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CONTENTS

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Dr. Richard T. Williams, Editor
IRIS NEWSLETTER
Department of Geological Sciences
University of Tennessee
Knoxville, TN 37996-1410

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IRIS
Suite 1440
1616 N. Ft. Myer Drive
Arlington, VA 22209
USA

OCEAN SEISMIC NETWORK NEWSLETTER, March 1990

Submitted by G.M. Purdy and Adam M. Dziewonski

- **Background**

A workshop, convened by G.M. Purdy of Woods Hole Oceanographic Institution and A.M. Dziewonski of Harvard University, was held in Woods Hole in 1988 to discuss the technical and scientific issues associated with the emplacement of a permanent network of broad-band seismometers in the deep ocean. The scientific rationale of such an effort is as follows.

Understanding the Earth's structure helps us to understand its origin, the dynamic forces at work within it in the past and present, and its evolution as a planetary body. The availability of data, which represent the remote sensing of the physical properties of the Earth's deep interior, is the necessary condition for the progress towards this goal. Some very encouraging results on whole Earth tomography have been obtained during the last several years. Yet, the current resolution of these images is very low. To improve it on a global scale it is necessary to deploy geophysical observatories on the ocean bottom.

Ocean floor stations are needed to improve source location (particularly depth), focal mechanism and rupture process determinations. These measurements are critical to studies of the depth of the seismic decoupling zone, the depth extent of outer rise events and the rheology of the oceanic lithosphere. Near field data, in particular ocean floor recordings, are needed to improve the resolution of source mechanisms of events not caused by faulting but by slumping or magmatic injection. Such studies have important implications for estimation of long-term seismic hazard. Existence of ocean bottom stations transmitting data in real time will have important implications with respect to tsunami warning and monitoring.

To achieve the scientific objectives, ocean floor observatories are essential. They are uniquely needed:

- To provide uniform global coverage in areas without islands;
- For regional studies of individual tectonic features;
- To sample wave propagation in 'normal' seafloor.

Oceanic islands are by definition located on anomalous structures. The crust is known to be anomalously thick, and in many cases the mantle structure will also be anomalous. Waveforms of body waves have been shown to be particularly complex at oceanic island stations. For these reasons, stations in the simple structure of normal ocean floor are important.

Although some profound technical difficulties are associated with the construction of such a network, none are considered intractable and it is judged that satisfactory solutions can be attained by carrying out a modest set of pilot experiments. Detailed accounts of both the scientific and technical issues are contained in the workshop report, copies of which are available from JOI, Inc., 1755 Massachusetts Avenue, NW, Suite 800, Washington, DC, 20036. Our goal is to establish a permanent network of 15-20 ocean floor observatories. Tentative locations for these observatories are denoted by the dark squares on the globe shown at the top of this Newsletter. These 2000 km squares denote regions devoid of islands, that can be sampled only with the use of ocean bottom stations.

- **Since the workshop...**

Our first action following the distribution of the workshop report was to write proposals to Joint Oceanographic Institutions Inc. (JOI) and to the Incorporated Research Institutions for Seismology (IRIS) requesting that they jointly support the formation of the Steering Committee. These proposals were successful and the committee was formed under the co-chairmanship of Adam Dziewonski and Mike Purdy. John Orcutt

(SIO), Hiroo Kanamori (CalTech) and Fred Duennebier (HIG) agreed to serve and during the past year we have met four times (two of these were held during the Spring and Fall AGU). Our level of funding is extremely modest (simply travel funds to attend a few meetings) but nevertheless we believe substantial progress has been made. We have journeyed to Washington to give briefings to NSF, ONR, DARPA, JOI and IRIS. A brief report has been given to the Federation of Digital Seismographic Networks at its meeting in Istanbul in August, 1989. A paper describing the present status of OSN plans was presented at the last Fall AGU in San Francisco. We have also briefed the U.S. Geodynamics Committee. Preliminary plans and schedule for pilot experiments and the installation of a permanent network have been formulated, and a proposal has been prepared and submitted to the Ocean Drilling Project to drill a hole ~300 km north east of Oahu in which OSN could carry out the necessary pilot experiments.

The function of this newsletter is to provide more details concerning these recent activities.

- **Emerging Technology**

It is obvious that the practicality of our plans for the OSN will be determined by the cost and complexity of solutions to the engineering challenges associated with the permanent emplacement of broadband digital seismographs in the ocean floor. Although many difficult problems remain in this regard, it is appropriate to begin this Newsletter on a positive note by drawing attention to a number of substantial engineering successes that have been achieved during the past year. Even without the direct stimulus of OSN objectives, these experiments have shown that many of the problems faced by OSN are solvable.

— Investigators from Scripps Institution of Oceanography and Woods Hole Oceanographic Institution successfully reentered DSDP drill site 534 in the Western Atlantic south of Bermuda using a thruster package on a cable from a conventional research vessel. An array of seismometers (unfortunately not broad band!) were deployed downhole and then successfully recovered several weeks later. It is possible that JOI will fund a modification of this wireline re-entry system that will be available to the U.S. community as a routine facility.

— Previous to this, Jacques Legrand and his colleagues from IFREMER were successful in using a submersible based reentry system to carry out logging operations at DSDP Site 396 on the flanks of the mid-Atlantic Ridge.

— Just a few months ago, Kiyoshi Suyehiro successfully emplaced a Guralp broad-band seismometer downhole from the drill ship JOIDES RESOLUTION in the Japan Sea.

— The U.S. Office of Naval Research is managing an Accelerated Research Initiative in ultra low frequency noise in the deep ocean and these research programs are providing not only a substantially increased understanding of ocean noise generation and propagation mechanisms but are also providing new technology for accurate timing and long duration high-capacity ocean floor data acquisition systems.

— The program to instrument Loihi seamount carried out by colleagues at the Hawaii Institute of Geophysics has successfully acquired a fiber optic cable link from the seamount to shore. This effort will yield much needed experience in academia in the use of ocean floor fiber optic cables for large volume realtime data telemetry.

— Plans for the reuse of old trans-oceanic telephone cables are being actively formulated by groups in the U.S. and Japan. A workshop co-sponsored by JOI and IRIS was held at HIG in January 1990 to evaluate the feasibility of operating the trans-Pacific cable (TPC 1) for research purposes.

The timeliness of our initiative to build an ocean seismic network is thus very clear, not only from a purely scientific point-of-view, as was established at our workshop, but also from a technical standpoint. Progress is being made with all the important issues: methods for sensor emplacement and recovery, data telemetry and recording, noise sources and propagation, and deep ocean broad-band sensors. The challenge for OSN is to build on this experience base and address the issues specific to the construction of a permanent observatory system. Substantial progress has been achieved in the past two years: we are no longer beginning from ground zero.

- **Data Telemetry**

Table 1 lists the obvious advantages and disadvantages of the three options: cable, internal recording and satellite telemetry. There is no obvious single solution to this issue. We believe the choice will vary depending upon the station location. In remote regions internal recording and annual data recovery by research vessel may be the only viable option. In some locations the need for real time data (for hazard warning, for example) may justify the expense of cable installation; in others reuse of existing cables may be possible. It is unfortunate however that the existing cable network crosses only four of our prime observatory sites. And finally, technological developments may in the future make satellite telemetry an attractive option.

- **Pilot Experiments**

Despite this progress, there is no question that pilot experiments are needed to address three key issues:

- How 'good' will ocean bottom observatories be compared with existing island stations? Noise and signals recorded by a broad band downhole sensor must be compared with that on a nearby high quality island station.

- How deep do the drill holes need to be for sensor emplacement? We must measure variations in broadband noise levels on a downhole sensor with depth below the ocean floor.

- Do we need drill holes at all? Comparisons must be made between broadband noise levels on a downhole sensor with identical seafloor and surficially buried broadband sensors.

The attached cartoon (Fig. 1) illustrates the components of such a pilot experiment, that if located near for example, Oahu, could answer all the above questions.

- **The Drilling Proposal**

An important step has been the submission of a proposal by Mike Purdy and Adam Dziewonski to JOIDES to drill a hole north-east of Oahu as a site for OSN pilot experiments. The location of the proposed site is shown in Fig. 2 relative to the known regions of slumping and lava fields mapped by Clague et al., 1988 and Moore et al., 1989. The site is located on the Hawaiian arch in about 4,500 m of water with a 150-200 m sediment thickness. We have proposed to drill 50-100 m into igneous basement, case the hole through the sediment and down to competent material in the basement. The site is 270 km from Oahu (15 hours steaming) and thus combines the advantages of proximity to a high quality GSN station in the Kipapa tunnel with the excellent logistical support available from the Hawaii Institute of Geophysics.

We believe that the single most important short term priority for OSN at this time is to get this hole drilled. This will provide the focal point that the community needs to make progress with tackling the technical and environmental questions. Once we get this hole firmly established in the JOIDES drilling plans then we can write proposals to various agencies to support the development of instrumentation for the Pilot Experiments. Although we anticipate that some degree of coordination will be required at this stage to ensure all the key measurements are being made by someone, we do not see OSN 'controlling' this drill hole. On the contrary, we would encourage any investigators (U.S. or non-U.S.) carrying out downhole measurements to use this site and thus add to the body of knowledge focussed at this one location. We would anticipate all downhole operations to be carried out using remote or wireline reentry techniques and would envisage a number of ~3-6 month long deployments of systems similar to those illustrated in Fig. 1.

- **Plans**

Although many unknowns remain, it is nevertheless necessary to try to formulate a schedule by which we hope to build the OSN, and also to speculate on the funding requirements. We have made an attempt at this and it is extremely tentative. As is obvious from the description of the phased approach that we describe below, we have tried to compromise between the extremes of blundering immediately into the installation of permanent observatories before we know properly how to design and locate them, and spending the next decade carrying out tedious technical assessments without ever recording data to help us understand the earth.

We tentatively propose a four phase program:

- *Phase 0: Present-1992.* Use existing funding sources to develop and test instrumentation necessary for the Pilot Experiments. We anticipate the need for ~$750K in 1991 for these activities.

