
- Completed draft report “Statement of Work for PBO GPS Archives” (June 24, 2004; second draft).
- Completed draft report “Statement of Work for PBO Strain and Seismic Data Archives” (June 27, 2004; first draft).
- Developed the first draft of the Request For Proposals for the PBO Data Analysis Centers and the Analysis Center Coordinator.
- Full complement of Berkeley Transportable Array stations is now available with complete metadata.



USArrayMonitor (http://roo.seis.sc.edu/USArrayMonitor), a tool for landowners to view data and events recorded by Transportable Array stations.

Array Network Facility real-time Transportable Array station monitor.

- First data from new USArray Transportable Stations was delivered to scientific researchers.
- USArray Data Management Plan was finalized and sent out for final review.
- University of California Berkeley regional network data are now flowing to the IRIS Data Management Center (DMC) but early problems with the metadata required extensive work by the Array Network Facility and the DMC to get it resolved.
- Representatives of IRIS, UNAVCO, and University of California San Diego discussed borehole seismic data management (August 24, 2004: La Jolla, CA).
- Representatives of UNAVCO and University of California San Diego discussed long-baseline laser strainmeter data and data management (August 24, 2004; La Jolla, CA).
- Explored using the Voyager Map tool and its applications for EarthScope data display.
- Discussed the exchange of data between the IRIS Station Information System and Antelope (August 9-11, 2004; San Diego, CA).
- Released USArray Data Management Plan.
- Installed SeedLink data server, which serves incoming data in real-time to consumers, at the IRIS Data Management Center.
- Installed AppareNet network monitoring software to provide extensive network status, monitoring, and feedback to all USArray data locations.
- Reorganized all USArray core system scripts to provide a comprehensive and coherent framework for managing USArray services.
- Developed and enforced a Request For Proposals Non-disclosure agreement and non-binding agreement (September 13-20, 2004). The RFP's are currently in review by the PBO Board and Standing Committee.
- Managing Statement of Work with each archive. Managing Scripps Orbit and Permanent Array Center (SOPAC) over budget response (September 14, 2004). This resulted in PBO management exploring a streamlined and under budget alternatives for archiving PBO GPS data.
- Created the GPS Analysis Center and Analysis Center Coordinator Request For Proposals, and released them for comment to the PBO Standing Committee and UNAVCO Inc. Board (September 28, 2004).
- EarthScope Data Products Group met to discuss progress and plans for the EarthScope Data Policy, EarthScope Data Management Plan, and EarthScope Portal (September 29, 2004; Seattle, WA).
- Continued to work with Mick Gladwin (strainmeter vendor) to get needed documentation, sample data, and feedback on data processing plan.
- Infrastructure related tasks include refining scripts for automated data downloading, reviewing the PBO Document Management System and updating/revising the PBO website.
- The Transportable Array station in Socorro, NM came back online after a 5 week communications outage.

- Sent image log data (thumbnail pictures and data files) from the EarthScope-SAFOD Pilot Hole to International Continental Drilling Program for public distribution.
- Began receiving and archiving hourly files from the GPS stations on Mt. St. Helens.
- Extended the virtual network system at the IRIS Data Management Center to include install date and certification date.
- Updated data request protocols at the IRIS Data Management Center to more intuitively handle requests specifying stations with virtual networks.
- Extended the Networked Data Collection processing system to support requests using Virtual Networks at the Federation of Digital Broadband Seismograph Networks and IRIS Networked Data Collection nodes.
- Began identifying the impact and associated costs of having the IRIS Data Management Center act as an archive and distribution center for data from the seismic components of EarthScope-PBO and EarthScope-SAFOD.
- Began beta testing of EarthScope Interactive Mapper.
- Delivered SAFOD Phase 1 cores, cuttings, and fluid samples from Phase 1 to the IODP Gulf Coast Repository in College Station, TX.
- Identified GPS Analysis Center and Analysis Center Coordinator candidates. Developed final statements of work for GPS Analysis Center and Analysis Center Coordinator subawards based on detailed. GPS analysis plan developed by T. Herring. Worked with M. Murray and T. Melbourne to arrive at final budgets for the Analysis Center subawards.
- Finalized statement of work and budget request for alternative GPS data archiving model.
- Enhanced mapping ability within the IRIS Data Management SeismiQuery for the generation of topographic maps used to report progress in USArray.
- Completed processing of the seismic data from the SAFOD Pilot Hole array.
- Released SAFOD Pilot Hole seismic data. The data are available from the Northern California Earthquake Data Center and the EarthScope website.
- Distributed material for draft GPS processing plan to T. Herring, T. Melbourne, and M. Murray. Received draft GPS processing plan from T. Herring on January 7, 2005.
- Finalized calibration method for PBO strainmeters.
- Wrote and distributed Strainmeter Processing Steps document.
- Made available information about USArray installation dates and certification dates.
- Serviced ANSS Backbone station in Bend, OR. Data is being manually downloaded to a portable computer. Plans to install a cell modem to communicate data changed because tests revealed that reliable cell phone service could not be obtained. A VSAT system will be installed during the next service visit.
- Re-evaluated PBO information technology needs, including hardware/software and purchased services such as maintenance contracts.
- Released PBO Operational Database (POD) and POD Operational Interface version 1.5.
- Began Uniform Product Distribution System development with the preliminary development of the web service-based product submission client and server.
- Repaired internet connection to SAFOD site. No data from the sonde was lost because it was recorded on site.
- Data from the Stage 2 seismic instrument and Pilot Hole collected in January and February sent to the Northern California Earthquake Data Center.
- Eight of the nine Mount St. Helens stations are being downloaded and archived approximately hourly. There have been occasional transient communications failures that we believe are due to weather, as well as recurrent problems with the VPN for those stations.

D. Prose (a freelance film maker supported by NSF) and assistant filming the installation of a Transportable Array site near Placerville CA.

- Finalized statements of work and budget requests for GPS Archiving.
- Worked with L. Gee to finalize University of California Berkeley strain data archiving statement of work and archiving budgets.
- Developed new model for local buffer at strainmeter stations, using PC-104 computers in place of the seismic logger. This lowers costs considerably.
- Developed Preliminary Design Review document for PBO data management system.
- Fully updated all permitting information in PBO Operational Database and made sure the uploaded data was correct.
- Added three new stations to the Transportable Array dataset at the IRIS Data Management Center.
- The Array Network Facility makes available a real-time Transportable Array station state-of-health monitoring tool, available on their website at. The status display includes communications status, data latency, GPS information, vault temperature and voltages.

USArray staff at the Array Network Facility building under construction at New Mexico Tech, Socorro, NM.

- Developed statement of work for archiving GPS data at the IRIS Data Management Center.
- Began redevelopment of IAGT support at the IRIS Data Management Center.
- Continued development of a signal processing software for the fiber-optic strainmeter for the SAFOD Main Hole. Significant progress has been made and it nears completion.

Instrumentation Activities:

- Began drilling with 44.5 cm (17.5 inch) bit at 585 m (1,920 ft).
- SAFOD Main Hole intersected Pilot Hole at ~1.06 km (~3,500 ft). A bridge plug was installed to separate the boreholes. The Main Hole was backed up 91.4 m (300 ft), and side track was drilled away from the Pilot Hole.
- Reached the target depth of 1.4 km (4,740 ft) for vertical section of SAFOD.
- Installed two stations in Southern California as part of a prototype network for broadcasting real-time, high-rate data for survey applications from GPS stations.
- Progress on Volcano Cluster GPS reconnaissance, including seven sites in Alaska (Augustine Volcano), 22 sites in the Medicine Lake/Mt. Shasta region, eight sites in Yellowstone, and 10 sites in Mt. St. Helens.
- Flexible Array deployment for telemetered array in Parkfield, CA postponed until October due to permit issues.
- Discussions begun with Mike Hansen of the Ohio Geological Survey regarding the upgrade of the Ohio ANSS Backbone site.
- New location for the Maine ANSS Backbone station discussed to increase logistics support and security. The new location is at Peaks-Kenny State Park on Sebec Lake (North of Dover-Foxcroft, ME).
- Performed borehole measurements at drill site in Parkfield, including: geophysical logging in vertical hole between 610-1,444 m (2,000-4,740 ft), coring at base of the vertical hole, fluid sampling, mini-fracture test. After the measurements, the 13 3/8 inch casing was set from the surface to 1,444 m (4,740 ft).
- Began direction drilling towards the San Andreas Fault in Parkfield, CA.
- Prepared for the installation of seven GPS stations in Alaska: five on Augustine Volcano and two on the mainland adjacent to the volcano. A field camp of 15 personnel is expected, including members from the National Science Foundation and the US Geological Survey.
- Requested a permit from the City of Delta, UT to install a GPS station at the Delta Municipal Airport.

- Installed four GPS stations in the Southern California Region that are part of a prototype network for broadcasting real-time, high-rate data for survey applications.
- New field support trailer was received and built up as a mobile work station for ANSS Backbone operations on the road.
- Completed 3 reconnaissance visits for the co-location of GPS monuments at ANSS Backbone sites.
- Installed Transportable Array telemetry at San Simeon site.
- Prepared for deployments of Stage 2 instruments at SAFOD (laser strainmeter behind the casing and the 3-component seismometer in the main hole).
- Prepared for Stage 3 borehole instrumentation deployments with Sandia National Lab and Paulsson Geophysical Services, Inc.
- Reached Phase 1 target depth (10010 feet measured depth) on September 16, 2004.
- Performed geophysical logging in main borehole on September 17 and 24, 2004.
- Cased and cemented the lower (deviated) part of the main hole (September 25-26, 2004)
- Began coring in the main borehole on September 30, 2004.
- Installed seven GPS stations on the Augustine Volcano and the mainland in response to high prioritization by the PBO Magmatic Systems Site Selection Working Group.
- Installed a Transportable Array station at Wishkah Valley School in Aberdeen, WA.
- Installed a Transportable Array station on Lummi Island, WA.
- Continued to work with Hughes satellite systems to get their system to transmit data from Transportable Array Stations.
- Purchased first cell modems to test their applicability for data transmission.
- Received 27 Guralp CMG-3T sensors for the Transportable Array.
- Upgraded 4 ANSS Backbone stations with STS-2 HG broadband and Episensors strong-motion instruments.
- Completed coring of the EarthScope SAFOD Main Hole. 38 feet of core were returned in two core runs.
- Installed and cemented into place the optical fibers for the University of California San Diego laser strainmeter in the EarthScope SAFOD Main Hole.
- Released the EarthScope SAFOD drill rig on October 10, 2004.
- Began long-term test of fluid build-up in the EarthScope SAFOD Main Hole.
- Continued characterization studies around the EarthScope SAFOD drill site.
- Installed the Parkfield Area Seismic Observatory (PASO) III Array in Parkfield, CA around the EarthScope SAFOD site with EarthScope USArray Flexible Array seismometers. The experiment was accelerated in response to the M6 Parkfield earthquake. Data telemetry consists of streamed 40 Hz data and event triggered 250 Hz.
- Continued installing EarthScope PBO GPS stations in the Pacific Northwest, Northern California, Southern California, and Alaska regions.
- Fixed incompatibility between the Quanterra Q330 data logger and the Hughes satellite system (VSAT), allowing for the installation of the Quanterra Q330 data logger at all ANSS Backbone Array sites.
- Received seven STS-2 low-gain seismometers and two STS-2 warpless baseplates and bell jars (allowing for installation isolated from atmospheric pressure changes) at the Albuquerque Seismological Laboratory.
- Changed design of solar power system for stations located in low light areas.

ANSS Backbone Global Seismographic Network station near Godfrey, GA.

- Continued working with SpaceNet and Hughes satellite vendors to complete the prototype set-up for EarthScope USArray Transportable Array stations.
- Updated ANSS Backbone station in Ely, NM with a STS-2 hi-gain sensor.
- Opened dialog with the University of Alaska Geophysical Institute for cooperation on an ANSS Backbone Array site on Wrangell Island, AK.
- Opened dialog the University of Nevada, Reno about providing site location and permitting support for EarthScope USArray Transportable Array sites in Nevada.
- Completed first EarthScope USArray Flexible Array experiment field data acquisition in Nevada.
- Conducted temperature log in the EarthScope SAFOD Main Hole with the USGS.
- Installed trench and signal cable conduits between EarthScope SAFOD wellhead and surface recording building.

The fiber optic strainmeter cables are attached to the outside of the casing as it is lowered down the SAFOD Main Hole. Centralizers are put in place to keep the casing centered in the open hole. The casing (and strainmeter) is subsequently cemented in place.

- Conducted comprehensive gyroscopic directional surveys of the EarthScope SAFOD Main Hole.
- Installed the Duke University Stage 2 seismic sonde in the EarthScope SAFOD Main Hole.
- Continued refinement of the target earthquake locations.
- Began installation of permanent power to the EarthScope SAFOD drill site.
- Selected EarthScope SAFOD Phase 1 cuttings and core chips sent off for thin section preparation.
- Continued testing satellite and cell phones for EarthScope USArray Transportable Array telemetry systems. The goal of these tests is to determine the long-term characteristics of each system.
- Continued station hardware system integration for EarthScope USArray Transportable Array stations to improve shipping and installation procedures.
- Installed two seismometers (STS-2HG) in sealed bell jars at the Albuquerque Seismological Laboratory and began testing to see if noise could be reduced by eliminating effects of atmospheric pressure changes. The goal is to evaluate the STS-2HG as a replacement for the STS-1 (which are no longer available) for the ANSS Backbone. The seismometers appear as quiet at long periods as the STS-1 seismometers. Recordings from the Sumatra-Andaman Earthquake will be used to compare ultra-long periods.
- Began drilling boreholes for strainmeters near Port Angeles, WA on the Olympic Peninsula.
- Completed reconnaissance for four strainmeter sites in the Mount St. Helens region, interfacing with Cascades Volcanic Observatory and USGS personnel. Eight sites were located and will be included in the permitting process with the US Forest Service.
- Reinstalled the Stage 2, 3-component seismometer in the SAFOD Main Hole.
- Began development of ultra-stable laser for optic-fiber strainmeter.
- Continued installation of GPS stations, borehole strainmeter stations, Transportable Array stations, and ANSS Backbone stations.
- Drafted a communications plan for Yellowstone National Park to supplement site specific information in the research permit.
- Received 4 borehole seismometers, the final Streckeisen STS-2 seismometers, and 11 Vaisala microbarograph transducers for the ANSS Backbone.
- Replaced the STS-2 HG seismometer with the STS-2 LG seismometer at 5 ANSS Backbone stations.
- Received quotes for Magnetotelluric instrumentation. Instruments for testing will be chosen in January 2005.
- Received the prototype Texans (single channel recorders for active source recording). Initial testing is to start in January. These units were originally scheduled for delivery in June, however problems with the new hardware design caused the delay.

- Experienced water problems at several Transportable Array stations due to usually wet weather in California. No major pieces of equipment have been lost. Incorporating vault design changes to prevent future damage.
- Conducted preliminary GPS site survey at 6 ANSS Backbone sites.
- The real-time telemetry from the PASO TRES Flexible Array experiment in Parkfield to the Array Network Facility is still not operating up to the promises of the manufacturer. All of the data are being recorded on site, but the Array Network Facility has been unable to achieve a telemetry rate sufficient to retrieve the data in real-time. The current plan calls for replacing the system with one from another manufacturer.
- The Flexible Array equipment for the Fault Zone experiment is still in the field in Parkfield. The rains in this area have made it impossible to get vehicles into the area where the equipment is located. The PI has promised to retrieve the equipment as soon as the conditions permit. The equipment is not needed until the March-April timeframe.
- Continued development of a signal processing software for the fiber-optic strainmeter for the SAFOD Main Hole. Significant progress has been made and it nears completion.
- Reviewed and reworked Alaska summer deployment plan based on new directives from NSF and changes in the Alaska regional staff.
- Finalized contract with Condor Earth Technologies for 19 GPS sites in the Northern California region for reconnaissance and permiting.
- Purchased 28 TopCon GB-1000 systems for campaign instrumentation. Placed orders for ancillary equipment to prepare 20 for packaged field deployment.
- Delayed the prototype 20 unit PBO MAGNET test campaign due to weather.
- Continued ANSS Backbone test vault experiment. When complete, five different surface vaults will operate simultaneously side-by-side.
- Received two Personal Digital Assistants for cloning programming of ANSS Backbone Q330 data loggers.
- Began initial testing of the prototype single channel active source data recorder (Texan). Testing was done in parallel with that done by the manufacturer. Initial testing has identified a hardware problem in the power supply with low temperatures and a low battery. This condition will require a modification to the power supply boards.
- Finished borehole core drilling in the Pacific Northwest. Of the 8 holes drilled, 7 were cored and 6 were determined acceptable.
- Reviewed the logging while drilling and fluid sampling service providers for data quality, sample integrity and reliability.
- Developed a strategy for testing and fluid sampling during SAFOD Phase 2, factoring in risk management, data quality, and costs.
- Remotely fixed sonde after a power surge scrambled the systems. The engineering team that built the sonde brought the downhole seismometer digitizer and telemetry system back up from Houston. The sonde failed again on February 24, 2005. It could not be repaired either remotely or from the surface. The sonde will be retrieved from the borehole in March and sent to Geospace for repair and modification if necessary.
- Finalized contract with J. Swanson for reconnaissance and permitting of 8 sites near San Juan Bautista, CA.
- Finalized contract with Condor Earth Technologies for reconnaissance and permitting 19 sites in the San Joaquin Valley.
- Set up, configured, and tested 4 ANSS Backbone site/noise survey systems, 4 instruments, and 2 Q330's and STS-2 LG's for test vaults.
- Changed Transportable Array vault designs after flooding from unusually heavy rains. Two weeks of maintenance was required to fix four of the flooded vaults.
- Pulled Stage 2 Seismic Sonde from Main Hole due to technical problems on from the SAFOD Main Hole on March 14, 2005.
- Heat flow measurement in the SAFOD Main Hole on March 15, 2005.
- Designed strainmeter enclosures and electronics packages.

Data from the magnitude 5.1 earthquake on June 15, 2004 in Baja California.

- Completed final logging of strainmeter boreholes.
- Tested and assembled strainmeter electronic packages.
- Received the first strainmeter. Assembled, loaded, and transported all equipment and materials to the borehole in the Pacific Northwest. After strainmeter failure on install site, transported and shipped strainmeter back to Australia for testing and repair.
- Permit package submitted for Carson City and Battle Mountain Bureau of Land Management for 20 GPS sites.
- Received Cost Recovery Agreement from California Bureau of Land Management for $1000 per site.
- Received modified prototype "Texan" instruments for testing. This second version of the prototype hardware has a new power supply that ensures proper operation at low temperatures.
- Reviewed final design of Northern Power solar system for Transportable Array VSAT systems.

Transportable Array style vault at the Albuquerque Seismological Laboratory for comparison tests with the standard MacMillan design used with the National Seismic Network station upgrades

- Meeting at the PASSCAL Instrument Center to conduct a design review of the performance of the pumps, AC VSAT enclosures and sensor tests.
- Transportable Array station in Fairfield, CA (POTR) was removed due to land ownership issues and has been temporarily replaced by station a station in Antioch, CA (BDM) until a long-term solution is worked out.
- Certified ANSS Backbone stations at Wupatki, AZ; Dugway, UT; and Hanford, WA.

