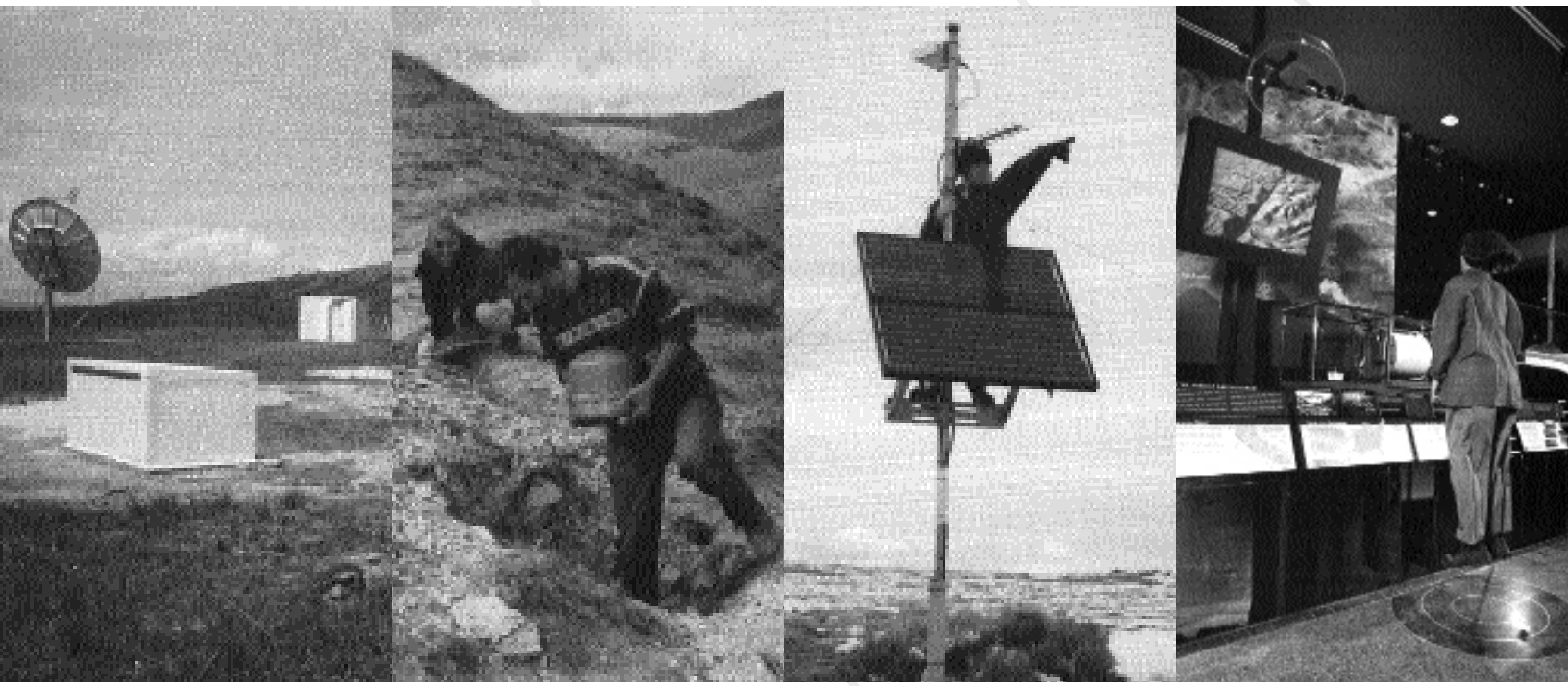
IRIS is a university research consortium dedicated to monitoring the Earth and exploring its interior through the collection and distribution of geophysical data.

IRIS programs contribute to scholarly research, education, earthquake hazard mitigation, and the verification of the Comprehensive Test Ban Treaty.

IRIS operates through a Cooperative Agreement with the National Science Foundation under the Division of Earth Science's Instrumentation and Facilities Program. Funding is provided by the National Science Foundation, the Department of Energy, the National Imagery and Mapping Agency, other federal agencies, universities, and private foundations. All IRIS programs are carried out in close coordination with the US Geological Survey and many international partners.



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Overview

It is often noted that one difficulty with life is that while we understand it backwards, we must live it forward. Yet even given the unknowns of forecasting, it is already clear that 1999 stands as a year of watershed opportunity for seismological research.

This year the Earth Science Division of the National Science Foundation began launching a major initiative, "Earthscope." A central part of Earthscope will be USArray, a new generation of portable instrumentation that promises to produce high-resolution, three-dimensional seismic images of North America's interior structure. Earthscope's images will allow us to unravel the geological formation of

Top: Anne Meltzer introducing the 11th Annual IRIS Workshop in Yosemite, California.

North America, and to see the convective forces and plate tectonic motions that produce our landscape, including such structures as the mid-continent rift, the Sierra Nevada uplift, the Rocky Mountains, the Yellowstone Hot Spot, and the San Andreas fault system.

Simultaneous with the Earthscope initiative, the US Geological Survey is preparing to install an Advanced National Seismic System (ANSS) across the United States. ANSS complements USArray by establishing permanent observatories to systematically record US seismicity, which, in turn, will yield accurate assessments of earthquake risk as we learn more about how and why earthquakes occur.

Against this buildup of new initiatives, the IRIS programs continue to provide a cornerstone for academic research in seismology. USArray, for example, is greatly facilitated by IRIS's strong communal approach to experiment design, data collection, and data distribution established through the precedence of the Global Seismographic Network, the shared PASSCAL instruments, and the open Data Management System. The success of the IRIS approach is clearly demonstrated both by the creation of strong communal facilities, and by the resulting increased numbers of scientists who are actively involved in exploring the Earth's interior.

Continuing the trend of fielding more experiments with more instruments each year, the PASSCAL program supported over 60 experiments in 1999. Yet demand for the instruments is unrelenting. The full instrument pool and the Broadband arrays are already scheduled to remain in near constant use around the world for the next two years. The development of a new PASSCAL instrument and the use of satellite communication systems will allow for more instruments to be deployed and maintained by fewer people in the future.

In 1999, the Global Seismographic Network (GSN) reaped the benefits of several years of site preparation work. New stations were installed in Botswana, Chile, Singapore, Brazil, Gabon, Uganda, South Dakota, Indonesia, the Marshall Islands, Midway Island, and Hawaii. Now standing at 119 stations, the GSN has surpassed the coverage provided by its predecessor, the WorldWide Standardized Seismographic Network. With continental coverage now over 95% complete, the GSN is focusing on oceanic coverage, real-time data distribution, and integration into the networks that are being used for earthquake hazards reporting and the monitoring of the Comprehensive Nuclear Test-Ban Treaty.