- *Phase 1: 1992-1994.* Major pilot experiment in 1993 (hopefully at the drill site shown in Fig. 2) with a downhole broadband sensor at various depths below seafloor, surface and surficially buried broadband sensors (as illustrated in Fig. 1), long period pressure measurements and current meters. Site must be located adjacent to a high quality island station and sediment thickness must be sufficiently small that basement penetration is easy. Speculations on the costs for these activities are included in Table 2 (in 1990 $). The instrumentation tasks envisaged for the 1992-1998 time frame are listed in Table 3.

- *Phase 2: 1994-1996.* Emplace the first five permanent observatories, but continue an active development program. On at least three of these sites, programs of auxiliary measurements should be carried out using seafloor and surficially buried broadband sensors, current meters, etc. Multiple returns to the sites should be carried out to monitor system performance (e.g., corrosion), adjust downhole sensor depth perhaps, and recover and deploy seafloor units.

- *Phase 3: 1996-?* Routine emplacement of the remaining 15 stations begins at the rate of approximately two per year. Full capability for data handling and routine station maintenance must be established at this time.

Our estimate of the annual cost of operations of a globally distributed 20 station network is $4.5-5.0M. We view the OSN as one component of the Global Seismic Network and thus all the above activities related to station siting and data handling etc. would be fully coordinated with IRIS, or when appropriate, other networks such as GEOSCOPE or POSEIDON.

- **U.S. Organization**

It is unclear what kind of organization within the United States OSN will need in the next few years. Obviously it will evolve substantially as the transition from pilot experiments and development to routine network operation occurs. At this time there seems little justification for more than the minimal steering committee effort that is ongoing. However, once we have a pilot experiment drillsite available to us some more substantial coordination and communication will be needed and funds for a staff person will have to be raised.

Also at this time it is unclear what formal relationships if any should be forged between OSN, JOI, IRIS and the funding agencies. Should OSN form a structure of its own and work directly with the agencies 'independently' of JOI and IRIS? (though obviously coordinated with both). Or should OSN simply be an advisory committee to provide input to JOI (as does the existing USSAC) on the expenditure of 'ocean sciences' funds, related primarily to the instrumentation and development of the network; and function as one more committee within the IRIS structure, to receive advice on station siting, and provide input on the expenditure of 'earth sciences' funds related to routine operation of the network and data handling?

Both models have shortcomings and discussions must continue to determine the best direction to take.

- **International Cooperation**

Although the focus of our recent efforts has been the initiation of a U.S. program, it is unreasonable to think of building a global ocean network without the formation of an international consortium to share the costs and responsibilities. Strong programs already exist in Japan (Suyehiro) and France (Romanowicz). We must at the earliest opportunity begin the coordination of our plans and efforts with these colleagues. One mechanism that will allow us to begin this is a new liaison group that is about to be formed by JOIDES to provide a formal mechanism for communication between JOIDES and the Federation of Digital Seismic Networks.

- **In Closing...**

We believe that the construction of a 20 station OSN is a practical goal. Success will require the interest, support and participation of a broad spectrum of earth and ocean scientists. We encourage this participation and urge

any readers who wish to learn more to contact a member of the steering committee. Although our project constitutes an important part of ODP's long range plan (at least ten months of drilling in the next ten years) we must continue to strive to retain the priority needed to obtain usage of such an expensive resource as the drill ship. Our first step must be to get the Pilot Experiment site drilled as soon as possible. We solicit your support to this end.

•••OSN NEWSLETTER UPDATE MAY 1990•••

Since the above text was written, we have heard that the JOIDES planning committee has recommended inclusion of the OSN pilot hole drilling in the schedule for early 1991. This is great news! Although the exact location relative to Oahu remains under discussion, it seems clear there is an excellent possibility that by mid-1991 the international seismology community will have available an ideal drill hole in which to carry out a wide variety of well-controlled experiments. We strongly encourage the preparation of plans and proposals to use this hole to make the measurements we need before serious planning for the OSN can begin.

TABLE 1
OPTIONS FOR DATA RETRIEVAL

ADVANTAGES	DISADVANTAGES
OCEAN FLOOR CABLE	
Real time data	High Cost
No timing or power problems	Limited Locations
Immediate knowledge of failure	
SATELLITE TELEMETRY	
Real (or near real time) data	Inadequate data rates
Immediate knowledge of failure	No reliable technology available for permanent surface buoys
INTERNAL RECORDING	
Low cost	No real time data or knowledge of failure
Simple	Power and timing problems
	Need for annual servicing

TABLE 2

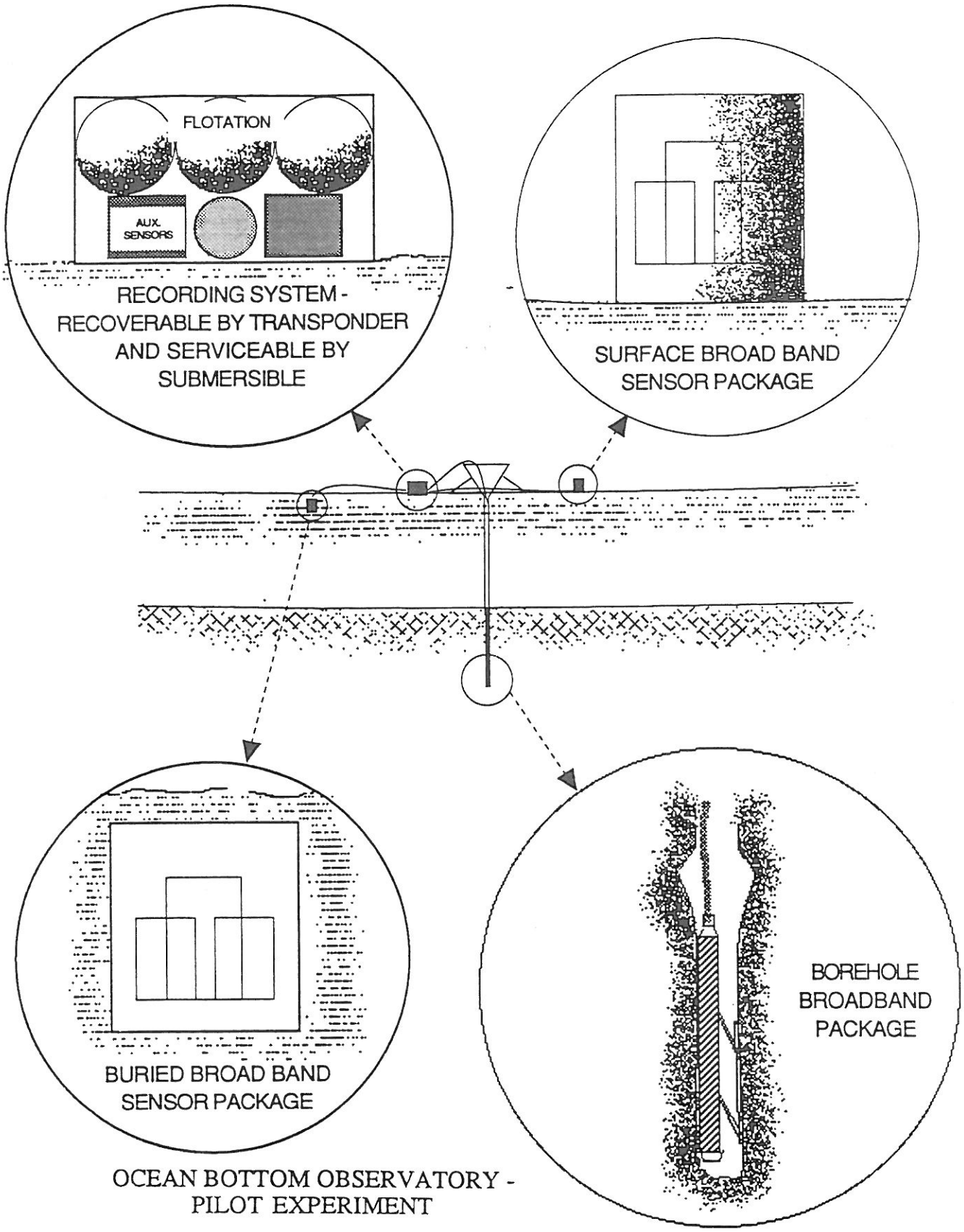
PRELIMINARY OSN COST PROJECTIONS (in $K)

	PHASE 1		PHASE 2	PHASE 3		
1992	**1993**	**1994**	**1995**	**1996**	**1997**	
Salaries	540	760	800	855	870	760
Ship Costs	100	1000	400	700	750	800
Field Prog-gram Costs	75	600	250	450	450	450
Hardware	250	250	500	500	200	200
Planning/ Mgmt.	100	100	100	100	100	100
TOTALS	**1065**	**2710**	**2050**	**2605**	**2370**	**2310**

TABLE 3

TASKS (INSTRUMENTATION)

1992	Design and construct one broadband downhole observatory system (BDOS:O); one broadband OBS (BOBS:O) and one buried broadband OBS (BBOBS:O).
1993	Complete construction of the above prototypes; carry out major pilot experiment. Begin construction of BDOS:1, BOBS:1 and BBOBS:1.
1994	Emplace first observatory (BDOS:1, BOBS:1, BBOBS:1). Begin construction of BDOS, BOBS, BBOBS 2 and 3. Service prototype observatory.
1995	Emplace BDOS, BOBS, BBOBS 2 and 3, begin construction of BDOS 4 and 5; service observatory 1. Recover prototype observatory.
1996	Emplace BDOS 4 and 5; redeploy BOBS:1 and BBOBS: 1; service observatories 1, 2, 3. Construct BDOS 6, 7.
1997	Emplace BDOS 6 and 7; service observatories 1-5; construct BDOS 8 and 9.
1998	Etc.