PART II: Performance Measures

MANAGEMENT STRUCTURE

EarthScope's goal is to explore the structure and dynamics of the North American continent at multiple scales – that of a fault (SAFOD), a plate boundary (PBO), and a continent (USArray). At each scale, instrumentation networks are being deployed to collect the various data sets – core samples, GPS, strainmeter, and seismic – resulting in a series of parallel subtasks:

SAFOD: San Andreas Fault Observatory at Depth

- Construct a multi-level, multi-component observatory to closely monitor at depth repeating microearthquakes on the San Andreas Fault
- Measure directly the physical state under which micro-earthquakes occur
- Recover rock and fluid samples from the active fault zone and surrounding crust

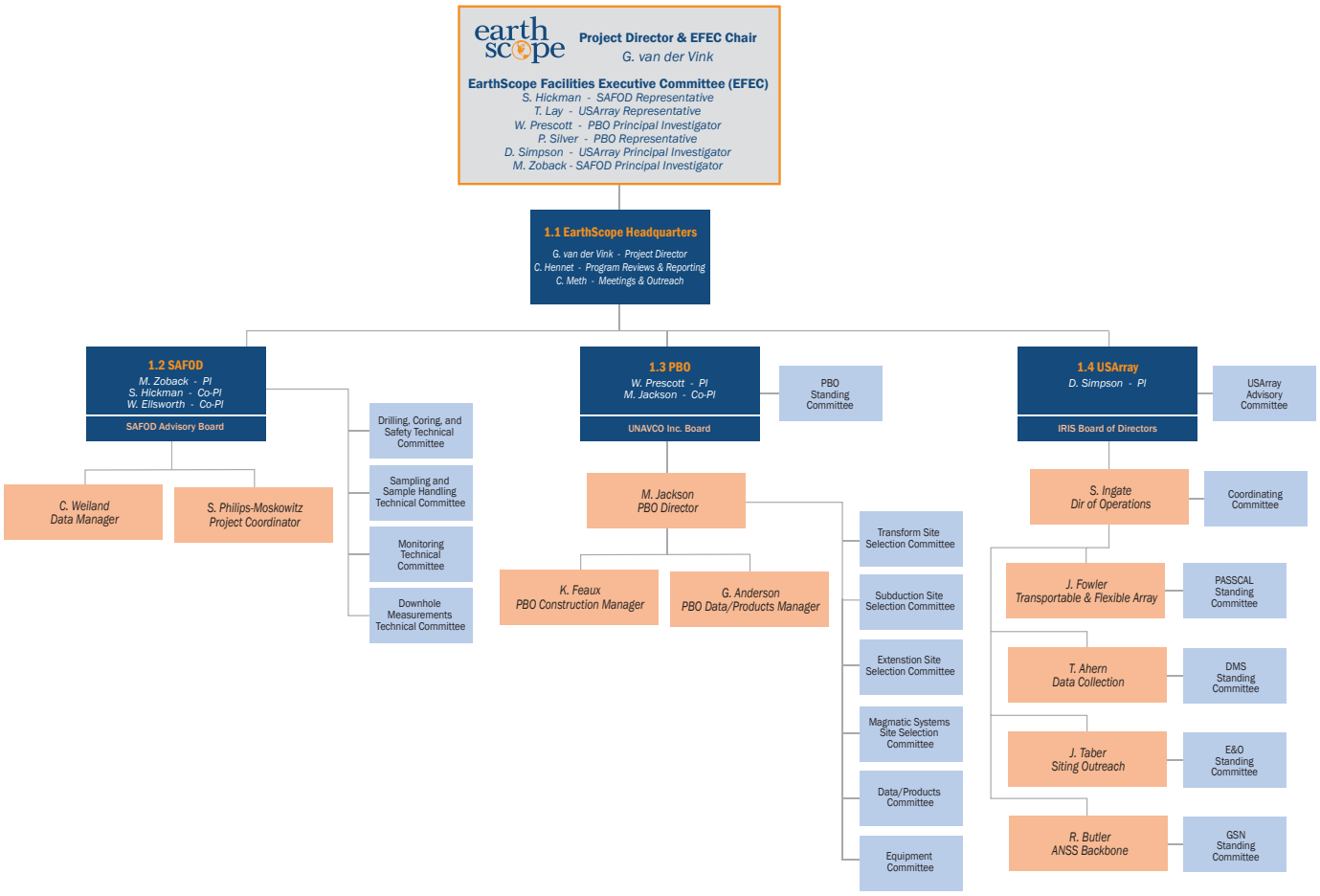
PBO: Plate Boundary Observatory of geodetic sensors

- Network of 100 Backbone GPS stations
- Network of 775 Permanent GPS stations
- Network of 175 Borehole strainmeters and seismometers
- Pool of 100 campaign GPS instruments
- GeoEarthScope – Geochronology & Images

USArray: Seismic arrays across the continent

- Network of 39 ANSS Backbone Network stations
- Network of 400 Transportable Array stations
- Pool of 2,400 campaign seismic instruments

EarthScope subtasks are implemented either through well-established and organized consortia that are experienced in deploying and operating networks of instruments, or, in the case of scientific drilling, through an academic and governmental partnership that has a strong history of collaboration. Representatives from each of the organizations compose the EarthScope Facility Executive Committee (EFEC). All members of the EFEC bear responsibility and are accountable for all aspects of the EarthScope project. The Project Director is the chair of the EFEC and has overall management authority for the project including responsibility for budget development, construction, and operation. Within the EarthScope management structure are various committees that serve in advisory and oversight roles, as well as change control boards. They help insure that EarthScope maintains its strong community interfaces and transparency.



EarthScope work is organized through the multi-level Work Breakdown Structure (WBS). It provides a clear breakout of scope, schedule, and actual costs. The first tier of the WBS (1 EarthScope) is referred to as Level 0, the second tier (1.1 EarthScope Management, 1.2 SAFOD, etc.) is referred to as Level 1, the third tier (1.1.1 EarthScope Management, 1.1.2 Program Reviews & Reporting, etc.) as Level 2, and so forth through the framework. The following box shows the EarthScope WBS through Level 3, although for most tasks there are multiple levels well beyond Level 3.

1 EarthScope

1.1 EarthScope Management

1.1.1 EarthScope Management
1.1.2 Program Reviews & Reporting
1.1.3 Meetings & Outreach

1.2 Drilling and Instrumentation of San Andreas Fault (SAFOD)

1.2.1 SAFOD Management
1.2.2 Drilling and Downhole Measurements
- 1.2.2.1 Subawards
- 1.2.2.2 Phase 1
- 1.2.2.3 Phase 2
- 1.2.2.4 Phase 3

1.2.3 Instrumentation
- 1.2.3.1 Subawards
- 1.2.3.2 Stage 1
- 1.2.3.3 Stage 2
- 1.2.3.4 Stage 3

1.2.4 Data Products and Sample Handling

1.3 Instrumentation of Plate Boundary (PBO)

1.3.1 PBO Management
- 1.3.1.1 Program Management Office
- 1.3.1.2 General IT Support
- 1.3.1.3 Training & Working Group Meetings

1.3.2 Long-baseline Strainmeter
- 1.3.2.1 General / GPS
- 1.3.2.2 Strainmeter
- 1.3.2.3 Data Products and Archive

1.3.3 Procurement
- 1.3.3.1 Campaign GPS Stations
- 1.3.3.2 Permanent GPS Stations
- 1.3.3.3 Borehole Strainmeter Equipment
- 1.3.3.4 Other Materials and Supplies
- 1.3.3.5 Computers, Software, Licenses

1.3.4 System Fabrication, Test, and Campaign
- 1.3.4.1 System Fabrication
- 1.3.4.2 System Testing
- 1.3.4.3 System Development
- 1.3.4.4 Campaign Support

1.3.5 Operations
- 1.3.5.1 Operations Management
- 1.3.5.2 Northern California
- 1.3.5.3 Southern California
- 1.3.5.4 Pacific Northwest
- 1.3.5.5 Basin and Range
- 1.3.5.6 Rocky Mountain
- 1.3.5.7 Alaska

1.3.6 Data and Data Products
- 1.3.6.1 Data Products Management
- 1.3.6.2 Analysis Center / Web Admin.
- 1.3.6.3 Data Archives
- 1.3.6.4 Data Storage Equipment

1.3.7 GeoEarthScope
- 1.3.7.1 Lidar Imagery
- 1.3.7.2 Geochronology

1.3.8 Project Support

1.4 Instrumentation of Continent (USArray)

1.4.1 USArray Management
1.4.2 ANSS Backbone Stations
- 1.4.2.1 Management
- 1.4.2.2 Procurement
- 1.4.2.3 Subawards

1.4.3 Transportable Array Stations
- 1.4.3.1 Management
- 1.4.3.2 Procurement
- 1.4.3.3 Subawards

1.4.4 Flexible Array stations
- 1.4.4.1 Management
- 1.4.4.2 Procurement
- 1.4.4.3 Subawards

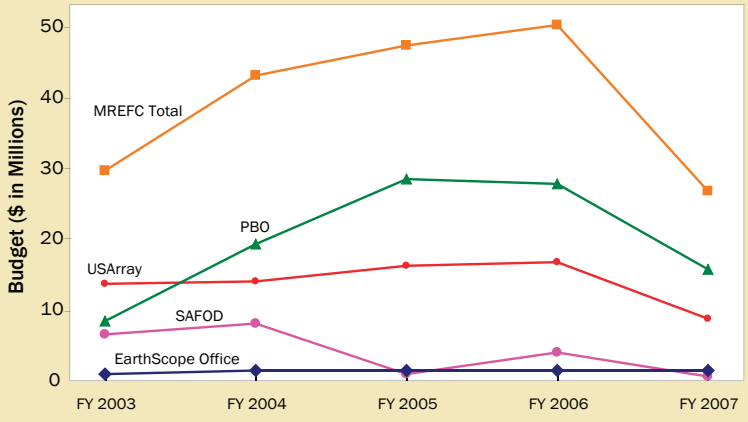
1.4.5 Data Management
- 1.4.5.1 Management
- 1.4.5.2 Procurement
- 1.4.5.3 Software
- 1.4.5.4 Development of Data Flow from USArray
- 1.4.5.5 Deployment and Operational Testing

1.4.6 Siting Outreach
- 1.4.6.1 Management
- 1.4.6.2 Procurement
- 1.4.6.3 Subawards
- 1.4.6.4 Publications

Level 2 tasks match the existing management structure of each organization with the scientific goals of each project. By structuring the activities in this manner, individuals responsible for each Level 2 task are identifiable from within each EarthScope management component.

Individuals	Level 2 Task
EarthScope Management	
G. van der Vink	1.1.1 EarthScope Management
C. Hennet	1.1.2 Program Reviews & Reporting
C. Meth	1.1.3 Meetings & Outreach
SAFOD	
M. Zoback	1.2.1 SAFOD Management
M. Zoback	1.2.2 Drilling and Downhole Measurements
W. Ellsworth	1.2.3 Instrumentation
S. Hickman	1.2.4 Data Products and Sample Handling
PBO	
M. Jackson	1.3.1 PBO Management
B. Stephanus	1.3.2 Long-baseline Strainmeters
M. Jackson	1.3.3 Procurement
C. Kurnik	1.3.4 System Fabrication, Test, & Campaign
K. Feaux	1.3.5 Operations
G. Anderson	1.3.6 Data & Data Products
C. Meertens	1.3.7 GeoEarthScope
B. Stephanus	1.3.8 Project Support
USArray	
S. Ingate	1.4.1 USArray Management
R. Butler	1.4.2 ANSS Backbone
J. Fowler	1.4.3 Transportable Array
J. Fowler	1.4.4 Flexible Array
T. Ahern	1.4.5 Data Management
J. Taber	1.4.6 Siting Outreach

EarthScope uses Earned Value Management (EVM) for managing the project and reporting to the National Science Foundation. The backbone of the structure is a baseline schedule, budget, and earned value system that is used to evaluate project progress.



Project funding for the construction phase of EarthScope. The expected operational lifespan of EarthScope is 15 years after construction is complete in Fiscal Year 2007

EarthScope Year 2 Baseline Time-Phased Budget at Work Breakdown Structure Level 2 (December 2004)

WBS Element	October	November	December	January	February	March	April	May	June	July	August	September	Total
EarthScope Management (WBS Element 1.1)													
1.1.1 EarthScope Office	$21,131	$99,177	$88,435	$82,757	$86,675	$82,381	$88,804	$85,724	$82,898	$90,843	$91,430	$85,065	$985,324
1.1.2 Program Reviews & Reporting	$0	$0	$0	$3,803	$14,100	$8,500	$11,500	$14,600	$4,500	$4,000	$5,000	$14,600	$80,603
1.1.3 Meetings and Outreach	$33,588	$12,327	$15,362	$5,697	$7,112	$9,550	$11,887	$13,610	$16,012	$5,695	$4,610	$4,710	$140,160
Contingency													$60,000
EarthScope Management Total	$54,719	$111,504	$103,797	$92,257	$107,887	$100,431	$112,191	$113,934	$103,410	$100,538	$101,040	$104,375	**$1,266,087**
SAFOD (WBS Element 1.2)													
1.2.1 SAFOD Management	$21,105	$21,105	$21,105	$21,105	$21,340	$21,340	$22,940	$34,311	$42,311	$63,929	$29,340	$29,920	$349,850
1.2.2 Drilling & Download Measurement	$1,421,543	$118,326	$10,650	$15,000	$15,000	$30,000	$40,000	$213,000	$1,076,000	$1,311,000	$1,783,000	$756,100	$6,789,619
1.2.3 Instrumentation	$228,452	$84,600	$77,805	$48,000	$6,600	$53,000	$0	$0	$54,000	$0	$0	$54,256	$606,713
1.2.4 Data Products & Sample Handling	$14,414	$14,414	$14,414	$21,126	$14,414	$14,414	$21,126	$14,414	$14,414	$21,126	$14,414	$21,467	$200,160
Contingency													$523,859
SAFOD Total	$1,685,514	$238,445	$123,974	$105,231	$57,354	$118,754	$84,066	$261,725	$1,186,725	$1,396,056	$1,826,754	$861,743	**$8,470,201**
PBO (WBS Element 1.3)													
1.3.1 PBO Management	$99,514	$99,514	$99,514	$93,414	$93,414	$93,414	$93,414	$93,414	$93,414	$93,414	$93,414	$93,414	$1,139,270
1.3.2 Long-Baseline Strainmeters	$24,883	$26,297	$20,733	$33,702	$38,744	$43,783	$46,509	$48,622	$50,253	$50,497	$54,097	$51,330	$489,450
1.3.3 Procurement	$535,378	$535,378	$535,378	$515,617	$515,617	$515,617	$515,617	$515,617	$515,617	$515,617	$515,617	$515,617	$6,246,685
1.3.4 System Fabrication, Test, & Campaign	$47,303	$47,303	$30,749	$28,441	$28,441	$28,441	$28,441	$28,441	$28,441	$28,441	$28,441	$28,441	$381,321
1.3.5 Operations	$727,268	$727,268	$727,268	$681,024	$681,024	$681,024	$681,175	$681,175	$681,175	$681,175	$681,175	$681,175	$8,311,928
1.3.6 Data & Data Products	$56,110	$56,110	$56,110	$62,614	$62,614	$62,614	$62,614	$62,614	$62,614	$62,615	$62,615	$62,615	$731,859
1.3.7 GeoEarthScope	$10,268	$10,268	$10,268	$107,355	$107,355	$107,355	$107,355	$107,355	$107,355	$107,355	$107,355	$107,355	$996,998
1.3.8 Project Support	$49,746	$49,746	$49,746	$47,978	$47,978	$47,978	$47,978	$47,978	$47,978	$47,978	$47,978	$47,978	$581,044
Contingency													$756,505
PBO Total	$1,550,470	$1,551,884	$1,529,766	$1,570,145	$1,575,187	$1,580,226	$1,583,103	$1,585,216	$1,586,847	$1,587,092	$1,590,692	$1,587,925	**$19,635,060**
USArray (WBS Element 1.4)													
1.4.1 USArray Management	$67,158	$68,158	$68,657	$181,448	$183,448	$188,948	$87,936	$88,936	$88,936	$156,616	$156,616	$168,117	$1,504,974
1.4.2 ANSS Backbone Stations	$52,571	$52,571	$101,514	$40,518	$40,438	$336,688	$62,095	$62,095	$171,925	$657,899	$657,799	$830,399	$3,066,512
1.4.3 Transportable Array Stations	$862,787	$471,287	$471,288	$827,954	$537,960	$537,961	$847,294	$617,294	$557,302	$919,803	$557,302	$906,302	$8,114,534
1.4.4 Flexible Array Stations	$118,608	$118,608	$118,609	$118,609	$118,610	$1,366,610	$268,610	$831,110	$268,612	$486,112	$118,612	$1,138,611	$5,071,321
1.4.5 Data Management	$43,176	$121,033	$31,055	$31,804	$31,555	$31,804	$31,804	$31,054	$31,055	$33,487	$31,986	$31,986	$481,799
1.4.6 Siting Outreach	$2,828	$2,828	$6,428	$2,828	$7,828	$6,328	$7,328	$4,828	$5,328	$7,913	$7,019	$5,685	$67,169
Contingency													$525,438
USArray Total	$1,147,128	$834,485	$797,551	$1,203,161	$919,839	$2,468,339	$1,305,067	$1,635,317	$1,123,158	$2,261,830	$1,529,334	$3,081,100	**$18,831,747**

MILESTONE PROGRESS REPORT

To track the program production goals and non-recurring system set-up, EarthScope has developed a detailed list of interim measures or milestones. The milestones are organized by quarter and Work Breakdown Structure (WBS) level as a framework to measure the project's progress against the Project Execution Plan (submitted to NSF on November 30, 2003; approval pending). The milestone list does not reflect changes to the schedule that have been approved through the change order process.

Year 1 Milestones

Quarter 1 (9/1/03 – 12/31/03)	Completed?
1.1 Project Director, Analyst, and Administrator hired	Yes
1.1 Project Execution Plan submitted for review	Yes
1.2 Stage 1 SAFOD monitoring subcontract awarded.	Yes
1.2 Phase 1 Drilling subcontract signed	Yes
1.2 SAFOD Advisory Board and Technical Panels named	Yes
1.2 SAFOD Data Manager hired	Yes
1.3 Critical PBO staff hired	Yes
1.3 PS purchase decision finalized	Yes
1.3 Rocky Mountain Regional Office established	Yes
1.3 Preliminary Design Review (PDR) of Permanent GPS Station equipment completed	Yes
1.4 Acquire hardware for IRIS DMC increased capacity	Yes
1.4 Issue award for Array Operations Facility	Yes
1.4 Issue award to USGS/ASL	Yes
1.4 6.7 equivalent ANSS Backbone stations installed	Yes

Quarter 2 (1/1/04 – 3/31/04)	Completed?
1.1 PBO site review completed by EFEC	Yes
1.1 First Quarter FY03/04 Report submitted (3/1/2004)	Yes
1.2 Construction of SAFOD Stage 1 monitoring instrumentation initiated	Yes
1.2 Subcontract for SAFOD Stage 2 monitoring instrumentation issued	Yes
1.3 PBO Archive subawards signed	No
1.3 RFP for PBO Processing Center released	Yes
1.3 RFP for PBO strainmeter released	Yes
1.3 Southern and Northern California Regional Office established	Yes
1.3 Critical Design Review (CDR) of Permanent GPS Station equipment completed	Yes
1.3 PDR of Borehole strainmeter equipment and procedures completed	Yes
1.4 Issue Award for Array Network Facility	Yes
1.4 Cooperative regional network stations data begins flowing to the DMC.	Yes
1.4 9 equivalent ANSS Backbone stations	Yes

Explanation for incomplete milestones:

1.3 **PBO Archive subawards signed:** PBO Data Management milestones have been delayed due to the need for a careful community review process of the PBO Data Management Plan. This five-month process had not been included in the original project plan, but was critical to ensure community acceptance of the PBO plan. As of this writing the Archive subawards have been chosen and contract execution is underway.

Quarter 3 (4/1/04 – 6/30/04)	Completed?
1.1 USArray site reviewed by EFEC	Yes
1.1 Second Quarter FY03/04 Report and Annual Report submitted (6/1/2004)	Yes
1.2 Phase 1 drilling of SAFOD Main Hole initiated	Yes
1.2 Construction of Stage 2 monitoring instrumentation initiated	Yes
1.3 PBO Processing Center subawards established	No
1.3 PBO strainmeter subawards established	Yes
1.3 Pacific Northwest, Basin and Range and Alaska Regional Office established	Yes
1.3 CDR of Borehole strainmeter equipment procedures completed	Yes
1.3 40 equivalent Permanent GPS Stations, 3 equivalent Borehole Strainmeters	Yes
1.4 Array Network Facility and Data Management Center communications tested.	Yes
1.4 10.6 ANSS Backbone stations	Yes

Explanation for incomplete milestone:

1.3 **PBO Processing Center subawards established:** The PBO GPS data analysis (Processing Center) plan is complete and statements of work are being defined at present. As of this writing the Processing Center subawards have been chosen and contract execution is underway.

Quarter 4 (7/1/04 – 9/31/04)	Completed?
1.1 SAFOD site reviewed by EFEC	Yes
1.1 Third Quarter FY03/04 Report submitted (9/10/2004)	No
1.2 Phase 1 drilling and related downhole activities completed	Yes
1.2 Stage 2 monitoring instrumentation deployed	Yes
1.2 Stage 1 monitoring system in SAFOD Pilot Hole deployed	No
1.3 PDR of PBO data archiving and Data solutions components completed	Yes
1.3 90 equivalent Permanent GPS Stations, 6 equivalent Borehole Strainmeters, 1 equivalent Long Baseline Strainmeter installed, and 28 equivalent Campaign GPS installations completed	No
1.4 DCN to ANF and DCN to DMC communications tests complete	Yes
1.4 13.8 equivalent ANSS Backbone stations, 28 equivalent Transportable Array stations, 240 Flexible Array equipment available	No

Explanations for incomplete milestones:

1.1 **Third Quarter FY03/04 Report submitted (9/10/2004):** With NSF's prior approval, the Third Quarter FY03/04 Report was submitted on September 17, 2004.

1.2 **Stage 1 monitoring instrumentation system in SAFOD Pilot Hole deployed:** This instrument will now be deployed in Spring 2005. Explanations for delay are in change orders SAFOD-004 and SAFOD-015.

1.3 **90 equivalent Permanent GPS Stations, 6 equivalent Borehole Strainmeters, 1 equivalent Long Base Strainmeter installed, and 28 equivalent Campaign GPS installations completed:** All goals were met with the exception of the Long-base Strainmeter. This instrument is forecasted to be installed in the spring of 2005. PBO management has had an on-site review of the revised Long-base Strainmeter schedule, which schedules completion of five instruments during the MREFC.

1.4 **13.8 equivalent ANSS Backbone stations, 28 equivalent Transportable Array stations, 240 Flexible Array equipment available:** Change Orders USArray-007 and USArray-008 defined new metrics for computing Transportable Array and ANSS Backbone equivalent stations. NSF denied these requests, but granted provisional authority to calculate Transportable Array and ANSS Backbone equivalent stations as described in these change orders. This is reflected in the CSSR.

The Backbone milestones reflect best projections available at the time of the Project Execution Plan (November 30, 2003) when proposals and negotiations with the prime ANSS Backbone subawardee, the US Geological Survey, were being concluded. Subsequent to these efforts, a comprehensive Work Breakdown Structure was adopted and the USGS subaward was issued in February 2004. Based on this WBS, the ANSS Backbone equivalent station count for this month is 16.2. Explanations of cost and schedule variance and why this milestone was not met are elsewhere in this report.

