EARTHSCOPE:
COMMUNITY COLLABORATION IN DISTRIBUTED SCIENCE

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EarthScope is a bold and ambitious undertaking to apply modern observational, analytical and telecommunications technologies to investigate the structure and evolution of the North American continent and the physical processes controlling earthquakes and volcanic eruptions.
EarthScope - the Plan
2003 MREFC Proposal
NSF FACILITIES AND RESEARCH

Physics and Astronomy
- LIGO - ALMA – IceCube – LHC - etc
- Experiment based
- Hypothesis driven
- Hierarchical
- Controlled data access and publication
- “Bricks and mortar” infrastructure
- Highly leveraged (DoD and DoE)
- Multi-national funding
- Decadal priority for experiments

Geosciences
- EarthScope - Ocean studies - Climate
- Discovery based
- Data driven
- Community governed
- Open data sharing
- Distributed observatories
- Collaborative
- Global partnerships
- Decadal-scale observations
WHAT NEXT?

The “Next Big Thing”

- In the Spirit of EarthScope
  - Sustain what has worked
  - Extend disciplinary engagement
  - Extend geographical reach
  - Enhance global partnerships
  - Refine observational success
  - Harvest existing observations
- Something Completely New
  - ????

The “Big Picture”

- Follow through on the EarthScope goal: “Understanding the structure and evolution of the continent and the physical processes controlling earthquakes and volcanoes”
- Reach beyond exciting individual discoveries, techniques and applications
- Synthesize, consolidate and integrate
- Demonstrate how our discoveries are, or can be, “transformational”
MOVING FORWARD

• **Demonstrate Success and Impact**
  • Explore ways to synthesize and consolidate the discoveries of EarthScope
  • Find new ways of developing and demonstrating integrated, cross-disciplinary science
    "the sum is greater that the parts"

• **Celebrate Differences**
  • Articulate and take pride in our scientific culture

• **Build on our Strengths**
  • Work with NSF to provide public, scientific and international visibility to EAR and EarthScope
  • Pursue the relevance of Earth Science
The face of our continent reflects the variety of geological forces that sculpted the landforms of the nation. Volcanic centers and active earthquake zones continue to shape the rugged and geologically young mountain ranges like those found in Hawaii, many of the western states and Alaska. In the east, the remnants of old and eroded mountain ranges border the coastline and scattered pockets of earthquake activity testify to the ongoing deformation of the continental interior. Written in the sediments and structures of the Great Plains is a complex history of even older cycles of deformation and erosion.

EarthScope will create a linked infrastructure for a continent-scale observatory of remote sensing geophysical instruments to probe deep beneath the surface, illuminate the underlying structure of the continent and help understand the variety of processes that continue to build and change the North American continent.

At the core of USArry will be a transportable array of 400 portable instruments that will gradually roll across the entire US over a ten year period, making 1-2 year-long observations at a total of 2000 sites. A permanent network of approximately 120 stations will provide long-term continuity to link together the data from the temporary deployments. Additional high resolution instruments will provide opportunities for special experiments in areas of special geological interest.

The backbone of the Plate Boundary Observatory will be an array of permanent stations equipped with GPS receivers and strain meters, extending along the western margin of North America from Mexico to Alaska. In the conterminous US and Alaska, existing sites will be augmented with 800 new sites to provide continuous observations at a spacing of approximately 150 km. Complete coverage of the plate boundary will require collaborative programs to install stations (gray) in Canada and Mexico, extending the network to cover all of North America.

Clusters of additional instruments will be installed on volcanoes, along the San Andreas system and near other major faults, to provide higher resolution studies of areas of high tectonic activity.

Deep within an active fault zone, the San Andreas Fault Observatory at Depth (SAFOD) will sample the fractured sub-surface of the fault and changes in fault properties below, using and other geophysical techniques. This instrument will help define the extent to which direct observations will define the extent to which our models accurately predict the response of the environment to regional and local changes in stress and provide a new understanding of the processes that shape earthquake nucleation and rupture.