OCEAN BOTTOM OBSERVATORY - PILOT EXPERIMENT

Figure 1

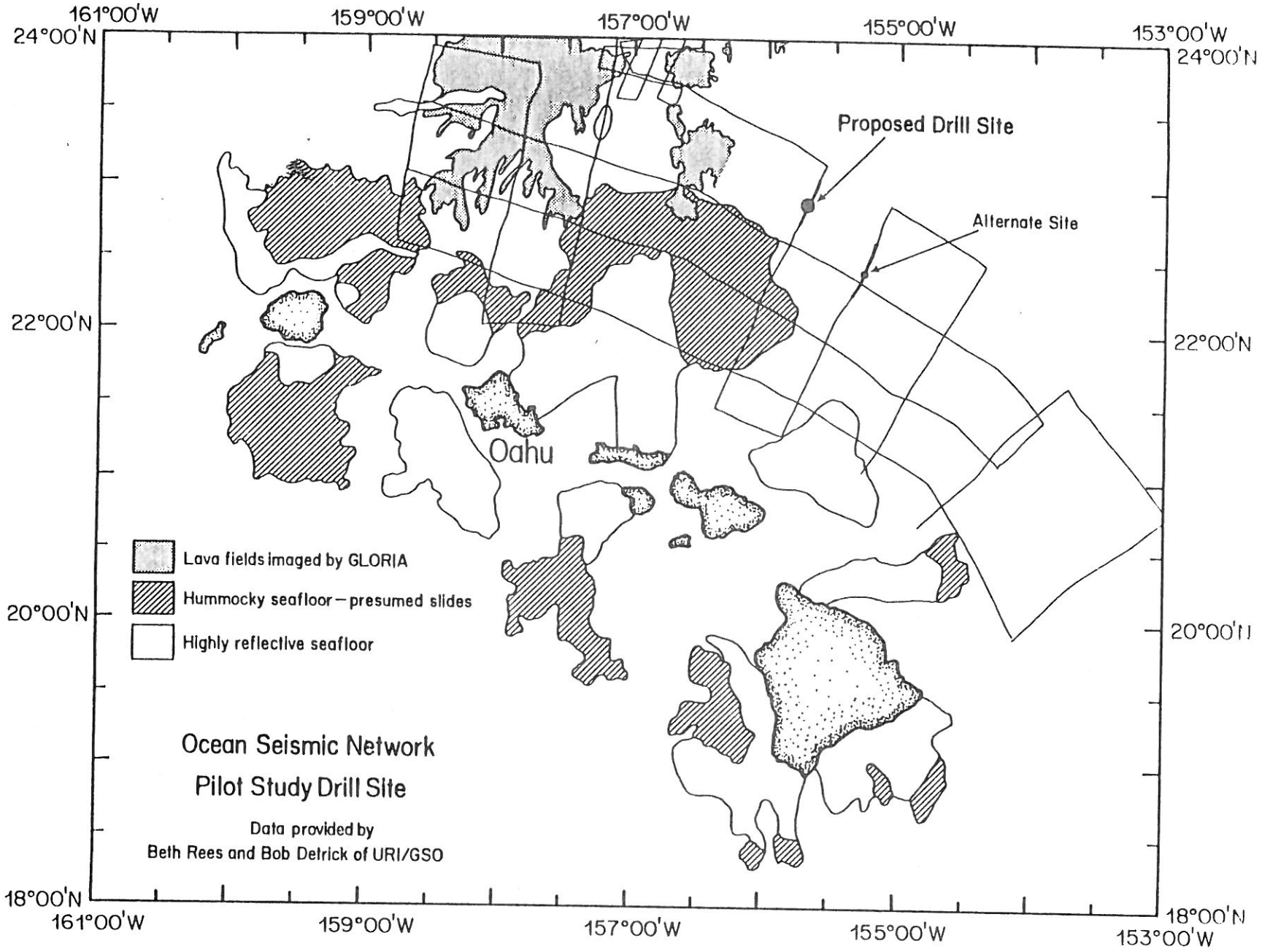

161°00'W
159°00'W
157°00'W
155°00'W
153°00'W
24°00'N
22°00'N
20°00'N
18°00'N
Proposed Drill Site
Alternate Site
Oahu
Lava fields imaged by GLORIA
Hummocky seafloor – presumed slides
Highly reflective seafloor
Ocean Seismic Network
Pilot Study Drill Site
Data provided by
Beth Rees and Bob Detrick of URI/GSO

Figure 2

NEWS ANNOUNCEMENT

Refraction Technology, Inc. (REF TEK) of Dallas, Texas, U.S.A., the leading U.S. supplier of portable, digital seismographs, announces that it has entered into a marketing agreement with Scintrex Ltd. of Concord, Ontario, Canada as of April 1, 1990. Scintrex offers a full spectrum of geophysical instruments for use in the search for minerals, ground water and geothermal resources through its extensive worldwide sales and service organization.

The five-year agreement calls for Scintrex to be REF TEK's exclusive distributor of seismological products worldwide except in the United States and the United Kingdom. REF TEK will maintain its long-standing representation by Kalamos International Ltd. in the United Kingdom. In addition, REF TEK Canada Corp. will continue selling REF TEK's oil and gas exploration instruments in Alberta, Canada.

The combination of REF TEK's advanced technology with Scintrex's marketing expertise will strengthen each company's competitive capacity to provide a high-quality service to the industry.

IRIS SierraSeis Users Group
Information on SierraSeis and IRIS-Seis

SierraSeis Maintenance Center
Lawrence Berkeley Laboratory
May 1990

SierraSeis Training

Sierra Geophysics has released a schedule of training sessions for SierraSeis. These three-day courses will take place on June 18-20, July 23-25, and August 27-29. Courses to be held autumn will be announced at a later date. For those who need to attend a course immediately, Sierra is holding courses during the first half of May. As part of the annual software maintenance fee, one person per site per year may attend a training session for free (travel expenses not covered). Additional persons may attend at a rate of $750/session (plus travel).

A training credit policy has been established by Tim Ahern of IRIS to cover attendance to these training sessions for people who have obtained SierraSeis through IRIS. Within this policy, one person per institution may attend a training session each year. Unused slots will be reallocated by IRIS in order to maximize the effective use of the total number of persons covered under the IRIS-Sierra maintenance agreement. Institutions which do not send anyone during one year will have higher priority the subsequent year. Please contact Tim for more information or to sign up for one of the training sessions.

The training sessions will be a mix of informal lectures and hands-on experience using SierraSeis. Each session will be limited to eight people due to hardware availability at the Houston training center.

Sierra is willing to tailor one session for IRIS members. This session can be either one of their scheduled sessions or an unannounced session, provided we have enough people to attend. Information such as software architecture, module programming, and package limitations regarding non-standard data can be examined; this information is not necessarily important for more routine (industry) processing, but is relevant to processing by IRIS members.

DMC Bulletin Board for SierraSeis Users

The DMC has created an electronic bulletin board for SierraSeis users. This will serve as one mechanism to convey news about the software.

To read from the bulletin board, one needs to "rlogin" or "telnet" to the DMC computer at UT-Austin (user=bulletin; password=board):

```
rlogin irisdmc.ig.utexas.edu -l bulletin
rlogin 128.83.149.25 -l bulletin
telnet 128.83.149.25
```

The bulletin board is menu-driven, self-explanatory, and simple to use. At the main menu, select option "u" (User comments); in the subsequent menu select option "s" (SierraSeis). After this point the bulletin board behaves like the UNIX mail command.

Messages can be entered into the bulletin board by sending text via email to **comments@irisdmc.ig.utexas.edu**. User hints and questions would be particularly useful and welcomed. One can peruse the information at one's convenience. Email sent directly to others can be CC:'d to the bulletin board.

The bulletin board is one possible mechanism for the convenient exchange of information regarding the package. Due to the various system configurations and capabilities that we have, a standard mechanism of communication common to all users does not exist other than

conventional mail. E-mail may be the next best thing; currently 70% of the SierraSeis users in the IRIS community have email addresses. It's a possibility that the SierraSeis Maintenance Center can receive user comments and auto-broadcast them back to those in the community who would like to receive them. This may be an easy way to get on-line help from each other and to keep abreast of user comments.

Installation of SierraSeis v1.3

Two small snags which may appear during your installation of SS v1.3:

(A) Compiling error during installation of SierraLib ("Sierra Modeling Products - UNIX installation guide": Fast installation, step 1d (page 7)): The SUN f77 compiler picks up a compiling error in subroutine DEVOU2 in file DEVLIBK.f. The following line of code can be modified:

CHARACTER BUFOUT*IBMAX

should become

CHARACTER BUFOUT*255

(B) Missing routines in link of MAKEDRV and TAPIN ("Sierra Modeling Products - UNIX installation guide": Fast installation, step 1e (page 7)): You may need to add the following archive libraries to the link list in the file "linkmd" and "linkgt":

../sseis13/lib/SYSLIB.a ../sseis13/lib/sseis.a

These are routines, more specific to SierraSeis, which need to be included.

Please forward any comments regarding unusual installation behavior either to the SierraSeis bulletin board or to the SMC at LBL.

Release of IRIS-SEIS v1.3

IRIS-SEIS will become available this month. The UNIX (SUN 4) version is currently operational at LBL; however useful documentation may take a few weeks to assemble. The IRIS-SEIS platform is an addition to SierraSeis and will be distributed to holders of valid SierraSeis site licenses. IRIS-SEIS has processors which perform data import/export to allow for external processing; user-definable headers; utility functions which adjust trace headers for the input of irregular data; and subroutine shells for adding new modules. Additional descriptions about IRIS-SEIS are available in the February 1990 issue of the IRIS newsletter.

IRIS-SEIS allows a user to use both IRIS-added and Sierra-provided processors within data processing streams. As part of the structural framework, IRIS-SEIS provides a third level for processor access which is to be used for local development/addition of routines. This third tier ("LOCAL-SEIS") can combine Sierra, IRIS, and home-grown modules within individual processing jobs. Home-brew routines can be passed along to the SMC for incorporation into IRIS-SEIS; these routines will be QC'd to ensure that variable names and subroutine structures are compatible with the SierraSeis environment.

Distribution of IRIS-SEIS will be via 9-track or Exabyte tapes using tar format. Transferral by some other format will be by arrangement. IRIS-SEIS occupies approximately 15 Mbytes of disk; the third tier LOCAL-SEIS uses 8 Mbytes (no local processors are defined yet).

SUN screen display of Monochrome .RAS files

Ahmed Zakaria Ahmed at the University of Utah has written a utility program named ZPLOT which will graphically display .RAS files on SUN monitors. This program is similar to Sierra Geophysics's RASVUE product and allows for panning and decimation of the plot file on the monitor. ZPLOT will also output to a Postscript laser printer.