The award for the Transportable Array contractor was not issued. The cost and size of this contract suggested that a pilot project first be conducted, giving USArray experience with tendering and monitoring progress made by a large company responsible for Transportable Array installations. The experience gained would result in a more accurately defined bidding process, evaluation and contractual wording. A Pilot Contract was negotiated with Honeywell after a competitive process for them to provide one full time field person as well as another 2 people part time for construction and installation of Transportable Array stations during April, May and June. This will allow USArray to meet the installation goals for this time period and will act as a prototype for the larger installation contract to be released later this summer. This pilot project started April 1, 2005. The request for proposals for the larger contract will be issued in June.

The milestone of 480 Flexible Array instruments was not reached, due to late delivery of the 400 “Texan” data recorders on order. These units were scheduled for delivery in March, however, problems associated with the new design have delayed the delivery. USArray has worked closely with the vendor on this issue since 2004 when the problem was identified and late delivery anticipated. As of the end of March 2005, all problems had been solved and production commenced. The delivery is expected to be completed no later than June 2005. No Flexible Array experiments have been affected.

Year 2 Milestones

Quarter 1 (10/1/04–12/31/04)	Completed?
1.1 EarthScope Office site reviewed by EFEC	Yes
1.1 Fourth Quarter FY03/04 Report submitted (12/1/2004)	Yes
1.3 CDR of PBO data archiving and data solutions components completed	No
1.3 143 equivalent Permanent GPS Stations, 12 equivalent Borehole Strainmeters, 1.5 equivalent Long Baseline Strainmeters installed, and 28 equivalent Campaign installations completed	No
1.4 21.4 equivalent ANSS Backbone stations, 36 equivalent Transportable Array stations, 480 Flexible Array equipment available	No

Explanations for incomplete milestones:

1.3 **CDR of PBO data archiving and data solutions components completed:** CDR of PBO data archiving and data solutions components completed: The completion of the CDR has been delayed beyond the original schedule due to the critical community review process for the PBO Data Management Plan, which took longer than originally forecast. Now that the Data Management Plan is complete and Analysis Center Statements of Work, strainmeter processing plan, and Archive contracts are almost complete, we anticipate rapid completion of the PDR, on which the CDR is dependent. We anticipate completion of the CDR by the fall of 2005.

1.3 **143 equivalent Permanent GPS Stations, 12 equivalent Borehole Strainmeters, 1.5 equivalent Long Base Strainmeters installed, and 28 equivalent Campaign installations completed:** All goals were met with the exception of Long-base Strainmeters. The first long baseline strainmeter instrument is forecasted to be installed in the spring of 2005. Schedule concerns on the remaining Long-base Strainmeters prompted a second on-site review at April 2005.

1.4 **21.4 equivalent ANSS Backbone stations, 36 equivalent Transportable Array stations, 480 Flexible Array equipment:** See explanation for milestone 1.4 in Year 1 Quarter 4.

Quarter 2 (1/1/05 –3/31/05)	Completed?
1.1 PBO site reviewed by EFEC	Yes
1.1 First Quarter FY04/05 Report submitted (3/1/05)	Yes
1.2 Contract for Stage 3 monitoring system signed	No
1.2 Samples and data distributed	Yes
1.2 Subcontract for Phase 2 drilling and related services signed	Yes
1.3 195 equivalent Permanent GPS Stations, 18 equivalent Borehole Strainmeters, 2.0 equivalent Long Baseline Strainmeters installed, 28 equivalent campaign installations completed	No
1.4 Award for Transportable Array Contractor issued.	No
1.4 23.1 equivalent ANSS Backbone stations, 48 equivalent Transportable Array stations, 480 Flexible Array equipment available	No

Explanation for incomplete milestones:

1.2 **Contract for Stage 3 monitoring system signed:** Contract for SAFOD Stage 3 monitoring not signed because the contract will go out to RFP as per recommendation form the SAFOD Monitoring Panel and technical details still being developed between SAFOD and Sandia National Laboratories.

1.3 **195 equivalent Permanent GPS Stations, 18 equivalent Borehole Strainmeters, 2.0 equivalent Long Base Strainmeters installed, 28 equivalent campaign installations complete:** 186 equivalent Permanent GPS Stations were complete, which are 9 short of the goal. A regional based revised planned has been implemented to meet the overall production goals. Borehole strainmeters and campaign instruments met this milestone. The long-base strainmeter program is behind plan. PBO management has held two program reviews (November 2004 and April 2005) and has required a corrective action plan from University of California San Diego.

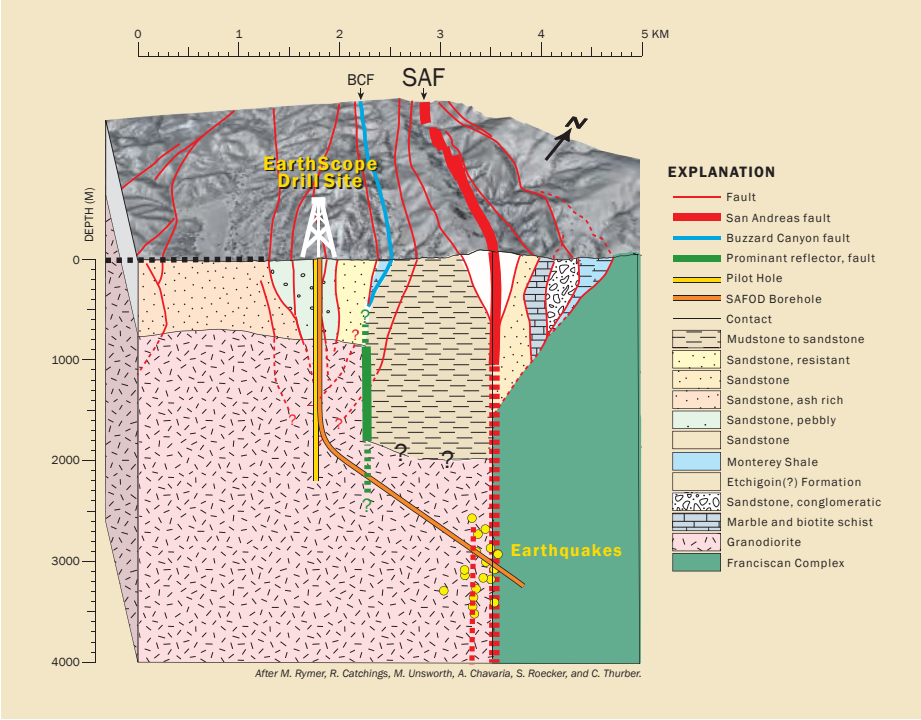
1.4 **23.1 equivalent ANSS Backbone stations, 48 equivalent Transportable Array stations, 480 Flexible Array equipment:** See explanation for milestone 1.4 in Year 1 Quarter 4.

TECHNICAL PROGRESS

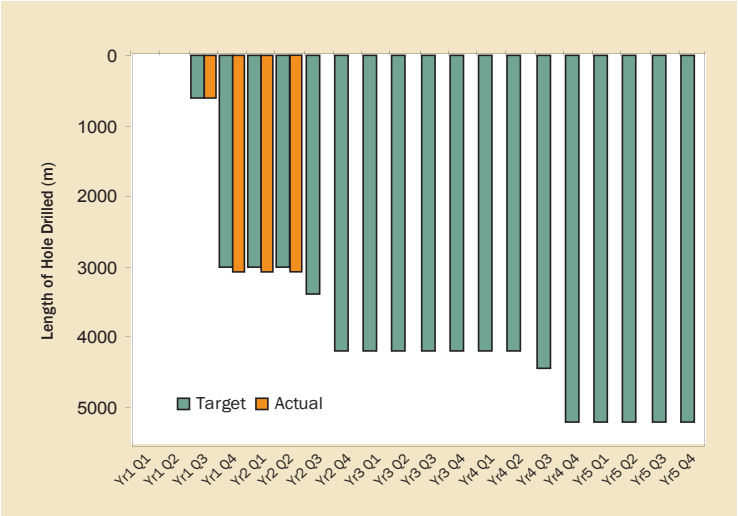
EarthScope measures progress in two ways: For the San Andreas Fault Observatory at Depth, progress is measured against depth drilled and timelines for the three phases of drilling and three stages of monitoring in the hole. For the geodetic and seismic stations, progress is measured in terms of the total number of steps in station installation (termed “equivalent stations”).

Drilling

The complete set of SAFOD drilling phases and monitoring stages are defined as follows: Phase 1: Drilling Main Hole. Phase 2: Drilling through the fault zone. Phase 3: Coring into the region of active earthquakes. Stage 1: Monitoring in the Pilot Hole with a retrievable string of 3-component seismometers. Stage 2: Strain monitoring outside the casing and seismic monitoring within the casing. Stage 3: Monitoring in active earthquake zone with seismic and pore pressure instrumentation.



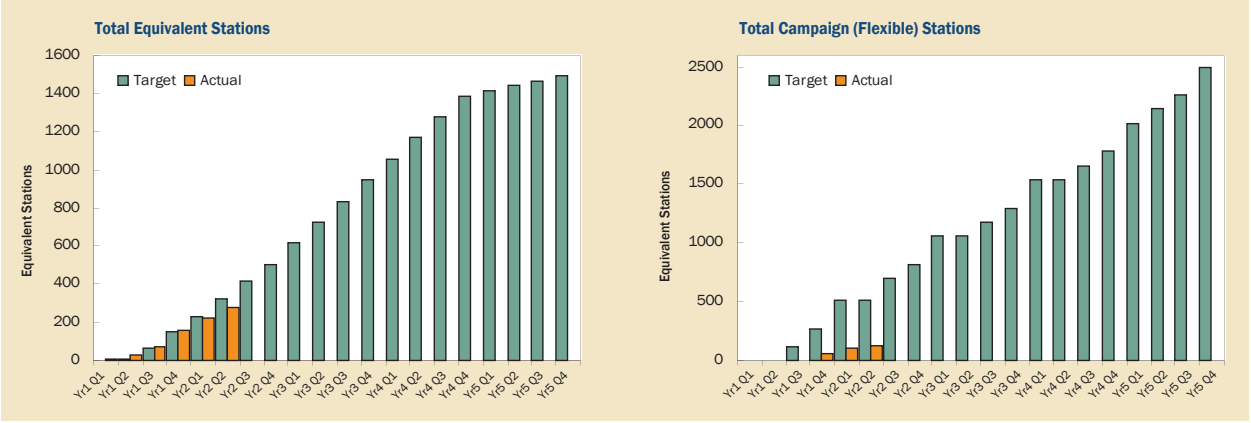
To track drilling progress, target lengths are provided by quarter. They represent the goal for the end of quarter. The Actual Length is the length of the borehole at the end of Quarter 2; it represents the depth measured along the borehole. Phase 1 drilling ended in September 2004, with a measured depth of 3,067 m and a horizontal offset of 1.1 km. Phase 2 drilling is expected to begin in June 2005.



Equivalent Stations

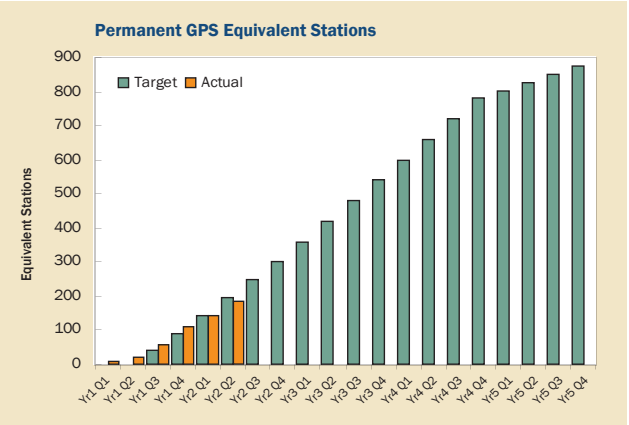
Installation of the geodetic and seismic stations involve several steps – procurement, assembly, permitting, site selection, installation, etc. The uncertainty and difficulty with each of these steps is highly site dependent. The EarthScope management system assesses progress at a greater degree of granularity than simply the completion of a station. Credit is given for each of the major elements so that technical progress can be more accurately measured. For example, if 90% of the activities for a specific EarthScope station are completed, the earned value for that station is credited at that time as 0.9 equivalent stations, rather than showing the station as simply incomplete until the remaining 10% is finished. Through such an "earned credit" measurement, we can monitor progress at a higher resolution than if we simply relied on the count of completed installations.

Over the next five years, EarthScope will install 1,494 stations across the country. The stations will include permanent GPS stations, borehole strainmeters stations, long-baseline strainmeters stations, ANSS Backbone seismic stations, and Transportable Array seismic stations. In addition, EarthScope will purchase 2,500 campaign GPS and seismic instruments, which will be available for temporary deployments and individual research experiments.



Permanent GPS Stations

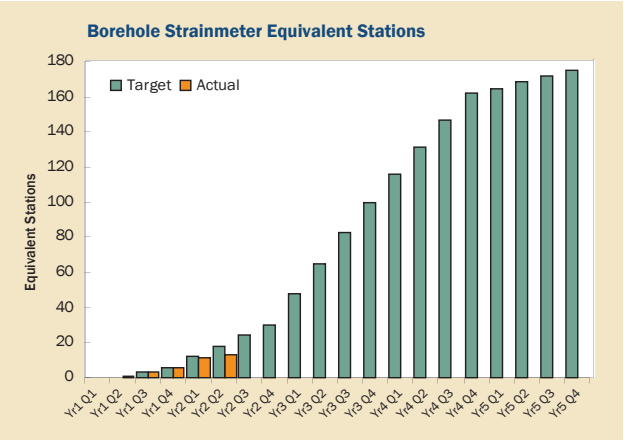
Permanent GPS stations measure ground movement on time scales of days to decades and over large spatial scales. They are used to cover long-period transients such as those associated with viscoelastic relaxation following an earthquake, decadal estimates of strain accumulation, plate motion, and spatial variations. Installation plans call for the deployment of 875 permanent GPS stations over five years. At the end of the quarter, 186 equivalent stations were installed, slightly under the end of quarter target. Reconnaissance and permitting activities remain higher than expected.



Permanent GPS Stations					
Metrics	**Installation Progress**		**Equivalent Stations**		
	Target	**Actual**	**% of Station**	**Target**	**Actual**
Equipment procurement and assembly	123	106	10%	12.3	10.6
Siting	627	592	5%	31.4	29.6
Reconnaissance	295	387	10%	29.5	38.7
Permit submitted	278	320	10%	27.8	32.0
Permit accepted	225	162	15%	33.8	24.3
Monument installation	123	106	20%	24.6	21.2
Equipment installation	123	106	15%	18.5	15.9
Site commissioning	115	94	5%	5.8	4.7
Data flow	115	94	5%	5.8	4.7
Product generation	115	94	5%	5.8	4.7
Total Number of Equivalent Stations			**100%**	**195.0**	**186.4**

Borehole Strainmeters

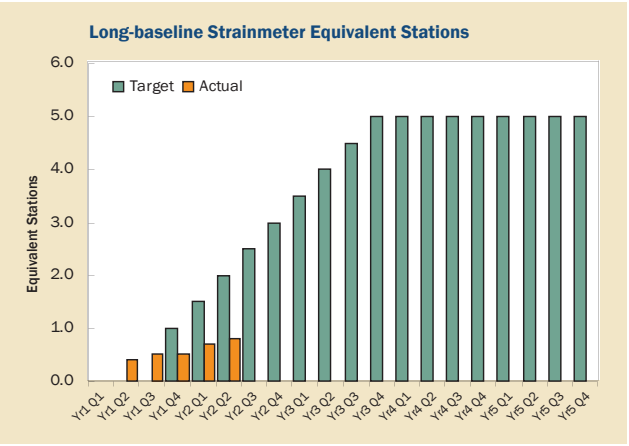
Borehole strainmeters recover short-term transient deformation and phenomena with periods ranging from seconds to months. They play a central role in observing phenomena that accompany and precede earthquakes and volcanic eruptions. As listed in the Project Execution Plan, installation plans call for the deployment of 175 borehole strainmeters over five years. At the end of the quarter, 13 equivalent stations were complete. Siting and reconnaissance are ahead of schedule, while drilling and equipment installation are behind.



Borehole Strainmeter Stations					
Metrics	**Installation Progress**		**Equivalent Stations**		
	Target	**Actual**	**% of Station**	**Target**	**Actual**
Equipment procurement and assembly	15	0	5%	0.8	0.0
Equipment testing and QA	15	0	5%	0.8	0.0
Siting	30	45	5%	1.5	2.3
Reconnaissance	25	45	10%	2.5	4.5
Permit submitted	25	27	10%	2.5	2.7
Permit accepted	21	14	15%	3.2	2.1
Drilling borehole	16	8	20%	3.2	1.6
Equipment installation	12	0	15%	1.8	0.0
Site commissioning	12	0	5%	0.6	0.0
Data flow	12	0	5%	0.6	0.0
Product generation	12	0	5%	0.6	0.0
Total Number of Equivalent Stations			**100%**	**18.0**	**13.2**

Long-baseline Strainmeters

Long-baseline strainmeter instruments have the high resolution of the borehole strainmeters combined with the long-term stability of GPS measurements. A few instruments will be used in carefully chosen locations to provide complementary information to both the borehole and GPS systems. Installation plans call for the deployment of 5 long-baseline strainmeters over three years. At the end of Quarter 2, 0.8 equivalent stations have been installed. PBO management has requested a corrective action plan from the long-baseline strainmeter subcontractor the University of California San Diego.

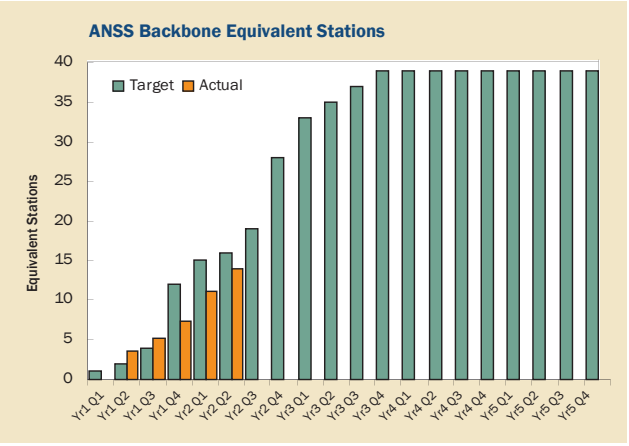


Long-baseline Strainmeter Stations

Metrics	Installation Progress Target	Installation Progress Actual	Equivalent Stations % of Station	Equivalent Stations Target	Equivalent Stations Actual
Reconnaissance	3	1	10%	0.3	0.1
Equipment procurement and assembly	2	1	10%	0.2	0.1
Siting	4	3	5%	0.2	0.2
Permit submitted	3	1	10%	0.3	0.1
Permit accepted	2	1	15%	0.3	0.2
Equipment assembly on site	2	1	5%	0.1	0.1
Strainmeter anchoring	2	1	15%	0.3	0.2
Equipment installation	1	0	15%	0.2	0.0
Site commissioning	1	0	5%	0.1	0.0
Data flow	1	0	5%	0.1	0.0
Product generation	1	0	5%	0.1	0.0
Total Number of Equivalent Stations			**100%**	**2.0**	**0.8**

ANSS Backbone

The ANSS Backbone is a partnership between EarthScope and the US Geological Survey. It will consist of a 100 permanent stations that will serve as the permanent reference network for the Transportable Array. The EarthScope contribution to the ANSS Backbone will consist of 13 Global Seismographic Network-quality seismic stations and 26 National Seismic Network-quality seismic stations as an integrated resource both for EarthScope science and for seismic monitoring. Installation plans call for the deployment or upgrade of these 39 stations over three years. Progress towards installation of the ANSS Backbone Stations is behind schedule with 14 equivalent stations complete. The shortfall is driven by siting activities which are behind schedule.

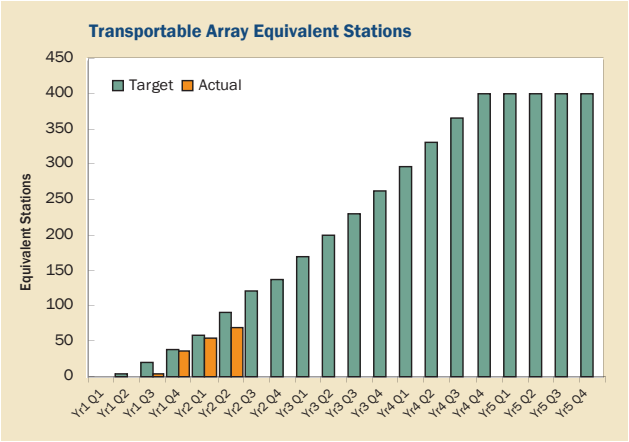


ANSS Backbone Stations*					
Metrics	**Installation Progress**		**Equivalent Stations**		
	Target	**Actual**	**% of Station**	**Target**	**Actual**
Procurement	18	24	27%	4.9	6.6
Siting	21	6	20%	4.2	1.2
Civil Works	14	0	4%	0.6	0.0
Equipment	27	28	12%	3.3	3.3
Installation	9	8	30%	2.7	2.4
Communications	1	3	3%	0.0	0.1
Certification	14	8	4%	0.6	0.3
Total Number of Equivalent Stations			**100%**	**16.2**	**13.9**

**Equivalent station metrics have been changed from those in the PEP with permission from NSF.*

Transportable Array

The Transportable Array will consist of 400 broadband seismic stations, deployed in a grid with a station spacing of ~70 kilometers. The array will advance across the country in a roll-along fashion, stopping at each location for a period of ~18 months. Installation plans call for the deployment of 400 broadband stations by the fourth quarter of Year 4. Different types of Transportable Array stations exist, such as new stations and pre-existing stations installed by regional network operators, which may or may not require different levels of hardware and software upgrades to meet Transportable Array standards. The target for the end of the quarter, 91 equivalent stations, reflects the current monthly baseline. The Transportable Array is currently behind schedule with 71 equivalent Transportable Array stations installed. The shortfall is due to lower than expected siting/permitting and construction/ installation activities.



