

# IRIS Newsletter

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Volume X, No.1

## A New Look

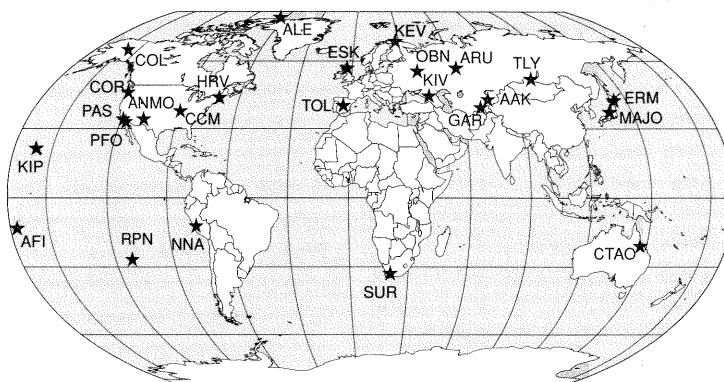
With this issue, the *IRIS Newsletter* takes on a new format, both in style and content. In the past, the Newsletter has served both as a forum for reporting general news of IRIS activities and as a "how-to" guide to the use of facilities. As IRIS and the services it provides have grown, there is an increasing need to provide members with an easily updated reference handbook. At the same time, we need to continue to inform members and friends of the progress of IRIS programs and experiments. The new format divides these two tasks into separate publications. The *IRIS Newsletter* will concentrate on general news. The *IRIS Handbook* will consist of a set of data sheets that will include basic information on the structure of IRIS and its programs and provide details on how to make use of IRIS facilities.

The Newsletter will be produced in the IRIS office. It will receive wide distribution, both to members and to a broad spectrum of people who are interested in the activities of IRIS. Denise Crump has been learning the intricacies and idiosyncrasies of PageMaker and has done an excellent job of preparing this first trial issue. This issue contains status reports from the program managers of the main IRIS programs. In future issues we plan to include reports of field experiments, news items on recent developments in programs and IRIS services and brief articles of interest to the IRIS community. We encourage you to make suggestions for topics and regular features and consider submitting articles.

## GSN

## Global Seismographic Network

GSN station deployment is supported by IRIS in cooperation with the USGS Albuquerque Seismological Laboratory; through the IDA program at UCSD; and with other IRIS member institutions. A complete list of operational GSN stations is contained in the IRIS Handbook. The details of the GSN program are described in the GSN Technical Plan recently signed by IRIS, the USGS, and NSF, which is available upon request from IRIS headquarters.



The Global Seismographic Network

## Technical Overview

The design goal for the GSN is for 24-bit digitization of the broad band seismometer at a continuous 20 sps sample rate. Three seismometers have been selected by the GSN Standing Committee to meet the very broad band requirements of the network: the Streckeisen STS-1 in vault installations, and the Geotech KS54000 and KS36000i borehole sensors. The KS36000i is a modified version of the SRO sensor. When the GSN began in 1986, only two manufacturers could produce the required 24-bit processors. IRIS-1 and IRIS-2 systems, in active production and deployment today, are built by Quanterra and Martin-Marietta, and have evolved from the original Harvard prototype system. The IRIS-2 is a separable, advanced version of the IRIS-1, with the capability of having the data acquisition functions at a remote site and connected via a telemetry link to data processing functions at a host organization's lab or building. The data logger for the US National Seismographic Network developed by Quanterra is very similar to the data acquisition module of the IRIS-2 system. While developing the design goal systems, the GSN also deployed versions of the

This Issue's BANNER GRAM - The seismogram at the top of the page is the radial component of the long-period (1 sps) velocity channel of a Magnitude 6.8 earthquake in the Bering Sea on February 20, 1991 recorded on the Streckeisen STS-1 seismometer at Pasadena, California. Data were acquired through the IRIS DMC dial-up system (*GOPHER*). Distance from Pasadena is 44.5°. Higher frequency P and PP phases contrast with the much longer period phases after the S arrival. The earthquake was in the central Bering Sea, along the edge of the continental shelf, about 500 km north of the Aleutian Island arc. This is the largest earthquake to have occurred in the Bering Sea since at least 1960. The preliminary focal mechanism, a normal fault with a large strike-slip component, and location indicate that the event occurred on preexisting faults associated with several large northwest trending sedimentary basins along the edge of the continental shelf.