The main product of our Consortium is data; and the core of all our programs is the Data Management System. Our archive currently contains over 11 terabytes of data with over 3 million station day files. In 1999, the Data Management System responded to over 35,000 requests for data, shipping the data within a median time of one day. Approximately one-third of the data requests are now serviced automatically within a few minutes. Software development at the Data Management System allows for both customized access to on-line data, and for simply making more data accessible, faster, and in formats that are more readily useable.

We can not, however, continue to reap the benefits of federal funding without instilling within the public a fascination and appreciation for seismology. Accordingly, our Education and Outreach Program is dedicated to expanding the presence of seismology and geoscience in the classroom. Through teacher workshops, intern programs, the development of educational materials, the PEPP program, and an affiliation with Teach-For-America, teachers are now including seismology in hundreds of school programs across the country. The IRIS posters and museum displays are similarly introducing millions of viewers each year to the basic discoveries of our science.

Despite our programmatic accomplishments, the greatest strength of our Consortium remains its ability to represent the collective scientific interests of over 100 organizations. Over 50 scientists from more than 30 research institutions have been actively involved with the small professional staff in administering IRIS programs over the last year. Seven committees, four subcommittees, and a series of ad hoc advisory groups have worked with the President, the Director of Planning, and the four Program Managers in operating and expanding the facilities available for seismology. Yet new opportunities continue to arise, and we must always stand ready to reassess our priorities and reevaluate our programs to meet the evolving interests of the research community. To meet this challenge, we need your suggestions and guidance for developing programs that both advance our science and meet the needs of our society. We encourage all of you to be active within the Consortium, to have your views represented, and to provide us with your ideas.

The Consortium

Eleventh Annual IRIS Workshop

Tenaya Lodge, Fish Camp, Yosemite, CA
June 8–12, 1999

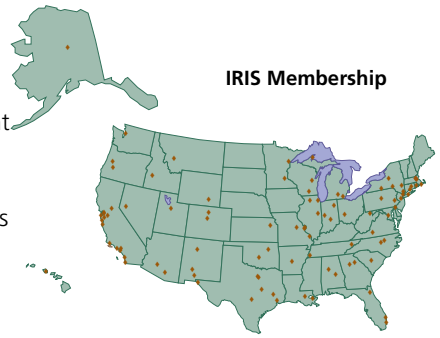
Each year IRIS convenes a workshop to review the state of the science and to discuss new ideas. The workshop provides an ongoing forum for input to IRIS programs and new initiatives; and provides an opportunity for demonstrations and training sessions. Through a student grant program, young scientists may attend the workshop at little or no cost, and thus become introduced to the programs and services of the Consortium.

Special thanks to the 1999 Workshop organizers: John Vidale and Gene Humphreys; the session chairs: Brad Hager, Michael Gurnis, and Tom Jordan; and a special thanks to the discussion group leaders: Jeffrey Park, Art Lerner-Lam, Alan Levander, Gary Pavlis, and Michael Wysession.

Governance

The IRIS management structure is an interface between the scientific community, funding agencies, and the programs of IRIS. The structure is designed to focus scientific talent on common objectives, to encourage broad participation, and to efficiently manage IRIS programs.

IRIS is governed by a Board of Directors consisting of representatives from each member institution. Operational policies are set by an Executive Committee elected by the Board of Directors. The Executive Committee, in turn, appoints members to the Planning Committee, the Program Coordination Committee, and to the four Standing Committees that provide oversight of the Global Seismographic Network (GSN), the Program of Array Seismic Studies of the Continental Lithosphere (PASSCAL), the Data Management System (DMS), and the Education and Outreach Program (E&O).



IRIS Membership

In addition, special advisory committees and ad hoc working groups can be convened for special tasks. It is the role of the Standing committees and the advisory subcommittees to develop recommendations for the Executive Committee which, in turn, evaluates and approves such recommendations on behalf of the Board of Directors.

IRIS Member Institutions

Institution—*Board Member • Alternate*

University of Alabama
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University of Alaska
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Arizona State University
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University of Arkansas at Little Rock
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Peter Schearer • Jon Berger
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Craig Nicholson • Ralph Archuleta
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Thorne Lay • Susan Schwartz
Carnegie Institution of Washington
Paul Silver • Selwyn Sacks
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Timothy Melbourne • Charles Rubin
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Colorado School of Mines
Thomas M. Boyd • Kenneth Larner
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Paul G. Richards • Arthur Lerner-Lam
University of Connecticut
Vernon F. Cormier • Lanbo Liu
Cornell University
Muawia Barazangi • Dogan Seber
University of Delaware
Susan McGeary
Duke University
Peter Malin • Eylon Shalev
Florida International University
Dean Whitman
University of Georgia
Robert Hawman • James Whitney
Georgia Institute of Technology
Leland T. Long • James Gaherty
Harvard University
Göran Ekström • Jeroen Tromp
University of Hawaii at Manoa
Gerard Fryer • Charles Helsley
IGPP/Lawrence Livermore National Laboratory
William Walter • Peter Goldstein
IGPP/Los Alamos National Laboratory
Hans Hartse • Leigh House
University of Illinois at Urbana Champaign
Wang-Ping Chen
Indiana University
Gary L. Pavlis • Michael Hamburger
Indiana University/Purdue University at Fort Wayne
Dipak Chowdhury
University of Kansas
Ross A. Black • Geoffrey Abers
Lawrence Berkeley National Laboratory
D.W. Vasco • E.L. Majer
Lehigh University
Anne Meltzer
Louisiana State University
Juan Lorenzo • Roy Dokka
Macalester College
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Thomas H. Jordan
University of Miami
The University of Memphis
Jer-Ming Chiu • Arch Johnston
University of Michigan
Larry Ruff
Michigan State University
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New Mexico Institute of Mining & Technology
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James Ni • Thomas Hearn
State University of New York at Binghamton
Francis T. Wu • Jeff Barker
State University of New York at Stony Brook
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Northern Illinois University
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The University of Oklahoma
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Brian J. Mitchell • Charles J. Ammon
San Diego State University
Steven M. Day • Eric Frost
San Jose State University
Donald L. Reed • Richard Sedlock
Southeast Missouri State University
Nicholas H. Tibbs
University of South Carolina
Tom Owens • Pradeep Talwani
University of Southern California
Ta-Liang Teng • David Okaya
Southern Methodist University
Eugene T. Herrin
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Syracuse University
Douglas K. Nelson
University of Tennessee
Richard T. Williams
Texas A&M University
Richard Gibson • Philip D. Rabinowitz
Texas Tech University
Harold Gurrola • Calvin Barnes
University of Texas at Austin
Clifford A. Frohlich • Stephen P. Grand
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Duryodhan Epili • Christopher Liner
University of Utah
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J. Arthur Snoke • John Hole
University of Washington
Kenneth Creager • Bob Crosson
Washington University, St. Louis
Douglas Wiens • Michael Wysession
West Virginia University
Thomas H. Wilson • Robert Behling
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Clifford Thurber • William J. Lutter
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Thomas Laudon
Woods Hole Oceanographic Institution
Ralph Stephen • Alan Chave
Wright State University
Ernest C. Hauser • Paul J. Wolfe
University of Wyoming
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Yale University
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U.S. Affiliate Member Institutions

