

**1998 FDSN Meeting
December 4-5, 1998
IRIS DMC
Seattle, Washington USA**

The meeting was called to order by Chairman Fukao. He began by giving his chairman's report. A brief summary of the FDSN goals was presented with the acknowledgement that great progress had been made toward meeting these goals. As the FDSN matures, Chairman Fukao indicated that perhaps a more formal FDSN structure, with a budget, might be reasonable. He drew the analogy with the Interridge program. He felt the extension of the FDSN data handling methods to other regional networks was appropriate. He also expressed the need to develop relations with the Comprehensive Test Ban Treaty Organization (CTBTO) monitoring system which consists of 50 primary and 120 auxiliary stations or arrays. Representatives from the International Monitoring System (IMS) and the International Data Center (IDC) were invited to this FDSN meeting to begin this cooperation. Chairman Fukao also alerted FDSN representatives to the fact that Streckheisen seismometers may stop being available in the future when Streckheisen retires next year. In conclusion Chairman Fukao mentioned that the upcoming IUGG meeting will have a Union Session on Integrated Global Monitoring Networks and urged FDSN representatives to submit an abstract..

The proposed agenda was approved with the modification that the CTBTO presentations would take place on the first day and the discussion about the FDSN station book would also move to the first day, if possible.

The minutes from the previous FDSN meeting in Thessaloniki, Greece were approved with minor modifications in the Geoscope, Taiwan, and China network reports. These minutes will be corrected and distributed by WWW.

Member Network Reports

We then began reports from the various networks.

China presented by Zhou Gongwei (Attachments A1 and A2)

Mr. Zhou presented the report for China. The first portion of his report was to summarize the current status of the New China Digital Seismographic Network (NCDSN) and the CDSN Data Management Center (DMC) located at the Institute of Geophysics in Beijing. There are 9 NCDSN stations and two stations of the older CDSN network that have not been upgraded to the new instrumentation level.

In total there are 650 seismic stations in China. There are 27 class A stations, 56 Class B stations, 11 CDSN/NCDSN stations, and 289 stations run in local networks. Additionally there are 20 telemetered networks with a total of 270 stations. Mr Zhou showed a detection capability map showing the detectable magnitudes from these stations.

A summary of the proposed new national network was provided. This network will consist of 50 real time stations, 140 portable stations, and 110 strong motion stations. The goal of this network is to detect all earthquakes within China with a magnitude of 5.0 or greater. It should be in place by the year 2000. All of the equipment for this network is being built in China with Chinese government funds.

Canada presented by Jim Lyons (Attachment B)

The Canadian National Seismic Network (CNSN) was presented next. The CNSN consists of about 70 stations, 5 equipped with STS-1 sensors, and 4 more equipped with GURALP CMG3 sensors and contributing data to the FDSN network. Of significance is the closure of Mould Bay (MBC) station and the movement of the Pemberton, BC station (PMB) to station LLLB, near Lillooet.

The CNSN data are available by autoDRM and they have serviced several hundred autoDRM requests to non-CTBT users.

Chile presented by Jaime Campos

The University of Chile has installed or plans to install 5 new broadband stations next year.

GEOFON presented by Winfried Hanka (Attachment C)

Since the last FDSN meeting GEOFON has installed stations in Greenland, Nicaragua, the Amazon Basin, Siberia, Chile and Namibia to enhance global coverage. In Europe stations in St. Petersburg, Portugal, Spain and Cyprus were installed and station HLG in the Baltic Sea was closed. Hanka highlighted many near real time GEOFON stations in Europe.

The GEOFON Data Center recently lost a key employee and will not be able to offer its data distribution services as it has in the past. For the short term GEOFON will distribute their data to the IRIS DMC and the IRIS DMC will generate customized SEED for users.

GEOSCOPE presented by Genevieve Roult (Attachment D)

GEOSCOPE now has 29 operational stations. 26 of these are actual GEOSCOPE stations and 3 stations are cooperating stations. There are a total of 12 stations with continuous VBB data. Station WUS in China is now equipped with an INMARSAT terminal.

GEOSCOPE always keeps its station book current,

Transfer functions are available on-line and can be used as input to evalresp. Geoscope recommends that evalresp be modified so that values are only plotted to Nyquist.

They produce noise estimates using the NEST application and these noise curves are available on-line over the WWW.