IRIS has made arrangements with Bob Smith at the University of Utah to distribute ZPLOT to the IRIS community. Source code for ZPLOT is available through the DMC and can be retrieved using ftp:

```
ftp irisdmc.ig.utexas.edu (128.83.149.25)
user name: ftp
password: [any characters]
ftp> cd pub
```

In this directory, there are two files: zplot.tar (885K bytes) and zplot.tar.z (490K bytes). The latter file is compressed. The tar command will extract the source; a makefile is included. Zak Ahmed will accept comments and/or suggestions regarding the program (zakaria@cs.utah.edu). Zak indicates that adding the capability to plot to a color Postscript laser printer would be straightforward. If sufficient demand is expressed for this option, then IRIS may be persuaded to cover the development costs.

X11 Pixmap screen display of Monochrome .RAS files

Rick Williams at the University of Tennessee, Knoxville, has developed a program based on ZPLOT to use X-11 to display monochrome .RAS files. Rick provides the following information:

X-11 is the "industry standard" window system for networked computer workstations that is distributed (gratis) through MIT. It is available for every kind of computer I know of. Pixmap is an X-11 way of storing raster images, either monochrome or color, and the X-11 package includes several routines for manipulating Pixmap images or making hardcopies on a variety of devices.

This .RAS->Pixmap program is available from Rick (rick@rockytop.gg.utk.edu).

SUN's and Raster plotters - a match not made in heaven

Raster plotters seem to be somewhat difficult to configure with SUN workstations. A VME bus is required on the SUN in order to interface with a Versatec plotter. An IKON controller can be used to work with the SUN/VME/Versatec combination (I believe this combination works on the field computers and at UCSB). IRIS is attempting to develop a SCSI-compatible controller.

CPU	controller	bus	plotter	comment
SUN3/60	IKON	VME?	Gulton	works for field computers
SUN	in development	SCSI port	Versatec	IRIS project
SUN4/330	IKON	VME	Gulton	works at IU - see below
SUN4/280	IKON	VME bus	24" versatec	works at UCSB

Gary Pavlis at Indiana University passes along the following information regarding getting a Gulton plotter to work from a SUN-4:

> It took me about two weeks to make this fairly vanilla plotting arrangement work. We have a configuration similar, but not identical, to that on the 3/160 IRIS field computer. It is:
>
> (1) A SUN 4/330 (that's a Sparc with a 5 slot VME chassis).
> (2) An IKON 10088 (I think that's the number) VME-Versatec controller.
> (3) A software driver called CONSULT-IKON88 (I think) purchased from SUN consulting.
> (4) A Gulton plotter.
>
> Now I thought this would make my life easy since it was so similar to the IRIS installation. It wasn't. The problem was that I had a different software driver, and the version SUN sent me the first round didn't work at all. They finally fixed it, and now it is quite

functional. I had to do two major things to make this work with SierraSeis:

(1) I had to modify the low level driver (in C) written by Sierra. One change was trivial and involved changing the includes to be appropriate for the different driver I was using. The other was a bug. The SUN 3 version had a error that the compiler on a SUN 3 seemed to accept and the code still functioned. Sierra knows about this.

(2) The code in Sierraseis 1.2 rasplot does not panel correctly when the plotter description describes the raster scan length in bytes (rather than inches). Sierra gave me a fix that I implemented.

We can now make plots directly with rasplot, but it wasn't an easy process to make it work. Hope this can help someone else.

-Gary

When SierraSeis resides on one CPU and the raster plotter is attached to another CPU, raster file translation may be necessary. If both CPU's are of the same type (i.e., SUN to SUN) no translation is required. For example, at WHOI, a 44" Versatec is connected to a SUN 3/60. Steve Holbrook is using SierraSeis on a SUN 4/370. Raster files are simply transferred from the SUN 4 to the SUN 3 via ftp (binary format; 4000 traces @ 15 sec take a minute or two). The Sierra program "rasplot" is required to drive the .RAS files from the SUN 3 to the plotter; due to the different operating systems, Steve had to install, with Sierra's blessing, a different version of SierraLib and Rasplot on the SUN 3.

If the bit pattern for 4-byte integers is different, then a bit-reordering will be required. For example, at the University of Southern California, SierraSeis resides on a SUN 4/390 while due to the presence of a pre-existing processing package, the Versatec plotter is attached to a MicroVax II. Due to the byte ordering difference between SUN and VAX/VMS architecture, raster files created on the SUN need to be byte-swapped in order to be properly plotted on the raster device.

Sierra supports a utility program named BMFT (Binary MetaFile Transfer) which performs the necessary reordering. It's possible that we can develop our own configuration-specific or generic utility programs as we become more familiar with Sierra raster file formats (e.g., USC is currently attempting to develop a SUN->VAX translation program). Tim Ahern thought that IRIS had access to BMFT; however this is marketed as an independent product by Sierra.

We can pass along other SUN/plotter configurations which work (or don't work) if such information is useful. Please forward info to the SMC @LBL or via comments@IRISDMC.

Comments/Reply: University of Utah and SMC @LBL

Comments From: zakaria@cs.utah.edu
Reply by: okaya@ccs.lbl.gov

Zak - Bob Smith gave me a list of notes regarding SierraSeis v1.3 which I believe you came up with. Some of these items are concerns - Sierra needs to address them once they are made aware of them. Following are some of my responses to your comments.

1) The lumping of all possible configurations into the same set of manuals makes it time-consuming to attempt to glean your site-specific information (e.g. 32 different graphic drivers discussed in one manual).

The listing of many graphic drivers in one manual is tough to wade through; but it seems to be necessary in order to be able to figure out which ones are needed (the full list covers all possibilities for all installation sites). What I've found is that the descriptions themselves are not useful. I've been working on the installation of SSv1.3 at three different sites (different

configurations) and I'm still having difficulty in figuring out which sites need which drivers. What they need to do is have this section with scenarios ("for .RAS files on a 24" Versatec, the driver you need is....; for vector plots on a SUN monochrome monitor using X-windows you need...").

2) The organization of the different configuration files (e.g. SGPROD, SGCONFIG, ... etc) and the mere dependence of EVERY thing, from installation to the smallest job, on their presence and accurate (rigid) syntax of the information in them is a major source of confusion.

The SGPROD/SGCONFIG is a relatively new item and was installed for security reasons; I guess Sierra did not want people to put their products on CPU's other than the ones they were licensed for. The use of these files are initially confusing. An explanation is provided within the SierraLib installation manual (Appendix B); a more complete explanation about these files and how products such as SierraSeis use them would be helpful.

3) The user interface is totally inflexible; sometimes if the user makes an error, he has to go kill the job from another terminal. (SierraSeis apparently disables the interrupt and quit signals).

You're right, the user interface could be better. We need to get the kill key back (^C on my stty) and the size of that banner is a pain (scrolls all of one's text lines off the screen).

4) The file naming and string parameter convention is in direct conflict with UNIX, because of the forcing of upper case names and mapping of names to upper case even if they were supplied in lower case, not to mention the inconvenience of typing in upper case on UNIX-based systems.

Some operating systems are not upper/lower case-sensitive (VAX/VMS, for example). From what I can see from the source code, all keyboard entry is automatically switched to upper-case. What Sierra could incorporate is an option flag to disallow the conversion to upper-case. This could be a runtime option (option card within /JOB?).

5) Even though the Gulton plotter is recommended by IRIS, there is no mention of it in the installation procedures.

As the Gulton is not a common plotter, I don't think Sierra may have an economic interest in supporting the unit. Gary Pavlis has had some experiences with a SUN/Gulton installation (see discussion above). If you come up with installation procedures which are different than Gary's, we should circulate them to others within IRIS and to Sierra.

6) Error messages are hardly useful or understandable from the user's point of view.

You're right on the error messages - they are at times cryptic. It's a common phenomenon which I know I'm also guilty of - error messages which mean something to the programmer but not necessarily to a user. We should recommend to Sierra to improve the explanations within the error messages or to add more information within the manuals (processor pages or in the appendix containing error messages).

Some messages become more easily decipherable after you've used the package for a while. I've found that if you find where in the proper subroutine the message came from, you can figure out why the error actually happened - this is often more useful than the error message. Within the .IPR or .EPR printout files, an error statement will have an error number and the subroutine in which the error occurred. If you edit the source for the subroutine, search for "MPEROR" - this subroutine is used to print the error message into the .IPR or .EPR file.

The line of code should look like, for example:

```
CALL MPEROR(NAME,13)
```

[Subroutine MPEROR will open the "ERRORS.LST" file in your SierraSeis .../run directory and extract the text message for error #13 for the subroutine name passed down in CHARACTER*8 NAME.] If you find this line of code, you can check the conditions which caused this routine to be called.

7) During the installation there are still errors or warnings from the compiler that the installer has to get into the source to fix.

Installation procedures do have some undocumented modifications required. For example, early in the v1.3 release installation, one installs the device drivers in directory .../slib15. In performing the initial compilation:

```
(%) sh -v compall
```

the file DEVLIBK.f has the following error:

```
SUBROUTINE  DEVOU2(BUFFER,IBCNT)
CHARACTER*(*) BUFFER
INTEGER       IBMAX
PARAMETER    (IBMAX=255)
CHARACTER     BUFOUT*IBMAX          ==> CHARACTER BUFOUT*255
```

Also, the initial link required to create MAKEDRV and TAPIN has several undefined routines within the shell file "linkmd". These routines are defined in two SierraSeis archive libraries and need to be added to the link list in "linkmd":

```
[f77 ....]
../sseis13/SYSLIB.a ../sseis13/sseis.a
```

If you've found others, can you document them? We can distribute your findings.

I will pass your comments on to Sierra (if you have not done so already). Your frustrations on these items is understandable; much time can be sunk into figuring out how to overcome these difficulties.