Institution—*Representative*

Naval Air Weapons Station, Geothermal Program Office
Francis Monastero

Foreign Affiliate Member Institutions

Institution—*Representative*

Academia Sinica, Institute of Earth Sciences, Taiwan
Honn Kao
Academy of Sciences, Seismological Center, Albania
Betim Muco
Australian National University
Brian Kennett
Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Mexico
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Geological Survey of Canada, Continental Geoscience Division
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Geophysical Institute, Czech Republic
Axel Plesinger
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So Gu Kim
Institute of Geophysics, Switzerland
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Institute of Geology, SSB, Beijing, PRC
Qiyuan Liu
Institute of Geophysics, Beijing, PRC
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Shao Xian Zang
Russian Academy of Sciences, Russia
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The University of Leeds, England
Roger Clark
The University of Queensland, Australia
Peter Mora
Tubitak-Marmara Research Centre, Turkey
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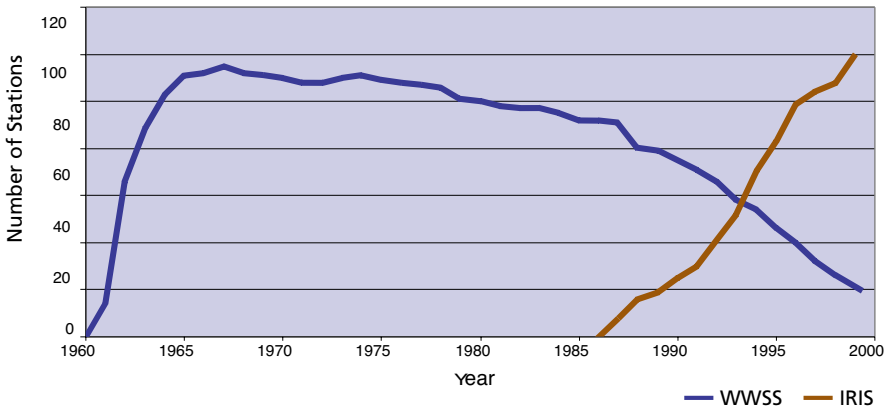
Helen Anderson
Utrecht University, The Netherlands
Roel Snieder
Victoria University, Institute of Geophysics, New Zealand
John Taber

Global Seismographic Network

In 1960 the World Wide Standardized Seismographic Network of analog seismometers was initiated to provide basic global coverage for seismological research and for nuclear monitoring. The WWSSN formed the core data for modern seismology and the discoveries in plate tectonics. Entering the digital age, legions of graduate students spent countless hours digitizing WWSSN photographic records for observations to be compared with newly computer-generated models of earthquake source dynamics and Earth structure.

Above: Finishing touches are being made at the borehole wellhead for a new GSN site in northeastern Brazil—Riachuelo, RCBR. The GSN equipment was installed by a USGS, Albuquerque Seismological Laboratory field team in March of this year. Broadband borehole sensors are installed at depths of 100 meters and 40 meters. There is also a low-gain sensor installed at the surface.

Top: IRIS/IDA station (MBAR) Mbarara in Uganda is entirely powered by solar panels.



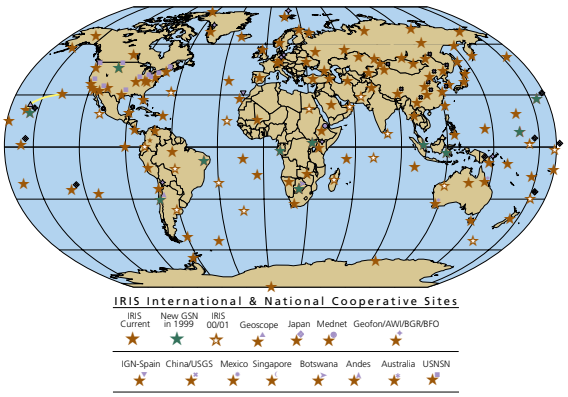
The growth of the digital Global Seismographic Network compared to the World Wide Standardized Seismographic Network(WWSSN). The GSN was initiated as the WWSSN instrumentation became obsolete and lost support for operation and maintenance. The GSN is designed as a sustainable network that will meet the data needs for the full range of scientific users for decades to come.

In 1986 the IRIS Global Seismographic Network of high-dynamic-range, broadband, digital seismic stations was established to build upon the seismological foundations of the WWSSN, creating a modern digital network with terabytes of data for synergism with theoretical, experimental, and computational advances in Earth sciences. Growing slowly at first, and then accelerating with funding from the nuclear verification community in anticipation of the Comprehensive Test Ban Treaty (CTBT), the GSN at 119 stations this year has surpassed its predecessor. A true measure of the value of this effort lies in the unprecedented use of the data by the seismological community. As the GSN reaches a stable size of 135 to 140 stations in the coming years, the focus upon operating and maintaining this state-of-the-art resource comes to the fore. Advances in real-time, global telemetry promise further opportunities for the GSN. Technology alone, however, will not sustain the GSN. The success of the GSN in the long term requires the perseverance and commitment of the community it serves.

Several years' efforts in site preparation activities at remote locations came to fruition this year. New GSN sites were installed in the Pacific, Africa, Asia, and North and South Americas. Two sites in the Pacific, Midway and Hawaii islands, are collaborative with the National Research Institute for Earth Science and Disaster Prevention (NIED) of Japan. Two new GSN Affiliate stations have joined from the Geological Survey of Botswana and the Meteorological Service of Singapore. The USGS Albuquerque Seismological Laboratory (ASL) installed new stations in Brazil, Gabon, South Dakota, Midway, and Hawaii. The University of California at San Diego IDA group installed new stations in Uganda, Indonesia, and the Marshall Islands in the Pacific. The Carnegie Institution of Washington installed a new IRIS University network station in Chile in collaboration with Fundacion Andes.

Beyond the installation of new stations, the GSN continues to evolve with improvements in instrumentation and capabilities. Upgrades by IDA of data acquisition systems to 24-bit design goals plus the addition of strong-motion sensors and microbarographs have taken place in Russia, Kyrgyzstan, and Kazakhstan. High-frequency broadband seismometers have been added by ASL at Western Samoa and in the Amazon basin of Brazil, and collaboratively with Australia at the Narrogin site. New GPS receivers have been installed at two Russian sites and meteorological sensors now augment all seven co-located GSN-GPS sites in Russia. Continuous VSAT satellite communications has been installed in Uganda and the Galapagos, in collaboration with NASA/JPL. A VSAT link installed in Gabon with cost sharing by its government to the GSN station near its University is the first Internet link into that country. The GSN is working with the CTBT Organization in Vienna, connecting GSN sites to the Treaty's communications infrastructure.

