Year 1 Annual Report

September 1, 2003 – March 31, 2004

earthscope

Submitted to the National Science Foundation
June 1, 2004
By the Project Director and the Members of the EarthScope Facilities Executive Committee:

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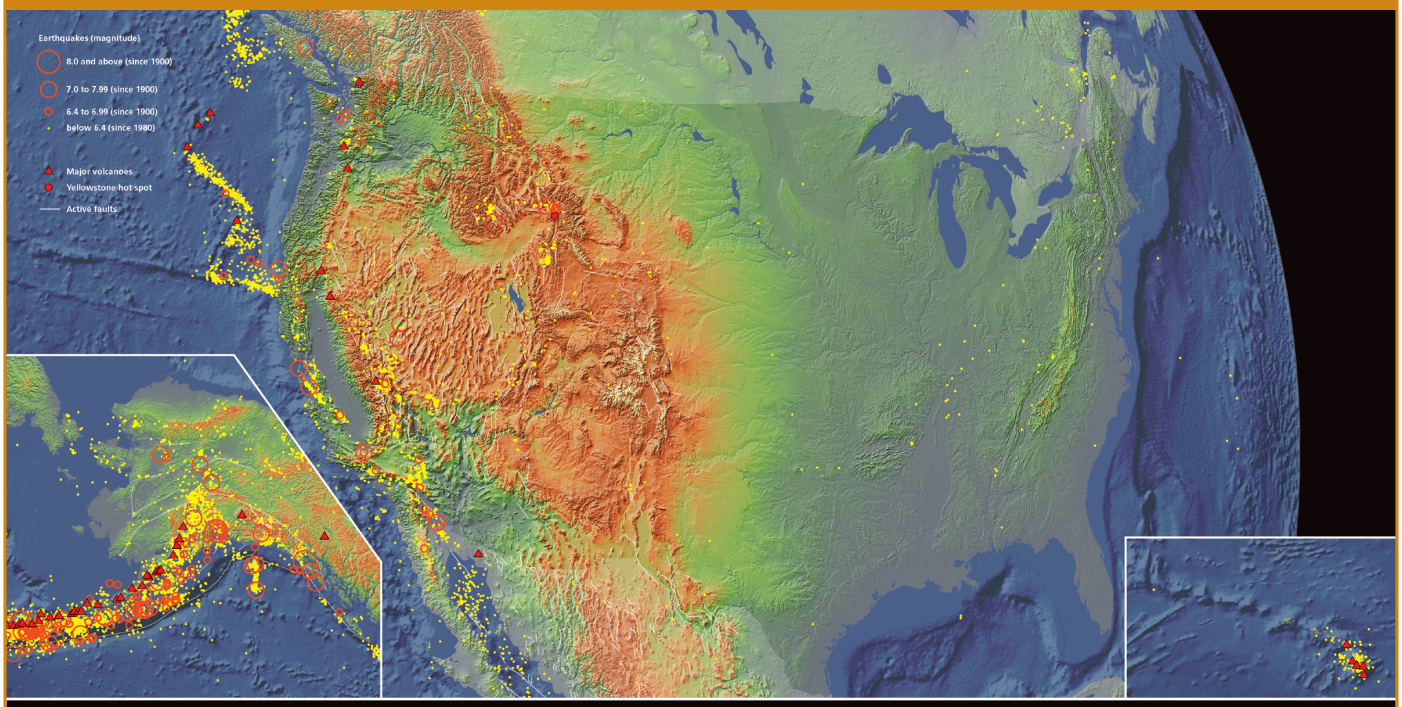

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EarthScope Status at a Glance

Overall Project Numbers *(page 34)*:

- 5-year work completed: 3%
- Cumulative overall schedule variance: -5%
- Cumulative overall cost variance: 0%
- Milestones completed: 24 of 27 through second Quarter
- Total number of change orders: 12

Data Resources Available *(page 33)*:

- SAFOD seismic data from Pilot Hole
- GPS stations: Colorado (1), San Simeon (5)
- ANSS stations: Wyoming (1), Nevada (1), Texas (1), Alaska (1)

Highlights *(page 3)*:

- EarthScope Project Execution Plan and overall management structure developed.
- Comprehensive geophysical models were developed for the characterization of SAFOD and the target earthquakes.
- Five GPS stations installed in response to the San Simeon Earthquake.
- New Mexico Tech provides $1.6 million of funding for the construction of USArray facility.

Major Project Concerns *(page 47)*:

- NSF R&RA Funding: Sufficient funding is needed to support proposals for EarthScope science and for preserving the health of the disciplinary research programs.
- Operations and Maintenance: Out-year funding projections for EarthScope contained within the Fiscal Year 2004 NSF Budget Request are approximately 50% of EarthScope's current estimates.
- EarthScope Portal: An EarthScope Portal with common data products and tools are required to make EarthScope data available to non-specialists and to promote inter-disciplinary research. Effort on the EarthScope Portal is beginning.

EarthScope Research and Related Activities*:*

- $3,600,000 of funded proposals with Fiscal Year 2003 funds.
- Request for Proposals Fiscal Year 2004 deadline: August.

Education and Outreach*:*

- Proposal developed to support an EarthScope Education and Outreach Coordinator and programmatic activities within the EarthScope office.

Part I: EarthScope Activities

Highlights

With the onset of funding on September 1, 2003, EarthScope developed a Project Execution Plan and an overall management structure. Following recommendations from the ESEC, transmitted to EarthScope, the EarthScope office took on additional responsibilities for meeting the project's overall scientific and educational goals. Within months, the first EarthScope data became available and proposals have been funded through the peer-review process to use these data. Following are just a few of the project's highlights from the first year:

Press Coverage:

Following the National Science Foundation (NSF) Press Release, EarthScope received strong coverage in periodicals read locally (e.g., *San Jose Mercury News*), nationally (e.g., *The New York Times*) and internationally (e.g., *Apple News* [China]). Geared towards scientists, an extensive article describing the EarthScope project was published in *Physics Today*. Also, a compilation of 19 articles were submitted in two special sections of the peer-reviewed journal *Geophysical Research Letters*.

Cash boost gets Earth project off the ground

Washington The Earth sciences received a major boost last week as the US National Science Foundation (NSF) agreed to spend $219 million over the next five years on EarthScope, a suite of observation projects.

The programme will use satellites and a network of 400 seismometers to improve geophysical monitoring of the planet (see *Nature* **405,** 390–392; 2000). The sensors will map and monitor, in real time, a wide range of natural phenomena, including plate tectonics, earthquakes and volcanic eruptions. They will also gather data from beneath Earth's surface, to study the planet's magnetic field and the motion of the continental plates. Some EarthScope projects are already under way, as the NSF has allocated some $30 million to the programme in 2003.

Nature (2003)

American Geophysical Union Fall Meeting:

EarthScope was well represented at the American Geophysical Union (AGU) Fall Meeting (December 8-12, 2003; San Francisco, CA). In addition to the numerous EarthScope participants and EarthScope related talks and posters, the EarthScope exhibit booth debuted to positive reviews and interest, serving as a nucleus for information and discussions about the project. Distributed at the booth were 500 tri-fold pamphlets, 200 copies of the NSF press release, 175 brochures, and numerous other articles and reports. AGU also provided a venue for the EarthScope Operations Group to meet for a dinner meeting, for G. van der Vink to meet with the JASON Group to discuss EarthScope as a JASON Education and Outreach (E&O) project, and for G. van der Vink to meet with the Interim Education and Outreach Network chair to develop E&O plans.

Project Execution Plan:

The EarthScope Project Execution Plan (PEP v1.0) was submitted to NSF on November 30, 2003. The PEP included the integrated EarthScope change control system, work breakdown structure, milestone list, scope and schedule for reporting, and earned value management system. The PEP was reviewed on January 22, 2004, in Washington, DC by a subcommittee to the EarthScope Science and Education Committee (ESEC). Formal recommendations from the review are expected soon.

San Simeon Earthquake Response:

Within the PEP, EarthScope developed a process for initiating and approving changes. Soon after it was in place, the change control process was put to test following the 6.5 magnitude San Simeon Earthquake. EarthScope's Plate Boundary Observatory (PBO) Transform Site Selection Committee was able to respond immediately to the earthquake and modify the GPS station installation plans. EarthScope's quick response to the San Simeon Earthquake successfully repositioned GPS stations to capture postseismic transients and longer-term viscoelastic-response fault movements. The measurements provide information about the earthquake process, including how strain accumulates, how strain is released, and how stress is transferred between various parts of the fault. The mainshock and

aftershocks were recorded by the seismic array installed at the San Andreas Fault Observatory at Depth (SAFOD) pilot hole. USArray worked with PBO personnel to examine the suitability of joint Transportable Array/PBO sites around San Simeon. A seismic station at one of these sites is expected by the end of April 2004.

SAFOD Characterization Studies:

With drilling of the San Andreas Fault Observatory at Depth set to begin on June 4, 2004, intensive preparation occurred throughout the year. The efforts focused on the precise location of the target earthquakes, and the development of comprehensive geophysical models for characterization of the crust between the borehole and the San Andreas Fault at the depth of the target earthquakes. Results of the various geophysical studies were synthesized through bi-weekly phone calls with the collaborating scientists.

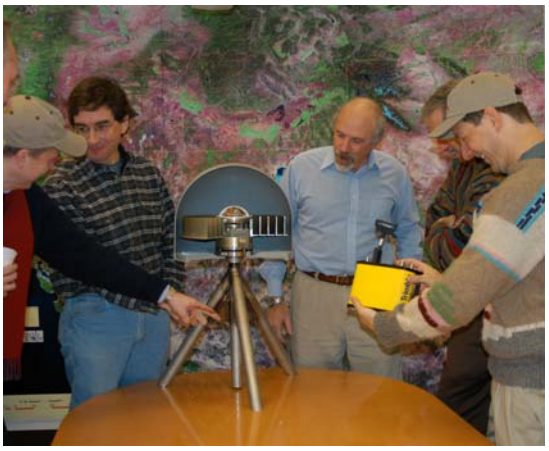
Array Operations Facility Approved:

Construction of the USArray Array Operations Facility in Socorro, NM, received approval by the New Mexico Tech Regents on March 16, 2004. The contract, which is being funded by New Mexico Tech, was awarded to ESA Construction, Inc. for $1.6 million. The facility will consist of an addition to the PASSCAL Instrument Center and include new office space and a conference center. The Array Operations Facility is expected to be completed in early 2005.

Architectural plans for the Array Operations Facility in Socorro, NM

PBO Site Review

The EarthScope Project Execution Plan calls for each EarthScope facility to undergo a site review each year. The site review of the Plate Boundary Observatory (PBO) was conducted in conjunction with the 1st Quarter EarthScope Facility Executive Committee (EFEC) Meeting. The site review included a tour of the facility and briefings on PBO operations, data and data products, data communication, database development activities, power and monumentation plans, and reconnaissance and permitting activities, including a demonstration of the GIS system for integrating instrument siting information. PBO emphasized that their program goals are (1) to install, operate, and maintain the PBO component of EarthScope on budget, on schedule and in accordance with EarthScope's scientific goals, (2) to keep a focus on an integrated EarthScope project, and (3) to adapt to evolving scientific needs.



EFEC site review of Plate Boundary Observatory. Left to Right: G. Ekström, S. Hickman, P. Silver, M. Zoback, C. Weiland.

The EFEC was impressed with the management organization and talented personnel addressing the wide range of tasks now being undertaken by PBO. PBO has a strong organizational and work breakdown structure. In addition, they have well-thought out structures, plans, and procedures for the acquisition of instruments; the facility is well organized and equipped; the staffing of regional offices and program operations is on schedule; the site-selection and permit process has creatively incorporated a sophisticated web-based GIS system that will save time, money, and insure that stations are optimally sited; they have flexible and adaptive procedures for site specific issues such as telemetry and power that will improve site installations; they have already identified and implemented procedures for the necessary

data processing and various levels of data products; they have formally documented their procedures and policies, including safety; and they have a excellent overall project management system, that is being efficiently executed by the PBO Director.

Overall, EFEC's assessment is that PBO is being extremely well managed and skillfully executed to meet or exceed the technical and scientific needs of EarthScope. The EFEC would like other parts of EarthScope to benefit from the advances that PBO has made in areas such as their web-based GIS system for station siting and their creative approaches to telemetry and communications.

The EFEC's assessment of PBO is consistent with that of the overall geodetic community at the PBO Standing Committee meeting on February 25, 2004. In a report to the UNAVCO Inc. Board of Directors, the PBO Standing Committee stated:

> "PBO has developed a strong management structure, has hired talented personnel, and is locating and staffing regional offices…PBO is off to a strong start and we congratulate Mike and his team for their excellent work."

Activity Details

In addition to installing stations and collecting data, the success of EarthScope requires strong involvement and outreach with the scientific community and the public. The mechanisms for community interactions include: EarthScope publications; an EarthScope presence at professional meetings through talks, posters, and the EarthScope booth; listening sessions and workshops; an extensive website; participation by the EarthScope Director in the meetings of the EarthScope Science and Education Committee; and plans for an Education and Outreach Program, EarthScope Portal, and Annual Meeting. Following are listings of these and management activities for the first half of Year 1.

Press Coverage:


Issues and Events

Ambitious Earth Sciences Project Aims to Crack Mysteries of Continents

- "NSF Awards $219 Million Over Five Years for EarthScope Project: Far-reaching Geosciences Effort to Understand the North American Continent." October 15, 2003. *NSF Press Release*, NSF PR 03-120.
- "Cash Boost Gets Earth Project Off the Ground." October 23, 2003. News in Brief, *Nature*, vol 425, p. 757.
- "California in Motion." November 16, 2003. Simon Winchester, The Sophisticated Traveler, *The New York Times Magazine*, p. 82.
- "Stanford, US Geological Survey Team Up to Get Inside Scoop on Quake Zone." November 24, 2003 (online). December 3, 2003 (print). Mark Shwartz, *Stanford Report*, p. 3.
- "Quake Observatory Going Underground." November 26, 2003. Peter Delevett, *San Jose Mercury News*, p. 1B.
- "Ambitious Earth Sciences Project Aims to Crack Mysteries of Continents." December 2003. Toni Feder, *Physics Today*, p. 32-34.
- "Project to Drill into Earth Fault: An Ambitious Project by Scientists in the US Try to Predict Earthquakes Will Go Ahead Thanks to a $20m Grant from the National Science Foundation." December 5, 2004 (online). Maggie Shields, BBC News.

- "Scientists Will Dig for Answers to Earth's Deep Secrets: Project Will Look at Mysteries Behind Quakes and Volcanoes." December 8, 2003. David Perlman, *San Francisco Chronicle*, A-4.
- "Earthquake Study by Drilling Through the Fault." December 24, 2003. *Apple Daily (Hong Kong newspaper).*
- "Pregnant San Andreas Could be Ready to Deliver." December 30, 2003. Paul Pringle, *Los Angeles Times*, p. A1.
- "Scientists Dig Deep to Study Earthquakes." January 2004. *Geoworld*, p. 14.
- "Why Must Earthquakes be this Devastating." January 4, 2004. M. Zoback, *The Washington Post*, p. B5.
- "Hlubinna Observator Pohlida Kalifornil." January 8, 2004. *Research Institute of Geodesy, Topography, and Cartography (VUGTK).*
- "Shaken—Not Stirred." January 13, 2004. C. Rickets, *Stanford Daily*, p. 3
- "Observatory Promises Data of 'Unprecedented Accuracy' at Tectonic Boundary National Science Foundation Project will Eventually Include 800 Monitoring Stations on Active Faults in 12 Western States." January 13, 2004. G. Koch, *Stanford Report*.
- "Close-up Seismologists Drawing to San Andreas Fault." January 16, 2004. P. Pringle, *Seattle Times*.
- "Alaska is Part of Nationwide Study of Earth." January 18, 2004. N. Rozell, *Anchorage Daily News*.
- "Magnifying a Continent." March 2004. Elisabeth Nadin, *Geotimes*, p. 30-31, 34.

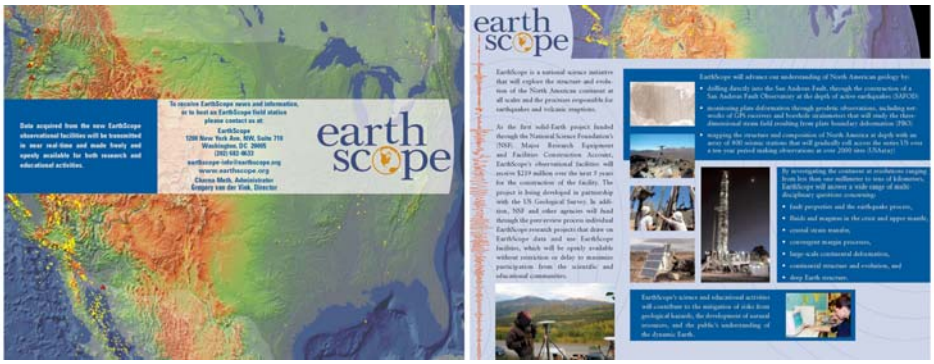
Presentations and Talks:

- Society of Exploration Geophysicists Annual Meeting (Dallas, TX): "EarthScope: A New Observatory for Earth Science." October 27, 2003. G. Ekström, S. Hickman, P. Silver, D. Simpson, W. Prescott, G. van der Vink, and M. Zoback.
- Geological Society of America Annual Meeting (Seattle, WA): "EarthScope Facilities for Investigations of Cascadia Seismicity." November 3, 2003. D.W. Simpson, S. Malone, and W. Prescott.
- EarthScope related talks and posters at the American Geophysical Union Fall Meeting (December 8-12, 2003; San Francisco, CA):
    - "Low Temperature Thermo-chronology From the SAFOD Pilot Hole: Constraining the Thermal History With Apatite Fission-Track and (U-Th)/He Analyses." A.E. Blythe, M.A. D'Alessio, R. Burgmann, and K.A. Farley.
    - "New Insights into Crustal Attenuation from Deep Borehole Studies." S.G. Prejean, R.E. Abercrombie, W.L. Ellsworth, K. Imanishi, H. Ito, and A. Stork.
    - "Earthquake Source Parameters Determined Using the SAFOD Pilot Hole Vertical Seismic Array." K. Imanishi, W.L. Ellsworth, and S.G. Prejean.
    - "Fine-Scale Structure of the San Andreas Fault and Location of the SAFOD Target Earthquakes." C. Thurber, H. Zhang, S. Roecker, W. Ellsworth, and P. Malin.
    - "3-D Terrain Corrections to Heat Flow Data, Topographically-Driven Groundwater Flow, and the Strength of the San Andreas Fault at Parkfield, CA." P.M. Fulton, D.M. Saffer, and B.A. Bekins.
    - "Isla Guadalupe, a Plate Boundary Observatory Remote GPS System: What's Next in PBO-Mexico?" J. Gonzalez Garcia.
    - "The Digital Library for Earth System Education: A Community Integrator." M.R. Marlino, and R.E. Pandya.
    - "The Plate Boundary Observatory Component of the EarthScope Facility." M. Jackson.
    - "A Reference Frame for PBO: What do We Have; What do We Need?" G. Blewitt.
    - "GPS Lessons Learned." M. Heflin.
    - "Before PBO: What Do We Know About Ground Deformation in the Cascade Range?" D. Dzurisin, M. Lisowski, M. Poland, C.W. Wicks, and A.K. Diefenbach.
    - "Expected Performance of the Proposed PBO Network from Numerical Simulations." D. Schmidt, J. Murray, and P. Segall.