(from Chuck Estabrook, Lamont-Doherty)

**continued from page 1**

Information of a more practical nature will be provided in the IRIS Handbook. All IRIS members will receive a copy of the Handbook, in a 3-ring binder format, which will be regularly updated to become a perpetual guide to IRIS activities and services. A standard indexing scheme and table of contents will keep track of current releases. The Handbook will be divided into sections for each of the IRIS programs. Topics for data sheets will include: a directory to IRIS programs and corporate structure; summaries of the status of programs and data holdings; a guide to software; how to request data; technical details of GSN and PASSCAL instrumentation; and schedules for PASSCAL field experiments. Examples of the format we propose and some sample data sheets are on display at the Workshop. The first release of the Handbook is expected during the summer. If you will provide us with your suggestions on what you consider to be the most useful topics for data sheets, we will try to see them included in the first distribution.

A wide variety of information of interest to IRIS members is available on the Bulletin Board at the Data Management Center. One purpose of the Handbook will be to serve as an index or window to what is available on-line on the Bulletin Board or elsewhere at the DMC (eg. e-mail directory, full man pages for programs, details of data holdings, instrument responses and station operation, information on requesting data, etc.).

Rick Williams of the University of Tennessee, in acting as editor of the Newsletter for the past six years, has provided an invaluable service to IRIS and its members. As expressed in the resolution passed at the December meeting of the Board of Directors, we extend our sincere thanks to Rick for all his work and we will strive to continue to meet the standards he has set.

We look forward to your comments and suggestions for improvement. \*

**David Simpson**

**continued from page 1**

PASSCAL instrument, termed IRIS-3, at many IRIS/IDA sites to establish a foundation network. These data loggers (built by Reftek) obtain the necessary dynamic range through a dual arrangement of overlapping high and low gain 16-bit digitization channels. In 1990 the GSN completed development with the PASSCAL program of a true 24-bit digitizer for the IRIS-3 data logger. Both the IRIS-1 and IRIS-2 systems have telephone dial-up access capabilities, which is being developed for the IRIS-3 system in 1991.

### **Current Station Activities**

**IRIS/USGS** - The production IRIS-2 data logger was installed on the ANMO borehole sensor at the Albuquerque Seismological Laboratory (ASL) in early November. The IRIS-2 system installation at COL, College, Alaska is currently underway. The SRO equipment on Guam is down. Rather than repair this equipment, the upgrade of GUMO will be accelerated, and will follow COL. The installation of Garni, USSR is scheduled to take place in the second quarter.

**IRIS/IDA** - The installation at FFC, Flin Flon, Canada, is planned for the second quarter, followed by BDF, Brasília, Brazil, and RAR, Rarotonga, Cook Islands. A site and noise survey is being conducted on Ascension Island in the South Atlantic Ocean. Within the Soviet Union, the Novosibirsk site, NVS, will probably be installed in the second quarter. Other Soviet sites require additional site preparation efforts, and will follow in the third quarter. IRIS GSN continues to support the Project IDA Network of LaCoste-Romberg gravimeters, many of which are collocated with IRIS/IDA broad band seismometer sites.

**IRIS/UNIVERSITY** - The installation of the new University of Arizona site near Tucson will likely occur mid-year. The UC Santa Cruz plans to upgrade their current GEOSCOPE station by adding a parallel IRIS GSN data logger will be coordinated with the GEOSCOPE maintenance team, probably late in 1991. Caltech's TERRASCOPE has established four new sites in Southern California which meet IRIS GSN design goals — GSC, Goldstone, PFO, Piñon Flat (in cooperation with IRIS/IDA), SBC, Santa Barbara, and ISA, Isabella.

