Minutes

International Ocean Networks (ION)

Breakfast Meeting

DRAFT

December 13, 2006 (AGU)

San Francisco

Attendees:

Adam Dziewonski
Peter Bromirski
Ralph Stephen
Rhett Butler
Barbara Romanowicz
Jean Paul Montagner
Adam Schultz
Bob Detrick
Seiji Tsuboi

Regrets from the following:

Becker
Person
Villinger
Mooers
Chave
Favali
Stutzmann
Deschamps
Taritts

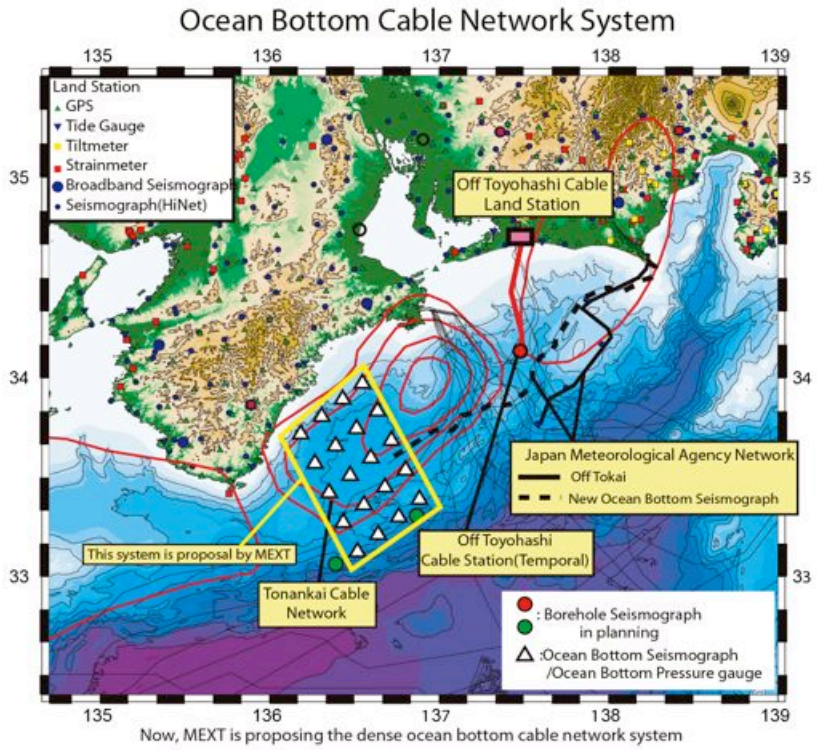
There have been so many developments in the US, with regard to the Ocean Observatory Initiative, and in other countries (e.g. ESONET under EC Framework 7, and others), that it is time for a fundamental review of ION's activities. Will the ION objectives be met under the emerging observatory plans? In light of these emerging plans should we hold a community workshop to produce a white paper to inform planning for new initiatives to achieve the ION science goals? These issues and questions were discussed with no definitive conclusions

ION is co-sponsoring with IASPEI a Special Session on "Underwater Observatories" (JSS016) at the 2007 IUGG meeting in Perugia (July 2-13, 2007). The

deadline for abstract submissions to the meeting was extended from January 15 to February 28. One abstract has been submitted so far. Adam and Barbara agreed to be the ION points-of-contact for this session.

Progress reports were presented by the various attendees as follows:

Tsuboi-san – Presented plans for the Tonankai cabled OBS array.



Rhett Butler – The Hawaii-2 Observatory (H2O) is no longer active and plans for further work are in a hiatus (Appendix 1 - although undated this letter was being distributed via email prior to December 1, 2005).

- An H2O proposal has been submitted to NSF. IRIS is not a participant in this proposal.
- Using its final H2O funds, IRIS has paid the License fees for 2007 for the Makaha Cable Station, on behalf of IRIS Ocean Cable.
- A formal request should be made to OBSIP to release data from at least one sensor of a deployment immediately without going through the 1-2 year moratorium. The PASSCAL policy is: "All passive experiments with five or more stations will designate at least one station as an "open station". The data from the "open station/s" will be made available to the public immediately upon being archived." (PASSCAL website: http://www.passcal.nmt.edu/information/Policies/data.delivery.html)

Jean Paul Montagner – France and Japan continue to struggle with funding and planning for the NERO observatory.