  - "Borehole Tensor Strain and Pore Pressure Noise from Mini-PBO Sites in the San Francisco Bay Area: Comparison with Parkfield Instruments." M.J. Johnston, G.D. Myren, M.H. Murray, and R.J. Mueller.
  - "Potential field Modeling of the 3-D Geologic Structure of the San Andreas Fault Observatory at Depth (SAFOD) at Parkfield, California." D.K. McPhee.
  - "Comparison of SAFOD Pilot Hole Phyllosilicate Mineral Assemblages to the Punchbowl Fault: Recognizing Post-faulting Alteration in Exhumed Fault Zones." J.G. Solum, and B.A. van der Pluijm.
  - ""Intelligent Design" of a 3D Reflection Survey for the SAFOD Drill-hole Site." G. Alvarez, J.A. Hole, S.L. Klemperer, B. Biondi, and M. Imhof.
  - "Heat Flow in the SAFOD Pilot Hole and Implications for the Strength of the San Andreas Fault." C.F. Williams, F.V. Grubb, and S.P. Galanis.
  - "The Denali EarthScope Education Partnership: Creating Opportunities for Learning About Solid Earth Processes in Alaska and Beyond." J.J. Roush, and R.A. Hansen.
  - Results from the Expanded and Upgraded High Resolution Borehole Seismic Network (HRSN) at Parkfield, CA." W.C. Johnson, R.M. Nadeau, and R.W. Clymer.
- The Salt Lake Rotary Club (Salt Lake City, UT): "The Yellowstone Hot Spot and EarthScope." February 3, 2004. R. Smith.
- Wyoming Engineering Society Meeting (Casper, WY): "PBO Siting and Reconnaissance." February 6, 2004. K. Bohnenstiehl. (The presentation led to the identification of at least five potential sites.)
- Utah Earthquake Hazards Conference (Salt Lake City, UT): "EarthScope and the Intermountain Region." February 26, 2004. R. Smith.
- UNAVCO Annual Meeting (Boulder, CO): "PBO with Summary of North America Reference Frame Working Group Activities." February 26-27, 2004. M. Jackson and G. Blewitt.
- Yellowstone National Park: "Shake and Bake Yellowstone: Plumes, Plums, Norris Disturbance and Scoping the Earth." March 1, 2004. R. Smith.
- International GPS Service Workshop and Symposium: "Building and Operating the Plate Boundary Observatory Using New Technologies." March 2, 2004. G. Anderson, K. Bohnenstiehl, D. Mencin, and M. Jackson.
- International GPS Service Workshop and Symposium: "The Plate Boundary Observatory: Operational Status and Data Plans." March 2, 2004. G. Anderson, K. Feaux, M. Jackson, and W. Prescott.
- Museum of the Rockies and Montana State University (Bozeman, MT): "Shake and Bake Yellowstone: Plumes, Plums, and the Norris Disturbance." Distinguished Lecture. March 3, 2004. R. Smith.
- Montana State University (Bozeman, MT): "EarthScope in the Intermountain West." March 3, 2004. R. Smith.
- Utah Geological Association (Salt Lake City, UT): "Utah and EarthScope." March 8, 2004. R. Smith.
- Thermal Processes in the Context of EarthScope (Salt Lake City, UT): "EarthScope Science and Education." March 18, 2004. R. Smith.
- Washington Council of County Surveyors Monthly Meeting (Ellensburg, WA): "PBO's Mission: Exploring the Pacific Northwest Region." March 18, 2004. K. Hafner. (Approximately 20 surveyors attended the meeting.)
- Thermal Processes in the Context of EarthScope (Salt Lake City, UT): "EarthScope Education and Outreach: Opportunities and Partnerships." R. Aster.
- Bureau of Reclamation (Denver, CO): "Siting, Reconnaissance and Permitting Activities on Bureau of Reclamation Land." March 30, 2004. M. Jackson and K. Bohnenstiehl.
- Schlumberger-Doll Research (Ridgefield, CT): "EarthScope: Imaging the North American Continent in Four Dimensions." March 31, 2004. P. Silver.

EarthScope Outreach:

- "EarthScope" tri-fold pamphlet published by EarthScope (November 2003).



- EarthScope Exhibit Booth at the American Geophysical Union (AGU) Fall Meeting (December 8-12, 2003; San Francisco, CA).

  The EarthScope exhibit booth debuted to positive reviews and interest at the AGU Fall Meeting. It served as a nucleus for information and discussions about the project. Distributed at the booth were 500 tri-fold pamphlets, 200 copies of the NSF press release, 175 brochures, and numerous other articles and reports. AGU also provided a venue for the EarthScope Operations Group to meet for a dinner meeting, for G. van der Vink to meet with the JASON Group to discuss EarthScope as a JASON Education and Outreach (E&O) project, and for G. van der Vink to meet with the Interim Education and Outreach Network chair to develop E&O plans.

- EarthScope Exhibit Booth at the American Association for the Advancement of Science (AAAS) Annual Meeting (February 12-16, 2004; Seattle, WA). Attended by: C. Meth and J. Mallett.

  The AAAS Annual Meeting provided EarthScope with an opportunity for outreach to scientific disciplines beyond the Earth sciences and to the general public. For two days during the meeting, AAAS opened the exhibit hall to over 3500 students, parents, local teachers, and other interested individuals. The response to the EarthScope project by the public was overwhelmingly favorable, and included a volunteer for hosting an EarthScope station in Duval, WA. Reconnaissance efforts are currently underway at this site.

Students visit EarthScope Booth at the Annual Meeting of the American Association of the Association for the Advancement of Science (February 2004).

- EarthScope News: EarthScope's Response to the San Simeon Earthquake (January 12, 2004) and "First Deep Drill Braced Geodetic Monument Installed" (March 17, 2004).

EarthScope's Response to the San Simeon Earthquake

On December 22, 2003, a magnitude 6.5 earthquake occurred on the Oceanic fault zone in the Santa Lucia Mountains of coastal Central California. The earthquake killed two people and collapsed or severely damaged 40 buildings in the Paso Robles-Templeton area. EarthScope's Plate Boundary Observatory (PBO) Transform Site Selection Committee responded immediately by modifying the GPS station-installation plan to record fault movements following the earthquake.

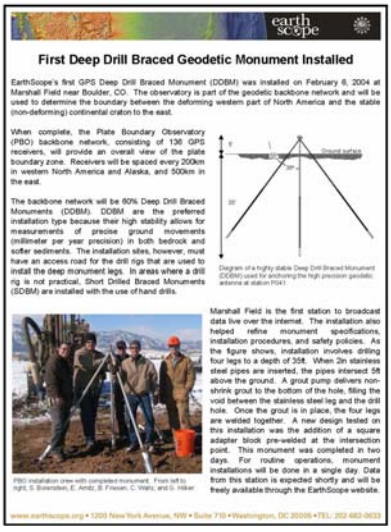
Beginning the day of the earthquake, the Site Selection Committee elevated the priority of two pre-planned GPS stations (P526 and P067) that lie to the south and east of the earthquake epicenter, allowing for reconnaissance and installation procedures to begin ahead of schedule. Three stations that were slated for Northern California were relocated north and east of the earthquake epicenter to enhance the area's coverage. They too were given the highest priority. The quick response to the San Simeon Earthquake has successfully repositioned GPS stations to capture postseismic transients and longer-term viscoelastic-response fault movements.

PBO Site	Name	Plan Status	Installed	Potential USArray
P295	Chimney Rock Ranch	Relocated	Yes	Yes
P035	Ramage Ranch	Original	Yes	No
P067	Cegg Ranch	Original	Yes	Yes
P576	Gallegos Ranch	Relocated	Yes	Yes
P578	Heard Property	Relocated	No	No

GPS monitoring of the viscoelastic response provides information about the earthquake process such as how strain accumulates and is released, and how stress is transferred between various parts of the fault. With the viscoelastic response there are two primary time constants, one on the order of days to weeks and the other on the order of months to years. Thus, by responding to earthquakes within a week of rupture, important information can be collected.

GPS reconnaissance began immediately after the San Simeon Earthquake and by Christmas two sites were located and construction permits were secured with private landowners. In addition to meeting the scientific needs, a site requires a sky view down to approximately 10 degrees above the horizon, bedrock, AC power and internet access (or installation of solar panels and data communications links), and unrestricted access for maintenance personnel. To date, four of the five stations have been permitted and are installed. PBO personnel are currently working with USArray staff to identify suitable stations to collocate GPS and broadband seismometers in the epicentral region.

About 40km northeast of the epicenter, at Parkfield, California, the mainshock and aftershocks were recorded by a number of local networks, including the 32-level seismic array installed in the EarthScope's San Andreas Fault Observatory at Depth (SAFOD) pilot hole in the summer of 2002 and the USGS Northern California Seismic Network. Very small (< 2 mm) right-lateral offsets on the San Andreas Fault were recorded on USGS creepmeters at Parkfield simultaneously with the San Simeon Earthquake. There was, however, no concurrent increase in seismicity rates on the San Andreas Fault, suggesting that the sympathetic response of the San Andreas to the San Simeon Earthquake was a near-surface phenomenon.



First Deep Drill Braced Geodetic Monument Installed

EarthScope's first GPS Deep Drill Braced Monument (DDBM) was installed on February 6, 2004 at Marshall Field near Boulder, CO. The observatory is part of the geodetic backbone network and will be used to determine the boundary between the deforming western part of North America and the stable (non-deforming) continental craton to the east.

When complete, the Plate Boundary Observatory (PBO) backbone network, consisting of 136 GPS receivers, will provide an overall view of the plate boundary zone. Receivers will be spaced every 200km in western North America and Alaska, and 500km in the east.

The backbone network will be 60% Deep Drill Braced Monuments (DDBM). DDBM are the preferred installation type because their high stability allows for measurements of precise ground movements (millimeter per year precision) in both bedrock and softer sediments. The installation sites, however, must have an access road for the drill rigs that are used to install the deep monument legs. In areas where a drill rig is not practical, Short Drilled Braced Monuments (SDBM) are installed with the use of hand drills.

Diagram of a highly stable Deep Drill Braced Monument (DDBM) used for anchoring the high precision geodetic antenna at station P041.

Marshall Field is the first station to broadcast data live over the internet. The installation also helped refine monument specifications, installation procedures, and safety policies. As the figure shows, installation involves drilling four legs to a depth of 35ft. When 2in stainless steel pipes are inserted, the pipes intersect 5ft above the ground. A grout pump delivers non-shrink grout to the bottom of the hole, filling the void between the stainless steel leg and the drill hole. Once the grout is in place, the four legs are welded together. A new design tested on this installation was the addition of a square adapter block pre-welded at the intersection point. This monument was completed in two days. For routine operations, monument installations will be done in a single day. Data from this station is expected shortly and will be freely available through the EarthScope website.

PBO installation crew with completed monument. From left to right, S. Borenstein, E. Arndt, B. Friesen, C. Walls, and G. Hilker

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Meetings:

- PBO Subduction Site Selection Working Group meeting (September 12, 2003; Seattle, WA).
- "Large Project Science Management Workshop" (October 2-5, 2003; Aspen, CO): G. van der Vink, C. Hennet, C. Shin, C. Weiland, W. Prescott, M. Jackson, C. Jones, B. Stephanus, D. Simpson, and S. Ingate.
- Meeting with State Geologists (September 17, 2003; Washington, DC).
- Discussed the Advanced National Seismic System (ANSS) Backbone Network with the Nation Research Council review committee (October 14, 2003).
- "Southern California Earthquake Center and EarthScope: A Workshop to Explore the Interaction" (October 14-15, 2003; University of Southern California, Los Angeles, CA).
- IRIS Data Management Standing Committee meeting (October 15-16, 2003; Woods Hole, MA). Discussed USArray data flow and archiving.
- IRIS Program for Array Seismic Studies of the Continental Lithosphere (PASSCAL) Standing Committee meeting (October 27-28, 2003; Socorro, NM). Discussed USArray stations, siting and products.
- "NSF Workshop: Cyberinfrastructure and the Geosciences: The Future Role and Impact of Cyberinfrastructure in Research and Education in the Geosciences" (November 11, 2003; Arlington, VA): G. van der Vink, C. Hennet, C. Meth, W. Prescott, and D. Simpson.
- PBO Magmatic Systems Site Selection Working Group meeting (November 14, 2003; Vancouver, WA).

- PBO Transform Site Selection Working Group meeting (November 19, 2003; Boulder, CO).
- Meeting with Regional Application Center for the Northeast GIS group from Cayuga College (November 25, 2003). American Geophysical Union (AGU) Fall Meeting (December 8-12, 2003; San Francisco, CA). In addition to the numerous EarthScope related talks and posters, AGU also provided a venue for the EarthScope Operations Group to conduct a dinner meeting, for G. van der Vink to meet with the JASON Group to discuss EarthScope as a JASON Education and Outreach project, and for G. van der Vink to meet with the Interim Education and Outreach Network chair to develop E&O plans.
- PBO Extension Working Group Meeting (January 13, 2004; Boulder, CO): Convened to prioritize Year 1-2 station installations for Basin and Range and Rocky Mountain Regions of PBO.
- GIS Development Meeting (January 19-20, 2004; Boulder, CO): Representatives from the EarthScope Office, PBO, USArray, and the Institute for Application of Geospatial Technologies (IAGT) discussed how IAGT's GIS capabilities could support EarthScope activities and the next version of the IAGT/PBO database interface. A follow-up meeting at the EarthScope Office (February 18, 2004) was planned to continue discussions.
- Project Execution Plan (PEP) Review (January 22, 2204; Washington, DC): Review Panel: J. Whitcomb (Chair), J. Orcutt, D. Mogk, B. Hartline, K. Karlstrom, C. Teyssier, R. Rudnick, C. Jarchow, and M. Purdy. EarthScope Participants: G. van der Vink, C. Hennet, C. Meth, M. Zoback, W. Prescott, M. Jackson, B. Stephanous, P. Silver, D. Simpson, G. Ekström. Formal recommendations from the panel are expected in June 2004.
- Informal EarthScope Facilities Executive Committee (EFEC) Meeting (January 22, 2004; Washington, DC): After the PEP Review, the members of the EFEC meet informally to discuss pressing issues: a single portal access for EarthScope data, EarthScope data products, hiring of EarthScope Office staff (web specialist and receptionist/office assistant), reviewing of the EarthScope Office design and build-out, and the creation of an EarthScope Planning Committee.
- Informal meeting with the Deputy Director for Large Facility Projects at NSF (M. Coles), B. Stephanus, and C. Shin (January 23, 2004; Arlington, VA) to discuss details of the PEP.
- EarthScope Science and Education Committee (ESEC) Meeting (January 23, 2004; Washington, DC): ESEC discussed and approved a statement concerning the tasks of the EarthScope Office and NSF EarthScope Program Office, and a statement describing duties and qualifications for the EarthScope Education and Outreach Coordinator. These statements were included in the previous quarterly report (p. 32-34):
- Meeting with DOSSEC (Drilling, Observation, and Sampling of the Earth's Continental Crust) to discuss strainmeter drilling subcontract (January 26-27, 2004; Salt Lake City, UT).
- Environmental Assessment Meetings with NSF Assistant General Counsel A. Eisenstadt (February 2, 2004; Arlington, VA):

  > The meeting established a categorical exclusion from the National Environmental Protection Act (NEPA), allowing EarthScope to install EarthScope stations without performing an Environmental Assessment. As the federal funding agency, NSF views the installation of EarthScope stations within NSF's description of categorical exclusion because the sites will neither individually nor cumulatively have a significant effect on the environment. In addition, EarthScope is developing procedures specifying that EarthScope installations will make all reasonable efforts to avoid highly environmentally sensitive locations. EarthScope does not need an Environmental Assessment to install EarthScope stations, unless so requested by individual landowners or local authorities.

- Meeting with Southern California Integrated GPS Network (SCIGN) (February 6, 2004; La Jolla, CA) to discuss PBO developments and explore possible collaborations: G. Anderson, Y. Bock, F. Webb, P. Jamison, and M. Scharber.
- San Andreas Fault Observatory at Depth (SAFOD) Technical Panel Meetings (February 5-6, 2004; Houston, TX). Participants at SAFOD Technical Panel on Downhole Measurements include: D. Alumbaugh, D. Goldberg, D. Seeburger, G. Ugueto, H. Yin, J. Kueck, L. Wohlgemuth, L. Capuano, M. Zoback, M. Mueller, M. Enderlin, and S. Hickman. Participants at SAFOD

Technical Panel on Drilling, Coring, and Safety include: K. Barnes, R. Ewy, P.J. Fox, E. Van Oort, J. Kueck, M. Utt, S. Willson, L. Wohlgemuth, L. Capuano, M. Zoback, and S. Hickman.

SAFOD convened meetings of two Technical Panels in Houston – the Downhole Measurements Panel and the Drilling, Coring and Safety Panel. The panel members were experts from a number of oil and gas companies, mostly located in Houston. At each meeting, the detailed plans for the entire project were presented by M. Zoback and S. Hickman, and there was a focused discussion on plans for Phase 1 drilling and downhole measurements to be undertaken during the summer of 2004. The panel members were excited by the opportunity to participate as advisors in the SAFOD project and provided a great deal of constructive feedback on currently planned activities. As these industry experts are now familiar with SAFOD, they are also available to provide advice on short notice should such advice be needed due to unexpected difficulties. The panels will next meet at the SAFOD site in September 2004.

- Pacific Northwest Geodetic Array (PANGA) Annual Meeting (February 6-7, 2004; Victoria, BC): Attended by M. Jackson, K. Feaux, and D. Mencin. Topics included siting of PBO stations within the Pacific Northwest and integration of existing regional networks into PBO.
- IRIS/USArray Global Seismographic Network Standing Committee (February 10-11, 2004; Golden, CO).
- EFEC 1st Quarter and PBO Site Review Meeting (February 11-12, 2004; Boulder, CO): The EFEC met in Boulder, CO, to approve the first quarter report and review PBO:

  Overall EFEC's assessment of PBO is that it is being extremely well managed and skillfully executed to meet or exceed the technical and scientific needs of EarthScope. The EFEC would like other parts of EarthScope to benefit from the advances that PBO has made in areas such as their web-based GIS system for station siting and their creative approaches to telemetry and communications.