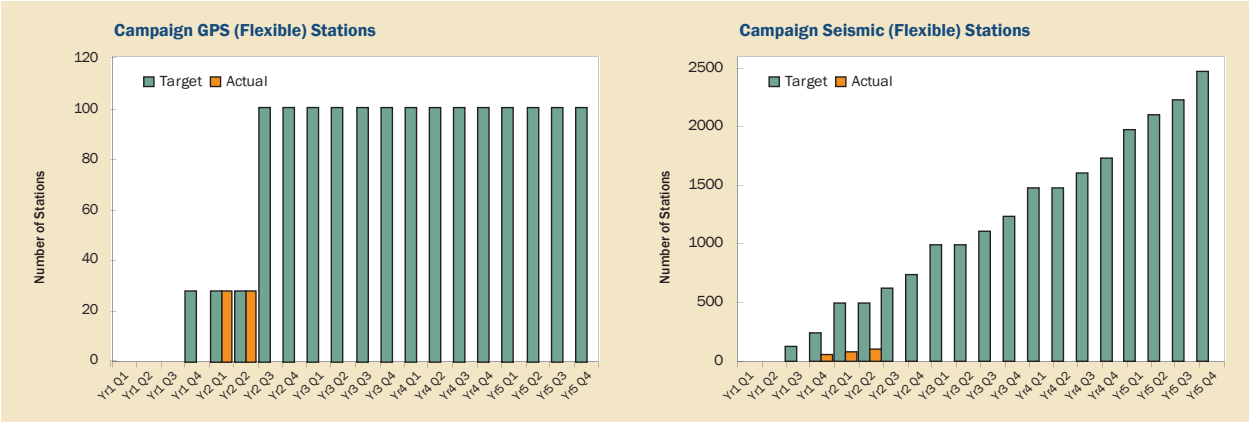
Transportable Array Stations*					
Metrics	**Installation Progress**		**Equivalent Stations**		
	Target	**Actual**	**% of Station**	**Target**	**Actual**
Equipment	80	94	51%	40.8	47.9
Siting/Permitting	204	66	7%	14.3	4.6
Construction/Installation	86	19	23%	19.8	4.4
Data flow/Other	85	75	19%	16.2	14.3
Total Number of Equivalent Stations			**100%**	**91.0**	**71.2**

**Equivalent station metrics have been changed from those in the PEP with permission from NSF.*

Campaign (Flexible) Stations

Campaign (flexible) stations will be provided for temporary deployments across the U.S. A pool of 100 portable GPS receivers will be available for rapid response to earthquakes and aftershock recordings, while a pool of 2,400 seismic stations will be available for earthquake studies and short-term active source experiments. Procurement plans call for the total of 100 flexible GPS receivers available by the third quarter of Year 2. For the seismic stations, 2,400 are scheduled to be available by the fourth quarter of Year 5. Procurement of the GPS is on schedule, but procurement of seismic stations is currently behind schedule due to late delivery of the Texan data recorders.

Campaign (Flexible) Stations		
Metrics	**Procurement Progress**	
	Target	**Actual**
GPS Campaign (Flexible) Stations	28	28
Seismic Campaign (Flexible) Stations	480	95



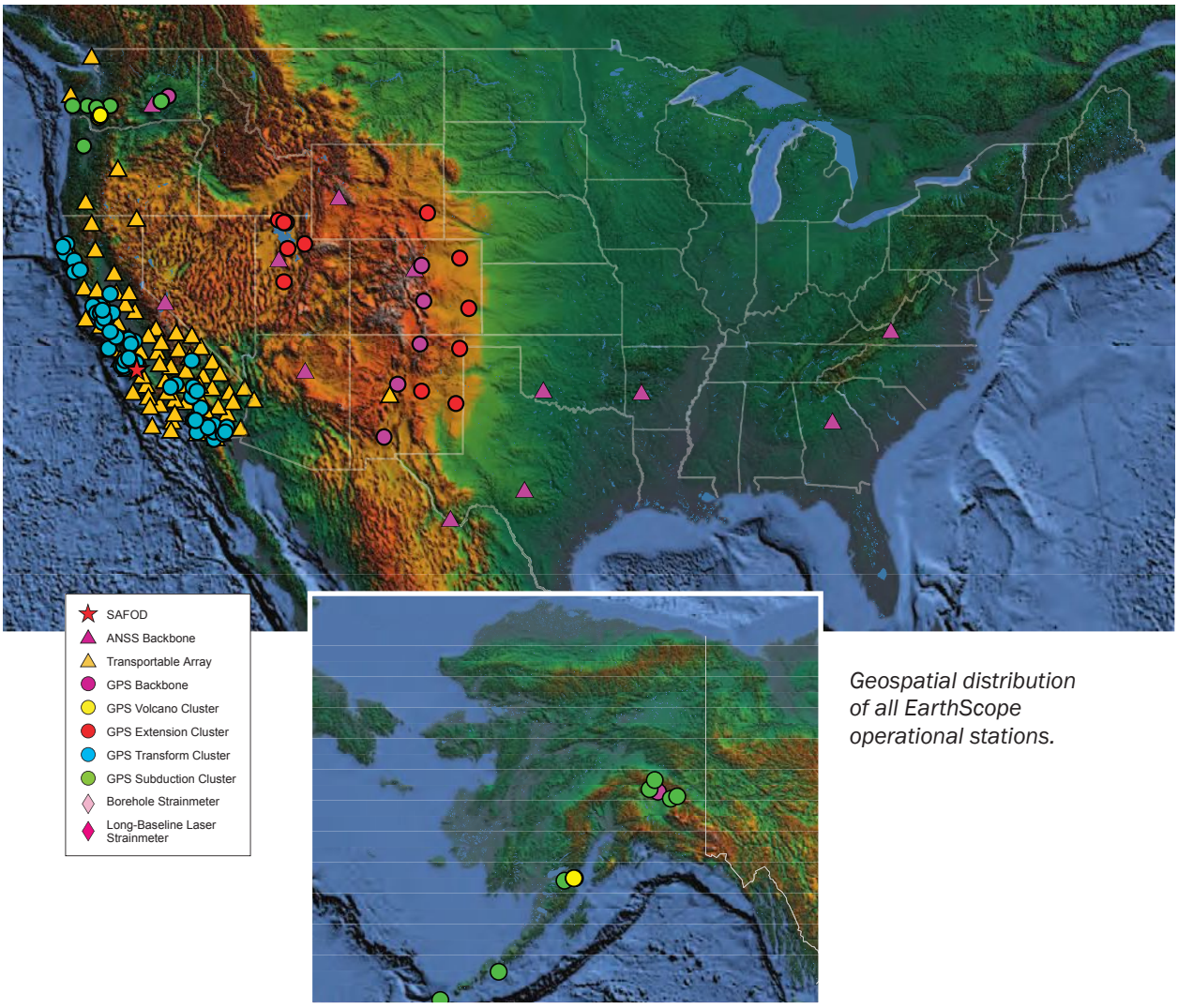
Completed Stations

Stations are considered complete when all the work for that station has been accomplished. The number of completed stations at the end of the 2nd Quarter is 318, consisting of 106 Permanent GPS Station, 13 ANSS Backbone Stations, and 76 Transportable Array Stations (17 new and 59 shared).

Total Number of Complete Stations	
Permanent GPS Stations	106
Borehole Strainmeter Stations	0
Long-baseline Strainmeter Stations	0
ANSS Backbone Stations	13
Transportable Array Stations	76
New Transportable Array Stations	17
Shared Transportable Array Stations	59
Campaign GPS Stations	28
Campaign Seismic Stations	95

Operational Stations

Twenty months into construction of the facility, data are already available from the seismic array in the SAFOD Pilot Hole, 8 GPS Backbone stations, 95 GPS stations, 13 ANSS Backbone stations, and 77 Transportable Array seismic stations. Data from the stations are freely available for both research and educational activities through the EarthScope website (www.earthscope.org).



Geospatial distribution of all EarthScope operational stations.

During the 2nd quarter, data from 28 new EarthScope stations became available. Most of the new stations this quarter are in California and include 19 Transform Cluster GPS stations and 3 Transportable Array stations. Data from 2 GPS stations on Mt. St. Helens are now available, as well as 3 GPS stations in New Mexico and 1 in Utah.

Deployment/ Station Code	Type of Instrument	Geographic Location	Longitude	Latitude	Elevation (m)	Date of Deployment	Date Type/ Sample Rate	Date Available	Comments
P086	GPS Extension Cluster	Kennecott, UT	-112.3	40.6	1341	1/14/2005	Geodetic GPS, 15 sec	yes	BR
P589	GPS Transform Cluster	Black Mountain Quarry, CA	-117.1	34.6	1148	1/14/2005	Geodetic GPS, 15 sec	yes	SoCal
P225	GPS Transform Cluster	Cull Canyon, CA	-122.1	37.7	117	1/21/2005	Geodetic GPS, 15 sec	yes	NoCal
P594	GPS Transform Cluster	Crow Canyon, CA	-117.4	35.9	937	1/21/2005	Geodetic GPS, 15 sec	yes	SoCal
P588	GPS Transform Cluster	DeVries Ranch, CA	-117.3	34.8	709	1/26/2005	Geodetic GPS, 15 sec	yes	SoCal
P181	GPS Transform Cluster	Miller Knox, CA	-122.4	37.9	72	2/1/2005	Geodetic GPS, 15 sec	yes	NoCal
P600	GPS Transform Cluster	Pushwalla, CA	N/A	N/A	0	2/2/2005	Geodetic GPS, 15 sec	yes	SoCal
P699	GPS Volcanic Cluster	Mt Saint Helens, WA	-122.2	46.2	0	2/3/2005	Geodetic GPS, 15 sec	yes	PNW
P690	GPS Volcanic Cluster	Mt Saint Helens, WA	-122.2	46.2	0	2/4/2005	Geodetic GPS, 15 sec	yes	PNW
P287	GPS Transform Cluster	Emery Ranch, CA	-120.7	36.0	0	2/5/2005	Geodetic GPS, 15 sec	yes	NoCal
P284	GPS Transform Cluster	Avila Ranch, CA	-120.9	35.9	0	2/7/2005	Geodetic GPS, 15 sec	yes	NoCal
HELL	Transportable Array	Mitchell Peak, CA	-119.0	36.7	1145	2/7/2005	Seismic, Broadband, 40 sps	2/11/2005	operating
T05C	Transportable Array	Eagle Field, CA	-120.7	36.9	46	2/7/2005	Seismic, Broadband, 40 sps	2/11/2005	operating
V03C	Transportable Array	Hunter-Liggert, CA	-121.2	36.0	336	2/23/2005	Seismic, Broadband, 40 sps	2/23/2005	operating
P230	GPS Transform Cluster	Morgan, CA	-121.8	37.8	0	2/26/2005	Geodetic GPS, 15 sec	yes	NoCal
P039	GPS Extension Cluster	Clayton Airport, NM	-103.2	36.4	1494	3/2/2005	Geodetic GPS, 15 sec	yes	RM
P476	GPS Transform Cluster	Santa Marga, CA	-117.2	33.4	310	3/2/2005	Geodetic GPS, 15 sec	yes	SoCal
P035	GPS Extension Cluster	Vaughn, NM	-105.2	34.6	1780	3/3/2005	Geodetic GPS, 15 sec	yes	RM
P224	GPS Transform Cluster	Sibley Volcano, CA	-122.2	37.9	407	3/3/2005	Geodetic GPS, 15 sec	yes	NoCal
P038	GPS Extension Cluster	Portales Airport, NM	-103.4	34.1	1213	3/4/2005	Geodetic GPS, 15 sec	yes	RM
P222	GPS Transform Cluster	Coyote Hills, CA	-122.1	37.5	53	3/7/2005	Geodetic GPS, 15 sec	yes	NoCal
P256	GPS Transform Cluster	Fallman, CA	-121.6	37.9	-121	3/16/2005	Geodetic GPS, 15 sec	yes	NoCal
P229	GPS Transform Cluster	Bishop Ranch, CA	-122.0	37.7	289	3/16/2005	Geodetic GPS, 15 sec	yes	NoCal
P262	GPS Transform Cluster	Waterbird, CA	-122.1	38.0	-8	3/18/2005	Geodetic GPS, 15 sec	yes	NoCal
P560	GPS Transform Cluster	Stokes, CA	-118.5	34.8	838	3/18/2005	Geodetic GPS, 15 sec	yes	SoCal
P494	GPS Transform Cluster	West Side ESCS, CA	-115.7	32.8	44	3/24/2005	Geodetic GPS, 15 sec	yes	SoCal
P217	GPS Transform Cluster	LaCrosse, CA	-121.7	37.1	72	3/30/2005	Geodetic GPS, 15 sec	yes	NoCal
P506	GPS Transform Cluster	Ramer Lake, CA	-115.5	33.1	-83	3/31/2005	Geodetic GPS, 15 sec	yes	SoCal

COST SCHEDULE STATUS REPORT

The Cost Schedule Report communicates the actual progress of a project while taking into account the work complete, the time taken, and the costs incurred to complete that work. It measures progress of these elements in monetary terms and is based on the project's Work Breakdown Structure. Schedule and cost variances of 10% or greater for Level 0, 1, and 2 tasks are explained in detail along with a proposal for remedial action if necessary in the variance reports on the following pages.

At the end of the 2nd Quarter, EarthScope is on schedule and on budget with 21% of the 5-year work completed.

Schedule Variances:

- **EarthScope Management** is on schedule at Level 1. At Level 2, EarthScope Management is 19% or $21,000 behind schedule for task 1.1.2 Program Reviews and Reporting. This variance is due to two scheduled meetings of the EarthScope Planning Committee that has not been formed yet.
- **SAFOD** continues on schedule at Level 1. At Level 2, SAFOD is 26% or $244,000 behind schedule for task 1.2.3 Instrumentation due to necessary changes in Stage 2 instrumentation and a continuing delay in Stage 1 fabrication. Delays in Stage 3 long-term monitoring are expected to be resolved by October 2005 when the Stage 3 subaward is issued.
- **PBO** is back on schedule at Level 1. Level 2 task 1.3.5 Facility Construction is again on schedule. Schedule variances for 1.3.6 Data and Data Products have decreased to 35% or $504,000 behind schedule. Variances increased slightly at Level 2 for tasks 1.3.2 Long-baseline Strainmeters (to 14% or $71,000 behind schedule), and 1.3.7 GeoEarthScope (to 83% or $293,000 behind schedule). The schedule variances for task 1.3.6 Data and Data Products is expected to significantly decrease over the next few months as data analysis and archive subcontracts are being finalized.
- **USArray** is currently 16% or $2,481,000 behind schedule at Level 1. This variance is due to variances at Level 2. While task 1.4.2 ANSS Backbone Stations is back on schedule, task 1.4.3 Transportable Array Stations is now 16% or $1,126,000 behind schedule and task 1.4.4 Flexible Array Stations is 30% or $1,063,000 behind schedule. The schedule variances are driven by a time-phase budget problem for task 1.4.3 Transportable Array Stations and procurement problems for task 1.4.4 Flexible Array.

Cost Variances:

- **EarthScope Management** is on budget at Level 1. At Level 2, the cost variance for task 1.1.2 Program Review and Reporting has increased to 29% or $25,000 over budget. This variance is due to an increased cost of printing scheduled reports and the cost of printing unscheduled reports.
- **SAFOD** continues on budget at Level 1. At Level 2, the cost variance for task 1.2.3 Instrumentation has decreased to 11% or $78,000 under budget. This variance is due to necessary changes in Stage 2 instrumentation and a continuing delay in Stage 1 fabrication.
- **PBO** is currently 11% or $1,793,000 under budget at Level 1. At Level 2, the budget underrun is mainly driven by an increased cost variance of 17% or $1,130,000 for task 1.3.5 Facility Construction. This variance is largely driven by a linear budget forecast for permitting support and other installation activities with seasonal fluctuations. Increased installation activities during the summer are expected to decrease this cost variance.
- **USArray** continues on budget at Level 1. At Level 2, USArray is currently on budget for most tasks and only reports a 33% or $428,000 budget underrun for task 1.4.1 Management. This cost variance is caused by the indirect general and administrative cost recovery that has been less than budgeted for USArray for this reporting quarter.

Cost Schedule Status Report for WBS Level 0, 1, and 2 Activities

(based on budgets and activies for Year 1 through Year 5)

WBS Element	Work Complete (% of 5 Years)	Cumulative $ (thousands) September 2003 - March 2005 PV (BCWS)	EV (BCWP)	AC (ACWP)	SV	SV % of PV	CV	CV% of EV	$ (thousands) for 5 Years BAC	EAC	Var.
EarthScope Management (WBS Element 1.1)											
1.1.1 EarthScope Management	29%	$1,568	$1,568	$1,600	$0	0%	($32)	(2%)	$5,434	$5,434	$0
1.1.2 Program Reviews & Reporting	17%	$108	$87	$113	($21)	(19%)	($25)	(29%)	$522	$522	$0
1.1.3 Meetings & Outreach	32%	$189	$189	$182	$0	0%	$7	4%	$588	$588	$0
Subtotal	28%	$1,865	$1,844	$1,895	($21)	(1%)	($50)	(3%)	$6,544	$6,544	$0
Contingency/Management Reserve									$193	$193	$0
Management Fee									$375	$375	$0
Total EarthScope Management									**$7,112**	**$7,112**	**$0**
SAFOD (WBS Element 1.2)											
1.2.1 Management	26%	$480	$466	$466	($14)	(3%)	$0	0%	$1,817	$1,817	$0
1.2.2 Drilling and Downhole Meas.	50%	$7,060	$7,218	$7,831	$158	2%	($613)	(8%)	$14,445	$14,445	$0
1.2.3 Instrumentation	30%	$926	$682	$604	($244)	(26%)	$78	11%	$2,242	$2,242	$0
1.2.4 Data Products and Sample Handling	23%	$206	$212	$213	$6	3%	($1)	0%	$910	$910	$0
Subtotal	44%	$8,675	$8,578	$9,114	($97)	(1%)	($536)	(6%)	$19,414	$19,414	$0
Contingency/Management Reserve									$1,054	$1,054	$0
Total SAFOD									**$20,468**	**$20,468**	**$0**
Plate Boundary Observatory (WBS Element 1.3)											
1.3.1 Program Management	33%	$1,515	$1,475	$1,355	($40)	(3%)	$120	8%	$4,482	$4,482	$0
1.3.2 Long Baseline Strainmeters	18%	$514	$443	$431	($71)	(14%)	$12	3%	$2,450	$2,450	$0
1.3.3 Procurement	14%	$4,843	$5,225	$5,144	$382	8%	$81	2%	$36,878	$36,878	$0
1.3.4 Fab/Test/Campaign	30%	$428	$428	$322	$0	0%	$106	25%	$1,437	$1,437	$0
1.3.5 Facility construction	17%	$7,415	$6,723	$5,593	($692)	(9%)	$1,130	17%	$39,923	$39,923	$0
1.3.6 Data & Data Products	17%	$1,436	$932	$807	($504)	(35%)	$125	13%	$5,550	$5,550	$0
1.3.7 GeoEarthScope	1%	$353	$60	$0	($293)	(83%)	$60	100%	$5,000	$5,000	$0
1.3.8 Project Support	136%	$994	$994	$836	$0	0%	$158	16%	$729	$729	$0
Subtotal	17%	$17,499	$16,280	$14,488	($1,219)	(7%)	$1,793	11%	$96,449	$96,449	$0
Contingency/Management Reserve									$3,426	$3,426	$0
Management Fee									$125	$125	$0
Total PBO									**$100,000**	**$100,000**	**$0**
USArray (WBS Element 1.4)											
1.4.1 Management	29%	$1,311	$1,304	$876	($7)	(1%)	$428	33%	$4,570	$4,570	$0
1.4.2 ANSS Backbone Stations	40%	$2,818	$2,550	$2,298	($268)	(10%)	$252	10%	$6,390	$6,390	$0
1.4.3 Transportable Array Stations	17%	$6,846	$5,720	$5,389	($1,126)	(16%)	$331	6%	$34,366	$34,366	$0
1.4.4 Flexible Array Stations	14%	$3,550	$2,487	$2,332	($1,063)	(30%)	$155	6%	$18,202	$18,202	$0
1.4.5 Data Management	44%	$1,087	$1,075	$1,147	($12)	(1%)	($72)	(7%)	$2,419	$2,419	$0
1.4.6 Siting Outreach	13%	$66	$60	$55	($6)	(9%)	$5	9%	$452	$452	$0
Subtotal	20%	$15,678	$13,197	$12,097	($2,481)	(16%)	$1,100	8%	$66,399	$66,399	$0
Contingency/Management Reserve									$3,324	$3,324	$0
Management Fee									$125	$125	$0
Total USArray									**$69,848**	**$69,848**	**$0**
Total EarthScope (WBS Element 1)											
EarthScope Management	28%	$1,865	$1,844	$1,895	($21)	(1%)	($50)	(3%)	$7,112	$7,112	$0
SAFOD	44%	$8,675	$8,578	$9,114	($97)	(1%)	($536)	(6%)	$20,468	$20,468	$0
PBO	17%	$17,499	$16,280	$14,488	($1,219)	(7%)	$1,793	11%	$100,000	$100,000	$0
USArray	20%	$15,678	$13,197	$12,097	($2,481)	(16%)	$1,100	8%	$69,848	$69,848	$0
Subtotal EarthScope	**21%**	**$43,716**	**$39,899**	**$37,593**	**($3,817)**	**(9%)**	**$2,307**	**6%**	**$188,806**	**$188,806**	**$0**
Total EarthScope Funding									**$197,428**	**$197,428**	**$0**

