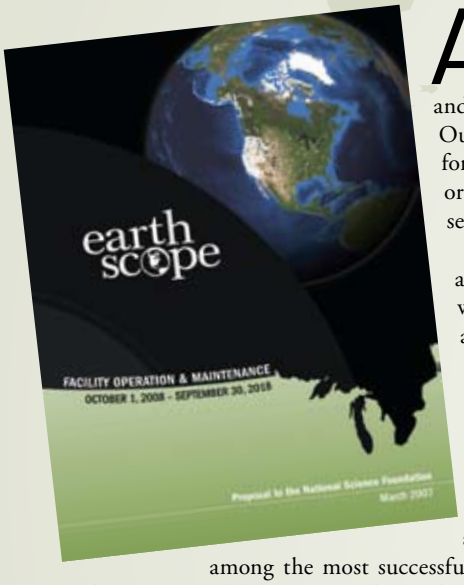
2008 IRIS at a Glance

IRIS
Incorporated Research Institutions for Seismology
www.iris.edu

Statement From the Chair

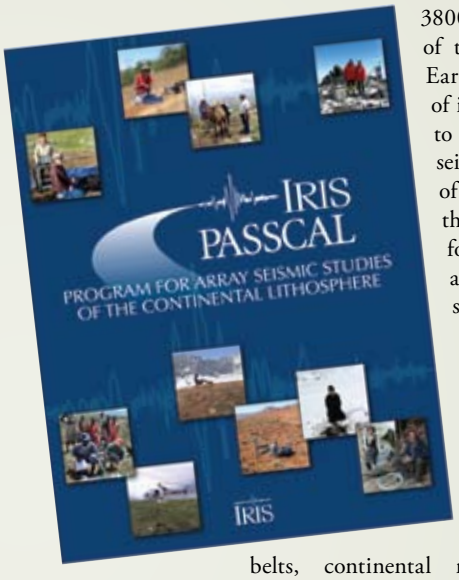


As the chair of the IRIS Board of Directors I am amazed at the depth and breadth of IRIS activities. Out community is extremely fortunate to have such an organization to operate our seismological infrastructure.

Construction of USArray as part of EarthScope was completed on time and on budget when the MREFC award ended on September 30, 2008. Thanks to the hard work of many individuals and organizations – especially UNAVCO, Stanford, and IRIS – EarthScope is among the most successful large projects funded by NSF. The Transportable Array is rolling, Flexible Array instruments are deployed in numerous projects, and high quality data flowing in quantities we would not have imagined just a few years ago.

I am confident that USArray will continue to deliver high quality data as EarthScope moves to its full Operations and Maintenance mode, and our challenge is to make exciting new discoveries. Over the past five years, NSF has funded numerous workshops and over 75 science EarthScope proposals, most with multiple PIs. The next few years will be exciting, as we see results emerging that will transform our thinking about how the North American continent evolved.

Congratulations to the PASSCAL staff on a great result from its recent program review. I was fortunate to attend the review and was impressed with the PASSCAL operation and especially the commitment of the IRIS and New Mexico Tech staff. PASSCAL has supported the deployment of



3800 stations worldwide in some of the most remote places on Earth, operates many thousands of instruments, and has helped to train a new generation of seismologists. The success of PASSCAL is reflected in the ever-growing demand for portable instruments to address a widening range of scientific questions.

As the PASSCAL review notes, the scientific impact of the program has been tremendous. There are new discoveries ranging from the crust to the core of the Earth – about the formation of mountain belts, continental rifting, subduction zone dynamics, mantle plumes & hotspots, cratonic roots, crustal evolution, and mantle convection, just to name a few. PASSCAL has played a role in recording events related to glacial melting and climate change, and become a leader in harsh environment seismic deployments with their pioneering work in Antarctica.

While I am extremely optimistic about IRIS, we continue to face challenges. The IRIS Core Programs remain strong but are strained by tight budgets despite working to improve efficiencies and attract other sources of funding. I urge everyone to participate in IRIS activities to ensure a strong future for seismology, including the biennial IRIS Workshops, and the annual IRIS Members meetings at AGU each December. I welcome comments and ideas from the community as we move IRIS forward, and I thank all of the partners that work with IRIS, the community members who serve on IRIS committees, IRIS staff, and NSF program managers.