Ralph Stephen/ Bob Detrick - Ralph passed out the ION proposal that was submitted to IODP for the October 1, 2006 submission date. This summarized pretty well the material that Bob D. presented on the ORION/OOI status, with the added info that the Southern Pacific Site was no longer in consideration. (Appendix 2)

Barbara Romanowicz - A project has been funded to connect the MOBB system to the MARS seafloor cable (Appendix 3)

Appendix 1: Larry Clark Letter on H2O Planning

Dear friends and participants in the H2O Observatory project:

I am writing to report that after extensive discussions internally at NSF and with numerous members of the research community, the Division of Ocean Sciences has reluctantly decided to put any further development of the H2O Observatory on an indefinite hold. This includes all current plans for a re-deployment. This decision was based on several factors:

- NSF is under significant resource constraints within the current fiscal year that will likely continue into the near future. As such there is increasing competition among highly rated research projects with large resource demands such as H2O. To the best of our knowledge, the minimum cost excluding ship time to proceed through the integration tests to deployment is close to $1.3M.
- The money alone is not the issue. A primary focus of our extensive internal discussions has been the scientific rationale for the H2O Observatory. These cross-divisional discussions have demonstrated that the scientific drivers for H2O are not as strong as they were at the time of initial funding. There are many highly rated, scientifically compelling proposals being declined for a lack of resources. A consensus of research programs is that the science justifying further H2O investments cannot be given the necessarily higher priority at this time.
- The proof-of-concept, test-bed element of H2O is no longer a strong supporting argument. Because of its analog system and fairly unique technical requirements, there is little engineering development related to H2O that will be essential to future OOI and ORION planning.

There are several other contributing factors as well that need not be mentioned. But for all these reasons we have determined that we are unwilling to make the large resource commitment needed to make the H2O Observatory operational at this time. Should the community feel that H2O is of sufficiently high scientific priority to justify the resources needed to make the site operational, we will be receptive to a new proposal to complete the work needed to proceed with testing and re-deployment of the H2O system. Such a proposal should include not only a very strong scientific justification for proceeding, but should also outline a management plan for the facility in both the testing and operations phases, as well as a documented estimate of the costs involved with integration testing, deployment, and future operations and maintenance. Needless to say, any new proposal would undergo peer review.

In summary, there is a great deal of very exciting science that we are currently not able to fund and the science drivers for the H2O site are not deemed to be competitive in the current resource climate. We leave it up to the community to determine how it wishes to proceed.

Sincerely,

Larry Clark
OCE Division Director

Appendix 2: ION Response Letter to IODP Proposal (631-Pre)

September 28, 2006

Drs. N.O. Eguchi & J.D. Schuffert
iSAS Office
2-15 Natsushima-cho,
Yokosuka, 237-0061,
JAPAN

Re: Proposal No. 631-Pre - Global siting plan for borehole geophysical observatories in the International Ocean Network

Dear Drs. Eguchi/Schuffert,

This is a third Response Letter to bring you up to date on our progress with Pre-Proposal No. 631. The ION community has been active over the past few years in planning and pursuing funding for installing broadband seismometers in existing holes and in coordinating long-term planning and standards with the new permanent seafloor observatory initiatives (OOI/ORION, etc). Figure 1 summarizes the ION "vision" for a network of broadband borehole seismometers to provide uniform seismic coverage over the surface of the globe. Not much has changed since this figure was first published in 2003.