LEGEND:

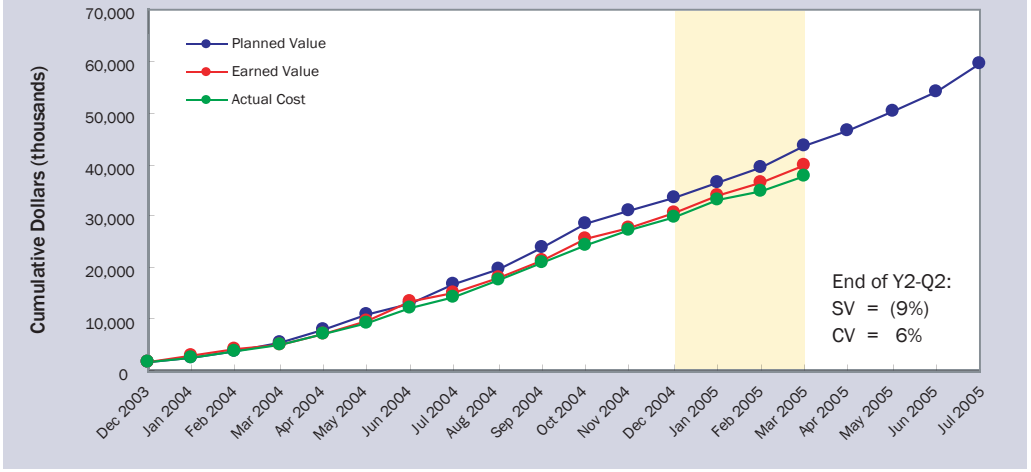
% work complete = PV / BAC
PV (BCWS) = Planned Value (Budgeted Cost of Work Scheduled)
EV (BCWP) = Earned Value (Budgeted Cost of Work Performed)
AC (ACWP) = Actual Cost (Actual Cost of Work Performed)
SV = Schedule Variance = (Earned Value – Planned Value)
SV % of PV = (Earned Value – Planned Value) / Planned Value

CV = Cost Variance = (Earned Value – Actual Cost)
CV % of EV = (Earned Value – Actual Cost) / Earned Value
BAC = Budgeted At Completion
(baseline budget plus any approved budget revisions)
EAC = Estimated At Completion
Var. = Variance = (Budgeted At Cost – Estimated At Cost)

** SV% and CV% equal or greater than 10% is explained in the variance explanations on the following pages.*

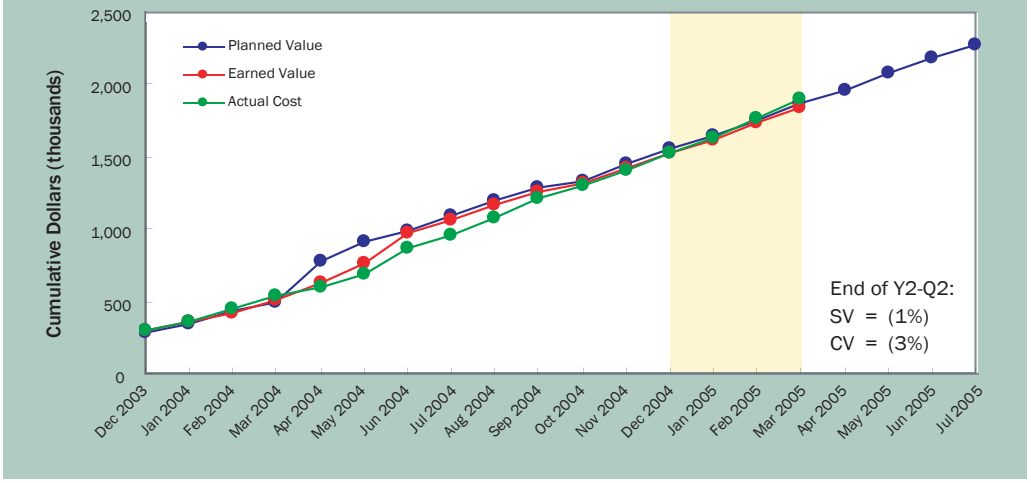
1 Overall, EarthScope has a schedule variance of -$2,307,000 or -9%, but is on budget for the work performed. The principal contributions to the negative schedule variance are the tasks 1.4.3 Transportable Array Stations and 1.4.4 Flexible Array Stations, which are examined in detail below.

1 EarthScope (Level 0)

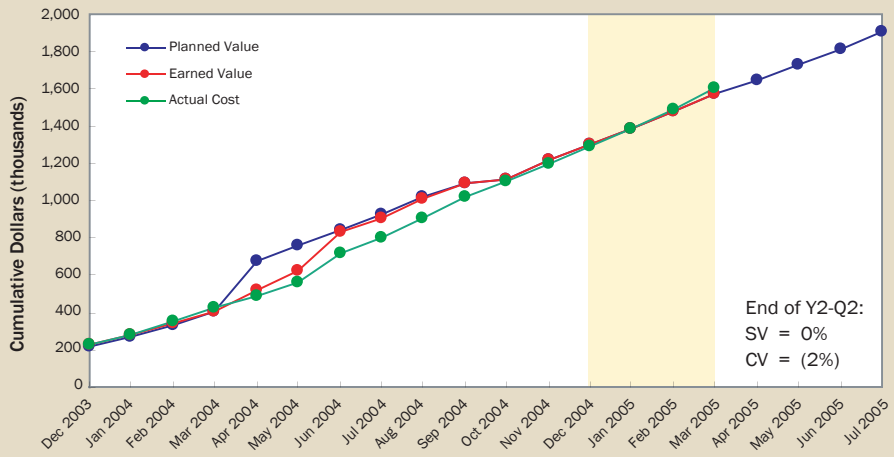


1.1 EarthScope Management remained on schedule and on budget throughout the quarter. Variances greater than 10% are reported at Level 2 for 1.1.2 Program Reviews and Reports.

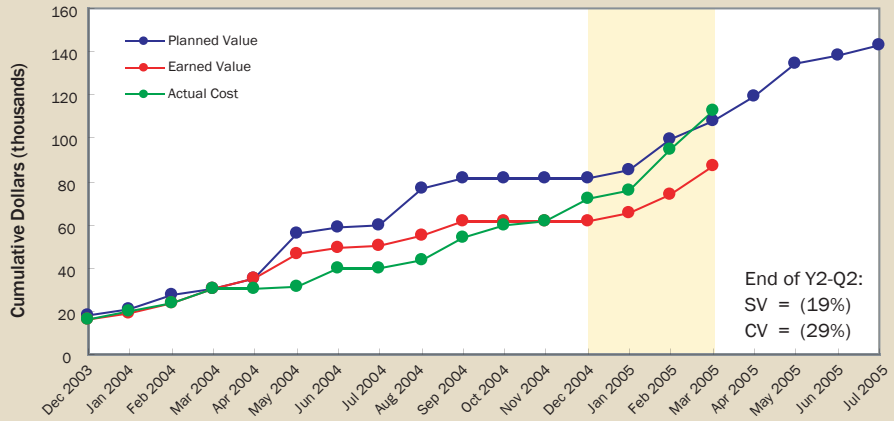
1.1 Management (Level 1)



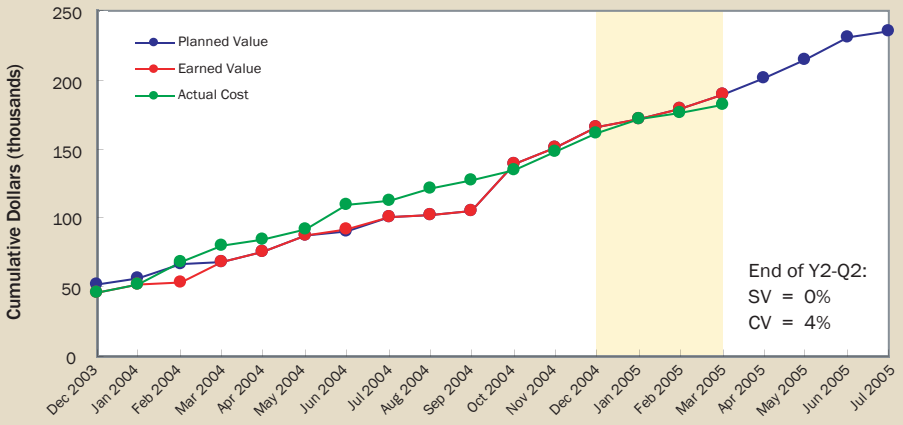
1.1.1 EarthScope Management (Level 2)



1.1.2 Program Review & Reporting (Level 2)



1.1.3 Meetings & Outreach (Level 2)



▶ *Variance Report:* 1.1.2 Management Program Reviews & Reporting

SV: **(19%) or ($20,500)** **CV:** **(29%) or ($25,477)**

■ **Reason:** The schedule variance is due primarily to not holding two Planning Committee meetings that were planned for Year 1. The cost variance is due to larger than expected costs for printing the quarterly reports. In addition, the cost for printing the Operations and Maintenance Proposal was not a budgeted item.

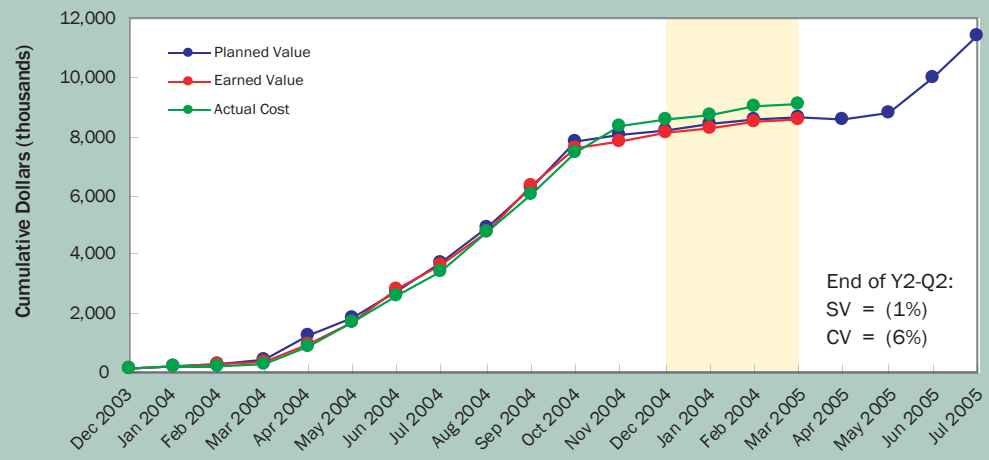
■ **Other Affected Tasks:** None

■ **Corrective Action:** NSF has asked EarthScope not to populate the Planning Committee at this time. If the Planning Committee cannot be formed, the Year 3 baseline for the EarthScope Office will be adjusted accordingly in September 2005.

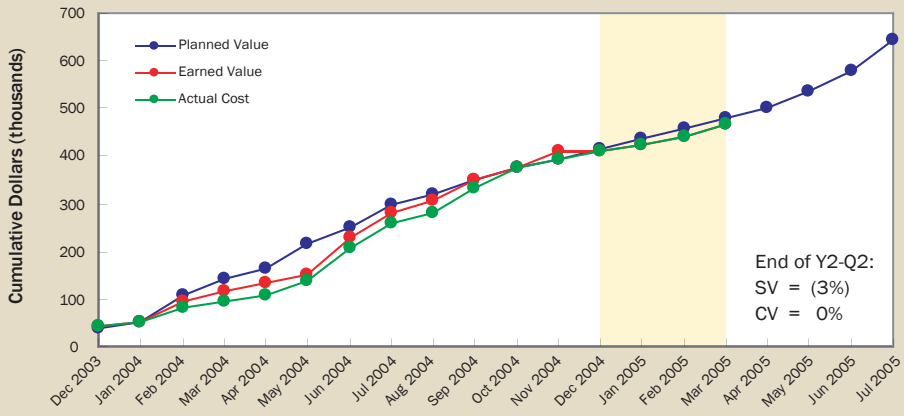
The printing of EarthScope reports and proposals is a necessary and important tool to effectively share EarthScope's achievements and plans with our funding agencies and the Earth science community. Quarterly reports costs are being decreased by switching from spiral binding to perfect binding. No other corrective action is needed at this time. The cost variance will be carried through Year 2. Year 3 budgets will be adjusted based on Year 2 actuals.

1.2 SAFOD continued to remain on schedule, but finished the quarter $536,000 or 6% over budget. At Level 2, task 1.2.3 Instrumentation remained behind schedule and underbudget due to necessary changes in Stage 2 instrumentation and a delay in Stage 1 fabrication.

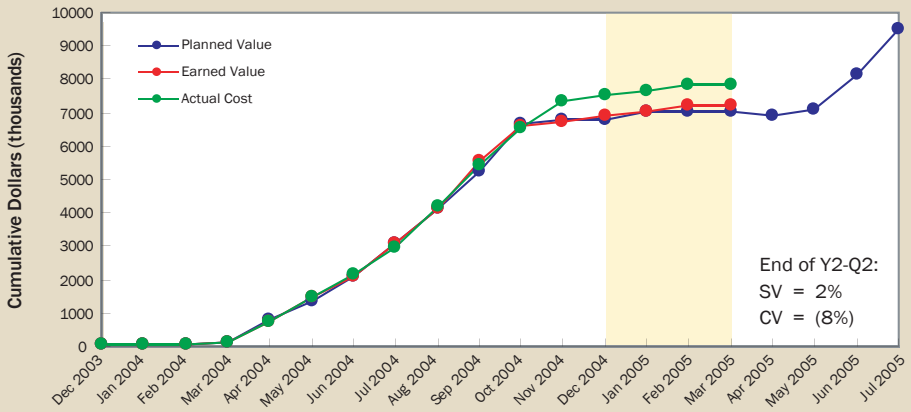
1.2 SAFOD (Level 1)



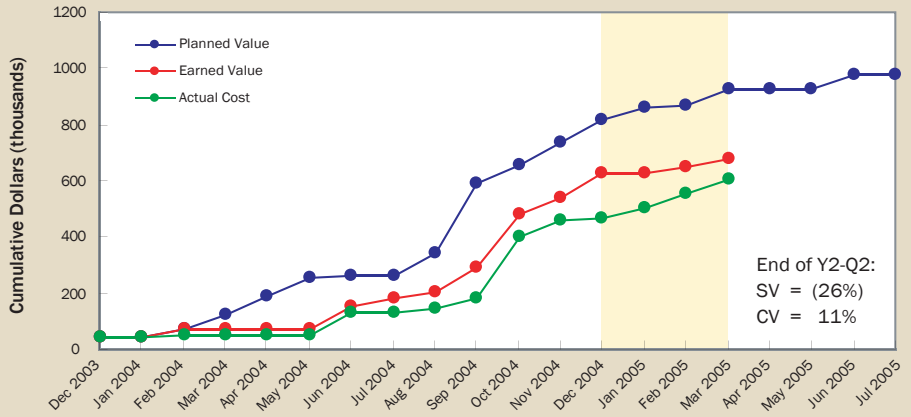
1.2.1 SAFOD Management (Level 2)



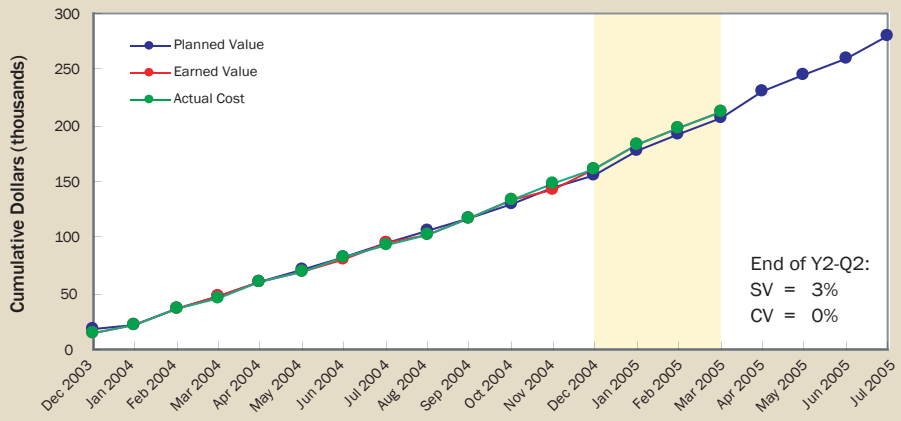
1.2.2 Drilling & Downhole Measurement (Level 2)



1.2.3 Instrumentation (Level 2)



1.2.4 Data Products & Sample Handling (Level 2)



► ***Variance Report:*** 1.2.3 Instrumentation

SV: (26%) or ($244,000) **CV: 11% or $78,000**

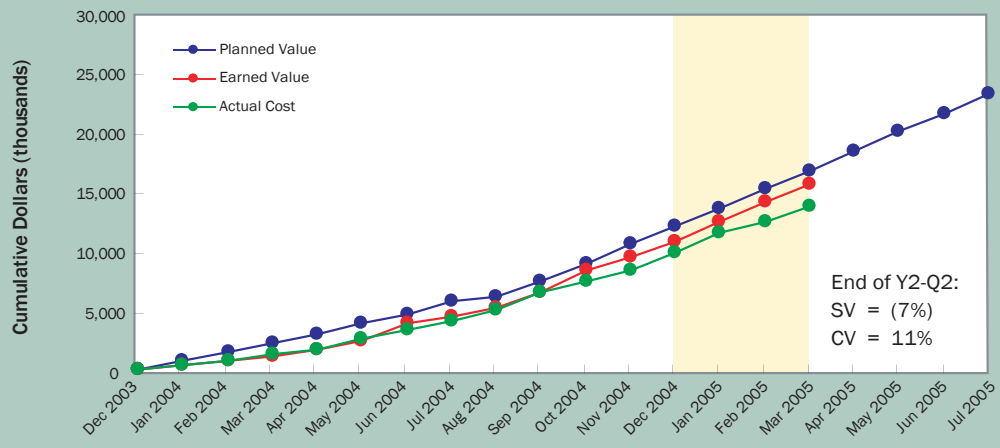
■ **Reason:** The schedule variance results from several factors. One is that the Stage 1 instrument fabrication was delayed. One of the principle instruments in the Stage 1 sonde is a strainmeter, and that unit remains incomplete. All other components are completed. The final assembly and testing of components are scheduled for April and the sonde is scheduled for installation in May without the strainmeter. The laser for the Stage 2 fiber-optic strainmeter is complete, and the data system is nearly complete. The unit is scheduled for installation in June 2005. The schedule variance further results from delays in the Stage 3 monitoring program. We are developing a detailed statement of work and plan to issue an RFP in June 2005 and to make an award by October 2005. This is resulting in about a 6 month delay.

■ **Other Affected Tasks:** Work on the long-term monitoring (Stage 3) has begun with the completed installation of permanent electrical power to the drill site.

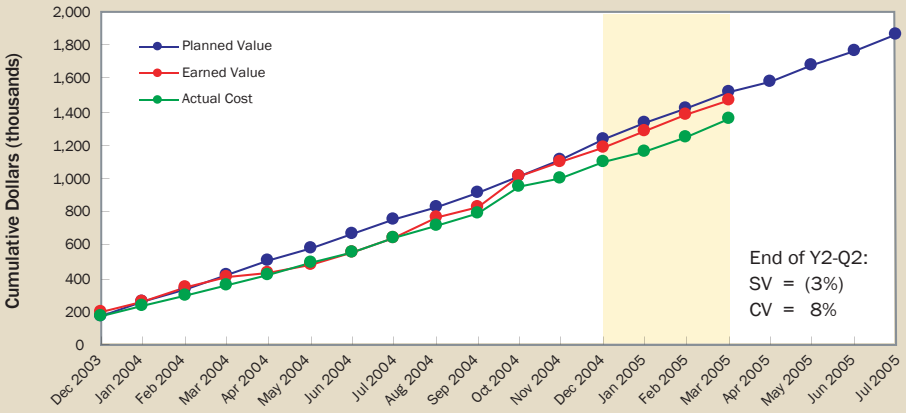
■ **Corrective Action:** The Stage 1 and Stage 2 systems are nearly complete and we remain in close contact with the subcontractors as we try to bring the systems on line. For the Stage 3 instrument we are working with Sandia National Laboratory to get the Statement of Work written and the RFP published.

1.3 The Plate Boundary Observatory (PBO) decreased its schedule variance over the quarter, finishing at 7% behind schedule. It is 11% ($1,793,000) under budget for the work performed. The current schedule variance is being driven by delays in task 1.3.6 Data and Data Products, which is explained in the variance report.