- Meeting with surveyors from Thurston and Pierce Counties, WA, to discuss specific siting opportunities for PBO permanent GPS stations for the Pacific Northwest (February 15, 2004; Ellensburg, WA).
- EarthScope Office met with Institute for the Advancement of Geospatial Technology (IAGT) to discuss collaboration directions (February 18, 2004; Washington DC): G. van der Vink, C. Hennet, C. Meth, D. Piwinski, and F. Pieper.
- Teleconference with PBO, USArray, Bureau of Land Management (BLM), and US Forest Service (USFS) to outline new strategy of dealing with local offices directly and BLM/USFS preparing national level guidance for such offices (February 19, 2004).
- IRIS Planning Committee Meeting (February 19, 2004; Harvard University, Cambridge, MA).
- IRIS/USArray PASSCAL Standing Committee Meeting (February 23-24, 2004; San Diego, CA): Transportable Array staff met with the Electromagnetic Society liaison to conduct initial discussions on integrating the magneto-telluric systems into Transportable Array operations.
- Meeting of key regional field personnel with PBO Facilities Construction Manager K. Feaux (February 22-23, 2004; Boulder, CO): The meeting was held to provide orientation and training to remote office construction staff on installation and construction procedures, documentation, and safety practices.
- PBO Standing Committee Meeting (February 25, 2004; Boulder, CO): Reviewed operational aspects of PBO and the draft Data and Data Products Plan.
- UNAVCO, Inc. Annual Meeting (February 26-27, 2004; Boulder, CO): Participants included over 100 members of the UNAVCO and EarthScope communities. Speakers included: W. Prescott, P. Silver, J. Whitcomb, Congressman M. Udall, and G. van der Vink.
- International GPS Service Workshop and Symposium (March 1-5, 2004; Berne, Switzerland). Attended by: G. Anderson, K. Feaux, M. Jackson, and W. Prescott.

- Meeting with the District Manager & Project Manager of the Tacoma Office for Layne-Christensen Drilling Company (March 3, 2004; Tacoma, WA) to discuss nature of PBO's drilling requirements, as well as how the Tacoma office could address the needs of the Pacific Northwest Region.
- Meeting with USGS to discuss the Parkfield geology and structure, and potential GPS and strainmeter sites (March 3, 2004; Menlo Park, CA). Attended by: B. Coyle, J. Langbein, T. Burdette, D. Myron, S. Hickman, and M. Rymer.
- Meeting with East Bay Regional Park personnel to discuss siting and permit activities for 11 GPS and four strainmeter sites in East Bay Regional Parks (March 3, 2004; Livermore, CA). Attended by: B. Coyle, D. Marshall, J. Heavener, and J. Swanson.

PBO Director, Facility Construction Manager and regional field personnel

- PBO construction staff visited the Alaska Regional Office to discuss summer logistical plans and meet with the Tsunami Warning Center, Alaska Volcano Observatory, Coast Guard, Air Force, and Alaska Department of Transportation personnel (March 10, 2004).
- IRIS GSN Standing Committee Meeting (March 10-11, 2004; Golden, CO). The second day was jointly held with the IRIS DMS Standing Committee. Attended by: K. Anderson, J. Berger, R. Butler, K. Creager, P. Davis, J. Dwyer, P. Earle, K. Fischer, B. Hutt, S. Ingate, G. Laske, T. Lay, J. Park, M. Ritzwoller, J. Tromp, and L. Wen.
- IRIS DMS Standing Committee Meeting (March 11-12, 2004; Golden, CO). The first day was jointly held with the IRIS GSN Standing Committee. Attended by: T. Ahern, H. Bolton, B. Beaudoin, P. Davis, D. Dodge, E. Garnero, S. Ingate, D. McNamara, G. Nolet, D. Okaya, A Trehue, S. van der Lee, and D. Wiens.
- Meeting with the California Department of Transportation to finalize permit application, the submission process, and different approval scenarios (March 11, 2004; Oakland, CA). Attended by: B. Coyle, A.J. Burgess, S. Nozzari, and J. Hsu.
- Meeting with Cowlitz County Surveyor to investigate the possibility of using already permitted Cowlitz County survey control points on Weyerhaeuser Logging land located west of Mt. St. Helens. The surveyor has offered to assist with pursuing "scientific use" permits with the logging company once site locations have been finalized in the area (March 11, 2004; Kelso, WA).
- Meeting with Berkeley Seismological Lab to discuss Existing Networks/PBO integration including the current status of Bay Area Deformation Array (March 11, 2004; Berkeley, CA).
- Meeting with Alaska Volcanic Observatory to discuss synergy with USGS for 2004 field plans (March 11, 2004; Anchorage, AK).
- Meeting with the California GPS Users Group (attendees included representatives from local surveyors, California Spatial Reference Center, and National Geodetic Survey) to discuss PBO siting and current real-time kinematic data access policy (March 12, 2004; Martinez, CA).
- Meeting with and Pacific Area Network Geodetic Array to exchange information regarding respective areas of focus, possible contacts, and where efforts could be combined (March 15, 2004; Ellensburg, WA). Attended by: K. Hafner, M. Miller, T. Melbourne, A. Miner, and M. Santillan.
- Meeting with Bureau of Land Management and US Forest Service to discuss permitting activities on federal lands (March 16-17, 2004, Boise, ID). Attendees included: K. Bohnenstiehl, G. Hilker, S. Powers, M. Hearst, and R. Busby.
- "Thermal Processes in the Context of EarthScope" (March 18-20, 2004; Salt Lake City, UT; EAR-0350566).

- EarthScope Briefing to House Appropriations Committee Staff (March 18, 2004; Washington, DC):

  G. van der Vink briefed majority and minority staff of the House Appropriations Committee on the current progress of EarthScope. The Appropriations staff expressed that they want a meeting with the Project Director after the President's budget is released and before Hearings and Mark-ups begin, a meeting with the Project Director during Mark-up of the Appropriations Bill in June to examine how EarthScope is fairing in the process, to drop by from time to time, and for the Project Director to alert the Appropriations staff of any problems or concerns as soon as they occur.

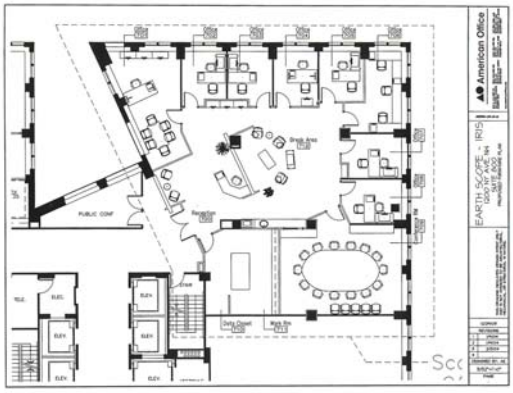
- EarthScope Briefing to Senate Authorization Committee Staff (March 22, 2004; Washington, DC):

  G. van der Vink briefed majority and minority staff of the Senate Authorization Committee on the current progress of EarthScope. The staff was interested in the details of the program, requested visits twice a year, requested copies of the quarterly reports, appreciated EarthScope's willingness to be transparent and maintain communications with them, thanked EarthScope for its position against earmarks to the NSF budget, and expressed interest in visiting EarthScope's field work this summer.

- Meeting with the Association of American State Geologists (AASG) (March 23, 2004; Washington, DC). Attendees: G. van der Vink, D. Simpson, J. Parrish (PA), M. Reichle (CA), R. Teissere (WA), L. Becker (VT), L. Cook (WY), J. Kipper (TX), and C. Real (CA). Siting and the change request system were reviewed. AASG expressed interest in Education and Outreach and policy for "shedding stations" to regional networks and for educational and outreach purposes.
- Meeting with the California Department of Transportation, Division of Aeronautics, Department of Water Resources, California State Parks and Recreation, Department of State Lands (School Lands), National Geodetic Survey, and California Spatial Reference Center (March 23, 2004; Sacramento, CA). Discussions involved siting and permitting on California Department of Transportation and regional airport property.
- IRIS Education and Outreach Standing Committee Meeting on (March 25-26, 2004; Phoenix AZ). Attended by: J. Taber, M. Hubenthal, R. Aster, K. Ellins, M. Hamburger, A. Kafka, S. Schwartz, S. Sempken, S. Stein, A. Velasco, and L. Wald (videoconference).
- Meeting with Kate Padilla of the Bureau of Land Management (March 26, 2004; Washington, DC): Attended by G. van der Vink, D. Simpson, C. Hennet, and C. Meth.
- Teleconference with IAGT (March 30, 2004): Review the current progress and priorities of IAGT's work in support of the EarthScope program.
- Meeting with Washington Spatial Reference Center to discuss possible site locations on US Coast Guard Land in Oregon (March 30, 2004; Ellensburg, WA).

EarthScope Office Specific Activity:

- The EarthScope office space (4,000 sq ft) in the American Association for the Advancement of Science office building (Suite 700) was negotiated and designed.
- Developed and submitted EarthScope Project Execution Plan
- Provided a Government Performance and Results Act (GPRA) "Nugget" for FY 2004 for Special Projects section: "EarthScope's Fast Response to the Central California San Simeon Earthquake."
- Hired EarthScope Director, Analyst, Administrator, and Office Assistant/ Receptionist.
- Developed Education and Outreach Proposal



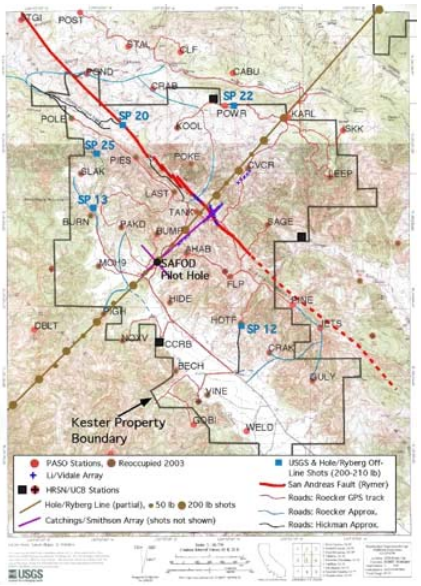
- Developed EarthScope Exhibit Booth
- Developed overall EarthScope management structure, including reporting schedule, change control process, system for site reviews, and document control system.

- EFEC Conference calls:
    - October 9, 2003: Discussed NSF Management Workshop, the Project Execution Plan, and initiating Operations Weekly Conference Calls.
    - October 16, 2003: Discussed Project Execution Plan. Approved EarthScope Exhibit Booth design.
    - October 30, 2003: Answered questions submitted to the EFEC by NSF. Discussed Project Execution Plan progress and Education and Outreach.
    - November 5, 2003: Discussed Project Execution Plan, responses to NSF questions, and upcoming press coverage.
    - November 13, 2003: Discussed upcoming press coverage, EarthScope Research and Related Activities Award status, and the Project Execution Plan.
    - November 20, 2003: Discussed the Project Execution Plan. Received an update on EarthScope Research and Related Activities awards from Kaye Shedlock.
    - November 26, 2003: Discussed Project Execution Plan, the new EarthScope tri-fold brochure, and American Geophysical Union Fall Meeting Schedule.
    - December 4, 2003: Discussed Project Execution Plan review process, and the upcoming American Geophysical Union Fall Meeting.
    - December 18, 2003: Discussed time-phased dollar baselines and monthly reporting schedule.
    - January 8, 2004: Discussed results of “trial-run” monthly report, status of time-phased budgets, and response to San Simeon Earthquake.
    - January 16, 2004: Prepared for Project Execution Plan review.
    - January 20, 2004: Discussed Project Execution Plan recommendations and National Environmental Protection Act compliance.
    - January 30, 2004: Discussed EarthScope Science and Education Committee recommendations to the National Science Foundation.
    - February 6, 2004: Discussed National Environmental Protection Act compliance and the first quarterly report.
    - February 20, 2004: Discussed first quarterly report, congressional briefings to take place in March, Year 2 budget planning, and EarthScope Synergy Meeting.
    - March 5, 2004: Discussed PBO Standing Committee recommendations for borehole strainmeters, EarthScope Operations Synergy Meeting agenda topics, and creating a statement of feasibility from EarthScope in support of future Science and Education Proposals.
    - March 19, 2004: Discussed the January Monthly Report, draft Education and Outreach proposal, coordination with EarthScope Request for Proposals to be issued in April, and funding for the EarthScope Office.
    - March 25, 2004: Unanimously approved that management and oversight of a potential education and outreach award will fall under the provision and guidelines of the “MOU between IRIS and the EFEC Concerning IRIS Management of the EarthScope Facility Office.” Discussed coordination with EarthScope Request for Proposals and congressional briefings.
- EarthScope Operations Conference calls:
    - October 15, 2003: Reviewed milestone list and monthly reporting form.
    - October 22, 2003: Discussed Project Execution Plan.
    - October 29, 2003: Discussed Project Execution Plan.
    - November 5, 2003: Discussed Project Execution Plan.
    - November 12, 2003: Discussed Project Execution Plan.
    - November 19, 2003: Discussed Project Execution Plan.
    - December 4, 2003: Discussed Project Execution Plan Review Process, development time-phased dollar baselines, and the reporting schedule.

- December 17, 2003: Discussed development of time-phased dollar baselines. Reviewed reporting schedule.
- January 7, 2004: Discussed results of "trial-run" monthly report, status of time-phased budgets, and response to San Simeon Earthquake.
- February 18, 2004: Review of quarterly meeting. Discussed congressional briefings to take place in March and EarthScope Synergy Meeting.
- March 3, 2004: Agreed to reformat technical progress tables. Discussed agenda topics and materials needed for the EarthScope Operations Synergy Meeting.
- March 9, 2004: Reviewed project status via the January Monthly Report. Discussed information needed for EarthScope Operations Synergy Meeting. Requested booth "props" from PBO and SAFOD. Agreed to accept PBO's milestone revisions and that no changes will be accepted after March 15, 2004.
- March 17, 2004: Discussion of Agenda for EarthScope Synergy Meeting
- March 24, 2004: Inquired about status and location of change orders. Discussed EarthScope Synergy Meeting
- March 31, 2004: Discussed what requires a change order, NSF's EarthScope Request for Proposals, and EarthScope Operations Synergy Meeting.

SAFOD Specific Activities:

- Hired SAFOD Data Manager.
- SAFOD Drilling contract established for Phases 1 and 2
- Review of Stage 1 monitoring system by Downhole Monitoring Technical Panel.
- The SAFOD Advisory Board and three Technical Advisory Panels were established.
- Set up website (http://quake.usgs.gov/research/parkfield/2003site.html) with technical details and data downloads related to the 2003 SAFOD site characterization studies. Included on the website is the map to the right showing the seismic deployments surrounding the SAFOD drill site.
- The site characterization studies continued in preparation for drilling on June 1, 2004.
- The Subcontract for Stage 1 monitoring (inside the Pilot Hole) was issued to Duke University. Construction of the equipment has started.
- Formalized collaboration with the International Continental Drilling Program (ICDP): ICDP has agreed to provide assistance in the following ways: salary and expenses for L. Wohlgemuth to serve as drilling manager; utilization of ICDP real-time project tracking, assistance of J. Kueck with downhole measurements and monitoring activities; plans for fluid sampling; and possible use of their fiber optic technology for Stage 2 Monitoring.



SAFOD seismic deployment map

PBO Specific Activities:

- Release of continuous station GPS request for proposals, testing, and vendor selection. Release of campaign GPS request for proposals.
- Established Long Baseline Strainmeter subaward including detailed Statement of Work and Earned Value reporting procedure.
- Preliminary design review for GPS infrastructure including monumentation, power, and data communications; preliminary design review for strainmeter borehole drilling specification
- Establishing a station reconnaissance and land use permit process including developing key GIS capability.
- Installed 5 stations in response to the San Simeon Earthquake. Data has been downloaded and archived from these sites.

- PBO's first deep drilled braced monument was installed at Marshall Field in Boulder, CO on February 5-6, 2004. Real-time data flow has started.
- Hired PBO Operations Manager, PBO Data and Data Products Manager, PBO Cost Schedule Coordinator, PBO Permit Coordinator, and Northern California Regional Engineer, Northern California Field Engineer, Basin and Range Regional Engineer, Pacific Northwest Regional Engineer, Pacific Northwest Field Engineer, and Alaska Regional Engineer.
- Fully integrated the NASA funded Institute for the Advancement of Geospatial Technology (IAGT) staff member into PBO's siting process and GIS activities.
- Implemented tracking and routing system for proposed sites. Began PBO Operational Database development process and created a database for tracking permitting status of sites.
- Finalized public version of PBO Arc Internet Map Server (http://arcims.unavco.org) for use in EarthScope station siting, reconnaissance, and permitting activities. Integrated USGS Quaternary Faults GIS layer into GIS database.
- Finalized membership of the Data Products Working Group.

PBO's Alaska regional office in Anchorage, AK

- Accepted the first Trimble NetRS GPS receiver which will be used in all permanent GPS stations. Received the first shipment of GPS receivers.
- Procured first wireless communication devices, established business relationship with Verizon, and defined communications model for wireless cellular data communications.
- Completed PBO Communications White Paper for the lower 48 states and reconnaissance report template.
- SCIGN/USGS-supplied construction equipment was moved to the PBO storage facility.
- Finalized the GPS station design; the enclosure and solar array design for release to vendors; and the meteorological instrument design for release to vendors.
- 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.
- Attached 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. Finalized plans to host the EarthScope Office email and web services.
- Completed Critical Design Review (CDR) of Permanent GPS Station Equipment, the PBO Standing Committee Borehole Strainmeter Recommendations Report, and the Preliminary Design Review (PDR) of Borehole Strainmeter Equipment and Procedures.
- Developed a PBO-wide and regional-specific Health and Safety Plan. PBO hired a Health and Safety consultant to develop plans that encompass national, state, and general and site specific health and safety requirements. It is anticipated that this activity will continue and evolve through the end of the program.
- Submitted of the SF299 Form (the application for federal right-of-way) for review by the Bureau of Land Management and US Forrest Service.

USArray Specific Activities:

- High-gain STS-2's were installed at three ANSS Backbone sites, followed by the collection of preliminary upgrade information.
- Global Seismographic Network Affiliates in Nevada, Wyoming, Texas, and Alaska became the first new sites under the USArray component of the Backbone.
- At the IRIS Data Management Center the USArray Real Time Computer System installed, the USArray redundant array of independent disks (RAID) data buffer installed, and the UPS System was ordered.

- Letter of Intent signed with California Integrated Seismic Networks for collaboration with regional networks in California.
- Finalized negotiations with California Institute of Technology for their participation, and continued negotiations with Berkeley for their participation.
- Hired the Deputy Program Manager at the Array Operations Facility, the Director of Operations for the Transportable Array, the USArray Software Engineer, IRIS Data Management Center Software and and the Lead Data Control Analyst.
- Examined the suitability of joint Transportable Array/PBO sites in San Simeon, CA. It is expected a seismic station at one of these sites will be installed by the end of April 2004.
- In preparation for upgrading the National Seismic Network and Global Seismographic Network stations for inclusion in the ANSS Backbone Array, the US Geological Survey's (USGS) Albuquerque Seismological Laboratory made site visits to asses satellite upgrade needs. Communication system upgrade needs were also assessed by USGS employees from Golden, CO. This information was collected without charge to EarthScope.

Glegg Ranch (P067), near San Simeon, CA. Possible telemetry site.