Susan Beck

Board of Directors

Susan Beck (Chair)	University of Arizona
Charles Ammon (Vice Chair)	Pennsylvania State University
Kenneth Creager	University of Washington
Don Forsyth	Brown University
James Gaherty	Columbia University
Steve Roecker	Rensselaer Polytechnic Institute
Anne Sheehan	University of Colorado
Brian Stump	Southern Methodist University
Suzan van der Lee	Northwestern University

IRIS NSF USGS science for a changing world

The Incorporated Research Institutions for Seismology is a university research consortium dedicated to exploring Earth's interior through the collection and distribution of seismographic data. IRIS programs contribute to scholarly research, education, earthquake hazard mitigation, and monitoring of nuclear explosions. IRIS operates facilities in partnership with the US Geological Survey, and with funding from the National Science Foundation, other federal agencies, universities, and private foundations.

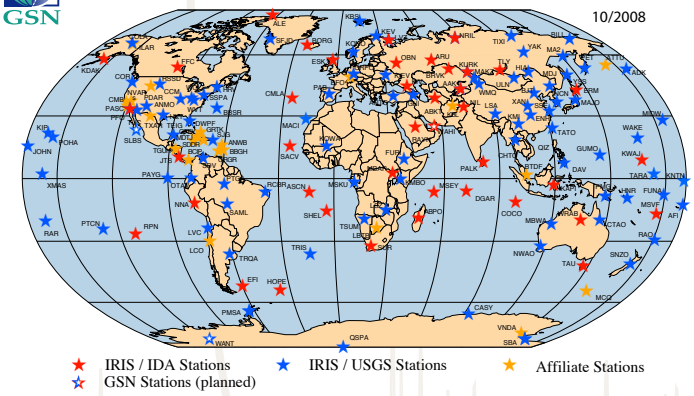
Global Seismographic Network

The Global Seismographic Network is a permanent network of state of the art seismological and geophysical sensors connected by available telecommunications to serve the scientific research and monitoring requirements of our national and international community. All GSN data are freely and openly available to anyone via the Internet. Installed to provide broad, uniform global coverage of Earth, 151 GSN stations are now sited from the South Pole to Siberia and from the Amazon basin to islands in the Indian Ocean, in cooperation with over 100 host organizations and seismic networks in 69 countries worldwide. The GSN coordinates closely with other international networks through the International Federation of Digital Seismograph Networks (FDSN), of which the IRIS is a founding member.

The GSN is primarily operated and maintained through the USGS Albuquerque Seismological Laboratory and through the University of California at San Diego IRIS/IDA group. Twenty GSN-Affiliate stations and arrays contribute to the network, including the 9-station USGS Caribbean Network and a new USGS/AFTAC station in Afghanistan. In collaboration with the U.S. National Earthquake Information Center, the GSN and NEIC are principal global sources of data and information for earthquake locations, earthquake hazard mitigation, and earthquake emergency response. In collaboration with National Oceanic and Atmospheric Administration Tsunami Warning Centers and Japanese Meteorological Agency, the GSN provides essential data for tsunami warning response globally. The GSN is an official observing system within the Global Earth Observing System of Systems (GEOSS).

GLOBAL SEISMOGRAPHIC NETWORK

GSN



GSN Standing Committee

Xiaodong Song (Chair)	University of Illinois at Urbana–Champaign
Susan Bilek	New Mexico Tech
Emile Okal	Northwestern University
Miaki Ishii	Harvard University
Laura Kong	UNESCO
David McCormack	Natural Resources Canada
Jeff McGuire	Woods Hole Oceanographic Institution
Fenglin Niu	Rice University
Jeroen Ritsema	University of Michigan
Bill Lieth	US Geological Survey, Reston
Rhett Butler	GSN Program Manager

PASSCAL

The Program for Array Seismic Studies of the Continental Lithosphere provides and supports a range of portable seismographic instrumentation and expertise to diverse scientific and educational communities. Scientific data collected with PASSCAL instruments are required to be archived at the IRIS Data Management Center. The access to professionally supported state-of-the-art equipment and archived, standardized data has revolutionized the way seismological research is conducted in the US. By integrating planning, logistical, instrumentation and engineering services and supporting the efforts with full-time professional staff, PASSCAL has enabled the seismology community to mount hundreds of large-scale experiments throughout the United States and around the globe at scales far exceeding the capabilities of individual research groups. Individual scientists and project teams can now focus on optimizing science productivity, rather than supporting basic technology and engineering. Small departments and institutions can now compete with large ones on a equal footing in instrumentation capabilities. Scientists working outside of traditional seismological subfields now have the ability to undertake new and multidisciplinary investigations. Standardized equipment and data formats greatly advanced long-term data archiving and data re-use for novel purposes.

Experiment participants install an air cell powered station in western Wyoming. The University of Arizona led La Barge experiment explores the viability of closely spaced broadband stations over a producting gas field for imaging and monitoring.