In the last response letter we advocated a staged approach to instrumenting borehole seismic sites. At the sites that are targeted for meeting ION objectives, autonomous borehole seismic stations should be deployed for a year or so, prior to installing the network infrastructure. As we know there are many logistical reasons as well as just plain bad luck that
lead to sub-optimal seafloor seismic installations. It makes sense that we should be able to demonstrate that a seismic installation is providing valuable, high quality data before committing to a high cost real-time acquisition system. (This is the plan that is being followed with the four broadband borehole seismic installations in the Western Pacific and Japan Trench [*Araki, et al.*, 2004; *Suyehiro, et al.*, 2002]. The systems are installed in an autonomous recording fashion while their data quality is being evaluated. The option of linking these sites to cables for real-time acquisition is left open for a second stage.)

Although progress towards global borehole sites has been slow, we have been gaining experience with cabled coastal seafloor seismic stations. 1) An autonomous recording seafloor station has been running in Monterey Bay for over three years [*Dolenc, et al.*, 2006; *Stutzmann, et al.*, 2001]. This sensor could possibly be converted to a cabled observatory to MBARI. If a proposal to drill in Monterey Bay is successful this site could also potentially be augmented with a borehole station. 2) A cabled seafloor station has been running for over a year in the Mediterranean off France as part of the Antares project. 3) Testing of the multidisciplinary seafloor observatory,

GEOSTAR, has been ongoing [*Monna, et al.*, 2005]. 4) Unfortunately the telemetry to the H2O station has been down for a number of years and it is not clear when this will become operational again. 5) Funding has been sought in Japan and France for a broadband borehole observatory at the Ninety-East Ridge Observatory (NERO) but so far without success. Because the site is so remote, technology is being developed to reduce maintenance efforts. This takes time. 6) Meanwhile the four autonomously recording broadband borehole installations off Japan continue to provide data to the extent that their power supplies, data storage capability, and ships schedules allow.

In the US we have been unsuccessful in securing funding for autonomously recording global borehole seismic stations. The strategy here has been to combine the ocean seismic network objectives with the multidisciplinary global observatory efforts, OOI/ORION, to get real-time continuous global observatories. The OOI/ORION Conceptual Network Design (CND) based on the workshop in Salt Lake City in March 2006 summarizes the thoughts to date. Although the ION Global Siting Plan (Figure 1) had been submitted as an RFA to the OOI/ORION office, compromises had to be made to coordinate these sites with other multi-disciplinary objectives. Figure 2 (from the CND) shows the top three sites that were chosen for the seismic, borehole and multidisciplinary observatories. 1) The mid-Atlantic Ridge site coincides with DSDP Re-entry site 396 that was drilled on Leg 46. 20 Unfortunately the East Pacific Rise site is not co-located with ODP Site 1243A that was drilled on ODP Leg 203. 3) The third site satisfies a strong recommendation from ION to place a seismic observatory in the Southern Pacific Ocean where there is a large gap in coverage. Figure 3 summarizes the OOI Global Siting Strategy after all multidisciplinary interests have been taken into account. The five sites labelled "A" have "top priority" and a priority was not assigned within this group. If the East Pacific Rise (A3) and the Western Southern Pacific (A5) sites are chosen for permanent observatories there would be a strong incentive to drill boreholes at these sites for ION global broadband borehole seismic installations.

The Ocean Seismic Network community will of course continue to pursue funding for autonomous broadband borehole stations at the existing boreholes sites shown in Figure 1.

It is worth noting that this pre-proposal focused specifically on sites to complete "uniform global seismic" coverage. Although supported by the ION community boreholes for test facilities, for non-seismic objectives, and for regional and local seismic objectives were not addressed.

Yours sincerely,

Ralph Stephen

References

Araki, E., et al. (2004), Improvement of seismic observation in the ocean by use of seafloor boreholes, *Bulletin of the Seismological Society of America*, *94*, 678-690.

Dolenc, D., et al. (2006), Monterey Ocean Bottom Broadband Station (MOBB): data analysis and noise reduction, *Seismological Research Letters*, *77*, 218.

