

## PLUME CRUISE 2 UNOLS CRUISE REPORT

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UNOLS CRUISE report:

<http://www.gso.uri.edu/unols/pcarform.htm>

- 1) ship: Ka-Imikai-O-Kanaloa (KOK)
- 2) cruise dates: jan 07 - jan 22, 2006
- 3) chief scientist: gabi laske
- 4) master: ross barnes
- 5) marine technician: gabe foreman
- 6) cruise number: plume 2
- 7) type of work: recovery of passive seismic OBSs
- 7a) funding source: NSF
- 8) area of operation: NP12
- 9) person to complete form: gabi laske
- 10) institution: sio
- 11) email: [glaske@ucsd.edu](mailto:glaske@ucsd.edu)
- 12) position on cruise: chief scientist
- 13) extent of meet objectives: 75-99%

### BRIEF DESCRIPTION OF SCIENTIFIC OBJECTIVES:

\* The primary objective of this cruise was to recover 35 passive seismic broad-band OBSs around the Hawaiian Islands. These instruments were deployed a year earlier to record teleseismic earthquakes. These data will allow us to image the Hawaiian mantle plume seismically.

\* A second objective was to deploy new instruments at 8 of the 35 sites. These instruments would augment a second array to be put in place on the third PLUME cruise in April.

\* A third objective was to perform seabeam surveys on transits between stations that fill in some of the holes that still exist in publicly available bathymetry maps. An area of special interest is the Maui Fracture Zone. Bathymetry data for this intriguing feature are not available at the NGDC. We had mapped the northern part of the fracture zone on the first deployment cruise a year ago. We planned to come back this year to map the southern part.

The primary and secondary objectives had the highest priority.

We were never able to establish contact to 3 of the 35 instruments, so we could not recover them. Instrument recovery therefore is just above the 90% level. Taking into account that we installed entirely new systems most of which have never been deployed in the ocean before, this recovery was extremely successful.

Due to a seismometer delivery problem, the assembly of the 8 new instruments got delayed significantly. This did not allow us the anticipated deployment on this cruise.

Somewhat unexpectedly, the ship's seabeam system did not function. We therefore did not perform any seafloor mapping and leave this objective for our next cruise.

- 14) rating of the science party: excellent or slightly below

### SUGGESTIONS OR COMMENTS FOR IMPROVING SCIENCE PARTY PARTICIPATION:

All members of the science party did an excellent job and contributed to a successful cruise. There is not much that could be improved. The science crew consisted of the chief scientist, the SIO and WHOI

OBS teams and a group of 5 observers. The SIO OBS team was represented by Cris Hollinshead and Mark Gibaud, the WHOI team consisted of John Collins, Vic Bender, Ken Peal, Jim Ryder and Rob Handy. John Collins is the co-PI on this project. Both OBS teams are very professional and this cruise was just another routine trip. Though both groups are basically doing the same thing they do have a slightly different modus of operandi. The WHOI team brings a lab van, fully equipped with computers, out of which they can operate nearly autonomously. However, this modus of operandi requires significant deck space which the KOK could barely meet. The SIO team comes with relatively little lab equipment. In comparison with the WHOI team, the SIO team has the advantage of requiring little space, on the main deck as well as berthing and in the lab. On the other hand, this makes the SIO team depend more on the ship's capabilities and a number of helping hands.

Our group of observers consisted of two earth sciences undergraduate students from San Diego State University (Sarah Johnson, Maureen Moses), an undergraduate student from U. Hawaii (Nadine Eisenkolb), Hilo, a volunteer from Oahu (Peter Drews) and a German reporter who lives in the San Francisco area (Horst Rademacher). Horst has sailed on research vessels before and Peter races on sailboats. For the other observers, this was the first extended cruise on something other than a whale watching boat or a cruise liner. All observers were very competent and were reliably keeping the cruise log. The observers were also eager to help with the retrieval of the SIO instruments. Though nothing bad happened, it would have been good to give the observers some kind of orientation before the first recovery (e.g. where to hook the instrument, where to stand and not to stand, how to wrap up the rope and store it afterward).  
this is the only reason for the "slightly below" rating.

