PLUME CRUISE 4/KM0706 UNOLS CRUISE REPORT

prepared and sent: June 12, 2007

UNOLS CRUISE report:
http://www.gso.uri.edu/unols/pcarform.htm

1) ship: Kilo Moana (KM)
2) cruise dates: may 11 - june 06, 2007
3) chief scientist: gabi laske
4) master: rick meyer
5) marine technician: brad issler/dan fitzgerald
6) cruise number: plume 4/km0706
7) type of work: recovery of passive seismic OBSs/multibeam mapping
7a) funding source: NSF
8) area of operation: NP12
9) person to complete form: gabi laske
10) institution: sio
11) email: glaske@ucsd.edu
12) position on cruise: chief scientist
13) extent of meet objectives: 74-80%

BRIEF DESCRIPTION OF SCIENTIFIC OBJECTIVES:

* The primary objective of this cruise was to recover the 38 OBSs of the second PLUME array on the Hawaiian Swell. This array was deployed on the Kilo Moana cruise KM0612 (Apr 12 - May 11, 2006) and recorded earthquakes for 13 months. Our primary interest focuses on teleseismic events to image the crust, upper mantle and transition zone beneath the swell. The records are anticipated to provide excellent surface wave data to constrain the crust/ lithosphere-asthenosphere systems, while body wave travel times, receiver functions and shear wave splitting data will concentrate on the deeper upper mantle and transition zone. We were fortunate enough to also record the large October 15, 2006 local earthquake. The observation of core-reflected phases from this event will give us unprecedented insight into structure near the core-mantle boundary and elucidate the question whether the Hawaiian plume originates there or not.

We recovered only 28 of the 38 instruments. We lost 5 of 13 SIO OBSs and 5 of the 25 WHOI OBSs. In 8 of the 10 cases, we never established contact with the instrument despite deploying a rescue beacon. Unfortunately, the rescue attempt failed in all 8 cases. In the remaining 2 cases, we were able to communicate with the instruments (both from WHOI) but they did not lift off the ocean floor, while we were on site. For details see the attached cruise report.

We had anticipated that the chances for recovery were relatively low at two sites. At site number #42 (see attached cruise report) we had deployed two instruments because we lost contact to the first one upon deployment a year ago. Since this site is crucial for our data coverage, we deployed a second instruments at the same location. We never established contact to either of these instruments during this recovery cruise.

One instrument that was lost from the first array was close to one of our new sites. We therefore planned to retry a rescue if time permitted. This third recovery attempt was also unsuccessful.

The reason for the disappointingly low recovery rate of 74% is currently unknown but possible scenarios include imploded floatation glass balls, burial of the instruments in the mud, weak acoustics and premature release. All but 3 instruments were lost in a large area to the southeast of the island of Hawaii. This caused a serious gap in our data coverage which potentially prevents us from addressing some key questions about mantle anomalies near the proposed location of the Hawaiian mantle plume. Details can be found in the attached cruise report.

* A secondary objective was to perform multibeam surveys on transits between stations to fill in crucial holes that still exist in publicly available bathymetry maps. Areas of special interest included, once again, the Maui Fracture Zone east of the islands, the southern Musician Seamount area, the Northern Arch Volcanic Field, the Molokai Fracture Zone, the Clarion Fracture Zone, various seamounts, including the Swordfish and Cross seamounts and an apparently unnamed terminated fracture zone north of the Clarion FZ. Near the end of the cruise, we had enough time to also map the Maui and Molokai FZs to the west of the islands where little is known about either of the two. See attached cruise report for details. Unfortunately, our multibeam expert (Dayanthie Weeraratne) could not participate in the cruise so that the data editing will be done at home.

* This was the first cruise on the KM dedicated to recovering OBSIP passive seismic instruments. Before our cruise was assigned to the KM, there had been concerns whether a large-scale recovery would be feasible on the KM due to its unconventional hull design. The recoveries went extremely smoothly and took no longer than recoveries on conventional mono-hull ships. For details see the attached cruise report.

14) rating of the science party: excellent

SUGGESTIONS OR COMMENTS FOR IMPROVING SCIENCE PARTY PARTICIPATION:

The science crew consisted of a number of individuals tied directly to the project (Laske, Collins), OBS personnel (Collins, Ryder, Handy, Aaron, Hollinshead) and personnel responsible for watch standing (Denolle, Garber, Hautmann, Lehmann, Smarek, Warner) in 4h--shifts. Two guests from Taiwan (Lin, Huang) joined the WHOI OBS team. All watch standers were undergraduate or graduate students at national and international universities. Smarek, a Yale graduate student, and Denolle, a visiting student from France, were sent by the Yale co-PI Dave Bercovici. Garber took the PI's undergraduate courses in Earth Sciences and Natural Disasters and accepted the offer to get field work experience. Warner is a beginning graduate student at San Diego State University and was recommended by colleague Rob Mellors. Hautmann and Lehmann are graduate students and the University of Munich, Germany. Both visited colleague Frank Vernon at UC San Diego and expressed interest in gathering field work experience. An SIO-wide search for watch standers was unsuccessful. Students argued that the cruise would be too long. The chief scientist is not sure how a month--long cruise could be made more attractive to graduate students. Adequate computer resources could be an issue. Apart from the usual watchstanding duties, which included keeping a detailed log during instrument recovery, Hauptmann and Lehmann were responsible to plot ship data. All watch standers helped out on deck when additional help

was needed. Since all watch personnel had a background in the Earth Sciences, we held a weekly seminar series on work that has been done on the Hawaiian Islands. Laske and Smarek also taught a class in plotting scientific data using GMT (Generic Mapping Tool).