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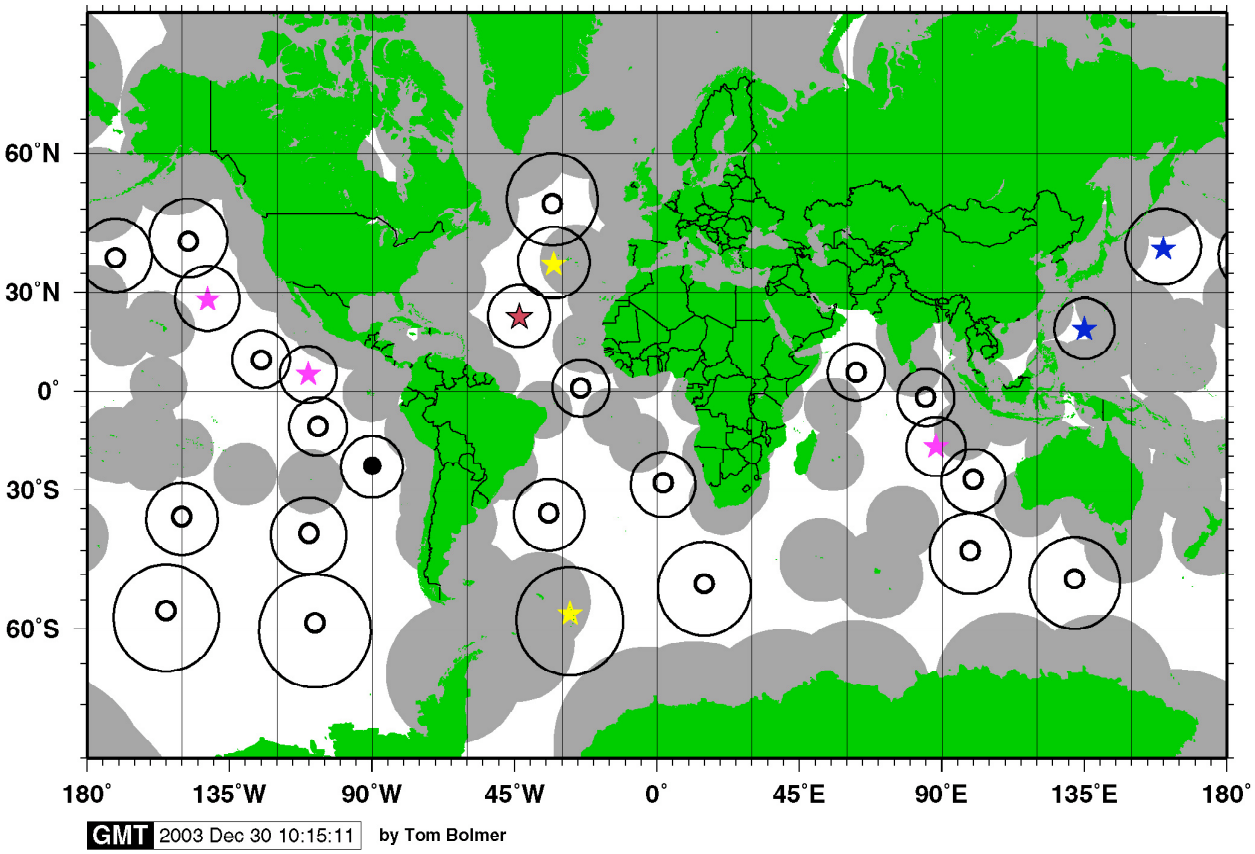

Figure 1: This figure summarizes the role of ocean borehole sites in global seismic coverage. The grey shaded regions indicate the surface coverage out to 1000km from continent and island stations. (These are distorted in the projection.) White spaces are gaps in the land based coverage. Existing and proposed ocean stations for global coverage are indicated by symbols surrounded by black circles at approximately 1000km radius. The different symbols show different levels of progress at the ocean sites: red star - the

Mid-Atlantic Ridge test site (the OSNPE and Japan Sea regional test sites are not shown), blue stars - presently operating borehole observatories (the Japan Trench regional sites are not shown), maroon stars - sites at which boreholes have been drilled but have not yet been instrumented, solid and open black circles - high priority ION sites proposed in 1996 but not yet drilled and yellow stars - other proposed sites which have not yet been drilled [*Butler*, 1995; *Purdy and Dziewonski*, 1988; *Stephen et al.*, 2003].