Geoscope CDROMs now only hold 10 days of data and they intend to go to DVD for further distribution.

IRIS GSN presented by Rhett Butler (Attachment E)

IRIS has completed 8 new station installations since the last FDSN meeting. They presently have plans to install stations in Hawaii, RSSD in South Dakota, Chile, Northwestern Brazil, Gabon, Midway, Raoul island.

Butler mentioned that the GSN no longer puts boreholes on small atolls since they only see 5 to 10 decibel reduction in the noise level in boreholes. Butler presented a summary of various GSN installations, showing borehole sites, those equipped with high frequency sensors and those that are IMS sites.

Butler reminded the FDSN that IRIS has a major portable instrumentation program in PASSCAL and that perhaps the FDSN has a role to play in dealing with data from portable instruments.

Bob Hutt from the USGS gave a brief review of the GTSN mentioning the changes AFTAC envisions in the future.

MEDNET presented by Salvatore Mazza (Attachment F)

All MEDNET stations are connected by modem using a satellite phone in some cases. There are 4 stations installed in Sicily and approximately 7 in the rest of Italy. MEDNET has made arrangements to begin receiving data from the Italian national power network seismic stations.

The Algerian and Albanian stations are now closed They have 2 stations in Antarctica. The data center is now using a new SEED writer they obtained from GEOFON. For political reasons MEDNET does restrict data from the two stations BGY and VSL.

Pacific 21 presented by Seiji Tsuboi (Attachment G)

Tsuboi mentioned that Pacific 21 has 56 stations in the FDSN station inventory, and 10 of these stations are in the FDSN network. Of the stations listed in the inventory 47 are existing stations, 6 are planned.

Pacific 21 consists of three groups. The Japanese Science and Technology Agency (STA) has two networks. The first is the SuperPlume network consisting of stations primarily on Pacific Islands, the second is FREESIA network of very broadband stations on the four main islands of Japan. The third component of Pacific 21 is the Ocean Hemisphere Project of ERI.

ERI installed two new stations since the last FDSN meeting, one in Korea and one in Indonesia.

Shingo Watada gave a demonstration of a new method developed by ERI/OHP that uses the Remote Method Invocation (RMI) protocol and JAVA to provide access to the three Pacific 21 data centers in a seamless manner.

Taiwan presented by Honn Kao (Attachment H)

The Broadband Array in Taiwan for Seismology (BATS) now has 11 operating stations. There are two more stations in the process of being installed and two more stations are planned. Three of the stations use STS-1 sensors and the remainder use STS-2 sensors. Most of the stations use REFTEK data loggers.

USNSN presented by Kaye Shedlock (Attachment I)

At the present time the USNSN is generating about 0.5 gigabytes per day. The network is distributing the data through the IRIS DMC in SEED format. Alternatively data are available in near real time via an autoDRM interface. As of the FDSN meeting, data for April and May of 1998 were just beginning to be sent to IRIS for distribution.

The maintenance of the dataless SEED volumes is going to be transferred to Albuquerque in the near future. At that time ASL will assume the responsibility for the generation of the dataless SEED volumes. Waveform data in miniSEED format will flow directly from the NEIC to the IRIS DMC.

Israel presented by Winfried Hanka

Hanka briefly indicated that he knew that 9 broadband stations were operating in Israel, some with the cooperation of Geofone.

Comprehensive Test Ban Treaty Organization presented by Sergio Barrientos. (Attachment J)

Barrientos began by showing the organizational chart of the Preparatory Commission.

A fairly complete summary of the CTBTO in Vienna was presented by Barrietnos. He indicated that in its final form the International Monitoring System (IMS) will consist of 50 primary seismic stations, 120 auxiliary seismic stations, 11 hydroacoustic stations of which five will be T-phase stations, 80 radionuclide stations, and 60 infrasound stations.

Of the 50 primary stations, 30 will be array stations, 19 will be 3 component stations and the nature of the final stations is still to be determined.

Of the 120 auxiliary stations, 7 will be arrays, 112 will be 3 component stations and 1 is still to be determined.

After the summary by Barrientos, Gerardo Suarez began discussing the importance of the auxiliary network in terms of the IMS network. Of the 120 auxiliary stations, 90 are part of existing parent networks, and 60 of these are part of the FDSN member networks. Auxiliary stations can become primary in case of failure of a primary. Data availability for primary stations must be 90% or higher and for new stations it must be 97% or higher.