Despite the length of the cruise, the chief scientist is completely unaware of any personal problems. Everybody got a long well and rules were followed. The captain sent out only one reminder to keep the common area clean but it is not clear whether it was the science team or the ship crew who left some beverage containers unattended in the lounge. Limited internet access was provided through two PCs, which is usually just barely enough for a science team. Though these are reserved for the science team, they are essentially shared with crew members, which necessitates good sharing habits even more. Nevertheless, the chief scientist did not have to step in a single time to remind sharing rules.

15) Rating of the ship operator pre-cruise activities: excellent

SUGGESTIONS OR COMMENTS FOR IMPROVING THE PRE_CRUISE PLANNING AND COORDINATION, LOGISTICS, OR SHORE SUPPORT:

There is not much to improve. Planning appears to be slightly more laid-back than at other places (e.g. SIO). However, the chief scientist was contacted properly and on time and communication was excellent using email. The shore support was also excellent.

Since we had been on the KM the year before, communication and planning was easy. The ship's computer resources for public access are somewhat limited so we brought an additional Mac G4 Power PC for local LAN access, data processing and as a teaching tool. Some students brought their own laptops which could be hooked up to the local LAN from any stateroom.

Shortly before the cruise, a local PI enquired about the possibility to send a piggy-back meteorological experiment with a graduate student along who would maintain the equipment. At this point of the cruise planning, birthing became a significant issue. The chief scientist also questioned whether it would make sense to send somebody along on a month long cruise just to exchange fluids in a measuring container once a week. The marine technician then agreed that he could take over the maintenance job and the piggy-back experiment was taken on board.

16) Rating of the ship operator supplied scientific equipment and marine technicians: excellent

SUGGESTIONS OR COMMENTS REGARDING THE OPERATOR SUPPLIED SCHIENTIFIC EQUIPMENT AND THE MARINE TECHNICIANS FOR THIS CRUISE:

The two marine technicians (Issler and Fitzgerald) were excellent and connected well with the science team. Both techs are extremely friendly and easy to get along with. Fitzgerald appears to have a solution ready for ANY request. Issler is relatively new but nevertheless was extremely helpful whenever he could. Both techs were invaluable assets both in the computer lab as well as on deck during our 24/7 operations. There was virtually no situation where the science party received a 'can't be done'.

Scientific and office equipment:

* computing facilities: this issue has already been addressed above. Public computing is limited. Compared to last time, we lost access to the only public Sun workstation on board. On the other hand, we were given access to some shipboard computers that were reserved for specific tasks to which we had no access on last year's cruise. As last year, the marine techs provided a laptop with Nobeltech navigational software. This PC was an essential tool in the communication between OBSIP personnel and the bridge during recoveries and site surveys.

* networking: On-board networking capabilities are excellent. LAN connections in virtually every room and lab allows the science team to hook up their computers to the ship's local network for printing and checking the ship's email accounts. The ship has access to the outside world through Inmarsat B and is part of the HiSeasNet (http://hiseasnet.ucsd.edu). The science crew received three dedicated IP addresses that allowed access to the outside internet. Two addresses were reserved for project PIs Laske and Collins, while the third one was shared between the science party and some members of the ship crew on a public PC. For reasons unknown, connectivity was somewhat slow. A science member requested hookup of his laptop to the internet. This would have been possible by programming a wireless router (provided by the chief scientist) and putting the public PC on dynamic DHCP. The marine techs initially recommended against this but then agreed that we could do this. However, further consideration of this matter resulted in dropping this idea.

* printing: printing was satisfactory. There is a copy machine in the library, two B/W laser printers in the computer lab and science office and one color laser printer in the computer lab which was the primary printer for most of the science team. The latter functioned during our cruise but may need some serious maintenance. The printer was moderately heavily used. Quite often though print jobs got stuck in the wait queue for unknown reasons during single-user usage and the printer had to be initialized. After week three at sea, the printer repeatedly developed paper jams. While many print jobs could be diverted to the B/W printer, some jobs did rely on a functioning color laser printer. One of the two B/W printer appears to be on a different network that does not work with Appletalk/Mac Computers. This is unfortunate as most of us brought Macs on board. A Deskjet plotter was intended to be used to print maps but ultimately not used.