- Received 5 STS-2 broadband seismometers for the ANSS Backbone, making the first order of 10 instruments complete. Received the first 11 of 30 STS-2 seismometers for the Transportable Array at the Array Operations Facility. Received 100 Quanterra Q-330 data loggers and 29 Guralp CMG-3t broadband sensors for the Transportable Array. Received 30 Reftek R-130 data loggers and 10 Guralp CMG-3t broadband sensors for the Flexible Array. Received data acquisition systems.
- Signed the subaward between IRIS and the USGS on February 18, 2004, formalizing the ANSS Backbone work (station installation and station upgrades) to be conducted by the USGS.
- The prototype USArray Transportable Array was installed at the Array Operations Facility.
- Completed negotiations and signed a contract with the California Institute of Technology for the sharing of data from 40 stations in Southern California. After these stations are upgraded, they will become part of the Transportable Array.
- Continued negotiations with the University of California, Berkeley to include stations in Northern California in the Transportable Array.
- Continued testing of competing satellite communications systems (SpaceNet and Hughes) for possible use in the Transportable Array.
- 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.
- Coordinated a sabbatical leave with Kate Padilla, Socorro BLM Field Office Manager, to explore strategies for permitting of EarthScope sites on Federal lands. Padilla's 2-month sabbatical will extend from March 14 to May 14, 2004.
- New Mexico Tech Regents approved a $1.6 million contract to initiate construction of the USArray Array Operations Facility in Socorro, NM, on March 16, 2004.
- Constructed prototype Transportable Array vault in Socorro, NM.
- Fabricated hardware for first Transportable Array station.
- Started ordering power and communications equipment for first five installations.
- Started working with the California Institute of Technology to implement the 40 samples/second data streams.


Installation of STS2 inside 36" prototype vault in Socorro, NM.

- Virtual Buffer of Uniform Data concept defined and partially implemented. Tested and/or modified several request mechanisms to support virtual networks.
- Planning has started to provide seismic instruments requested for three experiments funded under the Fiscal Year 2003 EarthScope Research and Related Activities program. These projects were funded for fieldwork to be undertaken prior to the availability of new USArray instruments. The IRIS/PASSCAL program has, however, been able to adjust schedules sufficiently to allow instruments to be provided from the core PASSCAL program. The experiments are:
    - Paso-Tres Experiment: S. Roecker (Rensselaer Polytechnic) and C. Thurber (University of Wisconsin). High precision event location of target events near SAFOD drill site with 13 short period, telemetered network.
    - Northwest Nevada Active Experiment: S. Klemperer, Miller, Colgan (Stanford University). Exploring the Moho topography and crustal structure in northwestern Basin and Range with 840 single channel Texans, 2 multichannel cable systems.
    - Parkfield Trapped Waves Experiment: Y.-G. Li (University of Southern California) J. Vidale (University of California at Los Angeles). Characterization of low-velocity damaged structure of the San Andreas Fault at Parkfield using fault-zone trapped waves using 70 short period autonomous stations.

Upcoming Activities

The 3rd Quarter of Year 1 will include the start of drilling into the San Andreas Fault and large outreach efforts at three professional meetings. Following are just a few of the activities that are anticipated for the 3rd Quarter.

Upcoming Meetings and Workshops:

- California Spatial Reference Center Meeting (April 1, 2004; Riverside CA).
- SAFOD Advisory Board Meeting (April 7, 2004; Washington, DC).
- Seismological Society of America Annual Meeting (April 14-16, 2004; Palm Springs, CA).
- IRIS/USArray Coordinating Committee Meeting (April 22-23, 2004; Boulder, CO).
- PBO staff will participate in a “mock” earthquake response exercise which we will use to install 4-6 permanent GPS stations and to train regional staff in construction, documentation, and safety practices (planned for April 26, 2004).
- California and Nevada Surveyors Association (April 5-6, 2004; Las Vegas, NV). Will be attended by C. Walls, B. Coyle, and G. Hilker.
- IRIS Instrumentation Committee Meeting (April 20-21, 2004; Denver, CO) to recommend to the IRIS Global Seismographic Network (GSN) Standing Committee prototypes for the next generation of GSN data logger, which will be used in ANSS Backbone stations.
- IRIS Coordination Committee Meeting (April 22-23, 2004; Boulder, CO).
- SCIGN Coordinating Board Meeting (April 26, 2004; Los Angeles, CA).
- IRIS Executive Committee Meeting (May 6-7, 2004; Seattle, WA).
- EarthScope Operations Synergy Meeting (May 10, 2004; Socorro, NM).
- EFEC Meeting and USArray Site Review (May 11-12, 2004; Socorro, NM).
- 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).
- “GreatBREAK: Preparing for EarthScope in the Great Basin and its Margins” (June 20-22, 2004; Tahoe City, CA; EAR-0346242).
- Environmental Systems Research Institute User’s Meeting (August 9-13, 2004; San Diego, CA).

Upcoming Publications:

- *Geophysical Research Letters* will publish two special issues with results from the SAFOD Pilot Hole. There are approximately 20 scientific papers in these issues.

EarthScope Booth Schedule:

- National Science Teacher Association Annual Meeting (April 1-4, 2004; Atlanta, GA).
- Seismological Society of America Annual Meeting (April 14-16, 2004; Palm Springs, CA).
- Geological Society of America Rocky Mountain and Cordilleran Joint Meeting (May 3-5, 2004; Boise, Idaho).

Upcoming EarthScope Talks:

- California Surveyors Association (Riverside, CA): "PBO component of the EarthScope Project, Southern California emphasis." April 1, 2004. M. Jackson.
- Seismological Society of America (Palm Springs, CA): "EarthScope in the western US: Current plans, goals and opportunities." April 15, 2004. G. van der Vink.
- Seismological Society of America (Palm Springs, CA): "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.
- Geological Society of America: Rocky Mountain and Cordilleran Sections (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.

SAFOD Upcoming Activities:

- Contract with Sandia National Lab for Stage 2 monitoring to be signed in May, 2004.
- Drilling of the San Andreas Fault Observatory begins June 1, 2004.

PBO Upcoming Activities:

- Finalize Data Management Plan, and version 1.0 of the PBO Operational Database.
- Develop a draft statement of work for PBO Archives and develop regional GPS monument and strainmeter construction contractor selection plan.
- Develop and refine safety plan for regional offices.
- Develop a generic PBO environmental assessment and site disturbance document to provide to federal, state, and municipal organizations.

Camp Elliot, near San Diego, CA, will be the first new Transportable Array installation in April.

USArray Upcoming Activities:

- The first actual data processed by Data Management Center (DMC) USArray channels is expected in April. This will include data streams from existing regional network stations. Buffer of Uniform Data (BUD) and BATS (BUD Archive Transfer System) tools are expected to be installed and working on the USArray BUD.
- Development of USArray Data Management Plan.
- Meeting with the Institute for the Application of Geospatial Technology (IAGT) and IRIS Data Management Center (DMC) to discuss how the DMC use of the Geographic Information Systems (GIS) expertise of IAGT.
- Installation of first new Transportable Array station.

Part II: EarthScope Performance Measures

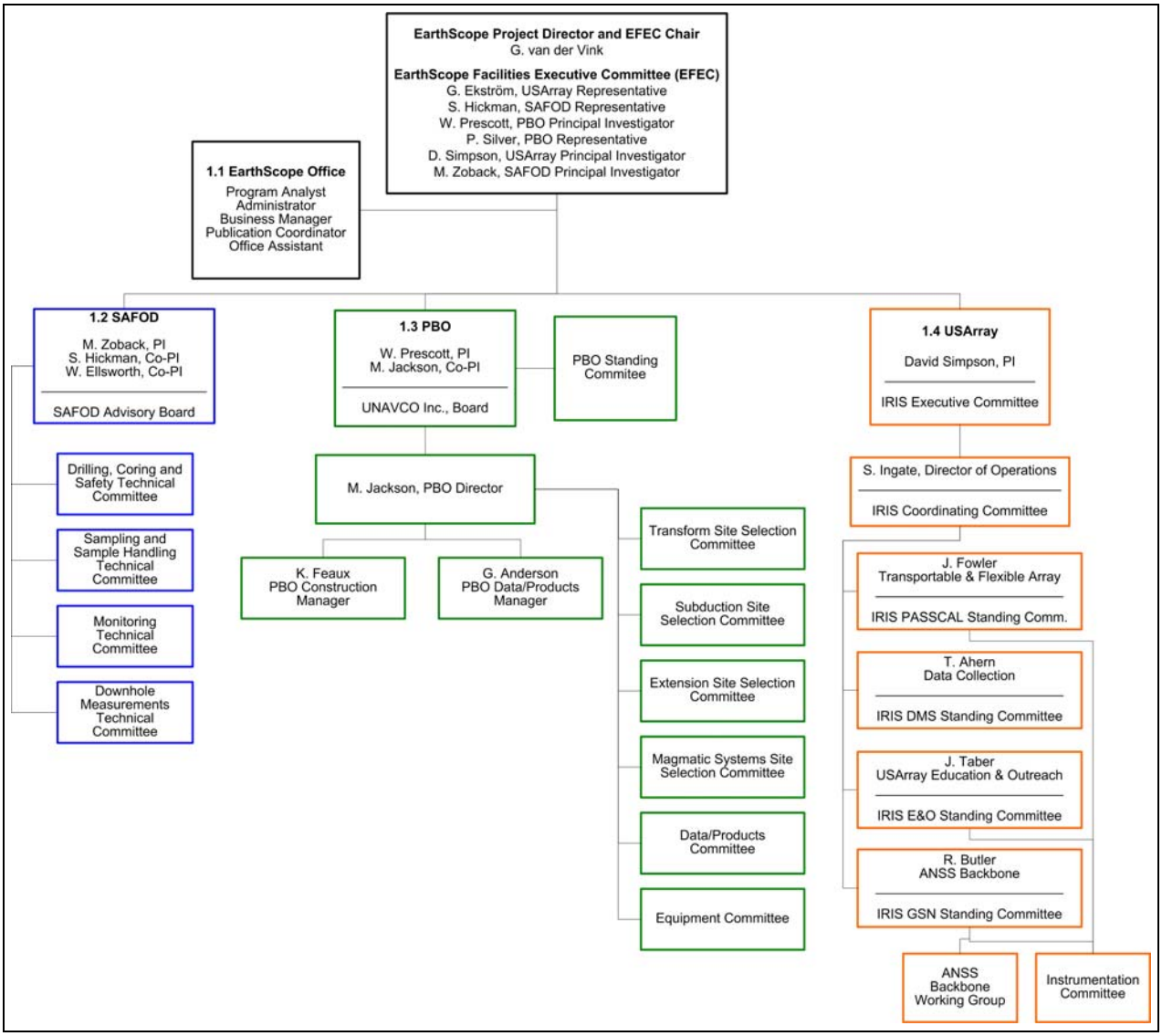
Management Structure

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 and fluid samples, GPS, strainmeter, and seismic – resulting in a series of parallel subtasks:

SAFOD: San Andreas Fault Observatory at Depth
Construct an observatory to monitor at depth repeating microearthquakes on the San Andreas Fault
Measure directly the physical conditions 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
Geo-EarthScope – Geochronology & Images
USArray: Seismic arrays across the continent
Network of 39 ANSS Backbone Network stations
Network of 400 Transportable Array stations
Pool of 2400 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 Management Structure



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.

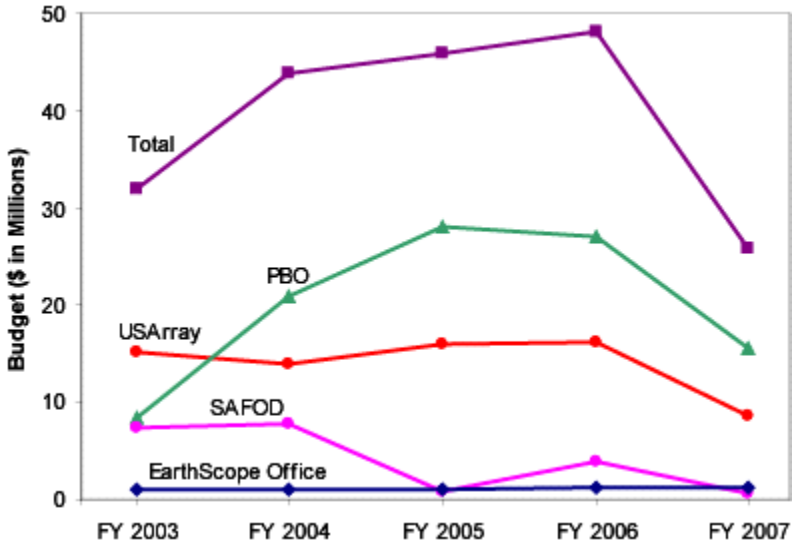
1 EarthScope

- 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 Subawards
    - 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 BH 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 equip,
  - 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.

Project	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 and 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 Subawards
	M. Jackson	1.3.3 Procurement
	C. Kurnick	1.3.4 System Fabrication, Test, and Campaign
	K. Feaux	1.3.5 Operations
	G. Anderson	1.3.6 Data and data products
	M. Jackson	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.



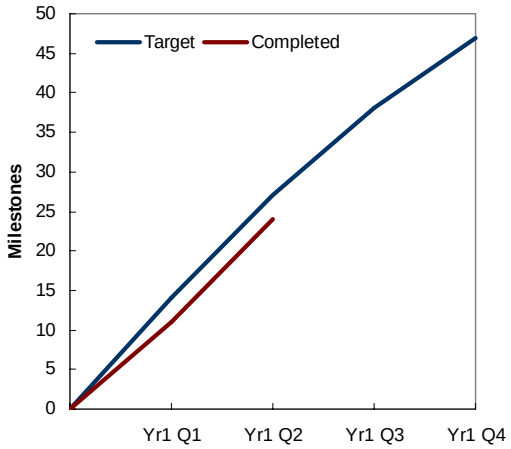
Project funding for the construction phase of EarthScope. The expected operation lifespan of EarthScope is 15 years after construction is complete in Fiscal Year 2007.

EarthScope Year 1 Baselines (at WBS level 2, in dollars)														compiled April 1, 2004
		Year 1	Sep 03	Oct 03	Nov 03	Dec 03	Jan 04	Feb 04	Mar 04	Apr 04	May 04	Jun 04	Jul 04	Aug 04	Sept 04
1.1	**EarthScope Management**														
1.1.1	EarthScope Office	1,094,846	37,719	63,476	57,437	56,587	57,939	63,111	72,060	247,959	92,111	78,357	91,136	93,024	83,931
1.1.2	Program Reviews & Reporting	81,553	4,445	11,308	1,000	1,000	3,000	6,600	3,000	5,000	20,600	3,000	1,000	17,000	4,600
1.1.3	Meetings and Outreach	105,086	6,697	30,672	1,604	11,504	4,414	11,039	2,404	6,304	12,404	3,604	9,415	2,405	2,620
	Contingency	0													
	Total	1,281,485													
1.2	**SAFOD**														
1.2.1	Management	352,727	0	23,411	8,411	8,411	13,640	55,669	31,135	24,135	52,415	32,135	50,295	20,935	32,135
1.2.2	Drilling	5,144,281	0	63,000	0	15,000	0	10,200	10,250	717,000	515,000	780,000	984,000	1,032,000	1,017,831
1.2.3	Instrumentation	523,522	0	0	44,100	0	0	27,778	52,778	66,478	66,478	66,478	66,478	66,478	66,478
1.2.4	Data Products	116,213	3,643	7,756	3,726	3,726	3,726	14,223	10,193	14,223	10,193	10,193	14,223	10,193	10,193
	Contingency	419,713													
	Total	6,556,456													
1.3	**PBO**														
1.3.1	Program Management	908,561	43,379	43,379	43,379	43,379	81,065	81,065	81,065	84,265	84,265	84,265	79,686	79,686	79,686
1.3.2	Long Baseline Strainmeters	326,300	4,899	4,899	4,899	4,899	29,792	29,792	29,792	31,755	31,755	31,755	40,687	40,687	40,687
1.3.3	Procurement	1,596,940	21,925	21,925	21,925	21,925	147,687	147,687	147,687	287,253	201,143	201,143	125,546	125,546	125,546
1.3.4	Fab/Test Campaign	217,445	5,680	5,680	5,680	5,680	21,636	21,636	21,636	21,636	21,636	21,636	21,636	21,636	21,636
1.3.5	Facility Construction	3,027,277	44,035	44,035	44,035	44,035	336,769	336,769	336,769	342,802	373,865	273,435	283,575	283,575	283,576
1.3.6	Data & Data Products	1,079,802	8,867	8,867	8,867	8,867	53,442	53,442	53,442	156,388	134,388	134,388	152,948	152,948	152,948
1.3.7	GeoEarthScope	0		0	0	0	0	0	0	0	0	0	0	0	0
1.3.8	Project Support	700,086	57,401	57,401	57,401	57,401	44,471	44,471	44,471	72,822	72,822	72,822	39,533	39,533	39,533
	Contingency	556,534													
	Total	8,412,945													
1.4	**USArray**														
1.4.1	Management	553,337	2,411	13,675	7,933	9,303	15,355	28,569	36,323	38,777	71,108	45,774	70,634	72,966	140,509
1.4.2	ANSS Backbone Stations	2,152,989	0	27,566	27,566	28,166	61,139	61,139	62,818	68,797	68,799	69,301	559,064	559,064	559,574
1.4.3	Transportable Array Stations	3,136,418	1,143	2,181	2,995	3,375	11,800	27,984	340,926	313,847	645,980	340,806	565,898	474,539	404,944
1.4.4	Flexible Array Stations	1,590,141	1,143	2,181	2,995	3,375	10,628	35,628	112,772	230,648	416,972	107,628	198,217	73,857	394,097
1.4.5	Data Management	752,290	8,848	33,958	366,968	17,343	54,957	44,038	29,482	33,983	30,150	31,038	35,718	33,841	31,969
1.4.6	Siting Outreach	58,127	0	0	0	0	0	1,337	3,151	4,651	5,137	8,168	10,518	13,018	12,149
	Carry Over for Year 2	4,817,204													
	Contingency	687,395													
	Total	13,747,904													

EarthScope Year 1 time-phased budget at work breakdown structure Level 2.

Milestones 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. These milestones are organized by quarter and Work Breakdown Structure (WBS) level as a framework in which to measure the project's progress. So far this year, 24 of the 27 scheduled milestones are complete. Explanations for incomplete milestones are reported following the table.