Suarez highlighted several areas of mutual interest between the IMS and the FDSN. There must be direct and fluid communication between parent networks and the IMS. There must be non-intrusive communication, via VSAT, for command and control functions. There must be authentication of the data. IMS and the FDSN should explore mechanisms to improve data availability and host technical training programs for local operators.

The IMS has several tasks to accomplish, including

- Build 14 new auxiliary stations
- Install a VSAT link to Vienna
- Supply additional power to stations for VSAT
- Implement data authentication
- Upgrade stations to hold a seven day buffer
- Upgrade specification to meet specification

Suarez liked the idea of inserting a PC between the DAS and the VSAT circuit. He mentioned that this is a very non-intrusive approach.

ORFEUS Data Center presented by Bernard Dost

Bernard Dost presented the ORFEUS Data Center presentation. He indicated that ORFEUS now has 19 CDROMs covering data before 1993. There will soon be an additional 6 CDROMs containing data for the year 1993. The data for 1994 are on-line and available and they already have 1998 data on-line.

ORFEUS working groups are quite active. They hosted an ORFEUS Working Group meeting at the Quanterra Working Group Meeting in Prague.

ORFEUS proposes that there should be a joint working group between ORFEUS and the FDSN on instrumentation.

IRIS Data Management Center presented by Tim Ahern (Attachment K)

Tim Ahern presented a brief summary showing the amount of data at the IRIS DMC that is from IRIS and/or FDSN data sources. Of about 7.5 terabytes of data at the IRIS DMC, about 1.5 terabytes are from non-IRIS FDSN sources.

The IRIS DMC continues to develop and support a variety of software that is used by the FDSN and others. These include rdseed, verseed, evalresp, relish, POD, WEED and the Net_DC software. These programs can be found at <ftp.iris.washington.edu> in ~ftp/pub/programs.

The IRIS DMC has a variety of user request tools. These include email-based tools such as

- WEED, BREQ_FAST, NetDC and XRETRIEVE

As well as WWW based tools such as

- WebWEED, WILBER, WebRequest and
- SeismiQuery

Which is a WWW based tool that provides information from the Oracle Database maintained at the IRIS DMC.

The IRIS DMC anticipates shipping over 35,000 data shipments this year, about 7,500 of these are for customized data volumes from the mass storage systems and the rest are shipments of FARM products or about 10,000 direct accesses of data in SEED volumes stored in the FARM or the SPYDER® datasets. Roughly 14.5% of all IRIS DMC data shipments were sent to seismologists outside the United States. The countries that most often access data from IRIS are Great Britain, Italy, Greece, Taiwan, France and Russia. More than 2500 data shipments were made to the international seismology community in 1998.

The DMC distributes a large amount of data that originates from FDSN networks. Canadian data and Italian (MEDNET) data were requested about 1500 times during the past 3 years.

International Data Center of the CTBTO presented by Steve Bratt (Attachment L)

Steve Bratt highlighted aspects of the Global Communications Infrastructure (GCI) during his presentation. About 2/3 of the IMS data will reach the IDC in Vienna through the GCI and 1/3 by other means. Data from US, Canada, France, Russia will be forwarded to Vienna by the National Data Centers of those countries. The VSAT hardware is very small and normally uses 85 watts of power. In some remote areas it may require 150 watts.

The IDC is going to use only two data formats. Continuous data will be transmitted over satellite using CD-1 format using TCP/IP. This will continue through 1999. After that the CTBTO will go to a system that uses acknowledgement of frames sent in UDP/Multicast. The latter format is known as CD-2.

Segmented data from auxiliary stations will be accessed using IMS1.0 format, more commonly known as autoDRM format.

There is a task leader to determine how data should be distributed to the outside world.

Continued FDSN Business

General discussion related to the CTBTO continued in the general business meeting. It was determined that the FDSN should establish a new working group related to coordinating the activities of the FDSN and the CTBTO. It was decided to defer the membership of this working group until the second business meeting.

The TERMS of REFERENCE for the FDSN were modified at the Thessaloniki meeting. Copies of the revised Terms of Reference were distributed and were adopted at this meeting.

The general business meeting was then adjourned in order to allow the Working Groups to meet.