### **Technical Developments**

Acceptance tests are being completed for the remainder of the first production run of IRIS-2 data loggers. A hybrid data logger is being developed for the Tucson, Arizona site, which will be a part of the GSN as well as the National Seismographic Network (NSN). The system will use an NSN data acquisition computer linked with a standard GSN IRIS-2 data processing computer.

The software for the current IRIS-3 systems is being completely rewritten into a more maintainable and manageable form. The new system will have improved timing and better communications in its separable configuration. All current IRIS-3 systems will be upgraded during 1991 to this configuration prior to integrating the 24-bit digitizer into the IRIS-3 system. Development of a dial-up interface for the IRIS-3 system will not begin until the third quarter.

Tests are currently underway at ASL comparing the Streckeisen STS-1 and STS-2 seismometers with the Geotech KS54000 borehole sensor, set up in a vault without the borehole packaging. The tests are aimed at evaluating the relative performance of the sensors under vault conditions, which may lead to a determination that a borehole configured STS-2 would meet or exceed the KS54000 performance.

## President's Corner

*Welcome to the third IRIS Workshop! This event, which began as a discussion of new PASSCAL experiments, has grown into an opportunity to focus on new research possibilities opened up by the new generation of digital instrumentation. We hope that it can be a forum for communication and generation of new ideas. Thus, poster papers and special interest group meetings are being particularly encouraged. Meetings will be held at the Workshop for Science Education, Advanced Instrumentation and Earthquake Science, to "test the water" and establish a degree of interest in such new initiatives.*

*The past year has seen IRIS complete its initial five year development into an operational program. In scale, however, we are still a small fraction of the program which was first proposed in 1984 by the seismological community and funded in 1985 by the NSF. The new IRIS proposal, for building the facilities to design goals, was submitted to the NSF in August 1990, and is now up for review by the National Science Board, following a very successful evaluation and review by mail reviewers and an ad hoc panel. We are requesting a doubling of budget for five years, and believe that the scientific case which has been made is quite strong.*

*Members are strongly encouraged to consider a response to either of the RFP's sent out earlier this year: for the Data Management Center, and for a second PASSCAL Instrument Center. IRIS encourages proposals which combine program interests and resources of the host institution with the specific needs of IRIS as described in the RFP's. We hope to see strong, creative proposals from our member institutions.*

*Finally, if you believe there are other ways in which IRIS can be useful to the research community, please speak to a Committee member, or, better yet, put it in writing to me at IRIS headquarters. The next five years will be an opportunity for our community to move beyond the basic IRIS facilities to other forms of cooperation and joint planning.*

*We need to hear from you! •*

**Robert A. Phinney, President**

## New Initiatives

While the current efforts of the GSN program are primarily focused on equipment upgrades and deployment of new stations, GSN initiatives are underway aimed at more timely access to data and improved global distribution of stations.

Two significant first steps have been taken toward achieving this goal. The steering committee for an Ocean Seismic Network, chaired by J.M. Purdy and A.M. Dziewonski, and supported by IRIS and JOI, has successfully applied for a deep ocean borehole to be drilled in March 1991 for OSN R&D efforts. IRIS has been working with the Earthquake Research Institute (ERI) of the University of Tokyo to reuse a retired undersea telecommunications cable for geosciences. On November 1, 1990, AT&T, Japanese KDD, and Hawaiian Telephone transferred ownership of the Guam-Japan section of Trans-Pacific Cable-1 to IRIS Ocean Cable, Inc. and ERI. A steering committee for Scientific Uses of Undersea Cables, chaired by A.D. Chave, has submitted a proposal to NSF for cable re-engineering in Guam. ERI is raising funds from the Japanese government for three geoscience observatories on the cable system.