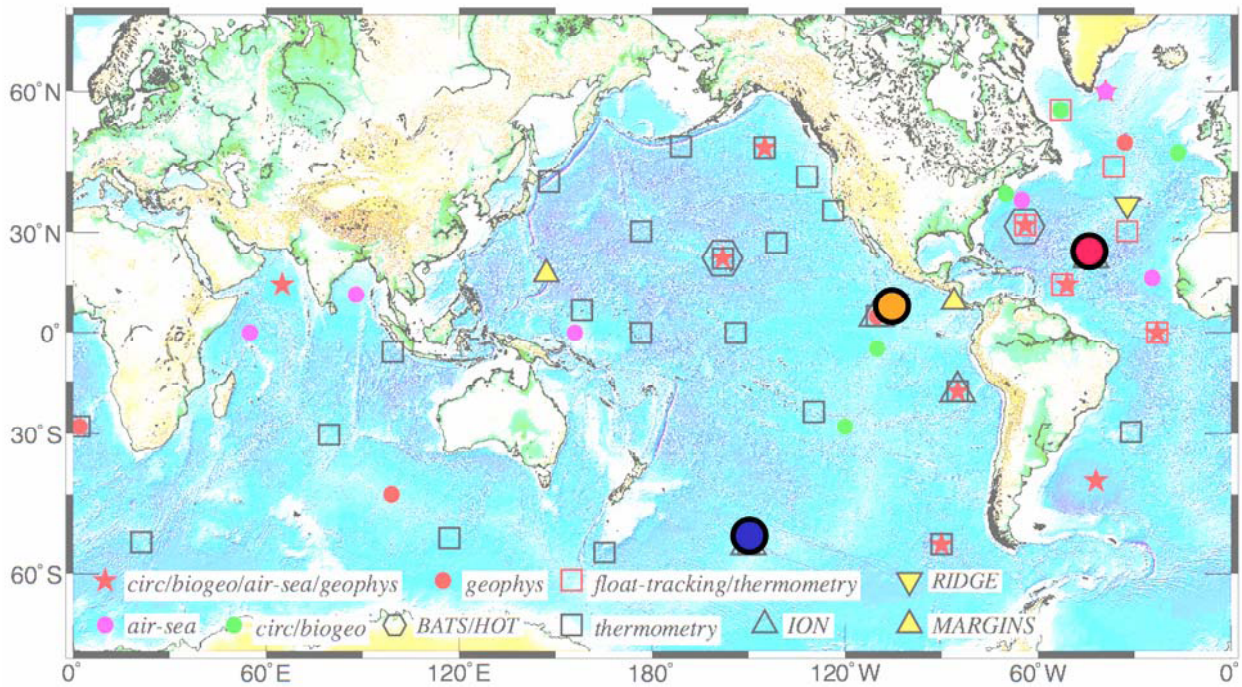

Figure 2. Recommended seismic, borehole, or multidisciplinary seafloor observatory sites. [*ORION Program Office*, 2006]