Global Seismographic Network



Above: Existing and planned installations in 2000/2001 for the Global Seismographic Network. Stations installed in 1999 are colored in green. Many GSN stations are operated under national and international partnerships.

New GSN Stations during the past year

Station	Site	Location	Operator	Type
POHA	Pohakuloa	Hawaii Island	ASL NIED	Borehole
MIDW	Midway	Midway Island	ASL NIED	Borehole
KWAJ	Kwajalein	Marshall Islands	IDA	Vault
KAPI	Kappang	Indonesia	IDA	Borehole
RSSD	Rapid City	South Dakota	ASL	Borehole
MBAR	Mbarara	Uganda	IDA	Borehole
MKSU	Masuku	Gabon	ASL	Vault
RCBR	Riachuelo	Brazil	ASL	Borehole
BTDF	Bukit Timah Dairy Farm	Singapore	Affiliate	Vault
LCO	Las Campanas	Chile	Carnegie	Vault
LBTB	Lobatse	Botswana	Affiliate	Borehole

Standing Committee

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University of California, Berkeley

Chuck Ammon
St. Louis University

Ray Buland*
US Geological Survey

Adam Dziewonski
Harvard University

Tom Heaton
California Institute of Technology

Thorne Lay
University of California, Santa Cruz

John Orcutt
University of California, San Diego

Anne Sheehan
University of Colorado, Boulder

Peter Davis**
University of California, San Diego

Bob Hutt**
US Geological Survey, ASL

*ex officio **non-voting observer

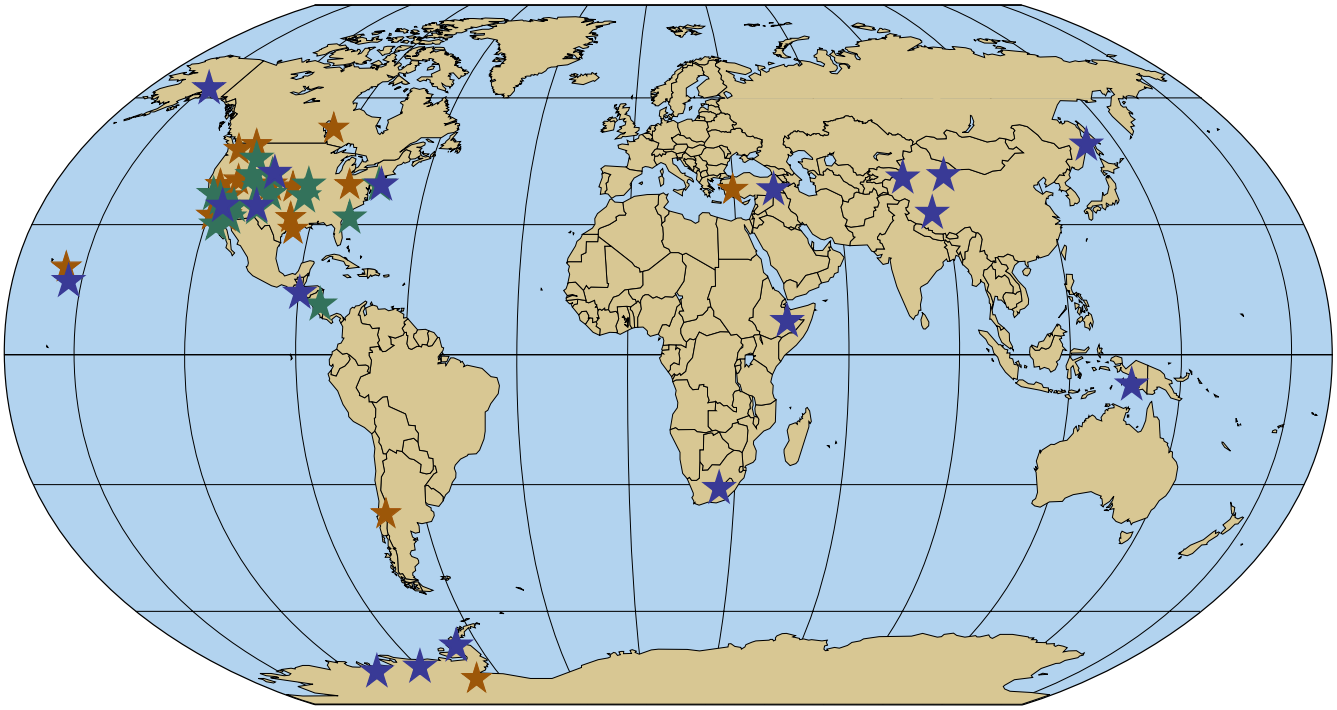
Rhett Butler
GSN Program Manager

With special thanks to those members who have completed their term of service on the GSN Standing Committee: Tom Heaton, Anne Sheehan.

PASSCAL

Program for Array Seismic Studies of the Continental Lithosphere

PASSCAL Experiments • 1999



PASSCAL Experiments • 1999		
Short Period	Broadband	Multichannel
★	★	★

Top: Dogan Seeber and local Turkish geologist installing a STS-2 as part of Cornell's array study of eastern Anatolia, near Horasan, Turkey.

Right: Tom Jackson maintaining equipment at the PASSCAL Instrument Center.

In 1999, the PASSCAL program set a new record. Over 60 experiments used PASSCAL instruments during the year. The instrument pool continues to grow steadily, with the number of broadband sensors now exceeding 200. Not only are we fielding more experiments each year, but we are also fielding more instruments for each experiment. This year 400 single channel "Texan" instruments owned by the University of Texas El Paso (UTEP) were added to the PASSCAL facility. These instruments were developed under a state of Texas grant with cost sharing from Refraction Technology. The initial grant allowed the delivery of approximately half of the instruments. A grant from the National Science Foundation allowed the purchase of the second half of the instruments. UTEP and IRIS participate in a Memorandum of Understanding whereby these instruments are made available to the IRIS community for research programs in a mode similar to the rest of the equipment. The 400 instruments have been used in several major active source experiments this year. Their low power requirements and small size make it possible for a small crew to deploy more instruments in less time than in the past. These 400 channels also significantly add to the approximately 1000 channels available through the conventional PASSCAL pool of instruments.