Telemetry to provide near-real-time access to data is a stated GSN goal. Satellite links are now being established to provide access to data from the USSR as part of the US/USSR Joint Seismic Program. Experiments are also underway with UCLA and the NSF Polar Programs to transmit data from the IDA station at the South Pole and with NOAA to collect VLP data from HRV and PAS. In a longer term project, GSN is also working with NASA to participate in the Wide Band Data Collection System, a part of NASA's EOS program. •

*Rhett Butler, GSN Program Manager*

## DMS

## Data Management System

The IRIS Data Management System manages data flow and data quality from the Data Collection Centers (DCC) to an archive at the Data Management Center (DMC), followed by distribution to the scientific community. It consists of nodes for data collection at Albuquerque Seismological Laboratory and the University of California, San Diego and a central archive at the University of Texas, Austin. Through Internet, it extends to the data users and to European users via the ORFEUS data center in the Netherlands. The archive is unique in the world in its commitment to handling continuous data streams at 20 sps. It has been functional for two years, and is already handling user requests in excess of the estimates made in a 1986 design study for the steady-state load of a fully implemented GSN. The DMS has also been designated as the first data center of the Federation of Digital Broadband Seismographic Networks, an international organization of groups that operate broadband recording stations.

### Data Archive

As of February, 1991, the DMS archive holds more than 63 gigabytes of data representing 23428 station-days of records from 53 stations. The archive grows at about 350 megabytes per day and the GSN volume is eventually expected to grow

## EXECOM News

*On February 5-6, we had the first full meeting of the new IRIS Executive Committee. The current EXECOM members are: Paul Silver, Terry Wallace, Gary Pavlis, John Orcutt, Jeffrey Park, Doug Wiens, Sue McGeary and George Thompson.*

*Several things were decided upon at the February meeting:*

*1) Brown University has been admitted to IRIS (finally!)*

*2) We have begun to set up panels to evaluate the DMC and PASSCAL instrument center proposals.*

*3) The Continental Dynamics Report is nearing completion and we expect a full document by May.*

*4) Special interest groups (SIGS) are being formed around topics in which IRIS members have expressed interest. So far, we have three: Education (contact D. Simpson), Instrumentation (contact R. Phinney) and a SierraSEIS user's group (contact T. Ahern or D. Okaya). Plans are for these groups to meet at Hilton Head. A Special Committee on Earthquake Research has also been formed and had its first meeting (contact Cliff Thurber).*

*As of the IRIS workshop, the IRIS Newsletter will be moved to IRIS headquarters. It will have a new format and the intent is for it to be as useful and informative as possible. Comments are gladly welcomed.*

*We have initiated discussions with the Smithsonian National Museum of Natural History to assist them in redesigning their Earth Science exhibit. Seismology plays an important role in parts of the exhibit. This is a long-range project, with the new exhibit planning to open in 1994. Also, in the short term, (within the next 6 months) we would like to place a prototype seismology exhibit in the Smithsonian, based around the Gopher system. \**

**Paul G. Silver**  
**Chairman, IRIS Board of Directors**

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to nearly one gigabyte per day. Since initiation of the DMC at Austin, an "Interim System" has been used to manage the archive. This will soon be updated to a "Prototype System" which will form the basis for data base management at the permanent DMC.

The Interim System is an assembly of flat files that manage the data archive and as such is not a true data base management system (DBMS). The Interim System only allows access to the waveform data by station-channel-time windows. The Prototype System has been developed by IRIS DMC staff and uses a commercial DBMS. This system greatly enhances the flexibility with which users can generate requests for data and parametric information. The Prototype System incorporates hypocenter and phase information from the NEIC and the ISC and makes associations to the waveforms within the DBMS. Users can therefore use the Prototype System to make requests for station-channel-time windows of data, data by event, or data by some complex query based upon information describing the events or stations.

### Data Distribution

To respond to a wide variety of user needs, the DMS provides a number of ways to access data. The goal is to allow users to reach any part of the archived data base through simple request mechanisms in a relatively short time. Requests can be submitted electronically or in written form and data returned via tape or over Internet. Pre-assembled datasets from important earthquakes and from field deployments of PASSCAL instruments have been compiled and are distributed upon request. A complete list of these special data sets can be found in the IRIS Handbook. Customized requests can specify time slices from all or selected stations. The *RETRIEVE* program provides a convenient method for users to interactively determine what data are available in the archive and generate requests. DMS serviced more than 150 customized requests for data during 1990.