* multibeam and echosounding system: the seafloor mapping system is excellent, and quite possibly the best in the UNOLS fleet. The data collected on this cruise will hardly need any editing. Further comments are found in the attached cruise report. The Knudsen echosounder worked much better on this cruise than on the last one a year ago.
We collected data continuously, for the entire 4 weeks of our cruise.

17) Rating of the scheduling of the cruise: excellent

SUGGESTIONS OR COMMENTS REGARDING ANY ASPECTS OF THE SCHEDULING PROCESS OR SHIP ASSIGNMENT:

we asked for an April-May cruise and we got it. After last year's deployment cruise on the KM, there was some disagreement between chief scientist and OBS personnel on whether or not to choose this ship for a recovery. The ship crew made significant changes to better accommodate OBSIP needs (see below).

18) Rating of the safety and shipboard and science operations: excellent

**SUGGESTIONS OR COMMENTS REGARDING ANY SAFETY ASPECTS OF THE CRUISE, SHIP,
CREW OR SCIENCE PARTY**:

The ship crew was excellent, very professional. Safety issues have been addressed adequately. The science party had an orientation and safety drill near the beginning of the cruise. The ship crew had several drills during the cruise. Lifelines were deployed everywhere. The chief scientist did not allow wearing flip-flops during operations. Life vests and hardhats were worn on deck during recoveries.

The chief scientist boarded the ship with a broken left wrist and was somewhat handicapped. The alpha marine tech was assigned to her to assist in emergency situations.

19) Rating of the officers and crew: excellent

SUGGESTIONS OR COMMENTS REGARDING ASPECTS OF SHIP'S CAPTAIN AND CREW SUPPORT:

The crew was excellent and the cruise a real pleasure despite its length. The science team felt very welcome and science and ship crews interacted extremely well. Six permanent members who had sailed with us last year requested to be assigned to this cruise even though they had gone to sea for a long time. New relieve personnel blended in quickly and well. The bridge officers communicated well with the science crew in the computer lab and lab 1. Marine technicians Issler and Fitzgerald were very knowledgeable and helpful and interacted extremely well with the science team. The food was excellent, and the whole ship team did an excellent job to keep the engines and everything else running.

During the deployment cruise last year, it was discussed that the high freeboard of the KM could hamper a successful OBS recovery. OBS personnel was also concerned that backing down on an instrument (approach with a mono-hull ship is alongside) increases the risk of submerging it beneath one of the hulls or the deck. The ship crew demonstrated during last year's cruise how an instrument could be hooked up using longer poles. Since then, they procured long light-weight carbon poles for easier hookup. An additional control unit was mounted on the stern to drive the ship while having eye contact of the instrument. This makes it much easier to maneuver the ship for a speedy recovery and also avoid that the instrument gets pushed beneath the stern.

20) Rating of the research vessel and its installed equipment: excellent

SUGGESTIONGS OR COMMENTS REGARDING THE VESSEL AND ITS INSTALLED EQUIPMENT:

The KM is a very nice, spacious ship and the chief scientist would prefer this ship for future cruises. The deck is reasonably large, not as large as that on the Melville but functional nevertheless. Colleagues who are used to a long but narrow stern may have to rearrange storage and operations to adjust to a short but wider stern.

Sources of acoustical noise on the ship are probably comparable to that of other ships though

the noise level is not entirely clear. Communication with the instruments varied largely. We had initially tried to switch off potential sources of noise (engines, water jacket, evaporator and steering pumps) but it was never established if the noise was caused on the ship or was of other origin. Some of the best communication was established when all pumps were running. Later in the cruise, we established that the starboard fuel purifier feed pump, that ran for 1h twice a day, caused noise in the 3.5 kHz Knudsen records. We confirmed that the OBS acoustics was also affected by this. The pumps were then not operated during later recoveries but were not an issue during earlier recoveries or attempts, due to the different timing. The chief scientist vaguely remembers that the incinerator on the R/V Melville may have interfered with acoustic communication. The incinerator on the KM has no effect.

The seafloor mapping tools are excellent. Data acquisition is reliable and the data quality is outstanding.

During the recoveries, we discussed that a utility crane to deploy and recover the towed WHOI transducer should be mounted within the A-frame on the port side instead of the starboard side as we did. Being on the starboard side, it may interfere with the recovery operations of the OBSs.

A minor suggestion: the labs on the main deck could use a few new, functional swivel chairs that can be adjusted high enough to reach the work benches. Currently, there don't appear to be enough and some are broken/not high enough.

21) **NUMBER OF SCIENCE DAYS LOST DUE TO**:
- none
- user--provided equipment: failing communication with the instruments required the OBS team to deploy the rescue beacon 8 times while only one such rescue was initially anticipated in the cruise planning. The recovery with a rescue beacon is controlled by the speed at which the winch can lower and recover the beacon and can easily add 3h+ to the time on site. Shorter recovery times at other sites and the high cruising speed of the KM compensated for the time lost during these rescue attempts.

sent to:
- ship operator
- PI
- UNOLS Office
- OCE program manager
- Linda Goad