PASSCAL has also influenced academic seismology in all parts of the world explored by US seismologists, and the program has on many occasions provided significant instrumentation to spur or augment international collaborations. Many of the standards and facilities pioneered by IRIS for instrumentation and data collection, archival and open exchange have been adopted by other groups in the United States and by seismological networks and organizations worldwide. This open-data culture has been embraced by other US data collection groups, and obligatory data archival requirements and standards have increasingly been stipulated by federal agencies.

PASSCAL Standing Committee

Alan Levander (Chair)	Rice University
Richard Allen	University of California, Berkeley
Matthew Fouch	Arizona State University
Tom Pratt	US Geological Survey, Seattle
Stephane Rondenay	Massachusettes Institute of Technology
Arthur Rodgers	Lawrence Livermore National Lab
Ray Russo	University of Florida
Lara Wagner	University of North Carolina, Chapel Hill
George Zandt	University of Arizona
James Fowler	PASSCAL Program Manager

Data Management System

The Data Management System receives, provides quality assurance, archives and distributes data from the GSN and PASSCAL programs, the USGS ANSS backbone, USGS and NOAA supported regional networks, EarthScope/USArray, networks of the International Federation of Digital Seismograph Networks, and other sources. The heart of the DMS is the Data Management Center in Seattle, WA, with the largest seismological data collection in the world that now exceeds 75 terabytes of observational data.

GSN data reach the DMC via real-time telemetry to the IDA facility at the University of California, San Diego, and the USGS's Albuquerque Seismological Laboratory. Principal Investigators and New Mexico Tech staff at the PASSCAL Instrument Center review PASSCAL data before they are made available from the DMC. The DMC also performs automated quality control on most real time data. Data Handling Interface servers at the DMC, ORFEUS in the Netherlands, NCEDC at Berkeley, the SCEDC at USC, and elsewhere, enable user applications to interact directly with distributed waveform server databases while performing analyses or integrating seismic and other types of data.

Currently, the DMC distributes data at a rate of about 28 terabytes per year, roughly twice the rate of data input. In the time it takes to read this page, the DMC will send roughly 300 megabytes of seismological data to fulfill researcher data requests! The DMS has transformed the manner in which seismology is now done, partly by developing Internet request tools that allow access to these data at the sample level. The data distribution statistics we now see attest to the central role that IRIS plays in modern seismological research.

At the DMS's third Metadata Workshop, in Kuala Lumpur, Malaysia, 55 seismologists from 22 countries learned about the latest tools for reliably collecting and documenting seismological data. A fourth Metadata Workshop is planned in Cairo, Egypt, during September 2009.

DMS Standing Committee

Doug Wiens (Chair)	Washington University
Chaitan Baru	University of California, San Diego
Elizabeth Cochran	University of California, Riverside
Paul Earle	US Geological Survey, Golden
John Hole	Virginia Tech
Meredith Nettles	Columbia University
Mike Ritzwoller	University of Colorado, Boulder
Douglas Toomey	University of Oregon, Eugene
Bill Walter	Lawrence-Livermore National Laboratory
Timothy Ahern	DMS Program Manager

Education and Outreach

The Education and Outreach (E&O) program is committed to using seismology and the unique resources of the IRIS Consortium to make significant and lasting contributions to science education, science literacy and the general public's understanding of the Earth. The E&O program has continued its development and dissemination of a well-rounded suite of educational activities designed to impact a spectrum of learners, ranging from 5th grade students to adults. These learning experiences transpire in a variety of educational settings ranging from self-exploration in front of one's own computer, to the excitement of an interactive museum exhibit, a major public lecture, or in-depth exploration of the Earth's interior in a formal classroom.

The efforts of the IRIS E&O program have recently been focused on the refinement and enhancement of ongoing core activities, and the expansion of their impact. For example the Educational Affiliate membership category and the Undergraduate Internship program have increased IRIS' impact among their respective audiences of undergraduate faculty and students. The objective of Educational Affiliate membership is to cultivate a base of non-research colleges and universities committed to excellence in undergraduate geoscience education through the co-development of E&O activities designed to address their needs.

A growing number of people explore seismological concepts through our interactive Active Earth Display – a smaller, more flexible version of the IRIS museum display – which is now in use at universities and visitor centers throughout the US.

E&O Standing Committee

Michael Wysession (Chair)	Washington University, St. Louis
Ines Cifuentes	American Geophysical Union
Kevin Furlong	Pennsylvania State University
Sue Hough	US Geological Survey, Pasadena
Glen Kroeger	Trinity University
Gary Pavlis	Indiana University
Laura Serpa	University of Texas at El Paso
Laura Wetzel	Eckerd College
John Taber	E&O Program Manager

USArray

As part of the EarthScope Project, IRIS built and now operates USArray – comprised of the Permanent Array to complete the USGS Advanced National Seismic System backbone, the Flexible Array pool of portable seismograph stations, the Transportable Array rolling across the continental US, and temporary and permanent magnetotelluric stations.