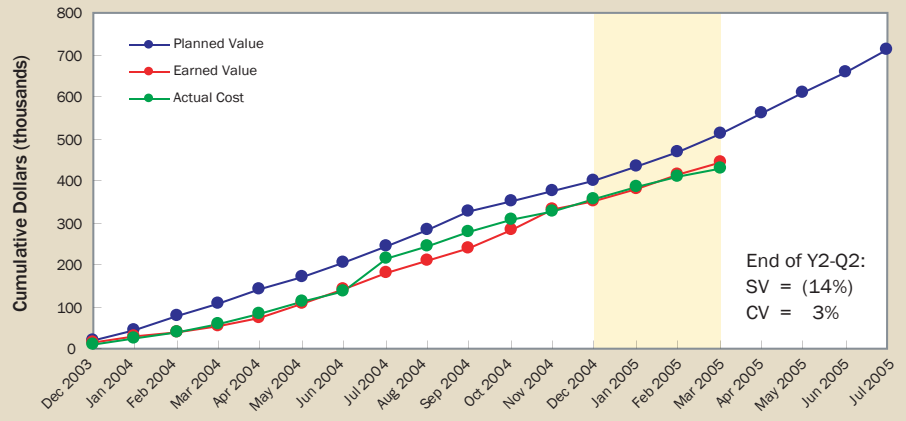
1.3 PBO (Level 1)



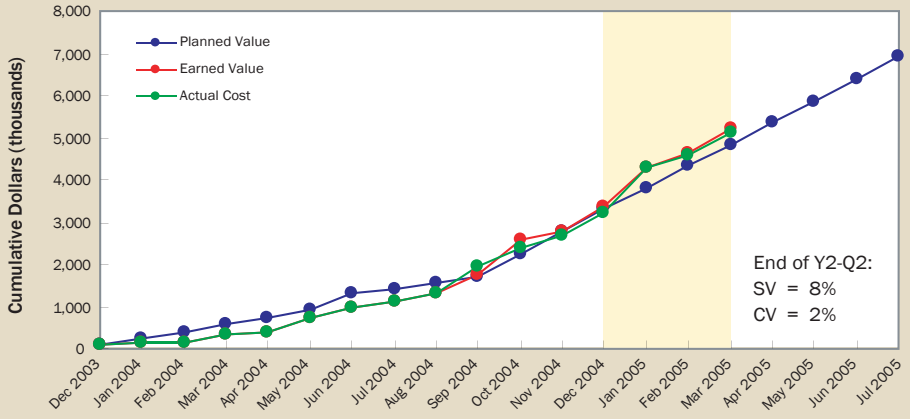
1.3.1 PBO Management (Level 2)



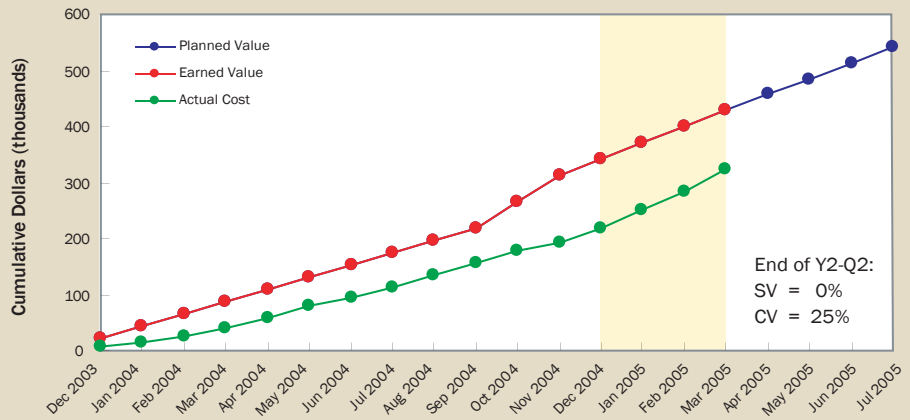
1.3.2 Long-baseline Strainmeters (Level 2)



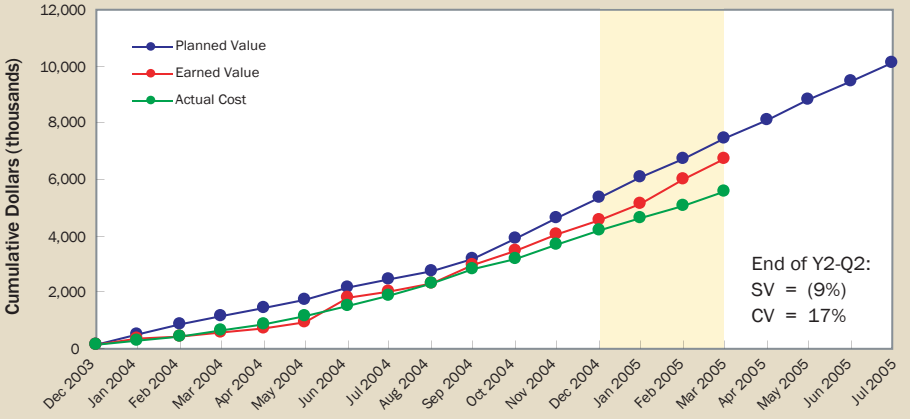
1.3.3 Procurement (Level 2)



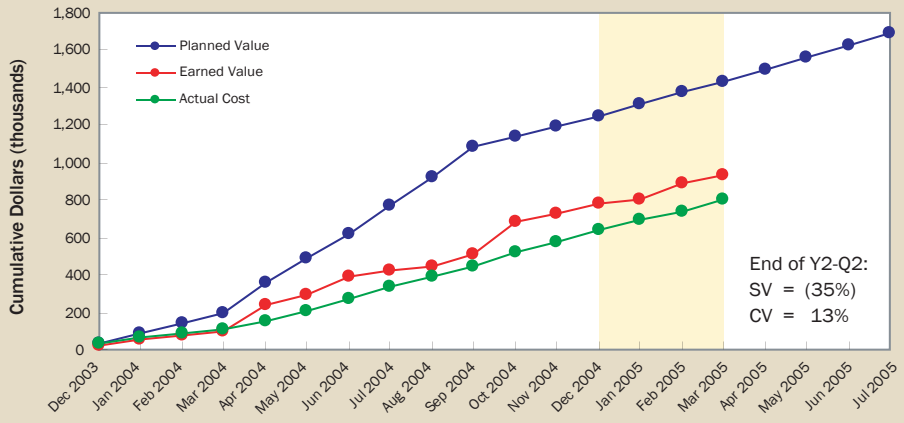
1.3.4 Fab/Test/Campaign (Level 2)



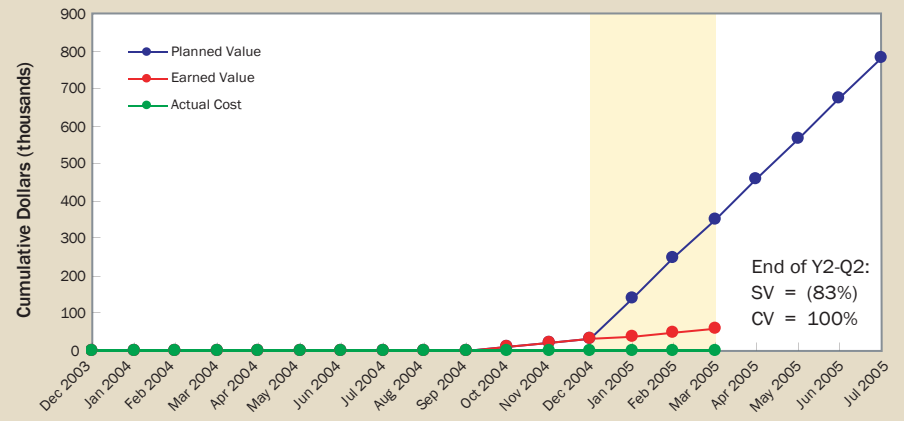
1.3.5 Facility Construction (Level 2)



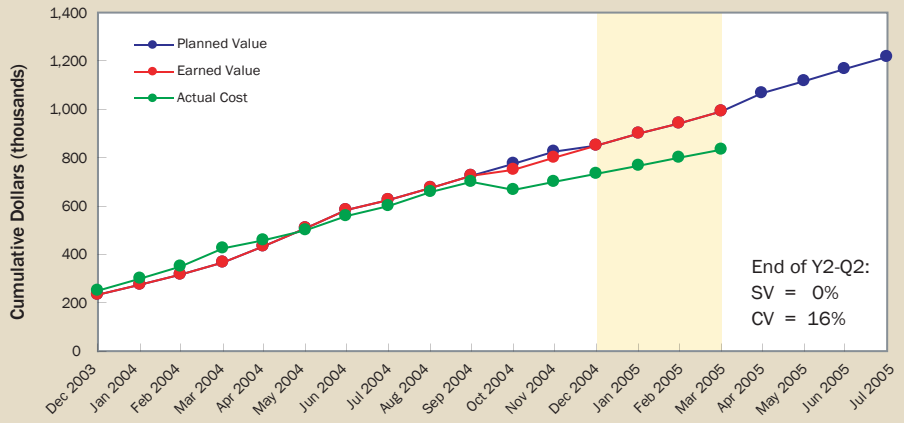
1.3.6 Data & Data Products (Level 2)



1.3.7 GeoEarthScope (Level 2)



1.3.8 Project Support (Level 2)



▶ *Variance Report:* 1.3.2 Subawards (Laser Strainmeter)

SV: (14%) or ($71,000)

■ **Reason:** This schedule variance is due to a six-month delay in a site usage permit for Unit 1, siting and permitting delays for the remaining units, and University of California San Diego personnel shortages. The subcontractor is focusing their efforts to complete construction of Unit 1. Personnel shortages, procurement, and permitting delays are delaying Unit 2 and 3 front-end activities.

■ **Other Affected Tasks:** None

■ **Corrective Action:** PBO has conducted an on-site cost and schedule review on April 18, 2005, which followed up a November 2004 Review. University of California San Diego forecasts data flow from Unit 1 by May 30, 2005 and has fallen behind on required permitting and siting activities for the remaining units. UNAVCO identified key permitting and staffing issues and proposed a corrective action plan to deliver all five units during the MREFC timeframe. University of California San Diego will respond to this plan in the next month.

▶ *Variance Report:* 1.3.4 Fab/Test/Campaign

CV: 25% or $106,000

■ **Reason:** Reduced charging by the Equipment Depot Engineer and a delay in hiring the Shipping and Receiving Technician and Campaign Engineer causes the positive cost variance.

■ **Other Affected Tasks:** None

■ **Corrective Action:** The Shipping and Receiving Technician has been hired and an experienced Campaign Engineer has been employed from the UNAVCO facility. These positions support PBO's production schedule. If required, the UNAVCO facility can supply additional personnel to meet peak requirements. This cumulative variance continues to be reduced monthly.

▶ *Variance Report:* 1.3.5 Facility Construction

CV: 17% or $1,130,000

■ **Reason:** The positive cost variance in the permitting support, Northern California, Basin & Range, and Rocky Mountain areas are driven by a number of factors. The permitting support budget was linear but the forecast costs will mainly occur later in the year (as more difficult permits and additional permitting support people come online). The regional variances will also decrease later in the year as more expensive deep-drilled based monuments are deployed. In general, increased installation activity during the summer season and delays in subcontractor invoicing will decrease this cost variance.

Task	Name	Schedule Variance	Cost Variance
1.3.5.1.2	Permitting	($188,000)	$242,000
1.3.5.2	Northern California Region	($150,000)	$204,000
1.3.5.3	Southern California Region	($164,000)	$154,000
1.3.5.4	Pacific Northwest Region	($32,000)	$105,000
1.3.5.5	Basin & Range Region	$24,000	$219,000
1.3.5.6	Rocky Mountain Region	$254,000	$307,000
1.3.5.7	Alaska Region	($436,000)	($101,000)
Total		**($692,000)**	**$1,130,000**

■ **Other Affected Tasks:** None

■ **Corrective Action:**

GPS: Additional permitting resources have been contracted in the California and Pacific Northwest Regions. Temporary and intern staffing are being hired to augment busy summer season. Alaska helicopter contracting and equipment staging has begun for Alaska summer installations and reconnaissance. The GPS production plans will continue to be managed, and experienced crews are focusing on meeting and exceeding the second year goals as was done in the first year.

Borehole Strainmeters: Outstanding borehole strainmeter instrument delivery issues and the focusing of early installations to the Olympic Peninsula in Washington (by the PBO Standing Committee) have driven negative cost and schedule variances. These delays and associated cost uncertainties were outlined to the National Science Foundation and the EarthScope EFEC during the February 16, 2005 PBO Program Review. The recent delay in the final installation of the first borehole strainmeter instrument is also cause for concern. PBO management will continue to evaluate schedule and cost impacts and will revise estimates to account for actual experience of the first units in Washington and Northern California. After this installation is complete, the program will have excellent cost and schedule data to forecast the remaining units.

► *Variance Report:* 1.3.6 Data & Data Products

SV: (35%) or ($504,000) **CV: 13% or $125,000**

■ **Reason:** The negative schedule and positive cost variance for PBO Data & Data Products is focused in the following tasks:

Task	Name	Schedule Variance	Cost Variance
1.3.6.2.3	Data Analysis & Archive Subcontracts	($442,000)	$18,000
1.3.6.4.2	PBO Operational Database	($35,000)	$0
1.3.6.1.3	Contract Code Development	$0	$107,000
1.3.6.4.1	Software Engineering	($37,000)	($8,000)
	Other	$10,000	$8,000
Total		**($504,000)**	**$125,000**

Subcontracting is a major driver to the area's negative schedule variance. The GPS Analysis Centers and Analysis Center Coordinator have been chosen through a proposal process. As of March 31, 2005, statements of work have been negotiated and contract execution is underway. The UNAVCO Facility Archive is currently archiving PBO data, and the subaward for the second GPS Archive at the IRIS Data Management Center is currently being contracted.

Specifications for borehole strainmeter data have been delayed until Year 2 in order to respond to further specification of strainmeter data product requirements made by the community and the PBO Strainmeter Working Group. Delays in receiving needed feedback from vendors on data formats, standards, and processing have also driven schedule delays. Despite these delays, vendor negotiations for strainmeter archive has been completed and final contract execution is underway.

Version 1.5.4 of the PBO Operational Database (POD) and POD Operational Interface (POI) were released in January, with enhancements over previous versions. The underlying database schema, a demonstration version of the POI, and installation instructions for the POD have been made available to the general community via the PBO web site. Contracts for version 1.6 of the POD and POI are under negotiation, with release of that update anticipated for May 2005.

The largest driver of the positive cost variance is from the first year's software projects that had been budgeted for, but were not required. For example, $106,560 was budgeted as contract code software, while nearly all software that needed development in the first year was developed in-house. Since this external software development was not required, the tasks were closed out and earned value taken at beginning of the second year.

- **Other Affected Tasks:** None
- **Corrective Action:** GPS data product specifications have been finalized, and contracts for Archives, Analysis Centers, and the Analysis Center Coordinator are in the process of being finalized. After the contracting process is complete we expect a rapid ramp of Archive and Analysis Center Activity. This will rapidly erode the large negative schedule as these resources come on line.

▶ *Variance Report:* 1.3.7 GeoEarthScope

SV: (83%) or ($293,000) **CV: 100% or $60,000**

- **Reason:** GeoEarthScope Coordinator has not been hired. This position was initially planned to be filled in October 2004. PBO is working with NSF and members of the Lidar and geochronology communities to provide well-focused targets for GeoEarthScope activities that maximize the return on budget and scientific return.
- **Other Affected Tasks:** None
- **Corrective Action:** PBO proposed a plan at AGU that NSF will consider including a request for proposals for imagery acquisition and geochronology in the next EarthScope Request for Proposals. Proposers will be encouraged to indicate how their proposal will contribute to the EarthScope Facility (i.e. station siting) as well as to advancing science. PBO resources will then be added after that plan is formulated.

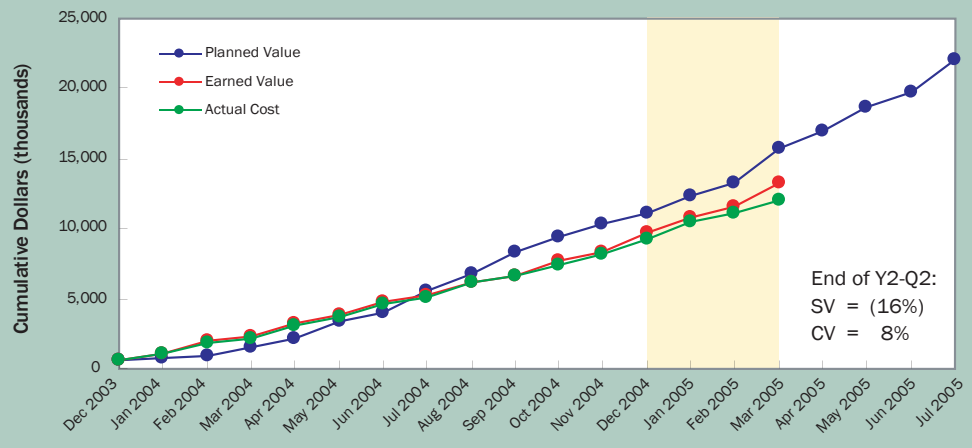
▶ *Variance Report:* 1.3.8 Project Support

CV: 16% or $158,000

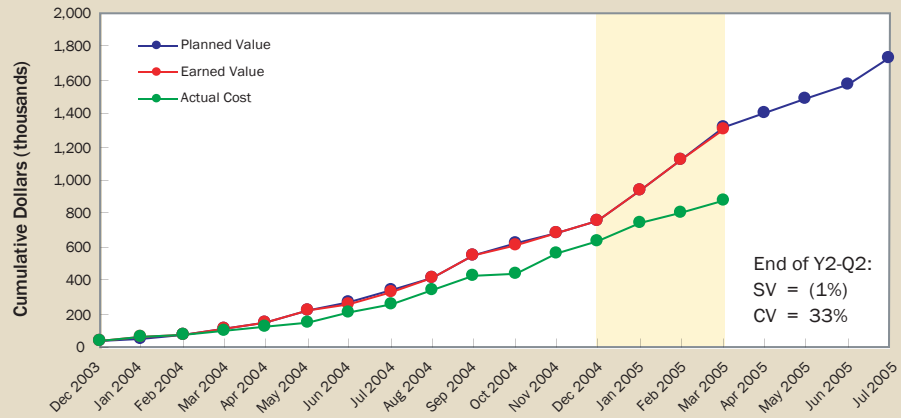
- **Reason:** This positive task variance is mainly driven by a NSF driven change in accounting practices that shifted UNAVCO management support to indirect costs as of January 1, 2004. Some of these costs were originally budgeted as direct costs in this area.
- **Other Affected Tasks:** None
- **Corrective Action:** This unexpended budget will be utilized in future period by previously planned vehicle and facilities costs.

1.4 USArray finished the quarter 16% ($2,481,000) behind schedule, but is 8% ($1,100,000) under budget for the work performed. The schedule variance is driven by 1.4.3 Transportable Array Stations and 1.4.4 Flexible Array Stations, which is explained in the variance report below.

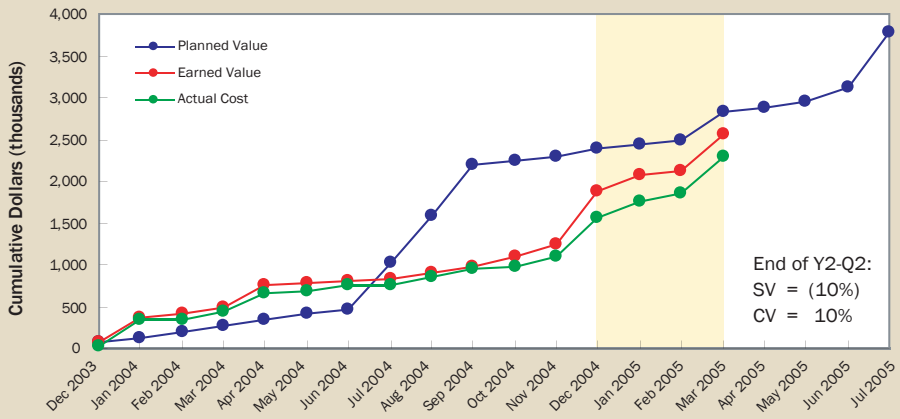
1.4 USArray (Level 1)



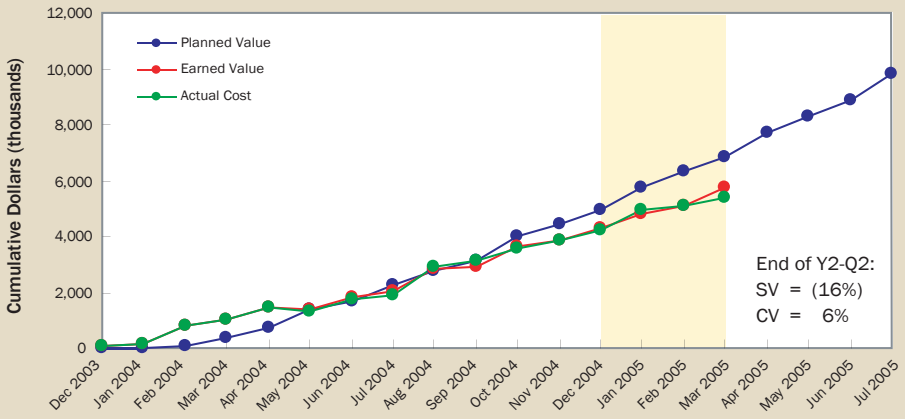
1.4.1 USArray Management (Level 2)



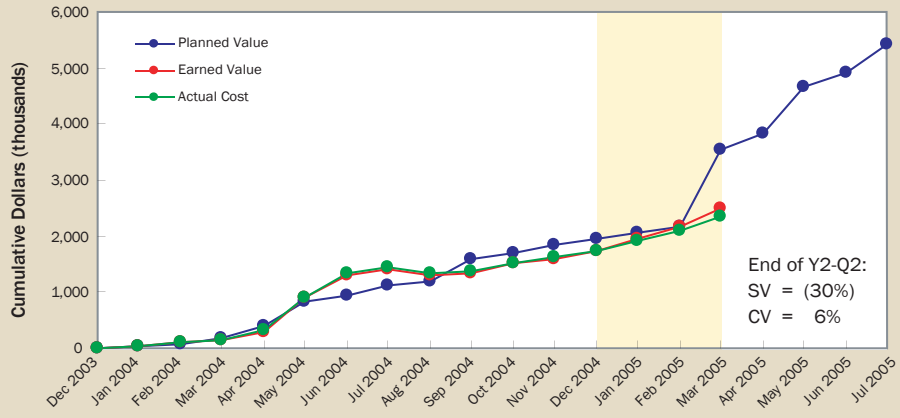
1.4.2 ANSS Backbone Stations (Level 2)