I'm sending a letter to the SierraSeis users within the IRIS community and will include your comments - others may have similar experiences. -David

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SierraSeis Users Group newsletter #2
David Okaya
SierraSeis Maintenance Center
Earth Sciences Division
Lawrence Berkeley Laboratory

SIERRASEIS USERS WITHIN IRIS COMMUNITY
May, 1990

Zak Ahmed	U of Utah		zak@cs.utah.edu
Ross Black	U of Kansas	(913)864-4974	
Larry Braile	Purdue University	(317)494-5979	braile@vm.cc.purdue.edu
Steve Day	San Diego State U	(916)594-2663	
Steve Elston	Princeton U	(609)258-4104	
Jim Fowler	IRIS	(703)524-6222	jim@iris.edu
Michael Frohme	Memphis State Univ.	(901)454-2177	
Steve Holbrook	Woods Hole O.I.	(508)548-1400 x2581	gume_wsh1@aqua.whoi.edu
Roy Johnson	U of Arizona	(602)621-4890	johnson@rsconvex.geo.arizona.edu
Eleni Karageorgi	LBL	(415)486-6709	elm@ccs.lbl.gov
John Karl	U Wisconsin, Oshkosh	(414)424-4432	karl@oshkosh.wisc.edu
Peter Malin	UCSB	(805)961-3520	
Ernie Majer	LBL	(415)486-6709	elm@ccs.lbl.gov
Sue McGeary	U of Delaware	(302)451-8230	
Ross McNeil	U of Utah	(801)581-3733	
David Okaya	SMC @ LBL	(415)486-7313	okaya@ccs.lbl.gov
Gary Pavlis	Indiana U	(812)335-5141	pavlis@gold.bacs.indiana.edu
Jack Pelton	Boise State Univ	(208)385-3640	
Bob Phinney	Princeton U	(609)258-4118	bob@weasel.princeton.edu
Jose Pujal	Memphis State Univ.	(901)678-2007	
Laura Serpa	U of New Orleans	(504)286-6801	
Bob Smith	U of Utah	(801)581-7129	gg-rbs@mines.utah.edu
Scott Smithson	U Wyoming	(307)766-5280	
Steve Sorenson	U of Arizona		sorenson@rsconvex.geo.arizona.edu
Martin Van Schaak	UCSB	(805)961-8415	
Ta-liang Teng	U Southern Calif.	(213)743-2717	teng@coda.usc.edu
Rick Williams	U of Tennessee	(615)974-6169	rick@rockytop.gg.utk.edu

---

IRIS-DMC, c/o UTIG, 8701 Mopac Blvd, Suite 205, Austin, TX 78759:

Tim Ahern	(512)471-0404	tim@iris.edu

IRIS-PASSCAL, 1616 N. Ft. Myer Drive, Suite 1440, Arlington, VA 22090:

Jim Fowler	(703)524-6222	jim@iris.edu

SMC at LBL (SMC, c/o CCS, Earth Sciences Division, Building 50E, Lawrence Berkeley Laboratory, Berkeley, CA 94720).

David Okaya	(415)486-7313	okaya@ccs.lbl.gov
Eleni Karageorgi	(415)486-7314	karag@ccs.lbl.gov
Tom Daley	(415)486-7316	tomd@ccs.lbl.gov
Tom McEvilly	(415)486-7347	mcevilly@ccs.lbl.gov

IRIS Global Seismographic Network

ERRATUM

In the December 1989 newletter, the station coordinates for Kislovodsk were incorrectly given. The correct latitude and longitude for KIV follows:

KIV Kislovodsk, U.S.S.R.

Host	Inst. Physics Earth, Academy of Sciences
Location	43.95°N 42.68°E
Data Logger	RefTek IRIS-3 (16-bit)
Seismometers	Streckeisen STS-1 VBB Continuous: 20 sps high gain Triggered: 20 sps low gain
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

IRIS E-mail Directory
by Rick Williams

Last modified 23 May 1990

To get the most recent version of this list try "finger rick@128.219.24.15" or send an E-mail message to "rick@rockytop.gg.utk.edu"

An astrisk (*) preceeding a name means that I was unable to send mail to the address given, but others may be able to use it. A carat (^) before a name means that individual is a member of the anisotropy interest group assembled by Joe Dellinger; contact Joe for details. The letter (j) before a name indicates a Japanese seismologist from the list compiled by Kiyoshi Suyehiro with additions by Kazuki Koketsu.

The letter (o) before a name means the address is old, and did not work the last time I tried it. Users are requested to let me know when they find an old or invalid address in this list, particularly when it is their own.

user@host.domain	who,where,date
marun@am-sun1.stanford.edu	^Marun Abbudi,Stanford,0390
a84690%tansei.cc.u-tokyo.ac.jp	Katsuyuki Abe,ERI U Tokyo,0390
nf03@dkauni2.bitnet	Ulrich Achauer,Karlsruhe,0689
agnew@ida.ucsd.edu	Duncan Agnew,IGPP,1188
70617,2421@compuserve	*James Agnew,Woodward-Clyde,0689
tim@iris.edu	Tim Ahern,IRIS,0889
aki%sei@kylara.usc.edu	Keiiti Aki,USC,0988
s.alexander@omnet	*Shelton Alexander,Penn St,0988
zrma04@trc.amoco.com	^Rusty Alford,Amoco Tulsa,0390
DAnderson/KOSMOS	*Don Anderson,Cal Tech,0689
sak@ice.geology.wisc.edu	Sridhar Anandakrishnan,U WI,0689
aster@cahuilla.ucsd.edu	Richard Aster,IGPP/Scripps,0689
auld@sierra.stanford.edu	^Bert Auld,Stanford,0390
bache%esosun.css.gov@seismo.css.gov	Tom Bache,SAIC,0889
ergj@crnlvax5.bitnet	Muawia Barazanoo,Cornell,0689
bard@utadnx.cc.utexas.edu	Bill Bard,U TX
jbarker@bingvaxu.cc.binghamton.edu	Jeff Barker,SUNY Binghamton,0988
barton@erebus.stanford.edu	^Colleen Barton,Stanford,1288
battis@afgl-vax.af.mil	James Battis,AFGL,0390
hbennett@msu.bitnet	^Hugh Bennett,MI State,0590
bennett@beno.css.gov	Theron J. Bennett,S-Cubed,0689
bergep@loihi.soest.hawaii.edu	^Patricia Berge,HIG,0390
jberger@ucsd.edu	Jon Berger,UCSD,0390
gcb@benioff.mit.edu	Greg Beroza,MIT,0689
berryman@icdc.llnl.gov	James Berryman,LLNL,0689
bevis@ncsumeas.bitnet	Mike Bevis,NC State,0589
selena%topaz.uucp@uunet.uu.net	Selena Billington,US Bu Mines,1289
bina@ciw.span.nasa.gov	Craig R Bina,DTM-CIW,0390
biondo@think.com	Biondo Biondi,Thinking Machines,0490
rrb@beno.css.gov	Bob Blandford,DARPA,0490
gbock@gara.une.oz.au	^Gunter Bock,U New England,0390
goetz@weasel.princeton.edu	Goetz Bokelmann,Princeton,1289
e_gs04@va.nmh.ac.uk	^David Booth,BGS,0390
rborcherdt@usgsresv.bitnet	Roger Borcherdt,USGS Menlo Park

bowmanb%s59.es.llnl.gov@lll-lcc.llnl.gov	Brenda Bowman,LLNL,0689
roger@rses.anu.oz.au	Roger Bowman,ANU,0389
tboyd@csm9a.mines.colorado.edu	Tom Boyd,CO Sch Mines,0490
braile@vm.cc.purdue.edu	Larry Braile,Purdue
bryndis@raunvis.hi.is	Bryndis Brandsdottir,U Iceland,0590
nina@utorphys.bitnet	^Nina Bregman,U Toronto,0789
brom@loihi.hig.hawaii.edu	Peter Bromirski,HIG,0689
burridge@sdr.slb.com	^Bob Burridge,Schlumberger,0390
e_gs17@va.nmh.ac.uk	^Iain Bush,BGS,0390
rhett@iris.edu	Rhett Butler,IRIS,0889
antoinet@beno.css.gov	Antoinette Campanella,S-Cubed,0889
t60pjc1@niu.bitnet	Phil Carpenter,Northern IL U
carter@beno.css.gov	Jerry Carter,Roundout Assoc.
cessaro@beno.css.gov	Robert Cessaro,Teledyne Geotech
chan@seismo.css.gov	Winston Chan,Teledyne Geotech,1288
chang%lamont@columbia.edu	Chia-Yu Chang,Lamont-Doherty,0689
chang%gldvxa.decnet@isdden.isd.usgs.gov	Pingsheng Chang,USGS Denver,1089
chapman@utorphys.bitnet	^Chris Chapman,U Toronto,0789
chen@geol.las.uiuc.edu	Wang-Ping Chen,U IL,0989
cheng@ino.ucar.edu	Abe Cheng,Svendrup Tech,0689
cec@iris.edu	C Chesley,IRIS,0889
cicerone@erl.mit.edu	Robert Cicerone,MIT,0689
jon@hanauma.stanford.edu	Jon Claerbout,Stanford
clarketj@memstvx1.bitnet	Tim Clarke,Memphis State,0389
clement@erebus.stanford.edu	William Clement,Stanford,0689
cipar@afgl-vax.af.mil	John Cipar,AFGRL,0390
shimon@ccs.lbl.gov	^Shimon Coen,CCS/LBL,0789
dcomte@uchcecvm.bitnet	Diana Comte,U Chile,0331
cooper@loihi.hig.hawaii.edu	Patricia A. Cooper,HIG,0689
coruh@vtvm2.bitnet	Cahit Coruh,VPI&SU,0189
costain@vtvm1.cc.vt.edu	John Costain,VPI&SU,0689
e_gs01%va.nmh.ac.uk@cunyvm.cuny.edu	^Stuart Crampin,British GS,1288
kcc@geops.geo.washington.edu	Ken Creager,U WA
bob@geops.geo.washington.edu	Bob Crosson,U WA
phil@rses.anu.oz.au	Phil Cummins,ANU,0389
tony@weasel.princeton.edu	FA Dahlen,Princeton,0689
tomd%ccs@lbl.gov	^Thomas M. Daley,LBL,1288
rz5@mace.cc.purdue.edu	Carl Daudt,Purdue,0390
huw@dix.gps.caltech.edu	J Huw Davies,Caltech,1089
pdavis@uclaiepi.bitnet	Paul Davis,UCLA,1289
davis@seismo.css.gov	Peter Davis,Teledyne Geotech,0189
scott@utig.ig.utexas.edu	Scott Davis,U TX Austin,0989
joe@hanauma.stanford.edu	^Joe Dellinger,Stanford,1288
jacques@ucsco.ucsc.edu	Jacques Delsemme,UC Santa Cruz,0689
denny%s51.es.llnl.gov@lll-lcc.llnl.gov	Marvin Denny,LLNL,0689
devane@bcvms.bitnet	John Devane,Weston Obs,0689
johnd@lamont.ldgo.columbia.edu	John Diebold,LDGO,0689
73720,1641@compuserve	*John Diebold,LDGO,0689
dalsqnt!rpp386!arcoexre!jimd@uunet.uu.net	oJim DiSiena,ARCO Plano TX,1288
ldorman@ucsd.edu	LeRoy Dorman,Scripps,0689
dost@geof.ruu.nl	Bernard Dost,ORPHEUS,1189
nluug.nl!ruugeof!douma@uunet.uu.net	^Jan Douma,U Utrecht,0789
drobnisdd@sds.sdsc.edu	Dan Drobnis,San Diego St
duba%s61.es.llnl.gov@lll-lcc.llnl.gov	Al Duba,LLNL,0589
ebel@bcvms.bitnet	John Ebel,Boston Coll
eberhart@gsvax0.menlo.usgs.gov	Donna Eberhart-Phillips,USGS,0689
eengdahl@isdres.isd.usgs.gov	ER Engdahl,USGS Denver,0689
eengdahl@usgsresv.bitnet	ER Engdahl,USGS Denver,0689
rae@chevron.com	Ray Ergas,Chevron La Habra,0490
john@hanauma.stanford.edu	^John Etgen,Stanford,1288
esmersoy@sdr.slb.com	^Cengiz Esmersoy,Schlumberger,0390
evans@andreas.menlo.usgs.gov	John R. Evans,USGS Menlo Park,0689
e_gs18%va.nmh.ac.uk@cunyvm.cuny.edu	^Russ Evans,British GS,1288
fan@eqsun.geo.arizona.edu	Guangwei Fan,U AZ,0390
086172@essdp2.lanl.gov	Michael Fehler,LANL,0689