December 5, 1998 Reports of the Working Groups

Working Group I — Station Siting and Attachment M) presented by Montagner

It was recommended that the chair of the FDSN should write to the IMS to ask if they would

become a member of the FDSN.

It was determined that the station inventory list should include the network code as a column in the list. The list of all the network codes should appear at the end of the inventory.

A total of 21 stations were added to the FDSN network.

It was recommended that each Working Group should create its own website.

Related to instrumentation , it was decided that the FDSN needed to clearly understand IMS equipment specifications. It was also thought that the ORFEUS and FDSN Instrumentation working groups should be coordinated.

Working Group II — Data Exchange and Formats presented by Bernard Dost

The Networked Data Center (NetDC) was discussed. Dost explained that it was basically a communication protocol between data centers. There is presently an experimental system working between the Northern California Earthquake Data Center at UC Berkeley and the IRIS DMC. Early in 1999, NetDC will be installed at ORFEUS and Geoscope. A report will be presented at Birmingham giving the results of the experiment.

A new Polynomial blockette for representing the response of non-linear systems was presented and open for comments. If no comments are received by January 15, 1999 then the blockette will be adopted.

IRIS presented a method for correcting time information in data that were already archived. Again this approach is open for comments until January 15, 1999. If no comments are received by then the approach will be adopted.

It was agreed that the Network Code could be upper or lower case. However, uppercase is always preferred.

The use of Frequency, Amplitude, and Phase for response information is still discouraged.

Working Group III — Software Coordination presented by Tim Ahern

This was the first meeting of this working group. Brief discussions took place about object oriented and CORBA frameworks as being considered by IRIS. It is felt that FDSN input and guidance in specific areas would be very fruitful

- The Business Model, the interrelationships between processes and data
- The Seismic Classes
- The need for a variety of CORBA services

It was mentioned that the EGS in the Hague in April 1999 will have a session devoted to software issues.

The Ocean Hemisphere's Project (OHP) Data Center at the University of Tokyo is using JAVA and Remote Method Invocation (RMI) to network data centers together within Japan. It was felt that this is an interesting approach and the FDSN should stay informed of activities in this area.

Other FDSN Business

The FDSN formed a working group on Coordination with the CTBT. Its purpose is to share information between the two organizations and also to act as a formal point of contact.

Jim Lyons of Canada was appointed as the Chair of this Working Group. It's name is FDSN Working Group IV, Working Group for CTBT Coordination.

Members of WG IV include

- Jim Lyons Canada (Chair)
- Rhett Butler, IRIS USA
- Winfried Hanka, Geofone, Germany
- Steve Bratt, CTBTO, UN
- Sergio Barrientos, CTBTO, UN
- Bernard Dost, ORFEUS, Netherlands
- Tim Ahern, IRIS USA
- Genevieve Roullet, Geoscope France
- Seiji Tsuboi, Pacific-21, Japan
- Kay Shedlock, USGS USA

ISC Report presented by Ray Willeman (Attachment N)

The International Seismological Centre (ISC) was represented at the meeting by Dr. Ray Willeman, the new ISC director. A summary of the ISC is attached as an appendix to these minutes. Willeman briefly described the organization of the ISC and discussed the various ISC products. He indicated that they currently use the Jeffrey-Bullen tables for travel times.

H₂O Report presented by Rhett Butler

Rhett Butler gave a brief report on the H₂O project. He indicated that seismic data had been recorded briefly by this system but a malfunction now necessitates a repair trip to the H₂O site that is scheduled for the fall of 1999.

Discussion then turned to possible new members of the FDSN. The following list resulted from that discussion.

- Iran, IIEES and Geophysical Institute
- Japan, Kiban
- Greece
- Spain, PTS
- AFTAC
- DASE with Caristan as the contact
- British Geological Survey
- Kazakhstan
- Kyrgystan

It was decided to have the next meeting in Birmingham, England in conjunction with the IUGG. If possible the meetings will be early in the second week (such as Monday) and later in the second week (preferably Tuesday). It was felt that evening meetings would work well.

The FDSN meeting was adjourned by the Chairman, Yoshio Fukao.

Respectfully submitted

Tim Ahern

FDSN Secretary

Additional Attachments:

Other Network Reports

Czech national Seismic Network Attachment O

Polish National Network Attachment P

Swiss Earthquake Monitoring System Attachment Q

Attachment R Terms of Reference

Attachment S List of Attendees

Attachment T TPC1 Report