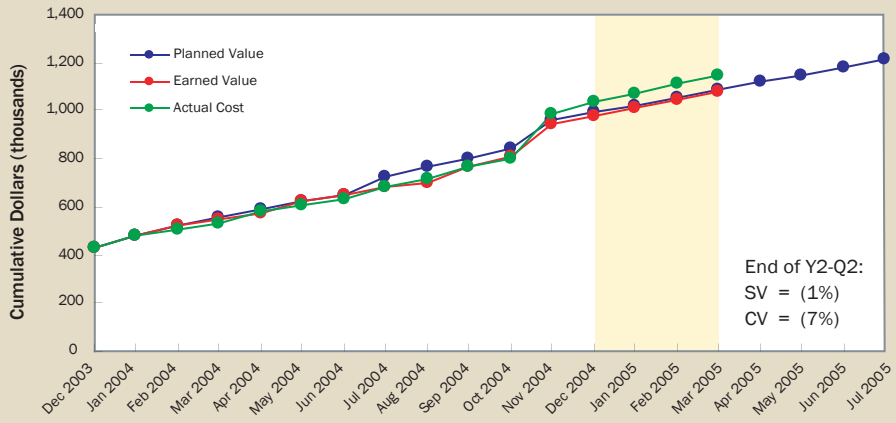
1.4.3 Transportable Array Stations (Level 2)



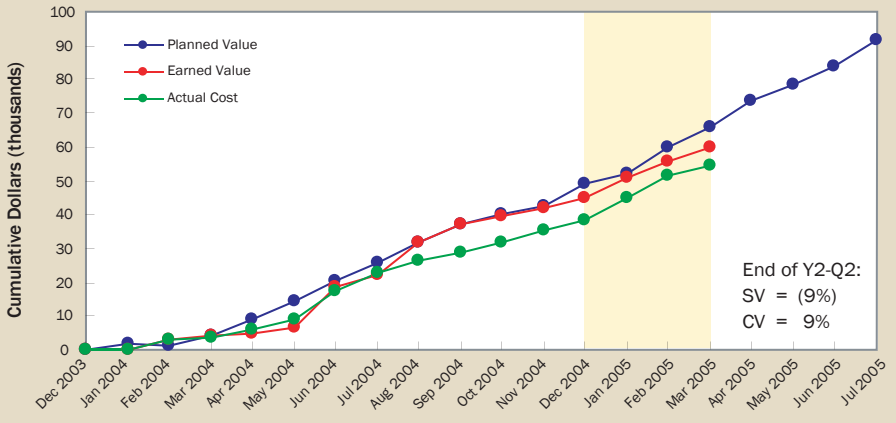
1.4.4 Flexible Array Stations (Level 2)



1.4.5 Data Management (Level 2)



1.4.6 Siting Outreach (Level 2)



▶ ***Variance Report:*** 1.4.1 USArray Management

CV: 33% or $428,000

■ **Reason:** Indirect General & Administrative expenses associated with all USArray components are accumulated and reported under this task. Indirect General & Administrative cost recovery for USArray has been less than base lined, because total program expenditures have been less than budgeted. As program expenses are incurred, the budgeted indirect cost recovery will be realized in subsequent periods.

■ **Other Affected Tasks:** None

■ **Corrective Action:** None required.

▶ *Variance Report:* 1.4.2 ANSS Backbone

SV: (10%) or ($268,000) **CV: 10% or $252,000**

Reason:

Schedule variances largely comprise the following:

- ($62,000) - Late delivery of CMG-3T sensors due to manufacturing delays. Defense Priorities and Allocations System related schedule slide anticipated;
- ($270,000) - STS-1 sensors are no longer manufactured. This is being addressed through Change Order USArray-010, which is in preparation;
- ($43,400) - Late delivery of high-resolution Q330 data acquisition systems. Expected delivery date is July 2005;
- ($152,000) - Deliberately delayed off-the-shelf GPS procurement, to take advantage of bulk-ordering with PBO. UNAVCO is now unable to process these equipment requests for the upcoming trips. We expect to receive these equipment in late May or early June;
- ($172,331) - Subaward to USGS, site work is behind schedule, due to relocation of the Albuquerque Seismological Laboratory in 2004, re-assigning engineers to Antarctica in late 2004, departure of senior manager, problems with Q330 system in the National Seismic Network VSAT system (now solved), and the shift in level-of-effort from new station installations to station upgrade work arising from delays in integrating the Q330 with VSAT.

Early arrival of STS-2 and KS54000 sensors reduced this schedule variance to the reported value.

Cost variances largely comprised the following:

- $9,568 – Episensor sensors were less than expected;
- $146,957 – Power systems were less expensive than expected, as they were based on GSN experience of systems in overseas regions with poor national power.

Increased invoice costs for STS-2 and KS54000 sensors reduced this cost variance to the reported value.

Other Affected Tasks:

Associated with the procurement tasks are level-of-effort tasks related to the receipt of the equipment, factory acceptance testing and entry initial documentation and entry into the database. Late delivery of equipment are not expected to significantly effect the schedule for field-work, the procurement variance is not expected to have an effect. The proposal for the procurement of equipment was designed so that equipment would be ordered and stored at our facility well in advance of the need for this equipment in the field to take into account possible delays in delivery.

Corrective Action:

New personnel have been added to the Albuequerque Seismological Laboratory field in March-April for new site surveys and support for installations to make up the schedule delays. This is expected to be caught up by quarter 9 (end of calendar year 2005). Change order USArray-010 adjusts the baseline for the STS-1 related delays at sets new equivalent stations targets.

▶ *Variance Report:* 1.4.3 Transportable Array

SV: (16%) or ($1,126,000)

■ **Reason:** The majority of the schedule variance (>90%) is associated with permitting and installation of stations. This is an anomaly. The MREFC proposal, page 59, anticipated 20 Transportable Array stations in Year 1 and 80 more (100 total) in Year 2. There were actually 62 installed at the end of Year 1 and 76 now, approximately on schedule. The variance is due to the absence of a direct tie between the schedule and the budget.

■ **Other Affected Tasks:** None

■ **Corrective Action:** A revised baseline is being prepared for the Transportable Array to alleviate this anomaly and provide more accurate reporting.

▶ *Variance Report:* 1.4.4 Flexible Array

SV: (30%) or ($1,063,000)

■ **Reason:** The majority (>90%) of the schedule variance is due to the late delivery of the single channel active source recorders (Texans). These units were scheduled for delivery in March, however, problems associated with the new design have delayed the delivery.

■ **Other Affected Tasks:** None. There are no funded experiments scheduled to use the instruments at the current time.

■ **Corrective Action:** USArray are working with the manufacturer to speed up testing and acceptance of the units. The current goal is to have the units delivered by the end of May.

CONTINGENCY SUMMARY

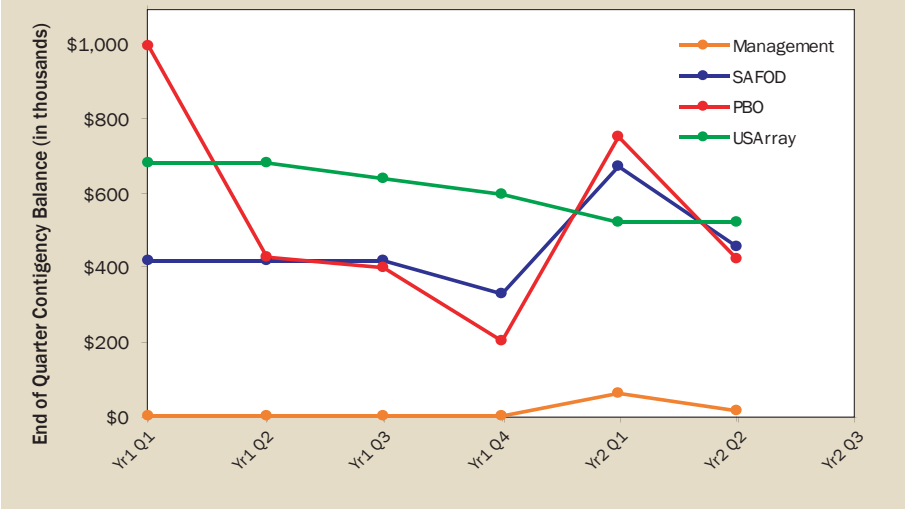
To mitigate the overall EarthScope risk, each management component of EarthScope reserves contingency funds for unforeseen events. The use of these funds for the quarter are reported in the contingency log below.

Contingency Log for Current Quarter

Description	Transactions
1.1 EarthScope Management	
Balance at Beginning of Quarter	$60,000
Additional Staff - Publications Coordinator	($47,271)
Ending Balance	$12,729
No Liens	$0
Ending Balance with Liens	$12,729
1.2 SAFOD	
Balance at Beginning of Quarter	$678,024
Site Preparation (Change Order SAFOD-012)	($216,000)
Ending Balance	$462,024
No Liens	$0
Ending Balance with Liens	$462,024
1.3 PBO	
Balance at Beginning of Quarter	$756,505
PBO 30 Moratorium Notice (impact to follow)	$0
PBO 18 California GPS SDBM ATV	($5,823)
PBO 19 BSM Geophysical Logging	($67,980)
PBO 20 BSM Tiltmeter	$134,436
PBO 21 Core Data Flow Infrastructure	($203,067)
PBO 22 Data Product Maintenance Contracts	($60,373)
PBO 23 Facility Construction Summer Labor	($88,751)
PBO 24 Tape Backup System	($38,560)
Ending Balance	$426,386
Alaska helicopter recon and installation (Year 2 Costs)	($200,000)
Network management and cost schedule labor	($65,000)
2004 UNAVCO G&A adjustment	$166,000
Regional permitting labor	($65,000)
Ending Balance with Liens	$262,386
1.4 USArray	
Balance at Beginning of Quarter	$525,438
No Contingency Used	$0
Ending Balance	$525,438
No Liens	$0
Ending Balance with Liens	$525,438

The Contingency Summary below tracks the use of contingency funds over the course of the project. Balances at the end of Year 2-Quarter 1 reflect the contingency used over the quarter plus the addition (if applicable) of Year 2 contingency funds.

Contingency Summary



** SAFOD contingency balance at the end of Y2Q1 and Y1Q4 were printed incorrectly. The graph above contains the correct balances.*

CHANGE REQUESTS

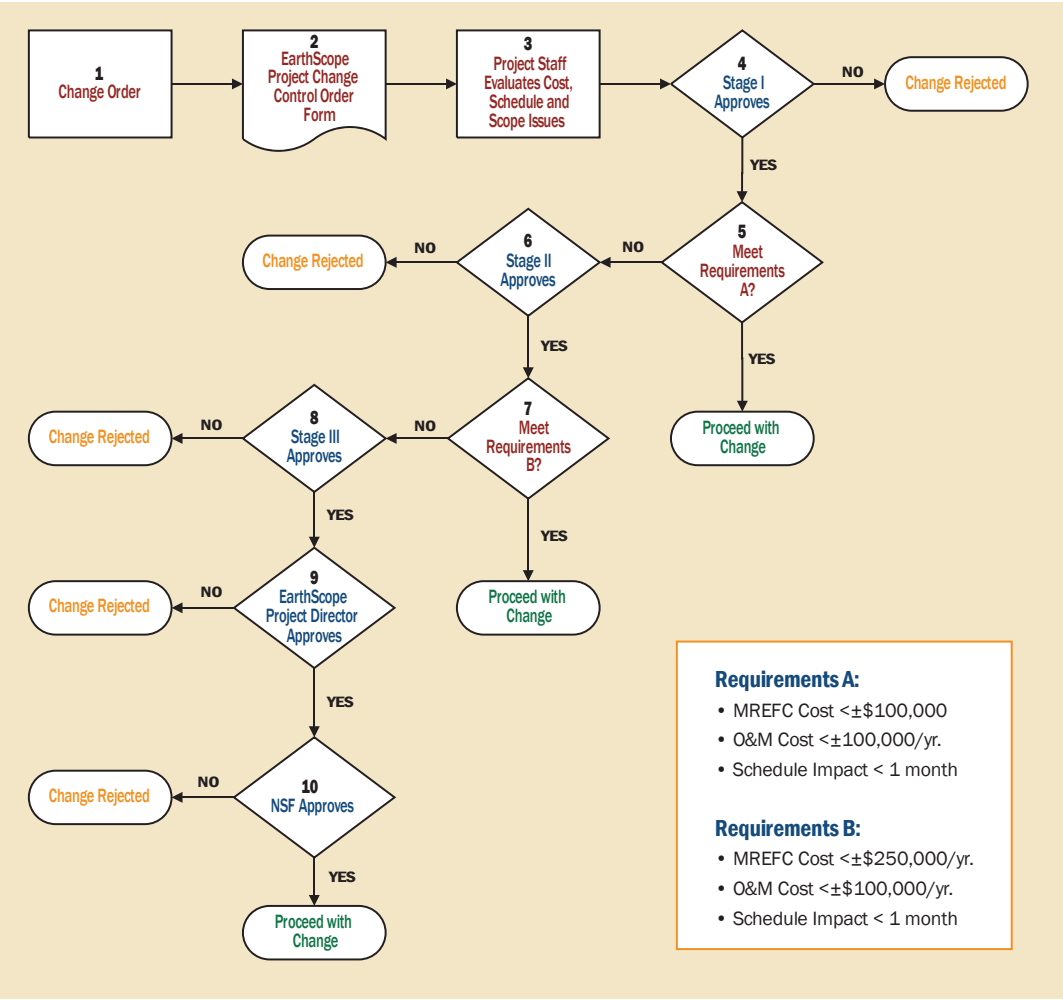
The approval process for a proposed project change is illustrated below. It is multi-tiered with the approval process based on the dollar value and impact of the proposed change. Proposed changes less than $250,000 to the MREFC cost, less than $100,000 per year to the Operations and Maintenance cost, or with an impact of less than one month require approval within the respective management component, sometimes with advisory committee consultation. For proposed changes over $250,000 to the MREFC cost, over $100,000 per year to the Operations and Maintenance cost, or with an impact of over a month, the change must also be approved by EarthScope Project Director and the National Science Foundation.

Change Orders are included in the Quarterly Report and copies are stored in the EarthScope Document Archive. The change control process outlined above is defined as follows:

1. **Change Order:** A cost account manager (e.g., Regional Engineering Manager, Operational Manager, Data Manager), the science community, or the program itself initiates the change process. Changes can be requests to cover additional scope or effort outside the current project budget or a request of project management reserve to meet project requirements that were not covered in the original budget. The Change Order can also request a reduction of budget and associated scope previously allocated to the project baseline (BCWS). Any realized cost savings will be shifted into the project management reserve.

2. **EarthScope Project Change Request:** The EarthScope Project Change Request is filled out by the requestor and a detailed time-phased estimate is made of the change.

3. **Project Staff Evaluates Cost/Schedule and Scope Issues:** Project staff evaluates cost, schedule, and scope issues associated with the change and verifies that the EarthScope Project Change Request is complete.



4. **Stage I Approves:** Stage I evaluates and then approves or denies the proposed change. Stage I is defined as:
   - The EarthScope Project Director for changes affecting 1.1 EarthScope Management,
   - The appropriate SAFOD Principal Investigator for changes affecting 1.2 SAFOD,
   - The PBO Director for changes affecting 1.3 PBO, and
   - The appropriate IRIS Program Manager for changes affecting 1.4 USArray.

5. **Meet Requirements A?:** If the impact of the change is less than $100,000 to the MREFC cost, the impact of the change is less than $100,000 to the Operations and Maintenance yearly cost, and the schedule impact is less than one month and does not require any changes to the milestone list documented in the most recent Quarterly Report, then the change may proceed. If not, Stage II approval is required.

6. **Stage II Approves:** Stage II evaluates and then approves or denies the change. Stage II is defined as:
   - The EarthScope Project Director for changes affecting 1.1 EarthScope Management,
   - The appropriate SAFOD Principal Investigator for changes affecting 1.2 SAFOD,
   - The PBO Principal Investigator for changes affecting 1.3 PBO, and
   - The USArray Principal Investigator for changes affecting 1.4 USArray.

7. **Meet Requirements B?:** If the change is less than $250,000 to the MREFC cost, the impact of the change is less than $100,000 to the Operations and Maintenance yearly cost, and the schedule impact is less than one month and does not require any changes to the milestone list documented in the most recent Quarterly Report, than the change may proceed. If not, Stage III approval is required.

8. **Stage III Approves:** Stage III evaluates and then approves or denies the change. Stage III is defined as:
   - The EarthScope Project Director for changes affecting 1.1 EarthScope Management,
   - The appropriate SAFOD Principal Investigator for changes affecting 1.2 SAFOD,
   - The PBO Standing Committee Chair for changes affecting 1.3 PBO, and
   - The IRIS Coordinating Committee Chair for changes affecting 1.4 USArray.

9. **EarthScope Project Director Approves:** The EarthScope Project Director evaluates and then approves or denies the change both as the Project Director and the Chair of the EFEC in consultation with the EFEC.

10. **NSF Approves:** The change is submitted to the National Science Foundation for approval.

Approved Change Orders:

During Year 2-Quarter 2, four change orders were approved.

Date Requested:	**November 18, 2004**	**Schedule Impact:**	**Minor**
Change Order:	**SAFOD-011**	**MREFC Cost:**	**($75,000)**
Requested by:	**C. Weiland**	**O&M Cost:**	**$0**
WBS Task:	**1.2.2.2**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: This change order requests management reserve funds to pay for extra borehole logging undertaken at the end of Phase 1 drilling. The original logging plan called for either wireline logging or Tough Logging Conditions logging. Because of the difficulty with getting the equipment down through the borehole in the deviated section of the hole, wireline logging was not successful to total depth. Consequently in order to log the deviated section of the borehole, we had to run the equipment down on the drill pipe (Tough Logging Conditions logging).

Status: Stage I approved by Mark Zoback on January 6, 2005
Approval Process Complete

Date Requested:	**December 1, 2004**	**Schedule Impact:**	**Minor**
Change Order:	**SAFOD-010**	**MREFC Cost:**	**($17,600)**
Requested by:	**C. Weiland**	**O&M Cost:**	**$0**
WBS Task:	**1.2.3.3**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: This change order requests $17,600 for Management Reserve Funds for the purchase of a hole-lock mechanism for Stage 2 seismic sonde. After the preliminary installion of the Stage 2 sonde, the data quality was poor because the sonde was not sufficiently isolated from vibrations particularly from the cable. The additional hole lock mechanism will improve the sonde position and contact with the casing and allow us to relax the tension of the cable. This will then improve data quality.

Status: Stage I approved by Mark Zoback on January 6, 2005
Approval Process Complete

Date Requested:	**January 31, 2005**	**Schedule Impact:**	**None**
Change Order:	**SAFOD-012**	**MREFC Cost:**	**($216,000)**
Requested by:	**C. Weiland**	**O&M Cost:**	**$0**
WBS Task:	**1.2.2.3**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: This change order requests management reserve funds to pay for the additional expenses associated with preparing the site for Phase 2 drilling. The main action required is cleaning and disposing of materials in the sump. At the end of Phase 1 drilling the sump has a substantial amount of cuttings and unrecovered drilling mud. The extremely heavy Autumn rains (300% of normal for Southern California) threatened to overflow the sump. So the materials in the sump needed to be excavated and trucked (over 40 truckloads) away to a disposal facility. The cost of the excavator, trucking, disposal, and environmental testing and on-site supervision is $216,000.

Status: Stage I approved by M. Zoback on February 7, 2004.
Stage II approved by M. Zoback on February 7, 2004.
Approval Process Complete

Date Requested:	**March 4, 2005**	**Schedule Impact:**	**None**
Change Order:	**ESO-003**	**MREFC Cost:**	**$47,271**
Requested by:	**G. van der Vink**	**O&M Cost:**	**$0**
WBS Task:	**1.1.1**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: Due to the concerns voiced by the EFEC on the staffing levels and workload of the EarthScope Office, a Publications Coordinator was hired in February. This change order updates the Year 2 EarthScope Office baseline to reflect the estimated budget cost associated with the additional staff person, whose salary expense is budgeted as 75% effort to the EarthScope Office MREFC award (for tasks associated with developing management reports and other MREFC materials) and 25% to the EarthScope Office E&O award (for publication tasks to be coordinated with the new E&O Manager).

Status: Stage I approved by G. van der Vink on March 7, 2005.
Approval Process Complete

Two change orders were previously approved but not reported.

Date Requested:	**July 29, 2004**	**Cost Impact:**	**$0**
Change Order:	**SAFOD-004**	**Schedule Impact:**	**Moderate**
Requested by:	**C. Weiland**	**WBS Task:**	**1.2.3.2**

Description: This change order revises the schedule for the development and deployment of the Stage 1 (Pilot Hole) sonde. The main change is a delay in fabrication and deployment schedule. There are some changes to instrument design, too. The main differences in design for the system currently under construction are the relocation of the tilt and pressure sensor systems to a separate, lever-arm hole lock module. This module will sit above the redesigned version of the integrated strain, the microelectromechanical system, and the seismometer system. Another design change is with the leading and trailing edges of the sonde, where centralizing clamp systems are now included. During model tests, it was found that proper locking of the strainmeter hole lock systems required a more-or-less centralized starting position. Thus the top and bottom centralizer are now incorporated in the design. Model tests show this approach to be working. A planned lab bench test will demonstrate the actual operation of this design change. The tiltmeter for the Stage 1 sonde will be from Geospace/Pinnacle systems collaboration rather than Gladwin tiltmeter originally proposed. The change results from cost and engineering considerations.