Year 1 Milestones	Completed?
Quarter 1 (9/1/03 – 12/31/03)	
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 GPS Permanent Station 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 1.0 equivalent ANSS Backbone stations installed	Yes
Quarter 2 (1/1/04 – 3/31/04)	
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	No
1.3 PBO Data Products Advisory Working Group Established	Yes
1.3 Data Management Plan Completed and Reviewed	No
1.3 Alaska and Pacific Northwest Regional Office established	Yes
1.3 Critical Design Review (CDR) of Permanent GPS Station equipment completed	Yes
1.3 PBO Standing Committee Borehole Strainmeter Recommendations Report	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.	No
1.4 2.3 equivalent ANSS Backbone stations	Yes

Quarter 3 (4/1/04 – 6/30/04)		
1.1	USArray site reviewed by EFEC	
1.1	Second Quarter FY03/04 Report and Annual Report submitted (6/1/2004)	
1.2	Phase 1 drilling of SAFOD Main Hole initiated	
1.2	Construction of Stage 2 monitoring instrumentation initiated	
1.3	RFP for PBO strainmeter released	
1.3	PBO Analysis Center and Anlysis Center Coordinator Request For Proposal Released	
1.3	Archive Subawards Finalized	
1.3	Northern California, Southern California, and Basin and Range Regional Offices established	
1.3	CDR of Borehole strainmeter equipment procedures completed	
1.3	40 equivalent Permanent GPS Stations, 3 equivalent Borehole Strainmeters	
1.4	Array Network Facility and Data Management Center communications tested.	
1.4	10.6 ANSS Backbone stations	
Quarter 4 (7/1/04 – 9/31/04)		
1.1	SAFOD site reviewed by EFEC	
1.1	Third Quarter FY03/04 Report submitted (9/10/2004)	
1.2	Phase 1 drilling and related downhole activities completed	
1.2	Stage 2 monitoring instrumentation deployed	
1.2	Stage 1 monitoring system in SAFOD Pilot Hole deployed	
1.3	PBO strainmeter subawards established	
1.3	analysis Center and Analysis Center Coordinator Statement of Work Complete	
1.3	90 equivalent Permanent GPS Stations, 6 equivalent Borehole Strainmeters, 1 equivalent Long Baseline Strainmeter installed, and 28 equivalent Campaign GPS installations completed	
1.4	DCN to ANF and DCN to DMC communications tests complete	
1.4	13.8 equivalent ANSS Backbone stations, 28 equivalent Transportable Array stations, 240 Flexible Array equipment available	
Year 2 Milestones		**Completed**
Quarter 1 (10/1/04 – 12/31/04)		
1.1	EarthScope Office site reviewed by EFEC	
1.1	Fourth Quarter FY03/04 Report submitted (12/1/2004)	
1.3	PBO Data Systems PDR Complete	
1.3	143 equivalent Permanent GPS Stations, 12 equivalent Borehole Strainmeters, 1.5 equivalent Long Baseline Strainmeters installed, and 28 equivalent Campaign installations completed	
1.4	21.4 equivalent ANSS Backbone stations, 36 equivalent Transportable Array stations, 480 Flexible Array equipment available	
Quarter 2 (1/1/05 – 3/31/05)		
1.1	PBO site reviewed by EFEC	
1.1	First Quarter FY04/05 Report submitted (3/1/05)	
1.2	Contract for Stage 3 monitoring system signed	
1.2	Samples and data distributed	
1.2	Subcontract for Phase 2 drilling and related services signed	
1.3	PBO Data Systems CDR Complete	
1.3	195 equivalent Permanent GPS Stations, 18 equivalent Borehole Strainmeters, 2.0 equivalent Long Baseline Strainmeters installed, 28 equivalent campaign installations completed	
1.4	Award for Transportable Array Contractor issued.	
1.4	23.1 equivalent ANSS Backbone stations, 48 equivalent Transportable Array stations, 480 Flexible Array equipment available	

Quarter 3 (4/1/05 – 6/30/05)	
1.1 USArray site reviewed by EFEC	
1.1 Second Quarter FY04/05 Report and Annual Report (4/1/04 – 3/31/05) submitted (6/1/05)	
1.2 Construction of Stage 3 prototype monitoring system initiated	
1.2 Phase 2 drilling of SAFOD Main Hole initiated.	
1.3 PBO data Archiving and Data Solutions components fully functioning	
1.3 248 equivalent Permanent GPS Stations, 24 equivalent Borehole Strainmeter, 2.5 equivalent Long Baseline Strainmeters installed, 28 equivalent campaign installations completed	
1.4 25 equivalent ANSS Backbone stations, 60 equivalent Transportable Array stations, 600 Flexible Array equipment available	
Quarter 4 (7/1/05 – 9/31/05)	
1.1 SAFOD site review by EFEC	
1.1 Third Quarter FY04/05 Report submitted (9/10/05)	
1.2 Phase 2 drilling of SAFOD main hole and related downhole measurements completed	
1.3 300 equivalent Permanent GPS Stations, 30 equivalent Borehole Strainmeters, 3 equivalent Long Baseline Strainmeters installed, 100 equivalent Campaign GPS installed	
1.4 28.9 equivalent ANSS Backbone stations, 80 equivalent Transportable Array stations, 720 Flexible Array equipment available	

Explanations for Incomplete Milestones:

1.2 Subcontract for SAFOD Stage 2 monitoring instrumentation issued: The subcontract for SAFOD Stage 2 monitoring instrumentation has not yet been issued. The main reason are some legal technicalities with the contract between Sandia National Laboratory and Stanford University. Lawyers from both sides have been negotiating the language. The contract should be signed soon.

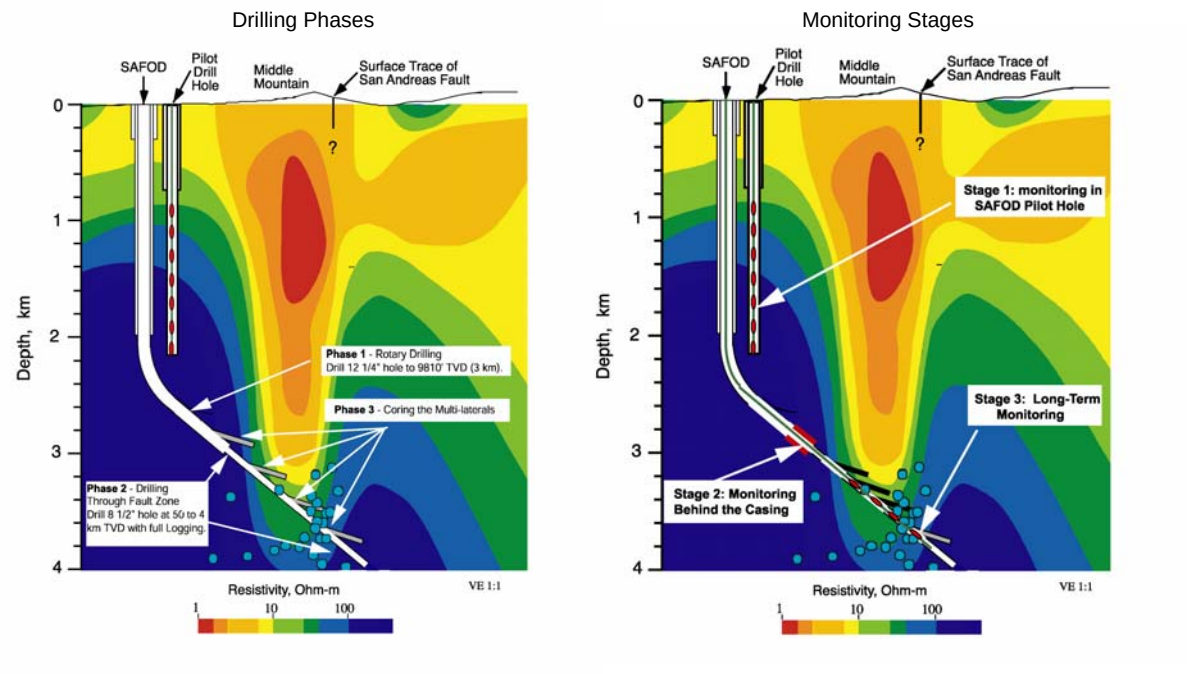
1.3 Data Management Plan completed and reviewed: This milestone was not completed in the second quarter because more community input was requested. In response to the request, PBO generated an additional version of the Data Management Plan and needed to provide sufficient time for the EarthScope community members to respond. We anticipate that the Data Management Plan will be finalized by May 15.

1.4 Cooperative regional network stations data begins flowing to the DMC: The milestone for flow of regional network data into the Data Management Center (DMC) was to be completed in March. Delays in the awarding of the Array Network Facility have delayed the data flow slightly, but nevertheless data from several stations in southern California were taking place in March 2004. We anticipate dataflow from additional regional network stations to begin in April 2004. Dataflow from stations in the ANSS Backbone were flowing to the DMC in March 2004.

Technical Progress

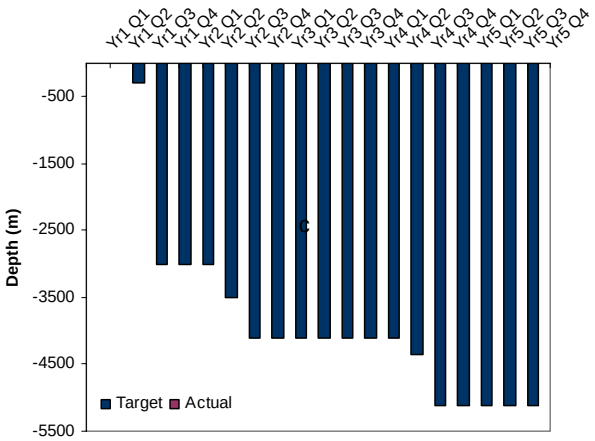
EarthScope measures progress in two ways: For the San Andreas Fault Observatory at Depth, progress is measured against depth drilled and timelines for the three phases of drilling and three stages of monitoring in the hole. For the geodetic and seismic stations, progress is measured in terms of the total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

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: Monitoring outside the casing with a set of deformation monitoring instruments. Stage 3: Monitoring in active earthquake zone with seismic and pore pressure instrumentation.



Phase 1 drilling will begin in June 2004. Site characterization work continued throughout the quarter in preparation for the drilling. The intensive efforts focused on determining the precise location of the target earthquakes and the development of comprehensive geophysical models for characterization of the volume of crust between the borehole and the San Andreas Fault at the depth of the target earthquakes.

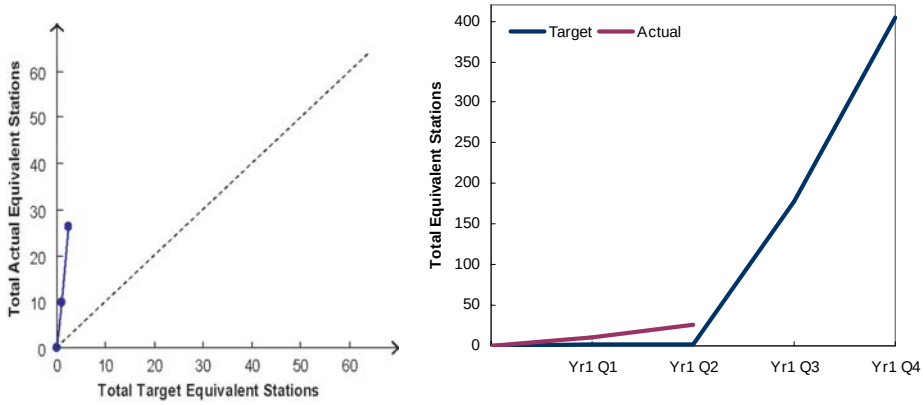
Drilling Progress	Drilling Progress	
	Measured Depth (m)	True Vertical Depth (m)
Yr1 Q1	0	0
Yr1 Q2	0	0
Yr1 Q3	-300	
Yr1 Q4	-3000	
Yr2 Q1	-3000	
Yr2 Q2	-3000	
Yr2 Q3	-3500	
Yr2 Q4	-4112	
Yr3 Q1	-4112	
Yr3 Q2	-4112	
Yr3 Q3	-4112	
Yr3 Q4	-4112	
Yr4 Q1	-4112	
Yr4 Q2	-4112	
Yr4 Q3	-4362	
Yr4 Q4	-5112	
Yr5 Q1	-5112	
Yr5 Q2	-5112	
Yr5 Q3	-5112	
Yr5 Q4	-5112	



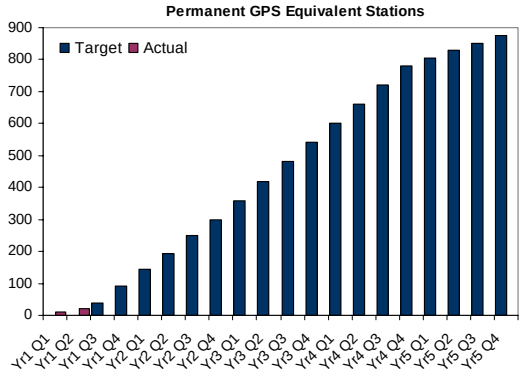
For the geodetic and seismic stations, installation involves several steps – procurement, assembly, permitting, site selection, installation, etc. The uncertainty and difficulty with each of these steps is highly site dependent. The EarthScope management system assesses progress at a greater degree of 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.

It is important to recognize, however, that stations can sometimes be considered "operational" before they are "complete". Often, for example, data are available (i.e., the station is thus considered "operational") even though upgrades to the communication system are still needed for the station to be "complete".

Over the next five years, EarthScope will install 1494 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 2500 campaign GPS and seismic instruments, which will be available for temporary deployments and individual research experiments. EarthScope is currently ahead of schedule with 26.3 equivalent stations, 10.2 more than the end of Quarter 2 target.

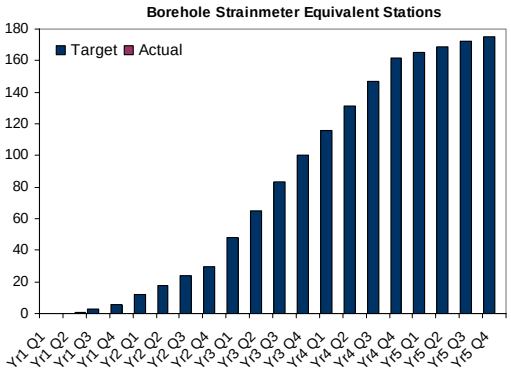


Permanent GPS stations measure ground movement on time scales of days to decades and over large spatial scales. They are used to cover long-period transients such as those associated with viscoelastic relaxation following an earthquake, decadal estimates of strain accumulation, plate motion, and spatial variations. Installation plans call for the deployment of 875 permanent GPS stations over five years. The plans call for 40 equivalent stations by the end of the third quarter. Equipment procurement, siting, permit acceptance, and monument installations are ahead of schedule, resulting in 21.4 equivalent stations for the second quarter. Data flow and equipment installation is less than product flow because borrowed equipment is being used at San Simeon. The borrowed equipment will be replaced and the stations will switch to real-time data flow.



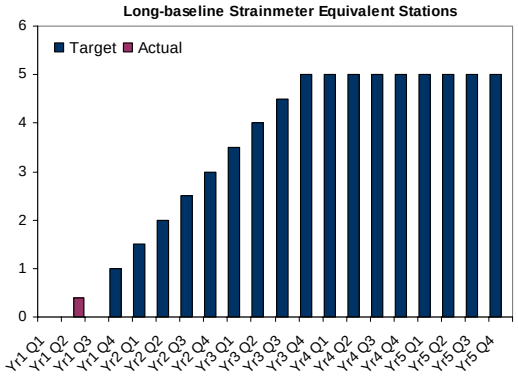
Permanent GPS Stations	Installation Progress		Equivalent Stations		
	Target	Actual	% of Station	Target	Actual
Equipment procurement and assembly	0	6	10%	0.0	0.6
Siting	46	127	5%	2.3	6.4
Reconnaissance	46	39	10%	4.6	3.9
Permit submitted	46	41	10%	4.6	4.1
Permit accepted	10	22	15%	1.5	3.3
Monument installation	0	11	20%	0.0	2.2
Equipment installation	0	1	15%	0.0	0.2
Site commissioning	0	6	5%	0.0	0.3
Data flow	0	4	5%	0.0	0.2
Product generation	0	5	5%	0.0	0.3
Total Number of Equivalent Stations			**100%**	**13.0**	**21.4**

Borehole strainmeters recover short-term transient deformation, phenomena with periods ranging from seconds to months. They play a central role in observing phenomena that accompany and precede earthquakes and volcanic eruptions. Installation plans call for the deployment of 175 borehole strainmeters over five years, starting with 3 equivalent stations in the third quarter of the first year. Siting, reconnaissance, and permitting are currently ahead of schedule, resulting in 0.9 equivalent stations by the end of the quarter.



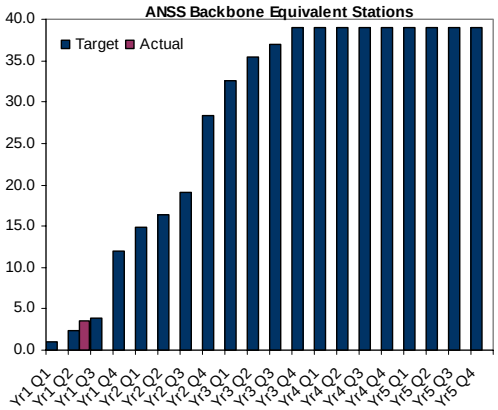
Borehole Strainmeter Stations	Installation Progress		Equivalent Stations		
	Target	Actual	% of Station	Target	Actual
Equipment procurement and assembly	0	0	5%	0.0	0.0
Equipment testing and QA	0	0	5%	0.0	0.0
Siting	1	3	5%	0.1	0.2
Reconnaissance	1	3	10%	0.1	0.3
Permit submitted	1	3	10%	0.1	0.3
Permit accepted	0	1	15%	0.0	0.2
Drilling borehole	0	0	20%	0.0	0.0
Equipment installation	0	0	15%	0.0	0.0
Site commissioning	0	0	5%	0.0	0.0
Data flow	0	0	5%	0.0	0.0
Product generation	0	0	5%	0.0	0.0
Total Number of Equivalent Stations			**100%**	**0.3**	**0.9**

Long-baseline strainmeter instruments have the high resolution of the borehole strain instruments 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. This quarter, progress was made towards the goal of achieving the first equivalent station by the fourth quarter. Because the permit is not yet accepted, the installation is 0.1 equivalent stations behind schedule.



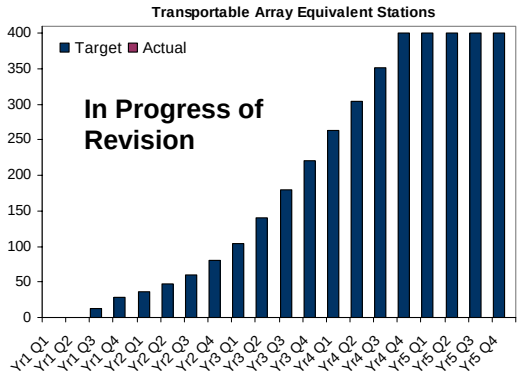
Long-baseline Strainmeter Stations	Installation Progress		Equivalent Stations		
	Target	Actual	% of Station	Target	Actual
Reconnaissance	1	1	10%	0.1	0.1
Equipment procurement and assembly	1	1	10%	0.1	0.1
Siting	1	1	5%	0.1	0.1
Permit submitted	1	1	10%	0.1	0.1
Permit accepted	1	0	15%	0.2	0.0
Equipment assembly on site	0	0	5%	0.0	0.0
Strainmeter Anchoring	0	0	15%	0.0	0.0
Equipment installation	0	0	15%	0.0	0.0
Site commissioning	0	0	5%	0.0	0.0
Data flow	0	0	5%	0.0	0.0
Product generation	0	0	5%	0.0	0.0
Total Number of Equivalent Stations			**100%**	**0.5**	**0.4**

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 the USGS seismic monitoring missionn. Installation plans call for the deployment or upgrade of these 39 stations over three years. Overall the progress towards installation of the ANSS Backbone Stations is ahead of schedule with 3.6 equivalent stations. The surplus is due to procurement, equipment, and installation progress offsetting the smaller than expected number of siting activities.