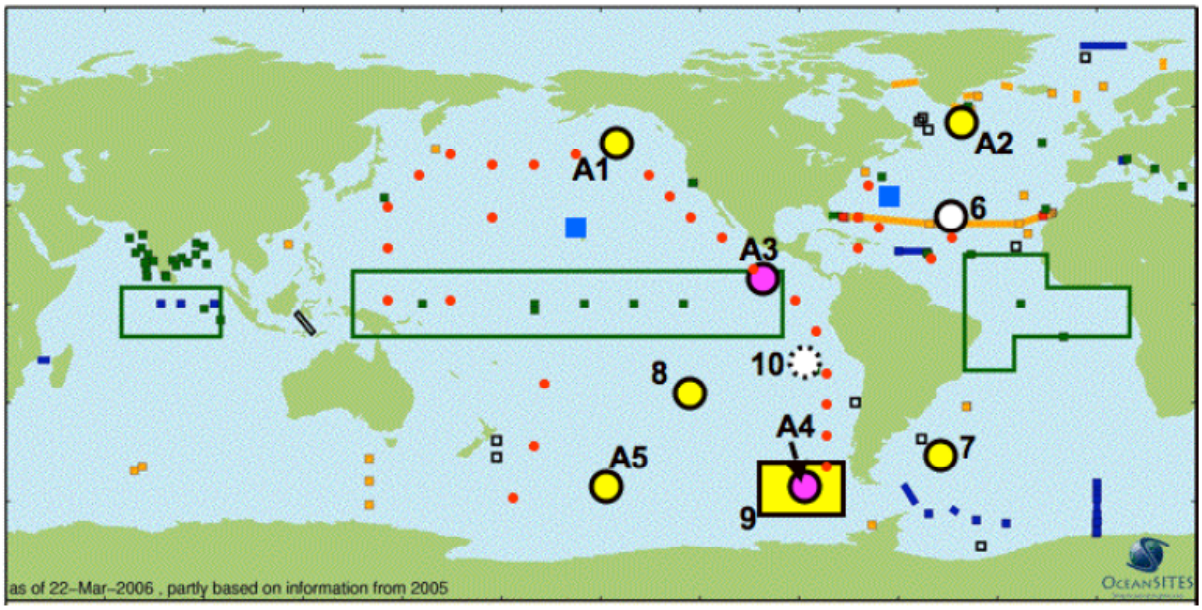

Figure 3. Distribution of Global OOI Sites (large labeled filled circles and rectangle) relative to the OceanSITES near-term network and future DART buoy locations (red dots). The Global sites labeled "A"n have the highest but equal priority; the priorities of the remaining Global sites increase with label number. Mooring types are indicated by color: yellow disks for acoustically-linked discus buoy, purple disks for SPAR buoy; and white disks for discus buoys with electrical-optical-mechanical (EOM) cables. The yellow square shows one possible location for the relocatable Global Pioneer Array, which will consist of a backbone of four sub-surface moorings and four gliders. The existing long-term oceanographic time series sites at Hawaii and Bermuda are shown by the blue rectangles. [*ORION Program Office*, 2006]

Appendix 3: "MOBB" (Monterey bay Ocean Bottom Broad Band project).

A continuously recording autonomous broadband seismic station was installed in April 2002 in Monterey Bay (California), 40 km off-shore at a water depth of 1000m, and has been operating ever since. MOBB (Monterey bay Ocean floor Broad Band project) is a collaborative project between the Monterey Bay Aquarium Research Institute (MBARI) and the Berkeley Seismological Laboratory (BSL). This is a pilot project towards extending the on-shore broadband seismic network in northern California, to the seaside of the North-America/Pacific plate boundary, providing better azimuthal coverage for regional earthquake and structure studies.

The system comprises a three component Guralp CMG-1 seismometer with a 360 s corner period, buried below the ocean floor, as well as a current meter and DPG (differential pressure gauge) installed in the vicinity of the seismometer. The recording and battery package, which is installed nearby in an anti-tralling device, is exchanged every 3-4 months with the help of the MBARI ROV Ventana. The data are archived at the Northern California Earthquake Data Center (NCEDC: http: //www.ncedc.org).

The data accumulated over the past 5 years has enabled studies of long period seismic noise in shallow buried near-coast ocean floor environments. We discuss the sources of this noise, which are either signal-generated (due to reverberation of seismic waves in the shallow seafloor sediments), or due to ocean processes such as infragravity waves. We have developed procedures to reduce the level of this noise by post-processing and illustrate this with some examples.

During the next year, we will develop an interface to connect the MOBB system to the MARS cable (Monterey Accelerated Research System; \url {http://www.mbari.org/mars/) whose termination is less than 4 km from our site. Connection to the cable will provide real-time, continuous seismic data which will be merged with the rest of the northern California real-time seismic system, as part of the Berkeley Digital Seismic Network (BDSN). This will serve as protoype for other real-time multi-parameter cabled systems which comprise both analog and digital devices with a variety of sampling and timing requirements, such as those planned in the context of the Ocean Observatory Initiative (OOI) program in the US.