Horst Rademacher wrote two articles (in German) for the Frankfurter Allgemeine Zeitung. One article discusses mantle convection in general and points out two OBS deployments to map mantle plumes, our PLUME experiment around Hawaii, and the "other PLUME experiment" around the southern Pacific superswell. At least one of the two articles can be found online:  
<http://www.faz.net/s/Rub2542FB5D98194DA3A1F14B5B01EDB3FB/Doc~ED85F451534994EEAA1E047F95EC57E28~ATpl~Ecommon~Scontent.html>

Maureen Moses works on an extensive outreach program for high-school students. Maureen collected extensive material about the project and interviewed a large cross-section of the scientific and ship's team for her outreach project on this cruise. We plan to continue the outreach effort by linking her web site to our plume web site, and by exchanging material. Our web site can be found at:  
<http://mahi.ucsd.edu/Gabi/plume.html>

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 phone and email. The shore support was also excellent.

There was one glitch. The PI contacted both OBS groups and relied on them to communicate to the Tech Support group directly to negotiate what is needed for the cruise. The PI learnt only upon boarding the ship that one crucial equipment was missing, or the technical specs inadequate. The odds for a successful OBS recovery are improved by using an RDF (radio direction finder) to pick up the radio signal that the OBS is sending once it has surfaced. The SIO group is using a fixed frequency that the KOK's RDF is compatible with. The WHOI group uses a variety of frequencies most of which were incompatible with the KOK's RDF. The frequencies were also incompatible with a hand-held unit that the WHOI group brought on board. After this problem surfaced, the ship operator decided to buy a proper unit and fly it to Hilo where we picked it up during an early phase of our

cruise. The pick-up in Hilo cost us about 20h in ship time, after re-arranging the order of instrument recoveries. Clearly, a lapse like this should be avoided in the future but I don't see that this is the responsibility of the chief scientist nor the ship operator.

A point the science team needs to take into account in the cruise planning is that the KOK is relatively slow. I had done my transit calculations using a speed of 10 knt. This is a cruising speed (or faster) that I experienced on other cruises and is also listed as cruising speed for the KOK on the U. Hawaii web site. On our cruise, the KOK did 8.5 knts on average, which is significantly lower, while the 10 knts were rarely reached. And this, while we experienced 'typical' trade wind weather. Cruise planners need to take this slower speed into account.

16) Rating of the ship operator supplied scientific equipment and marine technicians: no rating

#### **SUGGESTIONS OR COMMENTS REGARDING THE OPERATOR SUPPLIED SCIENTIFIC EQUIPMENT AND THE MARINE TECHNICIANS FOR THIS CRUISE:**

The question regarding the scientific equipment and the technical staff needs to be addressed separately.

The technical staff was excellent. We had one marine technician (Foreman), one computer technician (Mark ??) and one who was both (Poulos). This team helped as much as they could and tried to accommodate the science team's needs as much as possible. Foreman was very knowledgeable and hard working and had excellent people skills. Poulos also was extremely helpful and friendly and his help was much appreciated. Mark's help was also appreciated though his work load did not appear to be particularly high.

Now the scientific equipment:

\* computing facilities: The ship is equipped with about 2 PCs that were available to the science party for checking emails. To my knowledge, the science party made use of only one, the one in the conference room. I believe, the other PC is in the ship's office, which was used by the ship crew. Email contact was possible through email addresses provided by a contractor only. Email addresses and passwords were open and I found no way to change my email password. The WHOI OBS team brought Netgear boxes along that enabled us to hook up our own laptops into the ship's ethernet system. This allowed us to check our ship email accounts from our own Macs or PCs. There was no possibility to check our regular email. While this is not essential, having access to our own regular email accounts is a perk that most seagoing scientists would take for granted these days. There was no possibility to access the internet without hefty billing fees which I was unable to pay for. We found a dust covered hp deskjet with a serial port in the ship's tracking room. This printer would have been the only possibility to print out our updated cruise plans, watchstander's lists and instrument tracking log sheets that had to be updated during the cruise. Poulos installed this printer as a shared printer, but it could nevertheless not be seen from our Macs. The PC's software was not up-to-date so that PDF files were not accepted and printing was not possible. Also, the PC had Microsoft Word and Excel but did not accept my Mac Microsoft Office Word and Excel files. I therefore had to resort to a printer that the WHOI OBS group brought along. Not having computer equipment on board that allows us to print is almost inexcusable. Thankfully, the ship had a modern digital color copier that I used for printing multiple copies. Resorting to the printer in the WHOI OBS van was only an option as a last resort as lab space was extremely limited. Somewhat disappointingly, the ship's computer system did not include a workstation, such as a Sun workstation, on which we could have done some calculations (e.g. using a Fortran compiler). When I sailed on U. Hawaii's R/V Moana Wave in 1997, we had access to 1-2 Unix workstations and I simply assumed that we would have these again on the KOK. If I sail on the KOK again, I will certainly be better equipped. At the very least, with some Netgear boxes, an airport router and a printer.