The initial field test of the broadband array was completed in western Colorado August 1998. A second deployment of the array was conducted in South Africa in late 1998 through July 1999. The deployment represented a major advance for use of the broadband array in remote areas. In spite of early communications and power problems, the overall data return was significantly better than that obtained from a concurrent experiment with individual stand-alone instruments. Two sets of array equipment are now installed in separate experiments in the western part of the US. The system has proven to be very reliable in field operations and is considered a prototype for the systems of the future when all instruments will be able to communicate from the field through regular commercial communications systems.

The four multichannel systems have continued to be in high demand for both research and classroom programs. Multi-channel experiments now account for over 25% of all experiments.

The Instrumentation Committee has been developed to look at future hardware needs. A preliminary design specification for the new PASSCAL instrument has been distributed to the community, and can be viewed at [http://www.iris.edu/passcal/passcal.htm] Six manufacturers submitted ideas for implementing our design goals, and we will purchase prototype instruments over the next few months. The prototypes will be tested during the next year with the plan that systems will be ready for production in 12 to 18 months.

Finally, the PASSCAL program took delivery of the first ORBCOMM receivers this summer. These satellite communications systems allow scientists to have two-way communications with an instrument in the field for the purpose of sending and receiving state-of-health information. ORBCOMM represents a step up from the earlier ARGOS systems in that it is now possible to reset the instrument remotely. The first of the receivers are now deployed in the field for testing and evaluation.

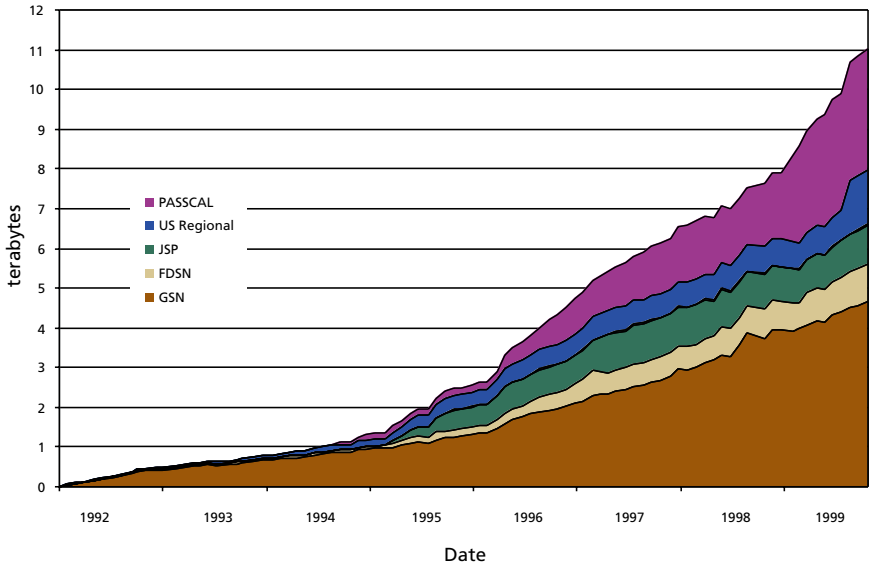
Data Management System

In 1999, the Data Management System (DMS) responded to over 35,000 requests for data, shipping the data within a median time of one day. Approximately one-third of the data requests were serviced automatically within a few minutes. The data archive now exceeds 11 terabytes (11,000,000,000,000 bytes), including more than 3,000,000 station day files.

The DMS is the primary distribution point for IRIS data. The data are stored in a 50 terabyte StorageTek mass storage system that has now been in operation for nearly two years. Beginning in 1999, the Data Management Center (DMC) is now archiving

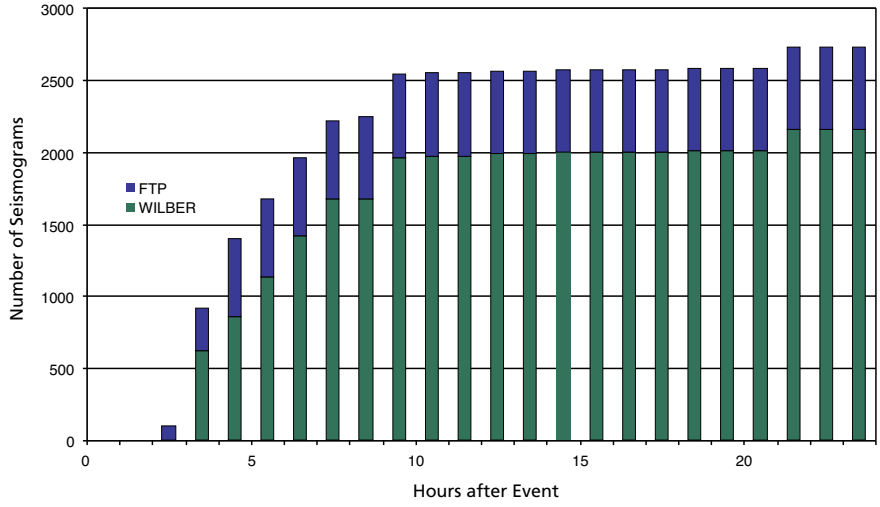
Available Data

This figure shows the amount of data in the IRIS archive from the following sources from the bottom to the top; IRIS GSN, FDSN, networks in the former Soviet Union (JSP), data from regional networks, and from the IRIS PASSCAL program. The data holdings of the IRIS DMC now exceed 11 terabytes. All of this data (with the exception of 1 terabyte of PASSCAL SEG-Y data) are in SEED format and seamlessly available using a variety of DMC access tools.



Hector Mine Earthquake

The SPYDER® system was developed and is maintained by the University of Washington. After the recent Hector Mine Earthquake, users accessed data from the SPYDER® system using both standard ftp mechanisms as well as the WILBER WWW access tool. During the first 24 hours after this event more than 2500 seismograms were shipped from the DMC, using completely automated methods.



Top: Heather McManmon maintaining a solar panel during the experiment in Lodore, Colorado.

data from the PASSCAL program at a higher rate than from the IRIS Global Seismographic Network (GSN). Data from PASSCAL experiments are accessible from the DMC in a manner no different than data from the GSN. In addition, the DMC also archives and distributes data from regional networks within the United States, non-US regional networks, as well as data from non-US networks operated by the Federation of Digital Broadband Seismographic Networks.

The DMS is also responsible for data quality from all IRIS data sources. GSN quality control is performed through the DMS nodes at the USGS Albuquerque Seismic Laboratory, the IDA group at Scripps Institution of Oceanography, the Waveform Quality Center at Harvard University, the University of Washington, and the DMC. PASSCAL data are quality controlled by the scientists in the field, the PASSCAL Instrument Center in Socorro, NM, and the DMC. All the major nodes within the DMS are connected by frame relay circuits to provide better data communication.