Status: Stage I approved by M. Zoback on September 27, 2004.
Stage II approved by M. Zoback on September 27, 2004.
Stage III approved by M. Zoback on September 27, 2004.
Approval Process Complete

Date Requested:	**September 14, 2004**	**Cost Impact:**	**$0**
Change Order:	**SAFOD-002**	**Schedule Impact:**	**None**
Requested by:	**EFEC**	**WBS Task:**	**1.2.2**

Description: This change order is to clarify the drilling plan (target depths) for Phase 1 and 2 drilling. These changes were incorporated into the Project Execution Plan (PEP) and baseline budget, consequently this change order has no cost or schedule impact. The PEP does not explicitly define these depths, moreover the PEP also uses two different illustrations to explain the drilling but they do not agree with each other. The important difference in the drilling plan between the EarthScope Proposal and the PEP is that the target vertical depth changed from 4.0km to 3.2km. The change in the overall depth of the well lowered the estimated cost of the well by $845,500. The budgetary impact of this change was incorporated to the SAFOD Baseline budget submitted with the PEP. Most of the cost savings from the shallower well, were committed to the salary for the SAFOD Data Manager, as recommended during the review of the EarthScope proposal. The SAFOD Data Manager staff position was not part of the proposal. The table of target depths is included with the change request.

Status: Stage I approved by M. Zoback on September 27, 2004.
Stage II approved by M. Zoback on September 27, 2004.
Stage III approved by M. Zoback on September 27, 2004.
Approval Process Complete

Denied Change Orders:

Two change requests were denied during Quarter 2.

Date Requested:	**September 22, 2004**	**Cost Impact:**	**$0**
Change Order:	**USArray-008**	**Schedule Impact:**	**Moderate**
Requested by:	**R. Butler**	**WBS Task:**	**1.4.2**

Description: The EarthScope Project Execution Plan, Version 1.0, dated November 30, 2003, contained projections of Equivalent Stations (Quarterly Milestones) and Categories of Effort (% of total station tasks) for the ANSS Backbone Stations. These reflected best projections available at a time when proposals and negotiations with our prime subawardee, the US Geological Survey Albuquerque Seismological Laboratory, were being concluded. Subsequent to these efforts, a comprehensive Work Breakdown Structure and associated plan was adopted and the US Geological subaward was issued in February 2004. This WBS has been reviewed and continues to serve as the project plan for the ANSS Backbone Stations. This change order updates and replaces the Project Execution Plan Equivalent Station Quarterly Milestones with ones based on the adopted plan. This change order also re-categorizes eight Categories of Effort noted in the Project Execution Plan into 7 new categories in the WBS that better represent the tasks involved in the establishment of the ANSS Backbone Stations.

Status: Stage I approved by R. Butler on September 22, 2004.
Stage II approved by D. Simpson on September 23, 2004.
Stage III approved by T. Owens on September 23, 2004.
EarthScope Project Director approved on October 14, 2004.
Comment: Change reflects improved determination of equivalent station measures and the resulting impact on milestones. This change will lead to better accounting of costs and schedule, but will not impact the overall schedule, cost or scope the project.
NSF EarthScope Program Director denied on January 6, 2005.
Comment: The PEP definitions/milestones may not be changed, but these requested changes will be introduced for consideration as part of the baseline review in 2005. The project may calculate and report the equivalent stations as described, providing full documentation in the quarterly reports.

Date Requested:	**October 20, 2004**	**Schedule Impact:**	**Minor**
Change Order:	**USArray-007**	**MREFC Cost:**	**$0**
Requested by:	**J. Fowler**	**O&M Cost:**	**$0**
WBS Task:	**1.4.3**	**Milestones Affected:**	**Yes**
		Other WBS Tasks Affected:	**None**

Description: USArray proposes to change the bases for equivalent stations for its Transportable Array component. The reason for this change is to include shared stations in the Transportable Array model and tie this model to earned value. The weightings for the station significance breakdowns are based on the relative costs of the components. This allows a straightforward relationship between equivalent stations and earned value.

Status: Stage I approved by J. Fowler on October 22, 2004.
Stage II approved by D. Simpson on October 25, 2004.
Stage III approved by T. Owen on October 27, 2004.
EarthScope Director approved on November 22, 2004.
Comment: Changes in equivalent stations have been discussed and revised to provide proper granularity for monitoring progress while still allowing flexibility needed.
NSF EarthScope Program Director denied on January 6, 2005.
Comment: The PEP may not be changed via change order. These changes will be introduced for consideration as part of the baseline review in 2005. The milestones should not change, but the project may calculate and report Transportable Array equivalent stations as described herein, providing full documentation in the quarterly reports.

One change order was denied during Quarter 1, but was not previously reported.

Date Requested:	**September 22, 2004**	**Cost Impact:**	**$0**
Change Order:	**ESO-001**	**Schedule Impact:**	**None**
Requested by:	**C. Hennet**	**WBS Task:**	**None**

Description: The EarthScope Project Execution Plan lists the completion of the Quarterly Reports and Annual Reports as milestones associated with specific submission dates. Quarterly reports, however, are approved during EarthScope site reviews, and the submission dates depend on the dates of the site review and may vary. Annual Reports are transmitted to the National Science Foundation via Fastlane during open reporting cycles set by the National Science Foundation. The EarthScope office will eliminate specific dates, leaving the milestones in the appropriate quarter.

Status: Stage I approved by G. van der Vink on September 24, 2004.
Stage II approved by G. van der Vink on September 24, 2004.
Stage III approved by G. van der Vink on September 24, 2004.
EarthScope Project Director approved on September 24, 2004.
NSF EarthScope Program Director denied on December 12, 2004.
Approval Process Complete

Pending Changes Orders:

Six change requests were pending at the end of March 2005.

Date Requested:	**March 10, 2004**	**Schedule Impact:**	**None**
Change Order:	**SAFOD-014**	**MREFC Cost:**	**$25,206**
Requested by:	**C. Weiland**	**O&M Cost:**	**$1,000**
WBS Task:	**1.2.3.4**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: This change order is to request funds for a highly accurate, highly reliable pressure and temperature recorder. This will be a wireline deployable instrument that will be a standalone instrument that we can use to monitor conditions within and at the bottom of the Main Hole. It is also prototype of tool that may be included with the Stage 3 monitoring package. As such, the funds for this tool will come from the Stage 3 instrumentation budget. As this tool comes with its own surface read-out and data recording system, we anticipate the only O&M costs will be the labor to deploy/retrieve the transducer.

Status: *Stage I approval pending.*

Date Requested:	**January 28, 2005**	**Schedule Impact:**	**<1 month**
Change Order:	**PBO-016**	**MREFC Cost:**	**$1,318,113**
Requested by:	**B. Stephanus**	**O&M Cost:**	**$0**
WBS Task:	**1.3.3 & 1.3.5**	**Milestones Affected:**	**No**
		Other WBS Tasks Affected:	**None**

Description: PBO Management continues to make its best efforts to deploy 175 borehole strainmeters as originally defined in the EarthScope MREFC Proposal. However, as the detailed costs of this project have been refined, specifically in the instrument procurement and installation planning process, significant cost concerns have arisen that need to be addressed. This cost concern focuses on $1,318,113 of additional borehole strainmeter funding required in Year 2 (10-1-04 thru 9-30-05) to cover instrument start up and shipping, drilling, travel to Washington State, and necessary recon and installation tooling for the first strainmeter crew not covered in the original budget. The cost increases are detailed in the change order.

Status: *Stage I approval pending.*

Date Requested:	**February 27, 2005**	**Schedule Impact:**	**>1 month**
Change Order:	**SAFOD-013**	**MREFC Cost:**	**$15,000**
Requested by:	**C. Weiland**	**O&M Cost:**	**$35,000**
WBS Task:	**1.2.3.3**	**Milestones Affected:**	**Yes**
		Other WBS Tasks Affected:	**1.2.1 and 1.2.3.4**

Description: This change order clarifies the instrumentation for Stage 2 fault zone monitoring instrumentation in the SAFOD project. We indicated in the EarthScope proposal and Project Execution Plan that we planned to use Sandia National Lab as the system integration contractor for the Stage 2 monitoring instrumentation. The Stage 2 monitoring plan now involves working with two subcontractors: Duke University for an “in hole” seismometer and University of California San Diego for a “behind the casing” strainmeter.

Status: *Stage I approval pending.*

Date Requested:	**March 4, 2005**	**Schedule Impact:**	**None**
Change Order:	**USArray-011**	**MREFC Cost:**	**$0**
Requested by:	**S. Ingate**	**O&M Cost:**	**$0**
WBS Task:	**2.4.2.3**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**2.4.6.2, 2.4.3.2, 2.4.5.2, and 2.4.3.5**

Description: USArray intends to use subawards to integrate the Backbone Magnetotelluric stations into the ANSS Backbone, and also for testing candidate Magnetotelluric systems for EarthScope. A competitive request for bids has been conducted and the award for the first year services wil be made to Oregon State University. Insufficient funds were identified in the USArray budget for the Backbone Magnetotelluric installations. The purpose of this change order is to re-program funds within USArray for this subaward.

Status: Stage I approved by J. Fowler, T. Ahern, and Rhett Butler on March 4, 2005.
Change order being reviewed by the EarthScope Project Director.

Date Requested:	**March 20, 2005**	**Schedule Impact:**	**>1 month**
Change Order:	**SAFOD-015**	**MREFC Cost:**	**$0**
Requested by:	**C. Weiland**	**O&M Cost:**	**$0**
WBS Task:	**1.2.3.2**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: This change order is to revise the configuration of the Stage 1 sonde. The Stage 1 sonde was designed to have a Gladwin strainmeter included into the package. However, the technical challenges of the strainmeter have made integrating it into the sonde more difficult than planned. Work will continue on integrating the strainmeter, but the sonde will be deployed in Spring 2005 without the strainmeter. Once the technical challenges have been met, we will pull the Stage 1 sonde and redeploy the complete package. There are no anticipated costs to the MREFC or O&M program related to this change.

Status: *Stage I approval pending.*

Date Requested:	**March 31, 2005**	**Schedule Impact:**	**None**
Change Order:	**SAFOD-017**	**MREFC Cost:**	**$0**
Requested by:	**C. Weiland**	**O&M Cost:**	**$25,000**
WBS Task:	**1.2.4**	**Milestones Affected:**	**None**
		Other WBS Tasks Affected:	**None**

Description: This change order is to change the repository for the SAFOD core and physical samples. The MREFC Proposal indicates that the samples will be stored at the USGS facility in Denver, CO. Instead the physical samples will be stored at the Gulf Coast Repository of the Integrated Ocean Drilling Program, in College Station, TX. The main reason we are not using the USGS core facility is that they have no provision for storing the core under refrigeration, and thus all of their core is stored dry in boxes at room temperature. This is unacceptable to SAFOD because we need to preserve the original fluid content of clays and other hydrous minerals as much as possible, and this is only possible by shrink-wrapping the core and then storing it in refrigerators, which can readily be done at the Gulf Coast Repository.

Status: *Stage I approval pending.*

Change Orders Summary:

Since the start of EarthScope, 44 changes have been proposed to the project.

Change Order		Cost Impact	Schedule Impact	Milestone Impact	Requested By	Date Requested	Status
1.1 EarthScope Management							
ESO-003	Hiring Publication Coordinator	$47,271	None	No	G. van der Vink	March 4, 2005	Approved - March 7, 2005
ESO-002	EarthScope Management - To document an administrative correction to the office Year 2 baseline.	$0	None	No	C. Hennet	December 23, 2004	Approved - December 28, 2004
ESO-001	Reporting - Remove dates from milestones, but leave in assigned quarter	$0	None	Yes	C. Hennet	September 22, 2004	Denied - December 8, 2004
1.2 SAFOD							
SAFOD-017	Store core and physical samples at Gulf Coast Repository of the IODP	$0	None	No	C. Weiland	March 31, 2005	Pending
SAFOD-015	Revise configuration of the Stage 1 sonde	$0	Major	No	C. Weiland	March 20, 2005	Pending
SAFOD-014	Purchase a wireline deployable pressure and temperature recorder	($25,206)	None	No	C. Weiland	March 10, 2005	Pending
SAFOD-013	Clarifies Stage 2 instrumentation	($15,000)	Major	Yes	C. Weiland	February 27, 2005	Pending
SAFOD-012	Phase 2 Drilling - Additional expenses associated with preparing the site for phase 2 drilling	($216,000)	Minor	No	C. Weiland	January 31, 2005	Approved - February 7, 2005
SAFOD-011	Phase 1 Drilling - Extra borehole logging	($75,000)	Minor	No	C. Weiland	November 18, 2004	Approved - January 6, 2005
SAFOD-010	Stage 2 Monitoring - Purchase a hole-lock mechanism for sonde to improve data quality	($17,600)	Minor	No	C. Weiland	December 1, 2005	Approved - January 6, 2005
SAFOD-009	Stage 3 Monitoring - For Paulsson Geophysical Services to provide standoffs and cable	($25,000)	Minor	No	C. Weiland	October 25, 2004	Approved - November 15, 2004
SAFOD-008	Phase 1 Drilling - Change in the casing plan	($55,000)	Minor	No	C. Weiland	October 13, 2004	Approved - November 15, 2004
SAFOD-007	Instrumentation - Electricity to drill site	($153,452)	Minor	No	C. Weiland	October 12, 2004	Withdrawn - December 9, 2004
SAFOD-006	Stage 1 Monitoring - Purchase GeoRes DSI unit	($14,600)	None	No	C. Weiland	September 16, 2004	Approved - November 15, 2004
SAFOD-005	Phase 1 Drilling - Revision of Phase 1 drilling plan	($90,000)	Minor	No	M. Zoback	September 14, 2004	Approved - September 27, 2004
SAFOD-004	Stage 1 Monitoring - Revised schedule for development and deployment of the state 1 sonde	$0	Moderate	No	C. Weiland	July 29, 2004	Approved - September 27, 2004
SAFOD-003	Phase 1 Drilling - Compensation to SAFOD for Baker Hughes gyroscopic error (repairs and lost drilling time)	$0	Minor	No	M. Zoback	July 19, 2004	Approved - September 26, 2004
SAFOD-002	Drilling and Downhole Measurements - Clarify the drilling plan for Phase 1 and 2 drilling	$0	None	No	EFEC	September 14, 2004	Approved - September 27, 2004
SAFOD-001	Phase 1 Drilling - Increase depth of 26" hole and extend the casing	($80,000)	Minor	Yes	M. Zoback	August 24, 2004	Approved - July 26, 2004
1.3 PBO							
PBO-017	Helicopter support for the Augustine Volcano deployment	($142,904)	Moderate	No	B. Stephanus	August 15, 2004	Approved - August 20, 2004
PBO-016	Borehole strainmeter start up for Year 2 from out years	($1,318,113)			B. Stephanus	January 28, 2005	Pending
PBO-013	Vehicle Costs - Additional reconnaissance vehicle	($29,036)	Major	No	K. Feaux	June 20, 2004	Approved - June 20, 2004
PBO-012	Shift money from contingency/ management reserve for early procurement of additional GPS/antenna units	($124,000)	Moderate	No	B. Stephanus	March 30, 2004	Approved - March 30, 2004
PBO-011	Borehole Strainmeter Standing Committee Support - Funds from Year 2 shifted to Year 1 budget	($22,000)	None	No	B. Stephanus	February 19, 2004	Approved - March 9, 2004
PBO-010	PBO Safety & Tooling Equipment - Add tooling and safety equipment to Year 1	($128,735)	None	No	B. Stephanus	February 19, 2004	Approved - March 19, 2004
PBO-009	Pacific Northwest Office Warehouse & Furniture	($36,062)	None	No	B. Stephanus	February 19, 2004	Approved - March 9, 2004
PBO-008	PBO Computers & IT Scope - Add equipment to the Year 1 computer & IT budget	($86,110)	Minor	No	B. Stephanus	February 19, 2004	Approved - March 9, 2004
PBO-007	Northern CA, Southern CA Regional Engineer Mgt. - Purchase an ATV to access sites	($4,999)	Minor	No	K. Feaux	January 5, 2004	Approved - February 9, 2004
PBO-006	Data & Data Products Subcontract - Correct estimation error	($9,437)	None	No	B. Stephanus	December 31, 2003	Approved - January 20, 2004
PBO-005	Data & Data Products - Addition of travel budget	($10,300)	Minor	No	B. Stephanus	December 31, 2003	Approved - January 20, 2004
PBO-004	GPS Receiver/Antenna - Revised budget	$100,000	None	No	B. Stephanus	December 31, 2003	Approved - February 9, 2004

Change Order		Cost Impact	Schedule Impact	Milestone Impact	Requested By	Date Requested	Status
PBO-003	Various Labor Tasks - Salary budgeted rates and delay in hiring four positions	$488,611	None	No	B. Stephanus	December 31, 2003	Approved - November 17, 2004
PBO-002	LSM SubAward - Shift start of the Longbase Laser Strainmeter SubAward from Year 2 to Year 1	($327,000)	Major	No	B. Stephanus	December 31, 2003	Approved - November 17, 2004
PBO-001	All Tasks - Transfer of Project Funds from Contingency/Management Reserve	($389,000)	None	No	B. Stephanus	December 31, 2003	Approved - November 17, 2004
1.4 USArray							
USArray-011	Re-program funds for ANSS magnetelluric installations	$0	None	No	S. Ingate	March 4, 2005	Pending
USArray-009	Data Management - Change WBS baselines	($76,654)	None	No	T. Ahern	September 16, 2004	Approved - October 1, 2004
USArray-008	ANSS Backbone - New Equivalent Station measures	$0	Moderate	Yes	R. Butler	September 22, 2004	Denied - January 6, 2005
USArray-007	Transportable Array - New equivalent station measures	$0	Minor	Yes	J. Fowler	October 20, 2004	Denied - January 6, 2005
USArray-006	Permanent Array - Purchase two (2) CMG-1T Broadband Seismometers	($41,000)	Minor	No	R. Butler	September 9, 2004	Approved - September 9, 2004
USArray-005	Siting Outreach - Delayed siting outreach discussions	$0	Minor	No	C. Shin	July 23, 2004	Approved - July 23, 2004
USArray-004	Deployment, Testing, Monitoring - Modification of Data Management Center office	($33,853)	None	No	T. Ahern	June 22, 2004	Approved - June 22, 2004
USArray-003	Procurement - Ventilation for computer room	($5,780)	None	No	T. Ahern	May 26, 2004	Approved - May 26, 2004
USArray-002	Procurement - Computing environment for Lead Data Control Analyst	($4,670)	None	No	T. Ahern	May 26, 2004	Approved - May 26, 2004
USArray-001	Management - Development of a Data Management Plan	($3,839)	None	No	T. Ahern	May 25, 2004	Approved - May 25, 2004

APPENDIX: Acronym List

AC	Actual Cost
ACWP	Actual Cost of Work Performed
ANF	Array Network Facility
ANSS	Advanced National Seismic System
ASL	Albuquerque Seismological Laboratory
BAC	Budgeted Actual Cost
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BLM	Bureau of Land Management
BSM	Borehole Strainmeter
CDR	Critical Design Review
CSSR	Cost Schedule Status Report
CV	Cost Varience
DCN	Data Concentrator Node
DMC	IRIS Data Management Center
DMS	IRIS Data Management System
E&O	Education and Outreach
EAC	Earned Actual Cost
EAR	NSF Division of Earth Sciences
EFEC	EarthScope Facilities Executive Committee
ESEC	EarthScope Science and Education Committee
ES-Ops	EarthScope Operations
EV	Earned Value
EVM	Earned Value Management
G&A	General & Administrative
GPRA	Government Performance and Results Act
GPS	Global Positioning System
GSA	Geological Society of America
GSN	Global Seismographic Network
IAGT	Institute for the Application of Geospatial Technology
IRIS	Incorportated Research Institutions for Seismology
IT	Information Technology
LWD	Logging While Drilling
MOU	Memorandum of Understanding
MREFC	Major Research Equipment and Facilities Construction
MS PHD	Minorites Striving and Pursuing Higher Degrees of Success in EarthSytem Science
MWD	Measurements While Drilling
MR	Management Reserve
NASA	National Aeronautics and Space Administration
NCEDC	Northern California Earthquake Data Center
NEES	Network for Earthquake Engineering Simulation
NSF	National Science Foundation
NSN	National Seismic Network
O&M	Operations and Maintenance
OMB	U.S. Office of Management & Budget
PASO	Parkfield Area Seismic Observatory
PASSCAL	Program for Array Seismic Studies of the Continental Lithosphere
PBO	Plate Boundary Observatory
PDR	Preliminary Design Review
PEP	Project Execution Plan
POD	PBO Operational Database
POI	POD Operational Interface
QA	Quality Assurance
R&RA	Research and Related Activities
RFP	Request For Proposals
SAFOD	San Andreas Fault Observatory at Depth
SCIGN	Southern California Integrated Geodetic Network
SV	Schedule Varience
TLC	Tough Logging Conditions
UNAVCO	University Navstar Consortium
USArray	United States Array
USGS	United States Geological Survey
VSAT	Very Small Aperture Terminal
WBS	Work Breakdown Structure

EarthScope is a national science initiative to explore the structure and evolution of the North American continent and to understand the physical processes controlling earthquakes and volcanoes. EarthScope is taking a comprehensive approach to investigating scientific questions at all scales — from the active nucleantion zone of earthquakes, to individual faults and volcanoes, to the deformation along the plate boundary, and to the structure of the continent and plate tectonic motion.

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