ferguson@utdallas.edu
foleyj@bcvms.bitnet
jim@iris.edu
w_foxall@csa3.lbl.gov
e_gs46%va.nmh.ac.uk@cunyvm.cuny.edu
neil@akolea.soest.hawaii.edu
paulf@lamont.ldgo.columbia.edu
friedman@tamvxocn.bitnet
gerard@loihi.hig.hawaii.edu
nf03@dkauni2.bitnet
cliff@utig.ig.utexas.edu
gerard@loihi.soest.hawaii.edu
15553kaz@msu.bitnet
pgdga@dcztu1.bitnet
gangi@tamgeop.bitnet
jan@garmany.ig.utexas.edu
eddie@seismo.gps.caltech.edu
gee@richter.mit.edu
a84687@tansei.cc.u-tokyo.ac.jp
isis!timna!seb@boulder.colorado.edu
hafidh@hal.css.gov
bruce@geophysics.rice.edu
gibson@erl.mit.edu
g_dg@va.ngi.ac.uk
given@servo.ucsd.edu
gohl%moho@uwyo.bitnet
verney@geology.wisc.edu
rsg@logos.jpl.nasa.gov
hamburg@gold.ucs.indiana.edu
rmhamilton/c@kosmos
b39068@tansei.cc.u-tokyo.ac.jp
hark@seismo.gps.caltech.edu
harris@erebus.stanford.edu
nrc.geophysics@omnet
sonnad@yktvmx.bitnet
hauk%s24.es.llnl.gov@lll-lcc.llnl.gov
jhays@note.nsf.gov
hayward@seismo.css.gov
hearn@geology.tn.cornell.edu
nluug.nl!ruugeof!helbig@uunet.uu.net
henkart@sioseis.ucsd.edu
henyey%sei@kylara.bitnet
jah@mpladm.ucsd.edu
jnrhi@chevron.com
c32244@tansei.cc.u-tokyo.ac.jp
sholbrook@red.whoi.edu
hood@loihi.soest.hawaii.edu
horowicz@eps.slb.com
horwitt@cahuilla.ucsd.edu
hough@lamont.ldgo.columbia.edu
glhsu@lsuvm.bitnet
nf03@dkauni2.bitnet
hutch@seismo.css.gov
e_gs31%va.nmh.ac.uk@cunyvm.cuny.edu
convex!texhrc!pli@uunit.uu.net
ingate@beno.css.gov
isacks@zircon.tn.cornell.edu
osby@cornella.bitnet
hans@seismo.css.gov
jjita@lbl.gov
iyer@andreas.menlo.usgs.gov
djackson@uclaiepi.bitnet
craig@hanauma.stanford.edu
jarpe%s02.es.llnl.gov@lll-lcc.llnl.gov
jih@seismo.css.gov

John Ferguson,UT Dallas,0689
Jack Foley,Boston Coll
Jim Fowler,IRIS,0889
Bill Foxall,LBL,0689
^Scot Fraser,British GS,0789
^Neil Frazer,HIG,0390
Paul Friberg,Lamont-Doherty,0689
Mel Friedman,TX A&M
^Gerard Fryer,HIG,1288
Karl Fuchs,via Uli Achauer,0689
Cliff Frohlich,U TX Austin
^Gerard Fryer,HIG,0390
Kaz Fujita,MI St
^Dirk Gajewski,Tech U Clausthal,0390
^Tony Gangi,TX A&M,0390
^Jan Garmany,UT Austin,1288
Ed Garnero,Caltech,0689
Lind S. Gee,MIT,0689
jRobert Geller,U Tokyo,0789
^Sebastien Geoltrain,CO Mines,1288
Hafidh AA Ghalib,ENSCO,0689
Bruce Gibson,Rice U
^Rick Gibson,MIT,0789
Dave Giles
Holly K. Given,IGPP UCSD,0689
Karsten Gohl,U WY,0689
W Verney Green,U WI,1089
Richard S. Gross,JPL/Caltech,0689
Michael Hamburger,IN U,0490
*Robert Hamilton,USGS Reston,0689
jKatsuhiko Hara,U Tokyo,0789
David Harkrider,Caltech,0889
^Jerry Harris,Stanford,1288
*Pembroke Hart,NAS,0689
Siamak Hassanzadeh,IBM,0689
Terri Hauk,LLNL,0689
Jim Hays,NSF
Chris Hayward,Dallas TX,0689
Tom Hearn,Cornell,0988
^Klaus Helbig,U Utrecht,0789
Paul Henkart,Scripps,0390
Tom Henyey,USC,0988
John Hildebrand,Scripps,0689
N Ross Hill,Chevron La Habra,0490
jNaoshi Hirata,Chiba U,0789
Steve Holbrook,Woods Hole,0189
^Julie Hood,HIG,0390
^Leon Horowicz,Schlumberger,0390
David Horwitt,IGPP,1188
Susan Hough,Lamont-Doherty,0689
Vindell Hsu,LSU
Peter Hubral,via Uli Achauer,0689
Kevin Hutchenson,St Louis U,0689
^Heiner Igel,British GS,1288
Philip Inderwiesen,Texaco,1089
Shane Ingate,Au BMR Canberra,0490
Bryan Isacks,Cornell,1088
Bryan Isacks,Cornell,1088
Hans Israelsson,CSS,0689
Joel Ita,LBL,1089
HM Iyer,USGS Menlo Park,0190
Dave Jackson,UCLA,1289
Craig Jarchow,Stanford,0390
Steve Jarpe,LLNL,0689
Rong-Song Jih,Teledyne Geotech

djohnson@note.nsf.gov
ccslj@csa2.lbl.gov
lejohnson@note.nsf.gov
johnson@rsconvex.geo.arizona.edu
mal@andreas.menlo.usgs.gov
jgmjo@chevron.com
t.jordan@omnet
julian@andreas.menlo.usgs.gov
donna@earth.nwu.edu
kadinsky@afgl-vax.af.mil
kafka@bcvms.bitnet
kao@geo1.las.uiuc.edu
karl@oshkosh.wisc.edu
martin@hanauma.stanford.edu
hitosi@gsjc3d.gsj.junet@relay.cs.net
bi00@utep.bitnet
kind@szgrf.bgr.dbp.de
eik@os.is
johnk%jupiter@nmt.edu.csnet
lknopoff@uclaiepi.bitnet
kxk158@rses.anu.oz.au
klaasjan@dutmgf1.tudelft.nl
kov@erebus.stanford.edu
lahr@andreas.menlo.usgs.gov
oklahoma%neic.decnet@isdres.isd.usgs.gov
spyros@erebus.stanford.edu
leary%sei@kylara.usc.edu
lee@rayleigh.mit.edu
whlw6@slac.bitnet
lentrich@lamont.ldgo.columbia.edu
alan@geophysics.rice.edu
e_gs35@va.nmh.ac.uk
craig@gauss.att.com
e_gs25%va.nmh.ac.uk@cunyvm.cuny.edu
lanbo@erebus.stanford.edu
world@tamgeop.bitnet
gpnosve@gitnve2.gatech.edu
john@seismic.psu.edu
ruth@geops.geo.washington.edu
lynnes@seismo.css.gov
e_gs33%va.nmh.ac.uk@cunyvm.cuny.edu
liz@iris.edu
imacgregor@note.nsf.gov
elmajer@lbl.bitnet
mallick@loihi.soest.hawaii.edu
steve@geops.geo.washington.edu
mangino@afgl-vax.af.mil
mandal@erl.mit.edu
geop00@ccm.umanitoba.ca
dee@iris.edu
marshall@beno.css.gov
art@utig.ig.utexas.edu
mmayhew@note.nsf.gov
tvmcevilly@lbl.gov
meyer@geology.wisc.edu
michael@andreas.menlo.usgs.gov
jbminster@ucsd.edu
mitchellbj@sluvca.bitnet
mithal@lamont.ldgo.columbia.edu
wmoon@ccm.umanitoba.ca
moos@erebus.stanford.edu
peter%ipgetg.uucp@uunet.uu.net
mortera@tamgeop.bitnet
dalsqnt!rpp386!arcoexre!chuck@uunet.uu.net
francis@hanauma.stanford.edu