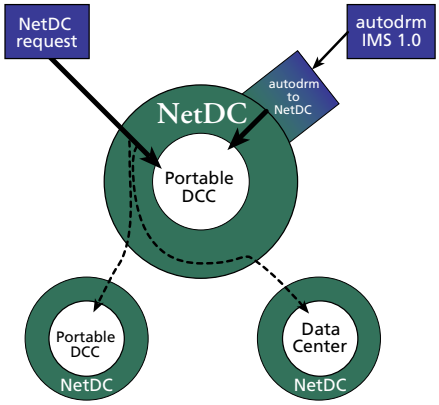
Progress toward providing data in near real time has continued at both the Albuquerque Seismological Laboratory with its LISS system, and at the IDA group at UCSD with the NRTS. The University of Washington's SPYDER® system now accesses data from more than 100 stations in near real time and packages the data into convenient data products complete with Web accessible graphics, and complete data files containing comprehensive metadata as well as waveforms. The WILBER system allows convenient access to the data in the SPYDER® and FARM data volumes. More and more users of the DMS are turning to these tools to meet their data requirements. For example, WILBER and standard ftp were used to transfer more than 2500 SPYDER® seismograms to individuals within 24 hours of the recent Hector Mine earthquake.

The DMS distributes a large amount of software. During the past year much of the software was rewritten in JAVA to make it platform independent. The effort has been done by leveraging the developments within the IRIS FISSURES software framework project. Presently the Portable Data Collection Center (PDCC) toolkit has been released in JAVA form. PDCC is a system that allows any data center to control the quality of seismic data as well as reformat these data into SEED format. Distribution of the PDCC system should make even more seismic data available from both domestic and non-US sources. The DMS will soon have its SEED writer rewritten in JAVA and already has many of its internal utilities in JAVA.

In the very near future we will make available a new system called NetDC. This system will be the first significant attempt at implementing a truly distributed data center. IRIS has teamed with GEOSCOPE in Paris, ORFEUS in the Netherlands and the Northern California Earthquake Data Center in Berkeley to prototype a system that allows data requestors to send requests to a single place and yet receive data that was distributed across multiple data centers. The first release will enable researchers to obtain an inventory of stations and channels available within the system, what the response to ground motion for a given seismic channel is, and also to make requests for seismic waveform data.

The Oracle database at the DMC now has seismic event information loaded from several NEIC and ISC sources such as the Monthly PDE, the QED and near real time event information from the NEIC finger mechanism. This information is directly accessible either through direct Structured Query Language (SQL) or by using the new SeismiQuery WWW interface. SeismiQuery can be found at http://www.iris.washington.edu/IRISquery.

SeismiQuery provides access to inventories of seismic stations, seismic events and complete information about the IRIS DMC data holdings. A new SeismiQuery feature is the coupling of information in Oracle with GMT mapping tools. These mapping features are available through SeismiQuery. We encourage you to use these tools.



Above: In order to provide access to even more data, the IRIS Data Management System is participating in the development of a distributed data center for seismic data. NetDC software routes portions of user's data requests to participating data centers and coordinates the return of data to the requestor. In this manner, seismologists will gain access to data held at numerous data centers. The NetDC system can be installed on top of any existing data management scheme or can use the Portable Data Collection Center software developed by IRIS. The system will service autoDRM requests but only for data held at the data center receiving the request.

Standing Committee

Alan Levander (Chair)
Rice University

Peter Goldstein
Lawrence Livermore National Lab

Bill Holt
SUNY, Stony Brook

Monica Kohler
University of California, Los Angeles

Jonathan Lees
Yale University

Stuart Sipkin
US Geological Survey, NEIC

Robert D. van der Hilst
Massachusetts Institute of Technology

Terry Wallace
University of Arizona

Bob Woodward **
US Geological Survey, ASL (from January to August '99)

Harold Bolton**
US Geological Survey, ASL (from September '99 to present)

Peter Davis**
University of California, San Diego

**non-voting observers

Tim Ahern
DMS Program Manager

With special thanks to Terry Wallace who has completed his term of service on the DMS Standing Committee.

Education and Outreach

The IRIS Education and Outreach (E&O) program uses the resources of the Consortium to integrate research with education. E&O program activities focus on seismology and related Earth science, but span all educational levels from public outreach to K-12 and college education. As can be seen from the table below, some programs are designed to impact large numbers of people, albeit sometimes briefly, other programs are designed to impact smaller numbers, but through a more prolonged interaction. Both approaches are fruitful. The casual visitor to a museum can have their interest in seismology and Earth science sparked by an interactive

Program	Description
Museum Program	Interactive exhibits
American Museum of Natural History Carnegie Museum of Natural History Franklin Institute Science Museum New Mexico Museum of Natural History	Accompanying educational materials to be developed in conjunction with participating museums
Summer Undergraduate Internships	Internships with scientists at IRIS member institutions
	Teach For America intern at IRIS headquarters
Educational Materials	Posters 1-page handouts Teachers guides Web site (www.iris.edu)
Teacher Workshops	Workshops at national professional meetings
	"Seismologists Learning to Teach the Teachers" workshop and follow-on local workshops through IRIS institutions
Seismometers in Schools	AS1 seismometers for schools

exhibit, accompanying educational materials and the ability to later visit the seismic monitor at the E&O web site. In contrast, a teacher attending one of our one-day workshops can return to his or her classroom armed with inquiry-based educational modules in seismology and Earth science that can be aligned with the National Science Education Standards.

Over the past year, our museum program has expanded to include exhibits at the American Museum of Natural History and at the Carnegie Museum of Natural History. Over the summer, Teach For America intern, Bella Desai, began developing short educational modules for use in conjunction with class visits to our museum displays. Over the next year, we will not only develop new displays, but also enhance the impact of existing displays by collaborating with the education departments at AMNH and the Carnegie Museum. The education departments work extensively with school teachers and classes in the New York City and Pittsburgh areas.

1999 was also the second year of our summer undergraduate internship program. There was a significant increase in the number of both students and host applications. Nine intern-host matches were made. Student applications were almost exclusively from individuals at non-IRIS institutions and included both public and private 4-year colleges and universities. The internship program highlights the real and broad opportunities for closer relationships between IRIS and non-IRIS institutions. Interns worked on a variety of field and laboratory-based projects.
A new feature of the internship program was the allocation of funding for students to present a paper at a professional meeting during the year following the internship. The funds for paper presentation encourage hosts to design projects to which students can make substantive contributions during their internship. Additionally, it provides undergraduates with the opportunity to attend a professional meeting and investigate career and graduate school opportunities in geophysics. Five interns will present first author papers at the 1999 Fall AGU.

A major new initiative started during the past year follows from a successful proposal to the Digital Libraries element of the Awards to Facilitate Geoscience Education. Over the next 2 years IRIS E&O will collaborate with UCAR, the Keck Geology Consortium, UC Boulder, the Alexandria Project and NASA's Universities Space Research Association, Earth Systems Science Education program to develop a prototype for a Digital Library for Earth System Education (DLESE). The digital library prototype is envisaged to provide both access to large data sets and a centralized location for resources for teaching geoscience at the undergraduate level. IRIS E&O will contribute access to IRIS' seismological data archives and educational resources that include user-friendly interfaces to seismological data.