Recently, the DMS expanded its ability to service requests by adding a method to submit batch request through electronic mail. This *BREQ\_FAST* system is beginning to see more and more use by the research community.

An extremely popular service provided by DMS is the ability to rapidly acquire data, immediately following a significant earthquake, from six GSN stations in the US and one in Japan. Following electronic notification from NEIC of a large event, the program *BADGER* at the DMC determines what time segments need to be retrieved from each GSN station and sends commands to its companion program *GOPHER* (either at DMS or at other remote data collection sites) to call up and retrieve data. These data are assembled at the DMC and can be accessed by users, within minutes to hours of an event, through *GOPHER-VIEW*. Currently more than 1,100 traces from more than 200 earthquakes exist in the *GOPHER* archive and this is increasing by about 70 traces per month. In 1990 the *GOPHER* system was accessed by users an average of 200 times per month. Discussions are underway with groups in Europe and Japan to increase the number of stations that will be accessed by *GOPHER*.

The DMS Bulletin Board - The electronic Bulletin Board at the DMC provides a method of distributing news and information to the IRIS community, as well as serving as a convenient method to communicate with DMC staff and enter requests for data. Information on station operation and the archive holdings are available and users can report problems they have observed in station performance. The e-mail list, previously published in the IRIS Newsletter, can also be easily accessed through the Bulletin Board.

New Mass Store - The IRIS Data Management System is in the process of acquiring its own mass storage system. The system being evaluated is a Metrum RS-600 (formerly Honeywell). The system is designed around a SUN workstation, a tape robot, and 3 VLDS Helical Scan tape read/write units. The mass store can keep 6 terabytes of data on-line in a configuration that makes the data appear as a UNIX file system. The system is physically small with only a 71 inch by 40 inch footprint. Tests indicate that the system can meet the file recovery goal which was an ability to "recover two hours of data for 128 GSN stations for 50 earthquakes with 3 long period and 3 broadband channels in less than 24 hours". Delivery is expected in March. It will take about two months to load a significant amount of data onto the new mass storage system before beginning extensive tests of its performance.

The Permanent DMC - With the anticipated growth of the GSN and PASSCAL programs and the associated increase in data volume, the load on the DMC will increase greatly over the next few years. In anticipation of this, a major IRIS commitment has been made to expand the DMC facilities. The first step in this direction is the establishment of a permanent home for the DMC, and the process of proposal submission is now underway. The deadline for proposal responses is April 5, 1991. It is expected that the new DMC will be established in late 1991. \*

*Tim Ahern, DMS Program Manager*

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## **PASSCAL**

### **Array Studies**

**P**ASSCAL experienced its first full year of field activities in 1990. As the graph below indicates, the available instrument complement rose to 90 in time for the start of the summer field season in June. Instruments were in the field for 610 instrument-months out of a total possible of 885 in 1990. The plans for 1991 are for an even busier year. The Instrument Use Schedule shown below indicates that seventeen projects are currently scheduled for support, including 7 large (>10 instruments) field programs. The schedule for the summer is already over-booked, and we will have to limit the number of instruments available to some of the experiments unless we can borrow instruments or move experiments.

### **Instrumentation**

Early use of the REF TEK instruments was plagued by a number of timing problems associated with the internal clocks and locking to the OMEGA radio time signal. A series of modifications made to the PASSCAL instruments during the fall of last year seem to have corrected the majority of these problems. The instruments behave in predictable ways now during periods when the clock locks and unlocks. The drift rates are within specification and all timing changes are logged so that the information can be used in post processing to correct for drift if desired.

The original ten prototype instruments are now in the process of being upgraded so that they have the same internal hardware as the smaller production units. This will enable us to use the instruments in more experiments.