Douglas Johnson,NSF
Lane Johnson,UC Berkeley
Leonard Johnson,NSF
Roy Johnson,U AZ,0190
Malcolm Johnston,USGS,0490
Glyn Jones,Chevron La Habra,0490
*Tom Jordan,MIT,0689
Bruce Julian,USGS Menlo Park,0189
Donna Jurdy,Northwestern
Katherine Kadinsky-Cade,AFGL,0390
Alan Kafka,Boston Coll
Hann Kao,U IL Urb-Cham,0390
John Karl,U WI Oshkosh,0689
^Martin Karrenbach,Stanford,0789
jHitoshi Kawakatsu,Japan GS,0789
Randy Keller,U TX El Passo,0189
Rainer Kind,GRF,1088
Einar Kjartansson,Reykjavik,1188
oJohn Knapp,NM Tech
Leon Knopoff,UCLA,1289
jKazuki Koketsu,ANU,0989
^Klaas-Jan Koster,Delft U Tech,0390
Robert L. Kovach,Stanford,0689
John Lahr,USGS Menlo Park,0689
Jim Lawson,OK Geol Surv,0689
^Spyros Lazaratos,Stanford,1288
^Peter Leary,USC,1288
Sang-Mook Lee,MIT,0689
*WHK Lee,USGS Menlo Park,0689
David Lentrichia,Lamont-Doherty,1289
Alan Levander,Rice U
^Xiangyang Li,BGS,0390
Craig Lindberg,Bell Labs,0689
^Enru Liu,British GS,0789
Lanbo Liu,Stanford,0390
Daniel Lizarralde,TX A&M,0689
Tim Long,GA Tech
John Louie,PA State U,0689
Ruth S Ludwin,U WA,1089
Chris Lynnes,Teledyne,0689
^Colin MacBeth,British GS,0789
Liz MacDowell,IRIS,0889
Ian MacGregor,NSF
^Ernest Majer,LBL,1288
^Subhashis Mallick,HIG,0390
Steve Malone,U WA
Stephen Mangino,AFGL,0390
Batakrishna Mandal,MIT,0689
Manitoba geophys. group,U Man,0489
Deanna Mann,IRIS HQ,1089
Margaret Marshall,S-Cubed,0689
Arthur Maxwell,UT Austin,0689
Michael Mayhew,NSF
Tom McEvilly,LBL,0989
Bob Meyer,U WI,1089
Andrew Michael,USGS Menlo Park,0689
Jean-Bernard Minster,Scripps,0689
Brian Mitchell,St Louis U,0988
Rakesh Mithal,LDGO,0689
Wooil M. Moon,U Manitoba,0489
Dan Moos,Stanford,0189
^Peter Mora,Inst Phys Globe,0789
Carlos Mortera-Gutierrez,A&M,0689
oChuck Mosher,ARCO Plano TX,1288
^Francis Muir,Stanford,1288

jeff@rockytop.gg.utk.edu
cliff@ice.geology.wisc.edu
nabelek@jacobs.cs.orst.edu
nagumo@loihi.hig.hawaii.edu
kkn%s06.es.llnl.gov@lll-lcc.llnl.gov
ni@physicsvax.nmsu.edu
dave@hanauma.stanford.edu
nolet@geof.ruu.nl
nolte@loihi.soest.hawaii.edu
norris@norris.rutgers.edu
nowack@ee.ecn.purdue.edu
nyq@ornl.gov
eugene%ipgetg.uucp@uunet.uu.net
okaya%ccs@lbl.gov
geomagic@kcgll.eng.ohio-state.edu
denio@scubed.com
orcutt@bull.ucsd.edu
rick@hanauma.stanford.edu
frott@jcuvax.bitnet
owens@tigger.geol.scarolina.edu
park%seismc.decnet@venus.ycc.yale.edu
patnaikgb@sluvca.bitnet
pavlis@gold.ucs.indiana.edu
e_gs32%va.nmh.ac.uk@cunyvm.cuny.edu
pelton@sapphire.idbsu.edu
mdp@lamont.ldgo.columbia.edu
joe@utig.ig.utexas.edu
bob@weasel.princeton.edu
phinney@iris.edu
leep@geology.wisc.edu
prange@erl.mit.edu
zafy@cornellf.tn.cornell.edu
sedas%neis.decnet@isdres.isd.usgs.gov
bpresgrave@usgsresv.bitnet
prother@sbitp.bitnet
pulli@seismo.css.gov
rjpulliam@lbl.gov
fred@hazard.span.nasa.gov
puster@benioff.mit.edu
tony@geops.geo.washington.edu
nitzan@taurus.bitnet
richards@lamont.ldgo.columbia.edu
richards%s49.es.llnl.gov@lll-lcc.llnl.gov
markr@utig.ig.utexas.edu
ritzwoll@geophysics.harvard.edu
rivers@seismo.css.gov
userfepq@rpitsmts.bitnet
al@geops.geo.washington.edu
250024@dhhdkrz5.bitnet
convex!drlc1!strooney@uunet.uu.net
jrundle@sandia.gov
stan@erebus.stanford.edu
ryaboy@seismo.css.gov
pierre@erebus.stanford.edu
kenji@seismo.gps.caltech.edu
apctrc!zjas23@uunet.uu.net
sue@iris.edu
userpcb@lncc.bitnet
np2314s@epri.bitnet
gg-gts@mines.utah.edu
susan@flatte.ucsc.edu
mxi@ornl.gov
mrinal@bullen.ig.utexas.edu
sena@erl.mit.edu
tjs%esosun.css.gov@seismo.css.gov

Jeff Munsey,TN Valley Auth,0190
Cliff Munson,U WI Madison,0689
John Nabelek,OR St Corvallis,0689
Shozaburo Nagumo,HIG U HI,0689
Keith Nakanishi,LLNL
Jim Ni,NM St,0989
^Dave Nichols,Stanford,1288
Guust Nolet,Utrecht U,0689
^Bertram Nolte,HIG,0390
Andrew Norris,Rutgers U,0689
^Robert Nowack,Purdue,0390
Jon Nyquist,ORNL,0390
^Eugene Obba,Inst Phys Globe,0390
Dave Okaya,CALCRUST,1288
Daniel RH O'Connell,OH St,0689
Dennis O'Neill,,0689
^John Orcutt,UCSD,1288
Rick Ottolini,Stanford
William Ott,John Carroll U,1089
Tom Owens,U South Carolina,0390
Jeffrey Park,Yale
Gagan Patnaik,St Louis U,0689
Gary Pavlis,IN U,0490
^Sheila Peacock,British GS,0789
JR Pelton,Boise State U,0390
Mark Petersen,LDGO,0689
JD Phillips,UT Austin,0390
Bob Phinney,Princeton
Bob Phinney,IRIS HQ,0989
Lee Powell,U WI,1089
Michael Prange,MIT,0689
Tom Pratt,INSTOC,0689
Bruce Presgrave,USGS Denver,0689
Bruce Presgrave,USGS Denver,0689
Bill Prothero,UCSB
Jay J. Pulli,Radix Systems,0689
Jay Pulliam,UC Berkeley,0689
Hans Pulpan,U AK,0390
Peter Puster,MIT,0689
Tony Qamar,U WA
Nitzan Rabinowitz,Israel IPR&G,0189
Paul Richards,LDGO,0989
Paul Richards,until July 1990,0989
Mark Riedesel,U TX Austin
Mike Ritzwoller,Harvard,0390
Wilmer Rivers,Teledyne,0689
Steve Roecker,RPI
Alan Rohay,Pac NW Lab,0689
^Bjoern Rommel,I Geop Hamburg,0789
Sean Rooney,Mobil Dallas,0689
John Rundle,Sandia,0689
Stanley Ruppert,Stanford,0689
Vladislav Ryaboy,CSS,0689
^Pierre Samec,Stanford,1288
Kenji Satake,Caltech,0689
John A. Scales,Amoco Res,0689
Sue Schock,IRIS DMC,0390
^Mike Schoenberg,U Para Brazil,0390
John Schneider,EPRI,0689
^Gerard Schuster,Utah,1288
Susan Schwartz,UC Santa Cruz,0689
Bob Selfridge,ORNL,0390
^Mrinal K. Sen,U TX Austin,0390
Arcangelo G. Sena,MIT,0889
Thomas Sereno,SAIC,0689

wycrutc@erenj.bitnet
shearer@bull.ucsd.edu
afs@benioff.mit.edu
shengold@lamont.ldgo.columbia.edu
rock@geophysics.rice.edu
sibol@vtvm2.bitnet
silver@ciw.span.nasa.gov
simpson@lamont.ldgo.columbia.edu
singh%ipgetg.uucp@uunet.uu.net
convex!drlc1!sudarshan@uunet.uu.net
ssipkin@isdres.isd.usgs.gov
geowhiz!sharon@spool.cs.wisc.edu
convex!texhrc!yss@uunet.uu.net
slack@cyclop.span
ats%s58.es.llnl.gov@lll-lcc.llnl.gov
apctrc!zmls04@uunet.uu.net
gg-rbs@mines.utah.edu
stew@geops.geo.washington.edu
snoke@vtvm2.cc.vt.edu
marvin@rockytop.gg.utk.edu
seth@earth.nwu.edu
stewart%sdr.slb.com@relay.cs.net
pauls@utig.ig.utexas.edu
stof@trc.amoco.com
sung%logos.span@vlsi.jpl.nasa.gov
carter@beno.css.gov
suyehiro@jpnoriut.bitnet
jchsw@chevron.com
fumiko@utig.ig.utexas.edu
toshiro@seismo.gps.caltech.edu
ctaylor@afgl-vax.af.mil
taylor@hal.css.gov
d.b.taylor@edinburgh.ac.uk
taylor%s26.es.llnl.gov@lll-lcc.llnl.gov
fresno@outlaw.uwyo.edu
teng%sei@kylara.bitnet
250023@dhhdkrz5.bitnet
dean@erebus.stanford.edu
clifft@geology.wisc.edu
trehua@jacobs.cs.orst.edu
apctrc!zsxt01@uunet.uu.net
usertsin@ualtamts.bitnet
b39959@tansei.cc.u-tokyo.ac.jp
roger@erl.mit.edu
junger@sun1.gd.usgs.gov
wiawung%hdetud1.tudelft.nl@cunyvm.cuny.edu
vandecar@irisuw1.geo.washington.edu
greg@iris.edu
vaneck@geof.ruu.nl
vasco@ccs.lbl.gov
swede@beno.css.gov
vergino%s15.es.llnl.gov@lll-lcc.llnl.gov
flvernon@ucsd.edu
vid@flatte.ucsc.edu
wald@seismo.gps.caltech.edu
wallace@eqsun.geo.arizona.edu
ward@wards.menlo.usgs.gov
srwgthw%m2g.dsir.govt.nz@uunet.uu.net
weber@szgrf.bgr.dbp.de
dweill@note.nsf.gov
jwhitcomb@note.nsf.gov
rotondo@bull.ucsd.edu
doug%wumv1.span@vlsi.jpl.nasa.gov
e_gs44%va.nmh.ac.uk@cunyvm.cuny.edu
plwilliams@lbl.gov