ANSS Backbone Stations	Installation Progress		Equivalent Stations		
	Target	Actual	% of Station	Target	Actual
Procurement	0.0	6.4	27%	0.0	1.7
Siting	5.2	1.5	20%	1.0	0.3
Civil Works	1.0	0.0	4%	0.0	0.0
Equipment	7.1	9.1	12%	0.9	1.1
Installation	0.7	1.2	30%	0.2	0.4
Communications	0.0	0.0	3%	0.0	0.0
Certification	4.0	4.0	4%	0.2	0.2
Total Number of Equivalent Stations			**100%**	**2.3**	**3.6**

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. The first 12 equivalent broadband stations are scheduled for the third quarter of Year 1. With the bottom-up baseline for the Transportable Array recently completed, the metrics used for computing equivalent stations are being revised to account for the complexity of deploying individual stations. Many 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. These metrics, along with Transportable Array station installation milestones, are being revised and will be distributed as soon as possible.

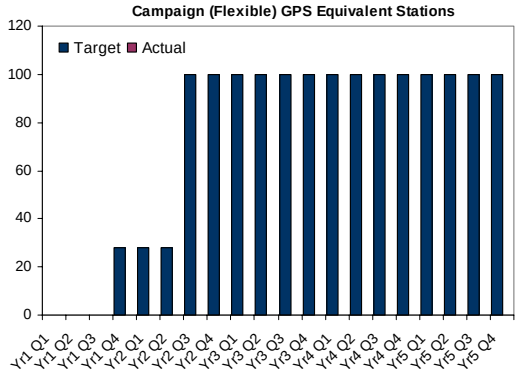


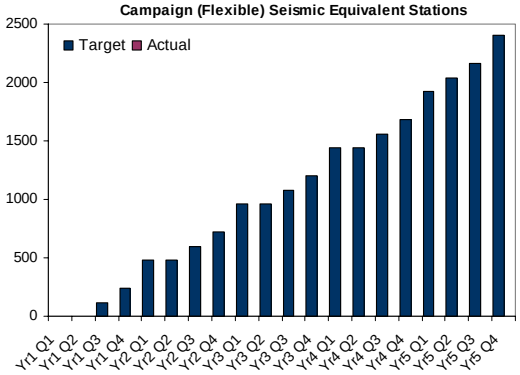
Transportable Array Stations	Installation Progress		Equivalent Stations		
	Target	Actual	% of Station	Target	Actual
Equipment procurement	0	0	5%	0.0	0.0
Equipment assembly and acceptance	0	0	5%	0.0	0.0
Permit submitted	0	0	20%	0.0	0.0
Permit accepted				0.0	0.0
Site preparation				0.0	0.0
Equipment installed				0.0	0.0
Site certification	0	0	5%	0.0	0.0
Data flow	0	0	5%	0.0	0.0
Total Number of Equivalent Stations			**100%**	**0.0**	**0.0**

In Progress of Revision

Campaign (flexible) stations will be provided for temporary deployments across the US. A pool of 100 portable GPS receivers will be available for rapid response to earthquakes and aftershock recordings, while a pool of 2400 seismic stations will be available for earthquake studies and short-term active source experiments. Procurement plans call for the first 28 flexible GPS stations to be available by the fourth quarter of Year 1 and the total of 100 flexible GPS receivers available by the third quarter of Year 2. For the seismic stations, 2400 will be available by the fourth quarter of Year 5 with the first 120 equivalent stations scheduled for the third quarter of Year 1.

Campaign (Flexible) Stations	Installation Progress		Equivalent Stations		
	Target	Actual	% of Station	Target	Actual
GPS	**0**	**0**			
Seismic	**0**	**0**			





Stations are considered complete when all the work for the station has been accomplished. The number of completed stations at the end of the 2nd Quarter is 5, consisting of 1 Permanent GPS Station and 4 ANSS Backbone Stations.

Total Number of Complete Stations	
Permanent GPS Stations	1
Borehole Strainmeter Stations	0
Long-baseline Strainmeter Stations	0
ANSS Backbone Stations	4
Transportable Array Stations	0
Campaign GPS Stations	0
Campaign Seismic Stations	0

Stations, however, can be operational before they are complete, such as when data is available even though upgrades to the communication systems are still planned. At the end of the 2nd Quarter, data is available from the seismic array in the SAFOD Pilot Hole, 12 GPS stations (5 of these stations were installed in direct response to the San Simeon Earthquake), and 4 seismic stations.

Available Resources

Deployment/ Station code	Type of Instrument	Geographic Location	Longitude	Latitude	Elevation (meters)	Date of Deployment	Data Type/ Sample Rate	Data Available*	Comments
SAFOD Pilot Hole	32 level seismic array	Parkfield, California	-120.3	35.6	-800 to -2100	10/1/2002	seismic, 500 Hz - 1 kHz	9/1/2003	operating station
AB37	Backbone GPS	Alaska (Denali Cluster)	-145.5	63.0	1137	10/1/2003	geodetic, GPS, 15sec	3/1/2004	operating station
AC61	Continuous GPS	Alaska (Denali Cluster)	-142.1	64.0	748	10/1/2003	geodetic, GPS, 15sec	3/1/2004	operating station
AC62	Continuous GPS	Alaska (Denali Cluster)	-146.3	63.1	1347	10/1/2003	geodetic, GPS, 15sec	3/1/2004	operating station
AC63	Continuous GPS	Alaska (Denali Cluster)	-145.8	63.5	815	10/1/2003	geodetic, GPS, 15sec	3/1/2004	operating station
AC64	Continuous GPS	Alaska (Denali Cluster)	-144.3	62.7	775	10/1/2003	geodetic, GPS, 15sec	3/1/2004	operating station
AC65	Continuous GPS	Alaska (Denali Cluster)	-143.7	62.8	736	10/1/2003	geodetic, GPS, 15sec	3/1/2004	operating station
P067	Backbone/Continuous GPS	San Andreas Mega Cluster	-121.0	35.6	122	1/10/2004	geodetic, GPS, 15sec	3/1/2004	operating station, San Simeon response
P278	Continuous GPS	San Andreas Mega Cluster	-121.1	35.7	498	1/10/2004	geodetic, GPS, 15sec	3/1/2004	operating station, San Simeon response
P295	Continuous GPS	San Andreas Mega Cluster	-120.8	35.7	611	1/10/2004	geodetic, GPS, 15sec	3/1/2004	operating station, San Simeon response
P526	Continuous GPS	San Andreas Mega Cluster	-120.9	35.6	434	1/10/2004	geodetic, GPS, 15sec	3/1/2004	operating station, San Simeon response
P576	Continuous GPS	San Andreas Mega Cluster (Baldy Mesa Road Yard)	-121.0	35.7	352	1/10/2004	geodetic, GPS, 15sec	3/1/2004	operating station, San Simeon response
P041	Backbone GPS	Boulder, Colorado	-105.2	39.9	1810	2/10/2004	geodetic, GPS, 15sec	3/1/2004	operating station
ANSS Backbone	3-component seismic	Attu, Alaska (ATTU)	173.0	52.9	250	2/24/94	seismic, broadband, 20sps	9/1/2003	operating station
ANSS Backbone	3-component seismic	Mina, Nevada (NVAR)	-118.1	38.4	2042	9/16/93	seismic, broadband, 40sps	9/1/2003	operating station
ANSS backbone	3-component seismic	Pinedale, Wyoming (PDAR)	-109.6	42.8	2199	9/8/89	seismic, broadband, 40sps	9/1/2003	operating station
ANSS backbone	3-component seismic	Lajitas, Texas (TXAR)	-103.7	29.3	1013	10/27/94	seismic, broadband, 40sps	9/1/2003	operating station

**since start of project*

Cost Schedule Status Report (CSSR)

The Cost Schedule Status Report (CSSR) communicates the actual progress of EarthScope while taking into account the work complete, the time taken, and the costs incurred to complete the work. It measures progress of these elements in monetary terms and is based on the project's Work Breakdown Structure (WBS). Schedule and cost variances greater than 10% are explained along with a detailed proposal for remedial action if necessary in the Variance Reports following the table.

At the end of our second quarter, EarthScope is on schedule and on budget with 3% of the 5-year work completed. While the overall schedule variance for EarthScope is 5% behind schedule, SAFOD, PBO, and USArray report schedule variances greater than 10% for two or more Level 2 tasks, resulting in schedule variances at Level 1 for all three components. SAFOD: The schedule variances are due to delayed invoicing (no corrective action required) and a delay in starting work on instrumentation (this variance will not affect other tasks but will be closely monitored). PBO: The schedule variances are due

to delays in site permitting, procurement and facility construction. These variances have been identified and explained at WBS Levels 3 and 4. No other tasks are affected. Corrective action has been taken. USArray: Schedule variances are identified at Levels 2 and 3. Positive schedule variances are due to equipment being delivered ahead of schedule. No other tasks are affected and no corrective action is needed.

The overall cost variance for EarthScope is 0%. All four EarthScope management components report one or more cost variance at Level 2. None of these variances, however, result in cost variances at Level 1. EarthScope Management: The EarthScope Office is reporting one Level 2 cost variance due to higher than expected booth travel and start-up equipment costs. SAFOD: One cost variance at Level 2 (1.2.3 Instrumentation) is due to delayed invoicing. PBO: Two positive and one negative cost variances are reported due to delayed hiring and higher than expected facility start-up expenses. USArray: USArray is reporting three positive cost variances due to direct costs associated with the USArray components, equipment deliveries ahead of schedule, and lower than budgeted labor cost.

Cost Schedule Status Report (CSSR) for WBS Level 2 Activities

This report is based on budgets and activities for Year1 through Year 5

Level	% of 5 yrs	$ (thousands) Cumulative Sept.03 - Mar.04							$ (thousands) for 5 yrs		
1.1 EarthScope Management	% work complete	PV (BCWS)	EV (BCWP)	AC (ACWP)	SV	SV% of PV	CV	CV% of PV	BAC	EAC	Var.
1.1.1 EarthScope Management	8%	402	410	426	8	2	(16)	(4)	5,430	5,430	0
1.1.2 Program Reviews & Reporting	8%	30	30	30	0	0	(0)	(0)	397	397	0
1.1.3 Meetings & Outreach	10%	68	68	80	(0)	(0)	(12)	(17)	670	670	0
Subtotal 1.1	8%	501	509	537	8	2	(28)	(5)	6,497	6,497	0
Contingency/Management Reserve									240	240	
Total 1.1									6,737	6,737	0
1.2 SAFOD	% work complete	PV (BCWS)	EV (BCWP)	AC (ACWP)	SV	SV% of PV	CV	CV% of PV	BAC	EAC	Var.
1.2.1 Management	7%	141	118	107	(22)	(16)	12	8	1,817	1,817	0
1.2.2 Drilling and Downhole Meas.	1%	98	107	107	9	9	(0)	(0)	14,019	14,019	0
1.2.3 Instrumentation	3%	125	72	48	(53)	(42)	24	19	2,224	2,224	0
1.2.4 Data Products and Sample Handling	5%	47	47	46	(0)	(0)	1	1	910	910	0
Subtotal 1.2	2%	411	344	308	(66)	(16)	36	9	18,969	18,969	0
Contingency/Management Reserve									1,508	1,508	
Total 1.2									20,476	20,476	0
1.3 Plate Boundary Observatory	% work complete	PV (BCWS)	EV (BCWP)	AC (ACWP)	SV	SV% of PV	CV	CV% of PV	BAC	EAC	Var.
1.3.1 Program Management	9%	417	407	363	(10)	(2)	44	11	4,482	4,482	0
1.3.2 Long Baseline Strainmeters	2%	109	53	57	(56)	(51)	(4)	(4)	2,450	2,450	0
1.3.3 Procurement	1%	574	320	320	(254)	(44)	0	0	36,878	36,878	0
1.3.4 Fab/Test/Campaign	7%	88	88	41	0	0	47	53	1,269	1,269	0
1.3.5 Facility construction	1%	1125	561	666	(564)	(50)	(105)	(9)	39,366	39,366	0
1.3.6 Data & Data Products	2%	195	100	108	(95)	(49)	(8)	(4)	5,298	5,298	0
1.3.7 GeoEarthScope	0%	0	0	0	0	0	0	0	5,000	5,000	0
1.3.8 Project Support	52%	363	363	421	0	0	(58)	(16)	700	700	0
Subtotal 1.3	2%	2,871	1,892	1,976	(979)	(34)	(84)	(3)	95,443	95,443	0
Contingency/Management Reserve									4,432	4,432	
Total 1.3									99,875	99,875	0
1.4 USArray	% work complete	PV (BCWS)	EV (BCWP)	AC (ACWP)	SV	SV% of PV	CV	CV% of PV	BAC	EAC	Var.
1.4.1 Management	2%	114	114	95	0	0	19	17	4,570	4,570	0
1.4.2 ANSS Backbone Stations	8%	268	498	431	229	85	67	25	6,349	6,349	0
1.4.3 Transportable Array Stations	3%	390	1,000	1,015	610	156	(14)	(4)	34,366	34,366	0
1.4.4 Flexible Array Stations	1%	169	132	131	(36)	(22)	1	1	18,202	18,202	0
1.4.5 Data Management	24%	556	545	535	(11)	(2)	10	2	2,298	2,298	0
1.4.6 Siting Outreach	1%	4	4	4	0	0	1	15	452	452	0
Subtotal 1.4	3%	1501	2293	2210	792	53	83	6	66,237	66,237	0
Contingency/Management Reserve									3,486	3,486	
Total 1.4									69,723	69,723	0
Subtotal EarthScope	**3%**	**5,284**	**5,039**	**5,031**	**(245)**	**(5)**	**8**	**0**	**187,146**	**187,146**	**0**
Total EarthScope									**196,811**	**196,811**	**0**

Legend	
% work complete =	BCWS / BAC
BCWS (PV) =	**B**udgeted **C**ost of **W**ork **S**cheduled (Planned Value)
BCWS (EV) =	**B**udgeted **C**ost of **W**ork **P**erformed (Earned Value)
ACWP (AC) =	**A**ctual **C**ost of **W**ork **P**erformed (Actual Cost)
SV =	**S**chedule **V**ariance = (Earned Value – Planned Value)
SV % of PV =	(Earned Value – Planned Value) / Planned Value
CV =	**C**ost **V**ariance = (Earned Value – Actual Cost)
CV % of PV =	(Earned Value – Actual Cost) / Planned Value
BAC =	**B**udgeted **A**ctual **C**ost is the baseline budget plus any approved budget revisions for Year 1
EAC =	**E**stimated **A**ctual **C**ost is the estimated budget at completion of Year 1
VAR =	Variance = (Estimated Actual Cost – Budgeted Actual Cost)

Variance Reports:

Level and Task: 1.1.3 EarthScope Management - Professional Meetings & Outreach	**CV:** (17%) or $(12,000)
Reason: 1.1.3.1. Meetings **CV:** $7,726 Expenditures for staff travel to other general meetings (AGU, IAGT, AAAS) has been greater than budgeted. **Other Affected Tasks:** None **Corrective Action:** This variance is expected to be absorbed by the prorated travel budget over the next months.	
Reason: 1.1.3.2 Outreach (EarthScope Booth) **CV:** $4,009 Booth computers expense and meeting costs have been greater than budgeted. **Other Affected Tasks:** None **Corrective Action:** Booth computer expenses are one time start-up expenses. We will closely monitor booth travel expenses to be able to budget this level 3 task more accurately. This negative cost variance will be absorbed within level 2.	

Level and Task: 1.2.1 SAFOD Management	**SV:** (16%) or ($22,000)
Reason: This variance results from several factors. The key factor leading to the schedule variance is the Stage 1 monitoring subcontract. Duke University has received the contract but has not started invoicing us. The contract has $15,000 overhead. **Other Affected Tasks:** None **Corrective Action:** None. Duke is making progress on building the instrument. The invoices will catch up soon.	

Level and Task: 1.2.3 SAFOD Instrumentation	**SV:** (42%) or ($53,000)	**CV:** 19% or $24,000
Reason: As with the variance in management discussed above, the key factor causing the variance is the sub contract with Duke University for the Stage 1 monitoring instrumentation. Work has started on the instrument package, but there was a slight delay in getting started. The Duke project lead stated that they can still meet the October target for deploying the instrument. The cost variance results from delays in Duke procurement as described above. **Other Affected Tasks:** The Stage 1 monitoring equipment will be going into the SAFOD Pilot Hole, and delay here will have no impact on Stage 2 or Stage 3 equipment, nor does it affect drilling at all. **Corrective Action:** We are requesting monthly progress reports on the Stage 1 equipment from Duke.		

Level and Task: 1.3.1 PBO Program Management	**CV:** 11% or $44,000

Reason: This area variance is mainly driven by task "1.3.1.5 Participant Support" which recorded a $39,000 positive variance. This is driven by a shift to later dates of some participant support meetings due to the availability of PBO personnel during the program start-up phase and some travel costs being shared by other UNAVCO accounts during its annual meeting.
Other Affected Tasks: None
Corrective Action: Future support meetings are being reforecast.

Level and Task: 1.3.2 PBO Subawards (Laser SM Subaward) 02.02.02	**SV:** (51%) or ($56,000)

Reason: This negative schedule variance is due to delays in the site permitting process of the first unit. The subcontractors believe they can correct this variance in future periods.
Other Affected Tasks: None
Corrective Action: This subaward in our baseline was started a year ahead of the original proposal to allow for these types of events.

Level and Task: 1.3.3 PBO Procurement	**SV:** (44%) or ($254,000)

Reason: The negative schedule variance for PBO procurement is focused in the following tasks:

Task	Name	Schedule Variance
1.3.3.2.1	Communications	($71,000)
1.3.3.2.2	Power and Enclosures	($77,000)
1.3.3.2.3	Monuments	($38,000)
1.3.3.2.4	Domes and Mounts	$12,000
1.3.3.2.5	Met Stations	($4,000)
1.3.3.2.6	Security	($10,000)
1.3.3.2.7	Cables	($23,000)
1.3.3.2.8	Receivers/Antennas	($33,000)
1.3.3.4.3	Supplies	($17,000)
1.3.3.5.1&2	Computers	$9,000
1.3.3.xx	Other	($2,000)
	Total	($254,000)

Communications is behind in the original plan due to advances in cellular data router technology and equipment availability. PBO is pleased with the price and performance of this technology but has shifted procurement to a just-in-time process to allow the maximum time for product development and availability. Power and enclosures were delayed to longer than anticipated due to an extended specification development process. However, as of this writing, over $221 thousand dollars of materials has been ordered and the resulting enclosures will result in faster installations. The ordering of monument supplies is also behind the original plan, but as of this writing, over $106 thousand dollars has been ordered. Domes and Mounts were ordered ahead of plan due for vender and lot size considerations. The meteorological stations have not yet been ordered as prices are above our original budget. Security fences will be installed on sites when required as will cables for the GPS units. Fifty Year 1 GPS Receivers and Antennas have been ordered along with twenty extra.
Other Affected Tasks: None
Corrective Action: Year 1 GPS Material, Equipment, and Supplies are currently on order or have a revised ordering plan (communications equipment). Meteorological Station equipment may be delayed until Year 2. The revised procurement schedule will support the Year 1 GPS production schedule. In fact, for key items such as the GPS receivers, an additional 20 units have been ordered to ease future availability issues. This will lead to a smooth production

process. Borehole Strainmeter Material, Equipment, and Supplies have not yet been ordered as was forecasted in the original budget baseline.