As we enter the new millennium we expect to see consolidation of core IRIS E&O activities and thus expansion of their impact and we will engage in educational assessment of our programs to date. Over the next year we anticipate formalism of the Educational Affiliates membership status in IRIS to foster links between IRIS institutions and colleges/ universities that focus primarily on undergraduate teaching. Finally, the success of the E&O program is directly attributable to those who have participated in its development and in volunteering their time and energy to carry out the activities described here. In particular we acknowledge the enormous contributions of members of the E&O committee since its inception in 1997, and we encourage participation by all IRIS members in future E&O activities.


Newsday

COVER STORY

Journey to the
Center Of The Earth

Museum takes an inside look at home, exotic home

Standing Committee

Larry Braile (Chair)
Purdue University

Jeff Barker
SUNY, Binghamton

Lind Gee
University of California, Berkeley

Michelle Hall-Wallace
University of Arizona

Glenn Kroeger
Trinity University

Guust Nolet
Princeton University

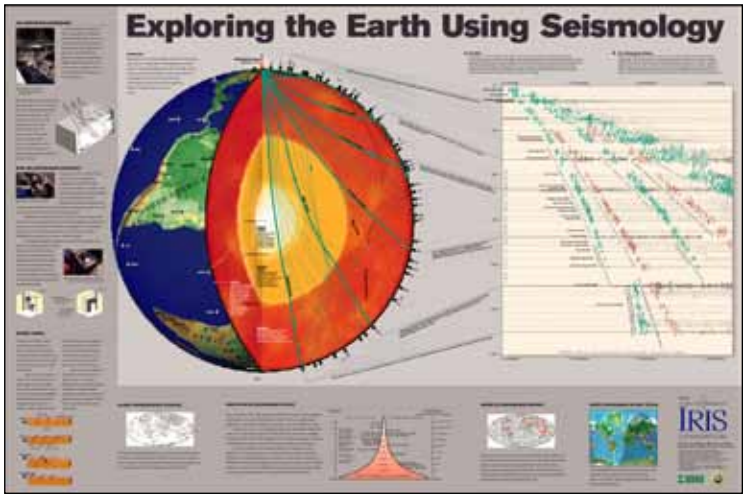
Bob Woodward
US Geological Survey, ASL

Catherine Johnson
E&O Program Manager

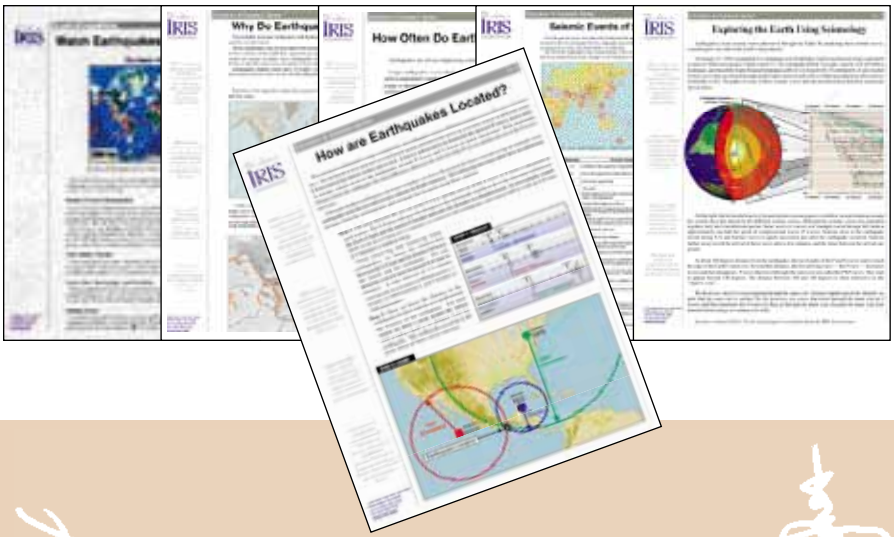
With special thanks to those members who have completed their term of service on the E&O Standing Committee: Bob Woodward, Guust Nolet

Activities and Publications

In partnership with the US Geological Survey, IRIS is expanding its museum program. In addition to the prototypes that are currently at IRIS headquarters in Washington, DC, the New Mexico Museum of Natural History in Albuquerque, NM, and the Franklin Institute Science Museum in Philadelphia, PA; additional exhibits are being developed at the Carnegie Museum of Natural History in Pittsburgh, PA, and the American Museum of Natural History in New York, NY. Within the next year, we expect the display program to reach an audience of approximately 8.75 million each year. With expansion of the program to include two or three additional museums over the next few years, the total audience for the full program could be as high as 10 million per year.



Through the Education and Outreach Program, IRIS has been developing and distributing posters about seismology. The posters are featured at various scientific and educational annual meetings, various workshops, and can be found on classroom walls around the world.



To attract the attention of students, educators, decision-makers, and the general public, IRIS has developed a series of "one-pagers."

The one-pagers provide succinct, hard-copy explanations of basic seismological concepts and they can easily be photocopied, posted, and mailed.

The IRIS Newsletter, with a distribution of 2500, is a well-illustrated collection of technical articles, field reports, news items, and policy discussions of interest to the IRIS community.