^Pravin Shah,EPR Houston,1288
Peter Shearer,IGPP UCSD,0689
Anne Sheehan,MIT,0689
Larry Shengold,Lamont-Doherty,1289
Ruey-Chyuan Shih,Rice U,0689
Matthew S. Sibol,VPI&SU,1189
Paul Silver,DTM-CIW,0190
David Simpson,LDGO,0689
^Satish Singh,Ins Phys Globe,1288
^Sudarshan Singh,Mobil Dallas,1288
Stewart Sipkin,USGS Denver,0390
^Xiao Rung (Sharon) Shih,U WI,1288
^Youngsun Shin,Texaco,1288
Philip Slack,UCLA,0689
Albert T. Smith,LLNL,0689
Martin L. Smith,Amoco Res,0689
Robert Smith,Utah
Stewart Smith,U WA,0789
Arthur Snoke,VPI&SU,0590
Marvin Speece,U TN,0190
Seth Stein,Northwestern
Lisa Stewart,Schlumberger,0689
Paul Stoffa,U TX Austin
^Christof Stork,Amoco Tulsa,0390
Li-yu Sung,JPL,0689
George Sutton (via Jerry Carter)
jKiyoshi Suyehiro,U Tokyo,0390
Chuck Sword,Chevron La Habra,0490
Fumiko Tajima,U TX Austin
^Toshiro Tanimoto,Caltech,0390
Charles Taylor,AFGL,0390
David Taylor,ENSCO,0689
^David Taylor,U Edinburgh,0390
Steve Taylor,LLNL,0989
Mary Templeton,U WY,1089
Ta-liang Teng,USC
Ekkehart Tessner,I Geop Hamburg,0789
George Thompson,Stanford
Cliff Thurber,U WI Madison,0989
Anne Trehu,OR St Corvallis,0689
Sven Treitel,Amoco Res,0889
^Constantine Tsingas,U Alberta,1288
jSeiji Tsuboi,U Tokyo,0789
^Roger Turpening,MIT,0390
John Unger,USGS Reston,0689
Ruud Unger,Tech U Delft,0390
John C. Vandecar,U WA,0689
Greg van der Vink,IRIS HQ,1089
Torild van Eck,U Utrecht,0490
Don Vasco,LBL,1089
Karl F. Veith,Pac Sierra Res,0689
Eileen S. Vergino,LLNL,0689
Frank Vernon,IGPP UCSD,0689
John Vidale,UC Santa Cruz,0689
David Wald,Caltech,0689
Terry Wallace,U AZ,0689
Peter Ward,USGS Menlo Park,0589
Terry H Webb,NZ DSIR Geoph,0190
Michael Weber,GRF,1088
Dan Weill,NSF,1089
James H. Whitcomb,NSF,0689
Rudolf Widmer,IGPP UCSD,0989
Doug Wiens,Wash U St Louis,1188
^Phil Wild,British GS,0789
Patrick Williams,LBL,0689

```
rick@rockytop.gg.utk.edu                    Rick Williams,U TN,1189
rick@utkvx.bitnet                           Rick Williams,U TN,1088
wiltschko@tamgeop.bitnet                    Dave Wiltschko,TX A&M,0988
jdcwi@chevron.com                           Dean Witte,Chevron La Habra,0490
becky@iris.edu                              Becky Wofford,IRIS DMC,0390
wolf@afgl-vax.af.mil                        Lorraine Wolf,AFGL,0390
cecily@benioff.mit.edu                      Cecily J. Wolfe,MIT,0190
mwoods@earth.nwu.edu                        Mark T Woods,Northwestern U,1089
bg4655@bingvma.bitnet                       Francis Wu,SUNY Binghamton
mew@earth.nwu.edu                           Michael Wysession,Northwestern,0689
e_gs41@va.nmh.ac.uk                        ^Gareth Yardley,BGS,0390
yedn@ubcmtsg.bitnet                        ^Matt Yedlin,UBC,0789
cy@cunixb.cc.columbia.edu                   Chuan-Sheng Yin,Columbia,1089
yomo@erebus.stanford.edu                    Kiyoshi Yomogida,Stanford,0689
zandt%s25.es.llnl.gov@lll-lcc.llnl.gov      George Zandt,LLNL
alex@ukcc.uky.edu                           Alex Zekulin,U KY,0789
zhang@seismo.gps.caltech.edu                Yu Shen Zhang,Caltech,0689
zhu@wuvm1.bitnet                            Anning Zhu,Wash U St Louis,0689
zoback@erebus.stanford.edu                 ^Mark Zoback,Stanford,1288
zucca%s27.es.llnl.gov@lll-lcc.llnl.gov      Jay Zucca,LLNL
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PERFORMANCE OF IRIS/IDA STATIONS IN THE USSR

Holly Given and Jonathan Berger
Institute of Geophysics and Planetary Physics
Scripps Institution of Oceanography
University of California San Diego
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In the February 1990 IRIS newsletter, the report on the status of the Data Management Center (DMC) showed that very little data from IRIS/IDA stations in the USSR had been entered into the DMC archive. The purpose of this report is to clarify that the IRIS/IDA USSR stations have been regularly recording data, and that data have been regularly processed through the IRIS/IDA Data Collection Center (DCC) in San Diego. Since February 1989, which we consider as the start of standardized operation, the USSR stations have had "up times" of between 70% to 98%, depending on the site.

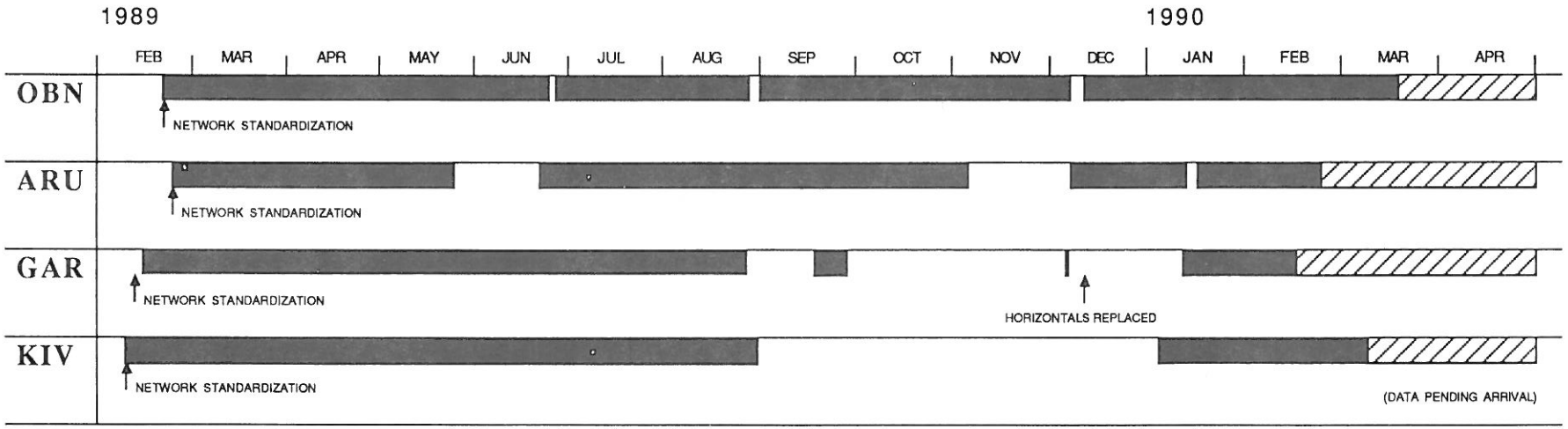
The bar chart shows the performance of the USSR stations since February 1989. Black bars show times for which data have been processed through the IRIS/IDA DCC and sent in SEED format to the Albuquerque Seismological Lab for transmission to the IRIS DMC in Austin. Typically, data are sent to ASL within 10 days of being received from the Soviet Union. However, during part of 1989 there was a delay in transmission to ASL due to difficulties in implementing the SEED format. The first shipment of data to ASL was in September 1989; the most recent in April 1990. In addition, data have been regularly sent to the Center for Seismic Studies in Washington DC in CSS format since May 1989.

Currently, 9-track tapes containing approximately 5 station-days each are received from the USSR Data Collection Center in Obninsk via air freight. Before this step can occur, the field volumes are sent from the individual stations to Obninsk, where they are archived and copied. Thus local transportation conditions affect the speed at which data arrive into the USSR DCC. We have been receiving data shipments from the USSR roughly once every two months. Hatched bars on the chart show periods for which data has been recorded, but has not yet been received from the USSR.

Users of the IRIS/IDA USSR data from 1989 may notice the following features in the data. Horizontal sensors at GAR appear to have been damaged, resulting in a degraded performance at periods below 10 s. The data are unaffected at shorter periods, where GAR shows the lowest noise levels of the four stations. The sensors were replaced in December 1989. KIV shows high horizontal noise levels below periods of approximately 300 s due to the nature of the pier construction. A new vault and pier are being constructed at KIV that should substantially reduce the long-period noise. A comprehensive analysis of the noise performance at the sites has been submitted for publication to the *Bulletin of the Seismological Society of America* and is available from us in preprint form.

IRIS / IDA / USSR PERFORMANCE

(as of MAY 1,1990)



Richard T. Williams
University of Tennessee
Department of Geological Sciences
Knoxville, TN 37996-1410