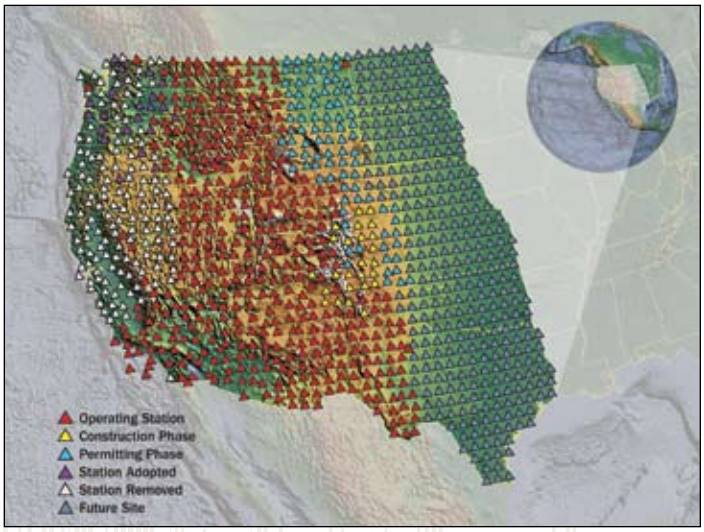
The major purchasing phase of the Flexible Array is now complete. The pool of 326 broadband stations, 120 short period stations and 1700 active source stations is operated by the PASSCAL Instrument Center staff at New Mexico Tech, who also provide experiment support and data download services.

With a station spacing of about 70 km, the Transportable Array is providing unprecedented coverage, enabling the production of high-resolution 3-D images of the Earth's interior and new insights into the earthquake process. The array consists of 400 transportable broadband seismic stations that are advancing across the country in a roll-along fashion. Each site is occupied for an average of 18 to 24 months and 400 broadband stations will occupy nearly 2000 locations over a period of 10-12 years. More than 600 Transportable Array sites have already been commissioned and the array is actively rolling eastward – over 150 stations in the western US have already been removed. Data availability for the Transportable Array stations has exceeded 90% for every month since operations were initiated, and availability is often above 95%. These high data return rates are the result of a careful station design, uniform station implementation, and network connectivity to all stations that allows near real-time state-of-health monitoring and initiation of corrective actions.

Daily updates on the status of the USArray and other EarthScope facilities are provided on the EarthScope home page (www.EarthScope.org) and plots of seismic data from both local and distant earthquakes show the quality and quantity of data already available for each event.

USArray Advisory Committee

Adam Dziewonski (Chair)	Harvard University
Michael Bostock	University of British Columbia
Göran Ekström	Columbia University
Matthew Fouch	Arizona State University
Rainer Kind	GFZ Potsdam
James Knapp	University of South Carolina
Thorne Lay	University of California, Santa Cruz
Joann Stock	California Institute of Technology
Rob van der Hilst	Massachusetts Institute of Technology
J. Douglas Walker	University of Kansas
Robert Woodword	USArray Director



Polar Operations

IRIS continues to expand its support capabilities in the world's cold regions through the Polar Support group at the PASSCAL Instrument Center. IRIS has long recognized the extra efforts and specialized equipment required to successfully conduct temporary and permanent seismic experiments in Antarctica and the northern polar-regions. Through two recent MRI awards, PASSCAL has developed and established a pool of specialized seismic equipment specifically designed to operate in the extreme cold environments. Along with the equipment, PASSCAL has created a dedicated staff to support this equipment and the investigators requiring data from the cold.

"Development of a Power and Communications System for Remote Autonomous Polar Observations" (in collaboration with UNAVCO) has successfully designed a system to record data continuously through the long Austral winter. The project has established test beds at the South Pole, McMurdo Station, and Minna Bluff. One of the systems at South Pole was constructed with the goal of operating autonomously through two winter seasons to determine the feasibility of skipping a year of maintenance visits, minimizing aircraft maintenance logistics requirements of future deep-field polar sites. Data from all the test systems are available in real time at the IRIS DMC.

"Acquisition of Cold Hardened Seismic Equipment" allowed the procurement of 35 cold hardened seismic systems designed in the first project. With the high demand for broadband sensors in Antarctica during the International Polar Year, including the Gamburtsev Antarctic Mountains Seismic Experiment and the Polar Earth Observing Network, all of the systems were immediately subscribed.

IRIS/PASSCAL personnel install a seismic station along the Trans-Antarctica Mountains in support of the POLENET program. (photo by Brian Bonnett - NMT/PIC)