Level and Task: 1.3.4 PBO Fab/Test/Campaign	**CV:** 53% or $47,000

Reason: The positive cost variance is caused by reduced charging by the Equipment Depot Engineer and a delay in hiring the Shipping and Receiving Technician.
Other Affected Tasks: None
Corrective Action: The Shipping and Receiving Technician has been hired as of this writing and the Equipment Depot Engineer continues to support critical warehouse/production support tasks. These positions will meet PBO's production schedule. If required, the UNAVCO facility can supply additional personnel to meet peak requirements.

Level and Task: 1.3.5 PBO Facility Construction	**SV:** (50%) or ($564,000)

Reason: The negative schedule variance for PBO Facility Construction is focused in the following tasks:

Task	Name	Schedule Variance
1.3.5.1.2	Permitting	($90,000)
1.3.5.2	Northern CA Region	($164,000)
1.3.5.3	Southern CA Region	($48,000)
1.3.5.4	Pacific Northwest Region	($67,000)
1.3.5.5	Basin & Range Region	($113,000)
1.3.5.6	Rocky Mountain Region	($17,000)
1.3.5.7	Alaska Region	($64,000)
1.3.5.8	Other	($2,000)
	Total	($565,000)

Reason: (1) The Permitting negative schedule variance is driven by permit support costs and consulting activities being expended later than planned. Early permits have focused on water districts and private land owners which required less outside support. The Regional Office's negative schedule variances have been driven by a number of factors: (2) Facilities and office expenses are a quarter behind plan; (3) Deep-drilled braced monument drilling costs are a quarter behind the original baseline plan; (4) Salary and the associated travel costs are behind the original plan; (5) Tooling and safety equipment have been purchased and the budgets have been shifted over to the regions for tracking and control purposes - a contingency change order has increased the budget for items omitted in the original plan; (6) Northern California strainmeter drilling startup costs have not yet commenced for the first unit; (7) Facility Construction earned value is understated for the first two quarters of Year 1 due to the following budget time phasing issues: Production is in a start up mode during Year 1 which means the production activity starts at low goals at the beginning of the Year 1 and builds rapidly to much higher goals at year's end. This accelerating rate of production is reflected in PBO's internal production goals, but has a different time phasing profile than the more linear budget items, such as regional staff salaries. In addition, non-recurring non-production goals, such as office and staff set up, were excluded from the formal Regional Office Earned Value to keep the system simple and to focus attention on construction.
Other Affected Tasks: None
Corrective Action: The following corrective actions will mitigate the current negative schedule variances: (1) In the permitting area, HDR Consulting has been contracted for overall permit support. In future quarters, Bureau of Land Management and forest service permitting will increase the need for additional contactor and other support. (2) All regional office leases have been arranged at the time of this writing with the exception of Northern California. The Northern

California lease is under negotiation and is expected to be completed in the coming week. Regional office personnel have been able to accomplish reconnaissance and permitting activities on-site and from alternate locations which have minimized production delays. (3) The PBO GPS Critical Design Review Document is complete which includes drilling specifications. Drilling support was already selected and tested for an initial evaluation at the Rocky Mountain Region and other selections are well under way. (4) As of this writing, all GPS regional personnel have been hired (for Year 1) and all but one strainmeter personnel has been hired. (5) Tooling is distributed to the regions and ready to support activities. (6) A preliminary design review document of the borehole strainmeter equipment and procedures has been completed. (7) The understatement of earned value is merely a time phasing problem and will correct itself in the next two quarters. Year 2's budget time phasing, earned value and production goals will be tightly integrated to avoid a repetition of this problem. Non-recurring set up tasks will be complete and therefore facility construction goals will reflect the total regional office effort. In summary, PBO has refined its plans and established workarounds to minimize the impact of the present negative schedule variance.

Level and Task: 1.3.6 PBO Data & Data Products	**SV:** (49%) or ($95,000)

Reason: The negative schedule variance for PBO Data & Data Products is focused in the following tasks:

Task	Name	Schedule Variance
1.3.6.4.1	Software Engineering	($61,000)
1.3.6.4.2	PBO Operational DB (POD)	($15,000)
1.3.6.4.3	Web Site Administration	($19,000)
	Total	($95,000)

Two software engineers and a web site administrator were not hired as of the close of this reporting cycle. The original budget plan assumed they will to be hired by March 2004. The original plan also forecast heavier contractor spending on the PBO Operational Database (POD).

Other Affected Tasks: None

Corrective Action: As of this writing the two software engineers have been hired. The web administrator will be hired shortly. This revised hiring schedule was prudent as the PBO Data Management Plan has entered final review which provides an overall technical baseline for these positions. The POD development is proceeding per a revised plan. After selecting a developmental contractor and refining the specifications, PBO realized that fewer dollars had to be spent for the POD's initial version.

Level and Task: 1.3.8 PBO Project Support	**CV:** (16%) or ($58,000)

Reason: The Project Support negative cost variance was mainly driven by vehicle expenses and the PBO facilities monthly allocation for Boulder Headquarters location.

Other Affected Tasks: None

Corrective Action: The PBO vehicle expenses were procured with some up front costs that were not taken into account in the initial time phasing. A contingency transaction is being prepared this month to cover two extra reconnaissance vehicles and additional items omitted in the original plan. The facilities allocation did not cover some non-recurring expenses for headquarters materials during the set up of PBO's 6350 Nautilus Drive Boulder headquarter location. PBO is tracking both the facilities and headquarters indirect rates closely for variances.

Level and Task: 1.4.1 Management	**CV:** 17% or $19,000
Reason: Indirect expenses are reported under Management, and reflect the positive variances associated with the direct costs of the other USArray components. **Other Affected Tasks:** None **Corrective Action:** None needed.	

Level and Task: 1.4.2 ANSS Backbone	**SV:** 85% or $229,000	**CV:** 25% or $67,000
Level and Task: 1.4.2.2 Procurement	**SV:** $385,674	**CV:**($12,905)
Reason: Equipment deliveries are occurring ahead of baselined schedule. **Other Affected Tasks:** None **Corrective Action:** None needed.		
Level and Task: 1.4.2.3 Subawards	**SV:**($156,339)	**CV:** $78,909
Reason: Schedule variance due to delay in issuing Albuquerque Seismological Laboratory subaward. Cost variance due to receipt of March invoice for fewer expenses than expected. Some tasks planned as part of the ANSS Backbone Array budget under the Albuquerque Seismological Laboratory subaward have been shared and supported by the U.S. Geological Survey. **Other Affected Tasks:** None **Corrective Action:** Continue to work with Albuquerque Seismological Laboratory to obtain invoices and/or better cost estimates.		

Level and Task: 1.4.3 Transportable Array	**SV:** 156% or $610,000
Reason: Equipment deliveries are occurring ahead of baselined schedule. **Other Affected Tasks:** None **Corrective Action:** None needed.	

Level and Task: 1.4.4 Flexible Array	**SV:** (22%) or ($36,000)
Reason: Procurement of misc. materials & supplies estimated for the 2nd quarter did not occur. The baselined Year 1 budget reflects an initial schedule of estimated purchases of small equipment (power, communications, lab equipment, and misc. supplies) that ensured delivery well in advance of the equipment's actual use. Without an immediate need in the second quarter, procurement of these miscellaneous materials & supplies is being coordinated with other activities and the items will be delivered later in the year. The adjustment in the procurement schedule will not impact the support of scheduled Flexible Array experiments. **Other Affected Tasks:** None **Corrective Action:** None needed.	

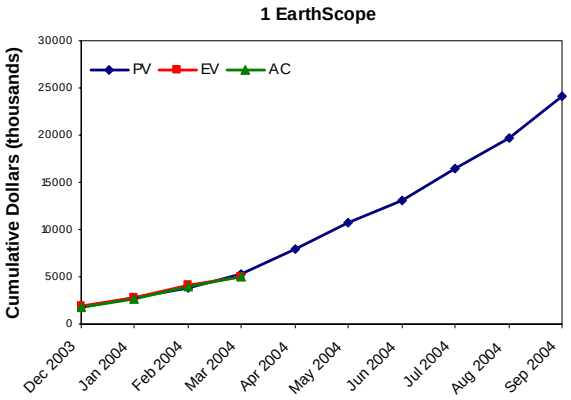
Level and Task: 1.4.6 Siting Outreach	**CV:** 15% or $1,000
Reason: Actual labor costs were less than budgeted. **Other Affected Tasks:** None **Corrective Action:** None needed.	

Cost Schedule Performance

The Cost Schedule Performance graphs show the planned value (the budgeted cost of the work scheduled), the earned value (the budgeted cost of work performed), and the actual cost (actual cost of work performed) over time. It allows an assessment of how budget items evolve over the course of the project and whether problems are temporary or are an indication of larger issues.

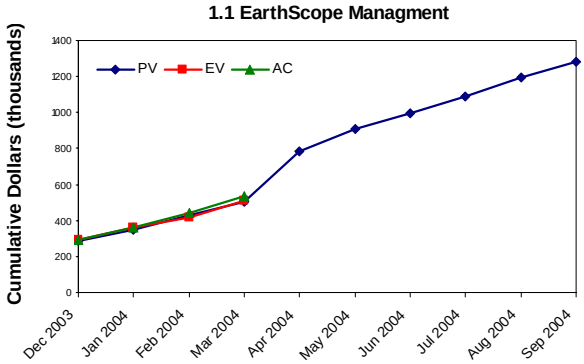
1 Overall, EarthScope has remained on schedule and on budget throughout the year.

1 EarthScope	Cumulative Dollars (thousands)		
	PV	EV	AC
Dec 2003	1,767	1,850	1,778
Jan 2004	2,721	2,806	2,656
Feb 2004	3,825	4,067	3,976
Mar 2004	5,284	5,039	5,031
Apr 2004	7,916		
May 2004	10,743		
Jun 2004	13,139		
Jul 2004	16,533		
Aug 2004	19,741		
Sep 2004	24,075		



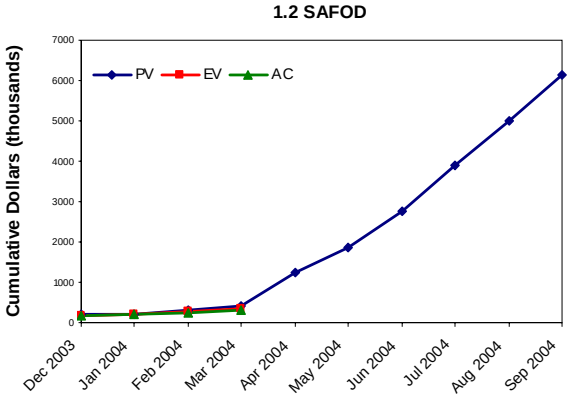
1.1 Starting out ahead of schedule in January, EarthScope Management fell behind schedule in February, but finished the quarter slightly ahead again. The actual cost of the work performed was high throughout the quarter, finishing with $36,000 over budget.

1.1 Management	Cumulative Dollars (thousands)		
	PV	EV	AC
Dec 2003	284	293	293
Jan 2004	348	358	358
Feb 2004	430	418	443
Mar 2004	501	509	537
Apr 2004	783		
May 2004	908		
Jun 2004	993		
Jul 2004	1,089		
Aug 2004	1,196		
Sep 2004	1,282		



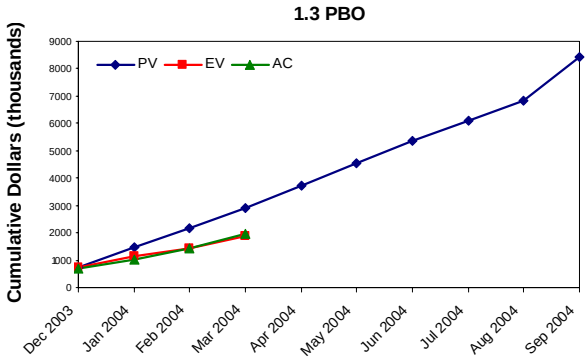
1.2 Following the establishment of EarthScope's final baselines, SAFOD adjusted its planned value to $181,000 for December 2003 and $199,000 for January 2004. The earned value in February dropped to $18,000 below the projected value, but the work completed slightly under budget. In March this trend continued, with SAFOD $67,000 behind schedule, but the work completed was slightly under budget.

1.2 SAFOD	Cumulative Dollars (thousands)		
	PV	EV	AC
Dec 2003	181	180	182
Jan 2004	199	196	196
Feb 2004	306	288	251
Mar 2004	411	344	308
Apr 2004	1,233		
May 2004	1,877		
Jun 2004	2,766		
Jul 2004	3,881		
Aug 2004	5,010		
Sep 2004	6,137		



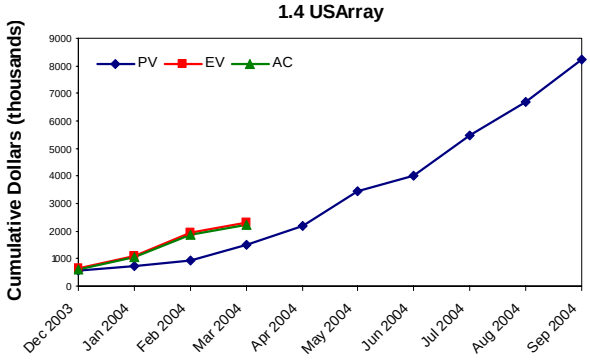
1.3 The Plate Boundary Observatory was behind schedule each month of the year (currently by $1,000,000). They completed the accomplished work on budget.

1.3 PBO	Cumulative Dollars (thousands)		
	PV	EV	AC
Dec 2003	745	731	702
Jan 2004	1,459	1,144	1,040
Feb 2004	2,174	1,418	1,428
Mar 2004	2,871	1,892	1,976
Apr 2004	3,709		
May 2004	4,528		
Jun 2004	5,348		
Jul 2004	6,091		
Aug 2004	6,835		
Sep 2004	8,413		



1.4 USArray was ahead of schedule for each month of the year (currently by $792,000). They completed the accomplished work on budget.

1.4 USArray	Cumulative Dollars (thousands)		
	PV	EV	AC
Dec 2003	557	646	601
Jan 2004	715	1,108	1,062
Feb 2004	916	1,943	1,854
Mar 2004	1,501	2,293	2,210
Apr 2004	2,192		
May 2004	3,430		
Jun 2004	4,033		
Jul 2004	5,473		
Aug 2004	6,700		
Sep 2004	8,243		



Contingency Summary

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

Contingency Log for Current Quarter 1 & 2 (dollars in thousands)	
Description	**Transactions**
1.2 SAFOD	
Beginning Balance	419
No Contingency Used	0
Ending Balance	419
No Liens	0
Ending Balance with Liens	419
1.3 PBO	
Beginning Balance	981
Extra Overhead Costs	(303)
Extra Facilities Costs	(86)
LSM Early Start	(327)
Covering Salary in Excess of Orginal Budget	(72)
Salary Savings Due to Later than planned Hiring Dates	191
Positions Delayed until Year 2	370
Receiver/Antenna Procurement Savings	100
Coverage of Extra Travel Costs	(10)
Coverage of Data & Data Products Subcontract Burden	(124)
Labor to S/C Fringe Savings	95
Campain Engr to Code S/C Fringe Savings	20
Regional Tranportation (Change Order: PBO-7)	(5)
IT Equipment Shift (Change Order: PBO-8)	(86)
PNW Budget Correction (Change Order: PBO-9)	(36)
Safety and Tooling Equipment (Change Order: PBO-10)	(129)
BH SM Standing Committee Support (Change Order: PBO-11)	(22)
20 Additional GPS Receivers and Antennas (Change Order: PBO-12)	(124)
Ending Balance	433
Extra Regional Office Costs	(100)
Permit Uncertainties	(233)
UNACO Burden Rate Uncertainties	(99)
Ending Balance with Liens	1
1.4 USArray	
Beginning Balance	687
No Contingency Used	0
Ending Balance	687
No Liens	0
Ending Balance with Liens	687

The contingency summary tracks the use of contingency funds over the course of the project. For the first quarter of Year 1, the percent complete is reported relative to the first year; for second quarter onward, the percent complete is reported relative to the entire 5 year project.

Contingency Summary ($ in thousands)								
1.2 SAFOD	Percent Complete*	Ending Balance	1.3 PBO	Percent Complete*	Ending Balance	1.4 USArray	Percent Complete*	Ending Balance
Start	0	419	Start	0	981	Start	0	687
Yr1 Q1	2	419	Yr1 Q1	1	1007	Yr1 Q1	6	687
Yr1 Q2	2	419	Yr1 Q2	2	432	Yr1 Q2	3	687
Yr1 Q3			Yr1 Q3			Yr1 Q3		
Yr1 Q4								
Yr2 Q1								
Yr2 Q2								
Yr2 Q3								
Yr2 Q4								
Yr3 Q1								
Yr3 Q2								
Yr3 Q3								
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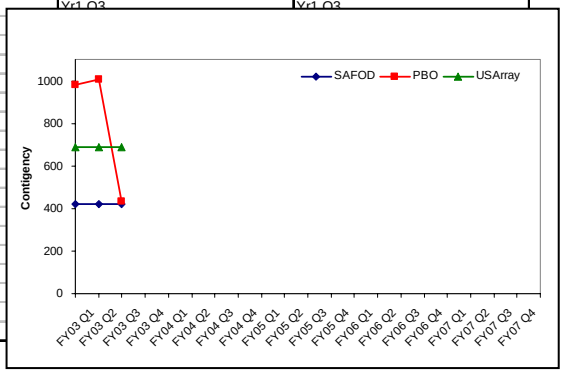
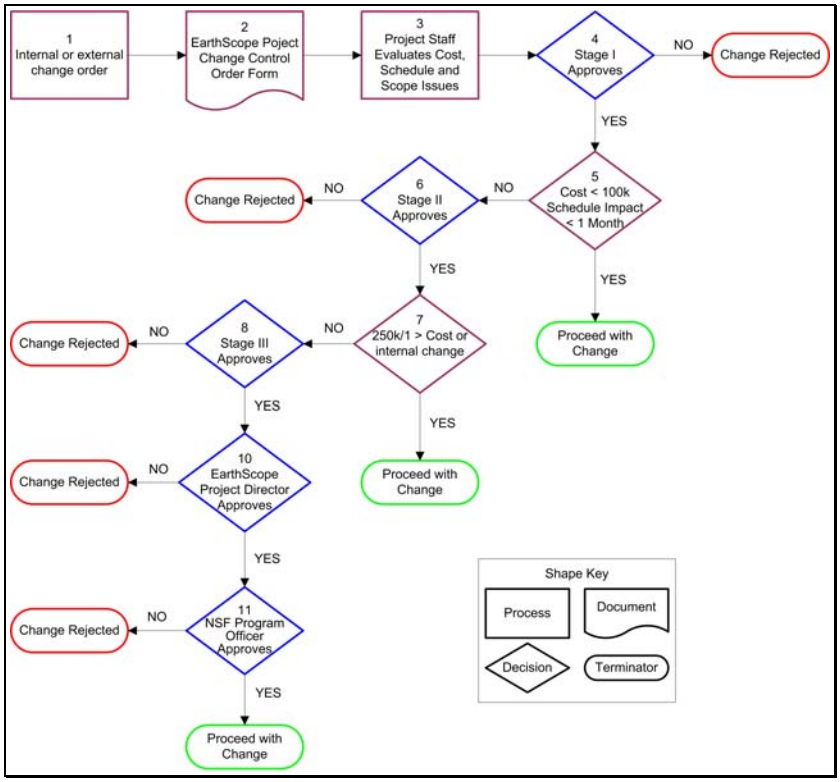


**For the first quarter of Year 1, the percent complete is reported relative to the first year; for the second quarter onward, the percent complete is reported relative to the entire 5 year project.*

Change Orders

The approval process for proposed project change is illustrated below. It is multi-tiered with the approval process based on both the dollar value and schedule impact of the proposed change. Proposed changes less than $250,000 or with an impact of less than one month are approved within their management component, sometimes with advisory committee consultation. For proposed changes over $250,000 or with an impact of over month, the change must also be approved by EarthScope Director and NSF Program Officer.