The testing of the broad-band sensors has been hampered by the fact that we have been unable to get delivery of instruments quickly enough to meet the demands from IRIS and other seismological programs. The installation of available sensors in PASSCAL field projects has been given priority over conducting controlled tests. More sensors are now becoming available and lab and field tests are underway. The field program now underway at Pinon Flats, as part of the US/USSR Joint Seismic Program, is making use of a variety of sensors and will provide important data on field deployments.

### **Software**

Software development is proceeding along two paths at the present. The first effort is aimed at modifications to the current software to improve the operation of scheduled experiments. This has required some rewriting of the input software to make it easy to handle the large data volumes expected. A quick look program, pql, has been written for rapid scanning of data. The second major development is the addition of a data base capability to allow the field computer to perform all of the functions typical of a Data Collection Center. This includes the generation of data tapes for the principal investigators as well as the Data Management Center. All of the programs developed in this project will be designed so that they can be effectively run by operators with a minimum of training. The processing framework will utilize standard interfaces so that IRIS members can port it to their own systems if they desire.

### **Field Experiments**

Two major experiments have been completed since the last issue of the Newsletter. The SAMSON experiment in North

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Carolina (led by Oregon State University with support from UCSD) finished during the first week of December. This experiment collected continuous data at 20 samples per second from in excess of 30 stations for about one month. This was an experiment to study noise generated by oceanic disturbances and the need for continuous data collection resulted in more than 20 MBytes per station per day. The Antarctic reflection/refraction experiment (Stanford University and DSIR, New Zealand) was completed in the last week of January. This experiment was conducted on the ice cap out of tents and portable shelters. In the 106 instrument deployments they had only one instrument from which they could not retrieve the data. The instruments and field computers worked extremely well

under rather harsh conditions.

Comments to date from the Principal Investigators indicate that the field support supplied by the personnel from the PASSCAL Instrument Center has been one of the major reasons for the success of the field efforts. In future planning, PI's and the PASSCAL Instrument Center need to work closely together to insure that qualified support personnel are available for the initial training and operational phases of all of the major experiments.

### Simple Instruments

Five prototype of the new REF TEK 3-channel simple instrument were delivered in December. Initial tests indicate that they perform as expected. Further laboratory and field

tests are now underway. Plans are to acquire a significant number of these instruments during 1991. These instruments were originally intended to be used in reflection and refraction experiments, however, the design is such that they can easily be adapted to operate in a broad range of experiments.

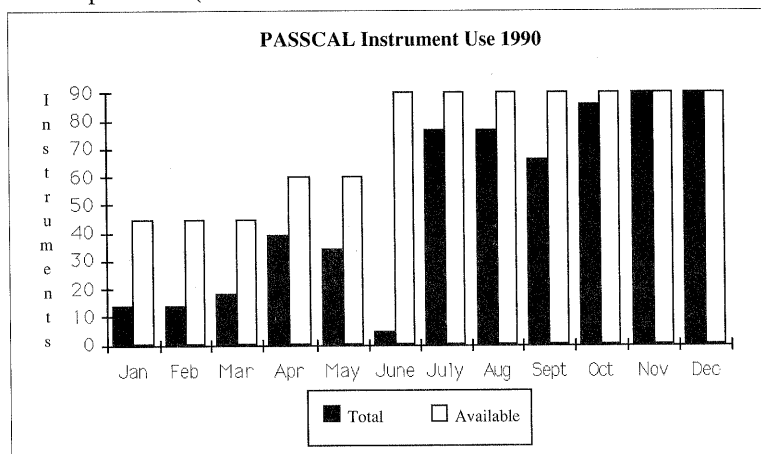
### Instrument Centers

The Instrument Center at Lamont now supports the operational and development activities of the PASSCAL

program. This center now houses the full complement of instruments and operates with the equivalent of four and one-half full time personnel. This staff provides maintenance and engineering support on the hardware and also provides field support for the PI's during experiments. During the next two years we expect to

more than double the number of instruments. This will require an additional center to house and support these new instruments. A Request for Proposals for a second Instrument Center has been sent out. The replies will be in at the end of March. There will be a committee appointed to evaluate a proposal for the continuation of the Lamont Center and establishment of this second Instrument Center. Plans are for the second Instrument Center to open during the third quarter of 1991. •