Meetings and Publications Subcommittee

Eugene Humphreys (Chair)
University of Oregon

Larry Braile
Purdue University

Roy Johnson
University of Arizona

Alan Levander
Rice University

Barbara Romanowicz
University of California, Berkeley

Gregory van der Vink
IRIS, Director of Planning

Financial Overview

Corporate Management

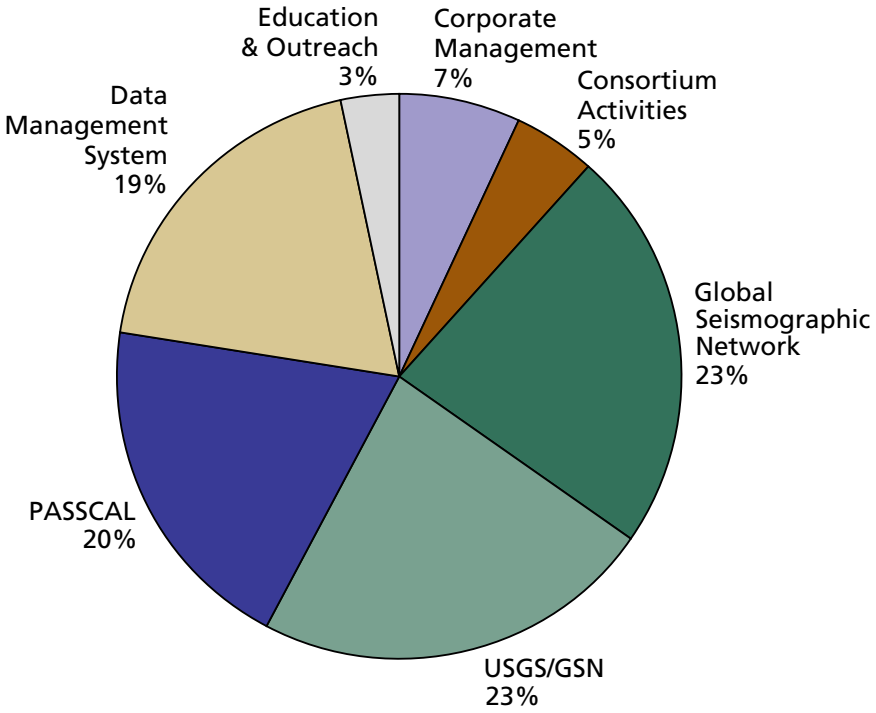
The administration costs include corporate administration salaries, business office salaries, accounting and legal consultant services, insurance, administrative staff, computer and office charges, and corporate travel costs.

Consortium Activities

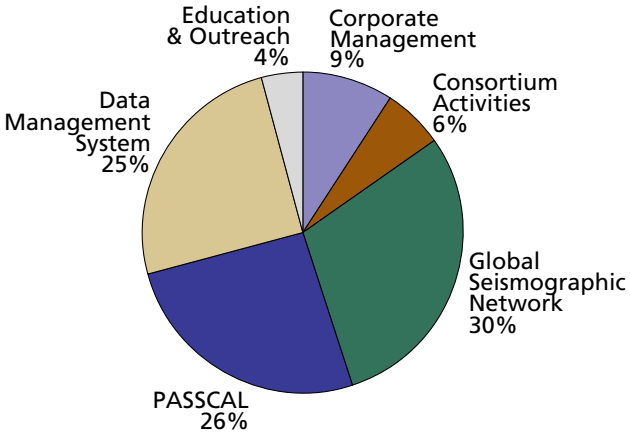
The consortium activities include meetings of the Executive Committee, the Planning Committee, and the Program Coordination Committee, development of special workshops, the annual IRIS Workshop, the IRIS Newsletter, other publications, and membership services.

The consolidated financial statements of IRIS and IRIS Ocean Cable, Incorporated, and the Auditor's Report are available from the IRIS business office upon request.

Total Program



Direct IRIS Support (July 1, 1999–June 30, 2000)



Budgetary Overview

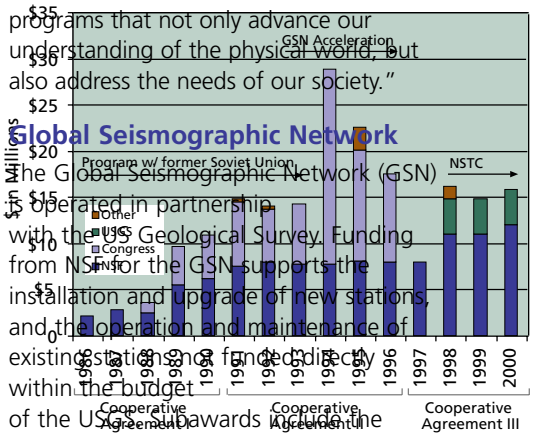
The Incorporated Research Institutions for Seismology (the IRIS Consortium) is a 501(C)(3) non-profit consortium of research institutions founded in 1984 to develop scientific facilities, distribute data, and promote research. IRIS is incorporated in the State of Delaware.

Funding History

Since 1986, IRIS has operated through five-year Cooperative Agreements with the National Science Foundation. Primary support for IRIS and its facilities comes from the Institution and Facilities Program of the Earth Sciences Division of NSF. From 1988 to 1996, IRIS received supplemental funding from the US Congress. Congress declared IRIS a program of "special Congressional interest" and provided funding for IRIS to the National Science Foundation through the Department of Defense. As stated by the Chairman of the Budgetary Committee "For the past several years, my colleagues and I have strongly supported funding for the seismological research conducted by IRIS. It has been our intention to advance the IRIS programs in order to provide a cost-saving, sustainable, multi-use resource not only for monitoring a future comprehensive test ban treaty, but also for monitoring global seismicity to mitigate earthquake hazards and to advance Earth science."

From 1988 through 1993, the funds were used for the development of seismological facilities in partnership with the Soviet Academy of Sciences. From 1994 through 1996, the funds were used to accelerate the installation of the Global Seismographic Network in preparation for the Comprehensive Test Ban Treaty negotiations.

Following the special funding for the Global Seismographic Network, an ad hoc Working Group of the National Science and Technology Council (NSTC) recommended that both the National Science Foundation and the US Geological Survey budget for the full cost of the program's continued operation and maintenance. Both agencies implemented the NSTC recommendation in 1997 beginning with their 1998 budget requests. In 1997, the Director of the National Science Foundation and the Director of the US Geological Survey recognized the development of the program as a "blue-print for scientific programs that not only advance our understanding of the physical world, but also address the needs of our society."



Global Seismographic Network

The Global Seismographic Network (GSN) is operated in partnership with the US Geological Survey. Funding from NSF for the GSN supports the installation and upgrade of new stations, and the operation and maintenance of existing stations and for modernization within the budget of the USGS. Subawards include the University of California, San Diego, the University of California, Berkeley, the California Institute of Technology, Columbia University, Harvard University, Albuquerque Seismological Laboratory, and Synapse Science Center, Moscow.

PASSCAL

Funding for PASSCAL is used to purchase new instruments, support the Instrument Center at the New Mexico Institute of Mining and Technology, train scientists to use the instruments, and provide technical support for instruments in the field. Subawards include the New Mexico Institute of Mining and Technology, Columbia University, Stanford University, the University of California, San Diego, and Indiana University.

Data Management System

Funding for the Data Management System supports data collection, data archiving, data distribution, communication links, software development, data evaluation, and web interface systems. Subawards include the University of Washington, Harvard University, the University of California, San Diego, Columbia University, and Synapse Science Center, Moscow.

Education and Outreach

Funding for the Education and Outreach Program is used to support teacher and faculty workshops, undergraduate internships, the production of hard-copy and web-based educational materials, the development of museum displays, and coordination with the Princeton Earth Physics Program (PEPP).

Budget and Finance Subcommittee

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University of California, Berkeley

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University Of California, San Diego

John Vidale
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Candy Shin
IRIS, Business Manager

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James C. Fowler	PASSCAL Program Manager

Top: David Simpson discussing future initiatives at a meeting of the IRIS Executive Committee