For Year 1, there have been 12 changes so far to the EarthScope project. Descriptions of the change orders and their current status are listed by WBS Level 1.

1.1 No Change Requests.

1.2 No Change Requests.

1.3 Six Change Requests:

PBO-1: In response to a National Science Foundation (NSF) mandate, UNAVCO Inc. submitted an Indirect Cost Rate (ICR) Proposal (October 30, 2003) affecting the budgeted baseline of the PBO Program. In the original proposal, PBO's share of UNAVCO headquarters costs were charged directly to the project at 30% of the total UNAVCO Inc. expenses. Per the ICR Proposal these costs, starting January 1, 2004, will be charged as an indirect rate. The allocation of costs based on a total cost input base result in PBO realizing a higher share of the total UNAVCO Inc. headquarters going to 60% in the first fiscal year. This action shifts $303,498 from MR/Contingency to Headquarter Overhead. This order also includes $85,502 shift from Management Reserve/Contingency to the PBO facility account. This facilities rate covers all facility expenses except those incurred in the regional offices which are charged direct to PBO. Facilities include costs such as building lease, utilities,

telephone, and Internet connectivity. These costs were underestimated in the original plan and this transaction corrects this omission.

- Requested by B. Stephanus on December 31, 2003 for a cost $389,000.
- Stage I approved by M. Jackson on January 20, 2004.
- Stage II approved by W. Prescott on February 9, 2004.
- Approved by Project Director on March 30, 2004.

PBO-2: This request for Contingency/Management Reserve is to shift the start of the Longbase Laser Strainmeter Subaward from Year 2 to Year 1. This allows the University of California to retain their key technical capabilities that are essential in constructing 5 PBO units. In addition this will allow UC a better overall project schedule. This additional time should lessen both program and technical risk. This Year 1 funding is for two thirds of the first unit.

- Requested by B. Stephanus on December 31, 2003 for a cost of $327,000.
- Stage I approved by M. Jackson on January 20, 2004.
- Stage II approved by W. Prescott on February 9, 2004.
- Approved by Project Director on March 30, 2004.

PBO-3: This addition of funds to Contingency/Management Reserve is due to the following: fine tuning salary budgeted rates to reflect regional market conditions, adjusting time phased budget to reflect the planned hiring schedule, and delay in hiring four positions until Year 2. The original budget had many positions starting on October 1, 2003 which allowed little time for a prudent screening and hiring process. Although most senior positions were staffed in October other regional and subordinate positions have been hired as the regional facilities and management structure have been developed. This resulted in some positions being hired in the November through February time frame. This has resulted in a refinement of the plan and will not impact the Year 1 Production Schedule. The EarthScope Data Integrator, Project Accountant, Borehole Strainmeter Products (1 of the 2 planned) positions have been delayed until Year 2. These delays should not impact the project and if they later are found to impact project schedule they will be reinstated in Year 1.

- Requested by Blaise Stephanus on December 31, 2003 for a cost of $448,661.
- Stage I approved by M. Jackson on January 20, 2004.
- Stage II approved by W. Prescott on February 9, 2004.
- Approved by Project Director on March 30, 2004.

PBO-4: Original budget was revised based on technical and price productivity improvement in the GPS receiver and antenna market. The average price of the receiver/antenna set has been revised from $8200 to $6200. This change order revises the Year 1 budget to correspond with these new market conditions.

- Requested by Blaise Stephanus on December 31, 2003 for a cost of $100,000.
- Stage I approved by M. Jackson on January 20, 2004.
- Stage II approved by W. Prescott on February 9, 2004. Approval process complete.

PBO-5: Travel was omitted in the original personnel estimates other than the Data Products Manager. This adjustment adds a modest travel budget to other Data Products personnel for Year 1.

- Requested by Blaise Stephanus on December 31, 2003 for a cost of $10,300.
- Stage I approved by M. Jackson on January 20, 2004. Approval process complete.

PBO-6: This transaction is to correct original estimation errors in Data & Data Products Subcontracts. Subcontract raw dollar value is increased by 40% to allow for subcontractor burden (at their facility). The original estimate only listed the likely wages they would pay their personnel. Dollars were applied from Contingency/Management Reserve to the tasks. The original estimate anticipated these costs as labor which included a fringe rate. This transaction backs out the fringe costs. Dollars were taken from the tasks and applied to Contingency/Management Reserve.

- Requested by Blaise Stephanus on December 31, 2003 for a cost of $9,437.
- Stage I approved by M. Jackson on January 20, 2004. Approval process complete.

PBO-7: It is estimated that at least 2% (8 of 400) of the sites in California will not be accessible by the PBO GPS installation trucks. In these cases, an ATV would be an ideal alternative to a helicopter in bringing installation hardware (compressors, generators, welders, batteries, enclosures, etc.) to the site. The purchase of a heavy-duty AWD ATV with cargo box, such as the Polaris ATP 500, would give PBO the ability to install GPS stations in otherwise inaccessible areas in California. Although this cost was not in the original budget, this is a request from management reserve for $5,500 for the purchase of the Polaris ATP 500 (or similar ATV) plus registration, insurance, etc. We recommend that the use of this vehicle be shared between the California regions or until the sharing becomes ineffective or until the regional need for the vehicle increases dramatically.

- Requested by Karl Feaux on January 5, 2004 for a cost of $4,999.
- Stage I approved by M. Jackson on February 9, 2004. Approval process complete.

PBO-8: This transaction is to add equipment to the Year 1 Computer and IT budget to cover GIS, improved remote office connectivity, and improved security. $32,481 of the $86,110 request involves purchase of a plotter, two Sun Servers, and RAID and tape storage devices along with supporting software. The plotter was originally scheduled to be purchased with Year 2 GeoEarthScope funds. The balance was scheduled to be purchased in Year 2 to primarily support the Data and Data Products area. Early purchase of these items allows the project an early start on many critical tasks. $15,601 of the $86,110 request is to support better network (VPN) connectivity between the main and remote offices. This is critical for effective PBO operations. In addition, IT security has been enhanced with firewalls and specialized devices. $9,002 of the $86,110 is additional headquarters costs associated with these costs.

- Requested by B. Stephanus on February 19, 2004 for a cost of $86,110.
- Stage I approved by M. Jackson on March 9, 2004. Approval process complete.

PBO-9: This transaction is to correct an error in the Pacific Northwest (PNW) regional budget. During the Year 1 baseline process, $36,062 was omitted from the final budget version for the PNW office. This covered office/warehouse lease, utilities/office supplies budget, and office furniture. Similar budgets were included for the other remote offices (except RM which is collocated at the Boulder facility). This change order corrects the error.

- Requested by B. Stephanus on February 19, 2004 for a cost of $36,062.
- Stage I approved by M. Jackson on March 9, 2004. Approval process complete.

PBO-10: This transaction is to add tooling and safety equipment to Year 1. Some short drill brace tooling equipment was included in the original budget, but in general, safety equipment and tooling was largely omitted from the Year 1 budget. This transaction corrects that omission and provides a detailed listing of the equipment and supplies (included on an attachment).

- Requested by B. Stephanus on February 19, 2004 for a cost of $128,735.
- Stage I approved by M. Jackson on March 9, 2004.
- Stage II approved by W. Prescott on March 18, 2004. Approval process complete.

PBO-11: This transaction is a shift of $22,000 to the Year 1 budget for Bore Hole Strainmeter Studies (06.02.02) from program contingency. The action was initiated by the PBO Director based on the recommendation of the PBO Standing Committee. The cost of one Bore Hole Strainmeter ($134,920) will be shifted over the life of the project toward study activities. This shift of funds will be initiated with Year 2 budget. To start activities in Year 1, $22,000 has been taken from contingency which will be paid back in Year 2.

- Requested by B. Stephanus on February 19, 2004 for a cost of $22,000.
- Stage I approved by M. Jackson on March 9, 2004. Approval process complete.

PBO-12: This transaction is a shift of $124,000 from PBO Program Contingency/Management Reserve to PBO Task 03.02.08 for early procurement of 20 additional GPS/antenna units. These are scheduled to be delivered in June/July 2004. Delivery of these units will allow greater flexibility in the PBO installation schedule. Installation crews will then be allowed to make complete installations ahead of schedule without GPS instrument shortages. This will allow the unit installations to occur with fewer trips to the site and therefore minimize potential cost growth and schedule delays. This is actually a shift forward of deliveries and Year 5 GPS/antenna quantities will be reduced by a corresponding 20 units. Since PBO does not have access to Year 5 funding at this time, the necessary budget is taken out of this year's Contingency/Management Reserve.

- Requested by B. Stephanus on March 30, 2004 for a cost of $124,000.
- Stage I approved by M. Jackson on March 30, 2004.
- Stage II approved by W. Prescott on March 30, 2004. Approval process complete.

1.4. No Change Orders.

Part III: Project Concerns and Action Plans

Overall Concerns and Action Plans

Project concerns relate both to the development of the facility and to the overall attainment of EarthScope goals. The major concerns, which relate to the overall attainment of EarthScope goals, are listed below. Specific concerns related to the development of the facility follow along with proposed action plans.

1. NSF EAR R&RA Funding: EarthScope's goal for a comprehensive understanding of the structure and dynamics of the North American continent requires the active participation of the broad scientific community and a fully-integrated, multi-disciplinary research program. As a result, EarthScope is committed not only to the collection of data, but also to insuring the use of the data by the largest possible number of scientists and educators. Sufficient funding is needed to support proposals for EarthScope science, and for preserving the health of the disciplinary research program.

2. Operations and Maintenance: Funding from the MREFC account is being used to construct the EarthScope facility in accordance with the account's guidelines. Once construction is complete, funding will be required for the following 15 years to manage, maintain, and operate EarthScope, and to support the science and educational activities associated with it. Out-year funding projections for EarthScope contained within the Fiscal Year 2004 NSF Budget Request are approximately 50% of EarthScope's current estimates. EarthScope and NSF need to establish the appropriate level of support that is needed and will be available to sustain EarthScope.

3. EarthScope Portal: All EarthScope data will be archived in established, open data management systems. An EarthScope Portal, with common data products and tools, is required to make EarthScope data readily accessible to promote interdisciplinary research. While the development of products and tools will be done primarily through university-based proposals, the overall architecture of the portal will be developed and maintained by EarthScope. The ESEC has formed a subcommittee to develop specific recommendations for data products, and the EarthScope office is hiring a web specialist to help develop and maintain the EarthScope Portal architecture. Community input, oversight, and review – either through the ESEC or an EarthScope committee – is needed for this task.

4. EarthScope Education and Outreach: The development of an effective EarthScope Education and Outreach program has been a concern ever since EarthScope was funded. This concern is being addressed through the development of a proposal for submission to the R&RA account to support an EarthScope Educational and Outreach Coordinator within the EarthScope office. The proposal has gone through internal review and will be submitted to the NSF by the end of June.

Project-specific Concerns and Action Plans

1.1 EarthScope Management

1. Concern: The Estimated Actual Cost associated with 1.1 EarthScope Management will exceed the Budgeted Actual Cost by $412,887. A full explanation, description of the variances, and a detailed budget explanation was provided on page 31 of the *FY 2003 1st Quarter Report (September 1, 2003 – December 31, 2003)*.

   Action: To correct this shortfall, we proposed on March 26, 2004 that from within the Fiscal Year 2003 award, funds in the amount of $412,887 be added to Cooperative Support Agreement #032310 (EarthScope Office) and decreased from Cooperative Agreement #0323309 (USArray). NSF denied this request. NSF will not allow such a transfer of funds between Cooperative Agreements during the

fiscal year. As an alternative, we are now proposing that NSF "forward award" the second year of funding for EarthScope Management. To accommodate the forward funding of $412,887 for EarthScope Management, we will implement changes in both the EarthScope Management and USArray funding schedules such that none of the annual totals are changed and none of the component five-year totals are changed. Unless this forward funding is approved, the EarthScope management line will run out of funds in May.

1.2 SAFOD

No Concerns: Previous legal problems with Sandia National Laboratory for the Stage 2 monitoring equipment development appear to now be resolved.

1.3 PBO

1. Concern: PBO management continues to be concerned about the acceptance of permits submitted. Permitting is the key limiting activity in the installation process of both GPS and strainmeter instruments.

   Action: Continue working closely with federal, state, and municipal organizations to emphasize the rapid turnaround required. Improve procedures for coordinating with USArray.

2. Concern: PBO management continues to be concerned about ongoing discussions by the PBO Standing Committee with respect to the viability of the borehole strainmeter and possible recommendations in delaying the installation schedule.

   Action: Work closely with the PBO Standing Committee to resolve outstanding issues and finalize siting plans.

3. Concern: PBO management is concerned about start-up costs for the borehole strainmeter system. Discussions with manufacturers indicate that a funding profile requires an infusion of start-up money and high instrumentation costs are required early in the project. Instrument costs would taper to lower levels in Years 3-5 resulting in a ~$75,000/instrument cost. There are two concerns: 1) PBO strainmeters were budgeted on a per instrument cost of $45,000 assuming a specific installation schedule. This is less than the ~$75,000 average cost over the 5 year MREFC project. 2) PBO does not have funds allocated to cover large start-up costs for strainmeter production (estimated to be ~$400,000).

   Action: Continue to work with strainmeter manufactures, PBO Budget Coordinator, UNAVCO Inc. Contracts Officer, and NSF sponsors to refine start-up and production costs.

4. Concern: PBO Management is concerned with pressure from the scientific community to change continually the proposed locations of PBO stations. Such changes are difficult from a construction perspective, as they result in an evolving target plan. We have to balance *ad hoc* re-planning activity with legitimate evolving science targets and the realities of permitting stations on the geographic extent of PBO.

   Action: The PBO Director will continue to work in an effective and constructive manner with the PBO Site Selection Working Groups and the scientific community to balance scientific and operational objectives.

5. Concern: PBO management is concerned that we are under-running our expected budget. This has overall implications for the project and for UNAVCO Inc. overhead rate distribution.

Action: PBO budget under-runs are due to delayed staff starts in drilling, contract support, material and equipment purchases, and from opening the regional offices later than anticipated. We will closely monitor expenditures in the next two quarters for Year 1. We anticipate that spending will increase with planned summer installation activities.

1.4 USArray

1. Concern: During the months of March, April and May of 2004, the Albuquerque Seismological Laboratory will be heavily involved in the reconstruction of and move to the Isleta facility.

   Action: We do not expect to completely shutdown during this time period, but there may be delays in some of the previously proposed work during this time window. This delay will extend through April, and possibly into early May.

2. Concern: Quotes have been sought for the purchase of six STS-1 seismometers for the Global Seismograph Network stations within the ANSS Backbone Array. We have been informed that the sensors are no longer available for purchase.

   Action: USArray Backbone is currently reviewing its contingency options.

3. Concern: Experiments were funded by NSF for use of instruments in the summer 2004, prior to the planned procurement of USArray equipment.

   Action: Coordination should be improved between EarthScope, the National Science Foundation (NSF), and the user community on the availability and schedule of instruments for use by Principal Investigators (PI) in Research and Related Activities funded experiments. IRIS/PASSCAL has been able to provide instruments from the core PASSCAL pool. In the future, the NSF Program Announcement and the EarthScope website should provide potential PI's with details on the procedures for submission of instrument requests and the schedule for availability of instruments.

Appendix: Acronym List

AC	Actual Cost
ACWP	Actual Cost of Work Performed
ANSS	Advanced National Seismic System
ASL	Albuquerque Seismological Laboratory
AAAS	American Association for the Advancement of Science
AGU	American Geophysical Union
AASG	Association of American State Geologists
BAIS	BUD Archive Transfer System
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BUD	Buffer of Uniform Data
BAC	Budgeted Actual Cost
BLM	Bureau of Land Management
CV	Cost Variance
CDR	Critical Design Review
DMC	Data Management Center
DOSSEC	Drilling, Observation, and Sampling of the Earth's Continental Crust
EAC	Earned Actual Cost
EV	Earned Value
EVM	Earned Value Management
EFEC	EarthScope Facilities Executive Committee
ESEC	EarthScope Science and Education Committee
E&O	Education and Outreach
GIS	Geographic Information Systems
GPS	Global Positioning System
GSN	Global Seismographic Network
GPRA	Government Performance and Results Act
IRIS	Incorporated Research Institutions for Seismology
IAGT	Institute for the Advancement of Geospatial Technology
ICDP	International Continental Drilling Program
NEPA	National Environmental Protection Act
NSF	National Science Foundation
PANGA	Pacific Northwest Geodetic Array
POD	PBO Operational Database
PV	Planned Value
PBO	Plate Boundary Observatory
PDR	Preliminary Design Review
PI	Principle Investigator
PASSCAL	Program for Array Seismic Studies of the Continental Lithosphere
PEP	Project Execution Plan
RAID	Redundant Array of Independent Disks
R&RA	Research and Related Activities
SAFOD	San Andreas Fault Observatory
SV	Scheduled Variance
SCIGN	Southern California Integrated GPS Network
USArray	United States Array
USFS	United States Forest Service
USGS	United States Geological Survey
UNAVCO	University Navstar Consortium
WBS	Work Breakdown Structure