*Jim Fowler, PASSCAL Program Manager*



	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
NMIT/NMSU Rio Grande	4	4	4	4	4	4	4	4	4	4	4	4
Utah - Yellowstone	5	5	5	5	5	5	5	5	5	5	5	5
S Carolina - Bad Creek	10	10	10	10	10	10	10	10	10	10	10	10
Stanford - Antarctic	30	30	30	30	30	30	30	30	30	30	30	30
ESSP Pinon Flats II	28	28	28	28	28	28	28	28	28	28	28	28
UCSD - Heard Island	6	6	6	6	6	6	6	6	6	6	6	6
Princeton		2	2	2	2	2	2	2	2	2	2	2
UNR		1	1	1	1	1	1	1	1	1	1	1
WISC - Miss. Embayment		10	10	10	10	10	10	10	10	10	10	10
Texas A&M - High Freq				50	50	50	50	50	50	50	50	50
USGS - Iceland			15	15	15	15	15	15	15	15	15	15
Tibet					13	13	13	13	13	13	13	13
Lamont Rocky Mtn Front				10	10	10	10	10	10	10	10	10
USGS - Alaska							20	20	20	20	20	20
USGS - Nova Scotia							20	20	20	20	20	20
UCLA / WISC - Lake Baikal						10	10	10	10	10	10	10
LBL - Parkfield		5	5	5	5	5	5	5	5	5	5	5
Total	83	73	50	89	97	72	112	92	62	52	22	22
Available	90	90	90	90	90	90	90	90	90	90	90	90

## JSP

### US/USSR Joint Seismic Program

The US/USSR Joint Seismic Program is a cooperative program between the United States and the Soviet Union. IRIS and the US Geological Survey represent the United States; the Institute of the Physics of the Earth of the Soviet Academy of Sciences represents the Soviet Union. From the US perspective, the purpose of the Joint Program is to provide facilities and data that will permit a practical understanding of seismic wave propagation in the Soviet Union, and interpretation of this data in terms of geologic structures and tectonic processes.

Research and data from the Joint Program can be applied to such policy issues as the mitigation of earthquake hazards and the monitoring of underground nuclear explosions. Consequently, certain organizations support IRIS for the technical contributions that the program can make to such issues: Congress provides funding because of the application to verifying nuclear test ban treaties; the work is carried out under Area IX of the agreement on Cooperation in the Field of Environmental Protection because of the application to earthquake hazards. IRIS views these applications as both a strength of the program and as an opportunity for its member institutions to contribute objective technical information on important issues of public concern. IRIS, however, assumes no position on policy issues.

#### Current Program

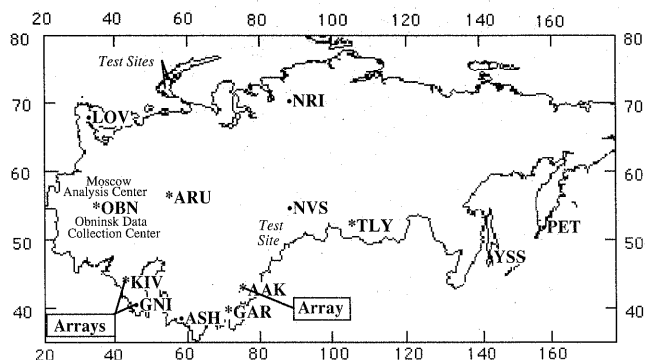
Under the IRIS/USGS/Soviet Academy agreement, high performance seismic stations, seismic networks, and portable arrays of seismic instruments are being installed in the United States and the Soviet Union. The major elements of the Joint Program include:

- 1) the installation of GSN stations within the US and USSR,
- 2) the development of two regional networks and a small aperture array, and
- 3) the associated data management, scientific collaboration, and exchanges necessary to incorporate Soviet data and Soviet seismology into the international community.

Under the Joint Program, six broad-band IRIS stations in the USSR are now routinely sending data back to the United States, and it is expected that IRIS and the USGS will eventually operate about 20-25 stations in the USSR. All of the work in this program is funded through non-NSF sources.

The current IRIS Soviet stations have been used to study many events teleseismically, including the Loma Prieta earthquake of October 1989. A principal scientific result from the

Joint Program so far is the discovery that Lg-wave amplitudes are far more stable than amplitudes of other regional waves or of teleseismic P-waves. This result is now greatly improving estimates of the yield of Soviet underground nuclear explosions.



- \* Station in operation
- Station being installed

In addition to the permanent broadband IRIS stations in the USSR, IRIS has successfully begun the installation and operation of regional networks and a small aperture array. This work was initiated at the request of the Soviet Union in 1989 for modern telemetered networks in Armenia and Kirghizia, two of the areas of greatest earthquake hazard in the USSR. A telemetered regional network is being installed near Frunze, Kirghizia, that in many respects is similar to the network now operated in Anza, California. With 10 stations each recording at 100 sample per second in a region of significant earthquake activity, the Kirghizia network is likely to generate important new data to study earthquake source processes. Embedded within this network will be a small aperture (2 km across) 25 station broadband array that is designed to study the phenomena of seismic wave scattering by shallow crustal heterogeneities. Several IRIS member institutions are involved in the research plan for this array, which addresses the fundamental aspects of wave field coherence. The initial plan for a regional network to study seismicity in Armenia has been modified due to political instabilities in the area. The network is being installed in the configuration of a tight array near Kislovodsk on the northern edge of the Caucasus. The US Geological Survey, however, continues to operate a three-dimensional dense array in and around a tunnel at the Garni Observatory in Armenia.

## Calendar

### MARCH

- 10 GSN Meeting  
US/USSR JSP  
Meeting, Hilton Head**
- 11-13 IRIS Workshop, Hilton  
Head**
- 19-22 ISOP Workshop,  
Denver, Colorado**
- 25-27 SSA, San Francisco**

### MAY

- 24-25 DMSSC Meeting, IRIS  
Headquarters**
- 28-31 AGU Spring Meeting,  
Baltimore, MD**

### JUNE

- 1-2 IRIS EXECOM, IRIS  
Headquarters**

*We would like to make the calendar  
a regular feature of the Newsletter.  
Please submit dates of interest to  
IRIS members, including meetings,  
and field programs.*

### the IRIS CONSORTIUM

The IRIS Newsletter is published  
quarterly by The IRIS Consortium.

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### Recent Developments

**Antarctica Station** - In cooperation with personnel from IPE, a new GSN station will be acquired and installed at a Soviet research site in Antarctica. The tentative location for the site is a tunnel (in rock) in Novolasarevskaya (70.46S, 11.50E). The data acquisition system will consist of IDA MKVII (IRIS-3) data loggers based on the PASSCAL hardware. Recent upgrade of this system now provides for 24-bit data acquisition of the broadband channels, 16-bit acquisition on the SP channels, and recording on 1.2GB DAT tape. Soviet personnel will be trained to operate the station.

**Telemetry** - Real-time telemetry for the collection of data has been a goal of the IRIS GSN program in general and of the Soviet program in particular. Due to the difficulties in accessing Soviet stations and facilitating repairs, telemetry is important for both timely data collection and state-of-health maintenance. Recently, the Soviet Union has agreed to begin the implementation of a real-time telemetry system within the USSR.

**Moscow Analysis Center** - To encourage expanded Soviet participation in cooperative research projects using data from the JSP and to provide a focus for training and the development of software, IRIS is assisting the Institute of Physics of the Earth in establishing an Analysis Center in Moscow. This Center will be equipped with Sun workstations and PC computers, available for the use of all Soviet and visiting US scientists working on the JSP. It is anticipated that the Center will open in mid-1991. •

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