\*seabeam system: When we came on board the KOK, we learnt that the seabeam system was out of

order. Apparently, this was a problem that could not be fixed on the fly. We were able to run the center beam for about 10 min at a time, which was just enough for us to get the water depth. This is essential information needed for tracking the rising OBSs. The loss of the seabeam system was disappointing but at the end did only mean that we could not map the southern part of the Maui Fracture Zone, a minor objective of this cruise. Also, since the instruments to be deployed were not available, the seabeam system was not crucial to this cruise, but it would have been, if we had done the 8 deployments. The unoperational seabeam system would have forced us to deploy instruments at the exact same location as we had dropped the prior instrument. This would have compromised our mission. We need the flexibility to relocate deployment sites to new locations on the transit between stations of array 1 in case instruments failed during the first deployment. However, during the planning of the cruise, I was confirmed several times that the KOK has an archaic but functional 70%-water depth seabeam system.

\*further comments under 20

17) Rating of the scheduling of the cruise: delicate issue  
Ship requested: R/V Melville or similar global class ship

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

The discussion of the adequacy of the ship is very difficult. I have thought very long if I should mention it at all, but for the sake of completeness of a standard unols post-cruise assessment, here it is.

We had originally asked for a global class ship and ended up on the KOK for budgetary reasons. To schedulers and funding agencies, this is a reasonable compromise. For people who get seasick it may not be. Having now done the cruise, I as the chief scientist agree that the anticipated recovery cruise is doable on a ship like the KOK but the science team has to be willing to make some compromises. In retrospect, our group was not well prepared and ill-equipped to come aboard such a ship. The reason for this is probably because scientists nowadays (can) take many perks (such as tech support, internet access and high-end computing facilities) for granted. Having learnt significantly from this cruise, and planning to be better prepared, I see no reason why we could not to use the KOK again.

With regard to time spent on the cruise, NSF thankfully granted us additional days for an anticipated port stop that we did not do. Had we not had this additional time, the slow progress of the KOK against the trade winds - at some point only 6 knts on average, on a 23h transit at the beginning of our cruise - would not have allowed us to meet our scientific objective in the allotted time frame. "Ship scheduling" needs to be aware of this when changing cruises over from a faster, global class vessel.

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

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

nothing to comment with respect to the ship crew. Safety issues have been addressed adequately. The science party had an orientation and fire drill near the beginning of the cruise, before reaching the Kaiwi Channel, seas getting rough and seasickness overcoming some of us. Lifelines were deployed everywhere. The ship is relatively wet and the chief scientist did not allow wearing flip-flops outside. Science crews should be advised to bring proper foot wear, especially when newcomers come on board.

Some of the SIO OBS recoveries were a little adventurous because the package swayed quite a bit. This was probably caused by a combination of things including: tag lines were not held tight enough, tag lines were applied at points above the center-of-mass instead below, inexperienced helpers had

no feel for how to react, the ship got caught by waves. It did appear sometimes that it was difficult for the bridge to hold the ship steady. Even during the recoveries of the more compact WHOI instruments, the seismometer that was dangling below the main package sometimes bumped into the ship's hull. This can destroy the \$25K-seismometer and we fear that we lost one of 32 recovered sensors because it failed to lock before recovery. The dangling of the seismometer is reduced, once its chain is secured by a tag line, but the sensor remains vulnerable during the time between being lifted out of the water and the seismometer chain being secured by the tag line. I am not sure how this can be improved on a future cruise. As far as personal injury is concerned, at no point was anybody even close to getting hurt.

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 I would sail with them again. The captain and many crew members interacted well with the science party which made this cruise as enjoyable as possible. The observers certainly had a good time! After some initial technical glitches, the bridge officers communicated well with the watchstanders in the OBS lab van and were extremely helpful when we requested changes in action. Marine technicians Foreman and Poulos were very capable and interacted well with the science team. Foreman has a cheerful personality which makes working with him particularly easy. The food was excellent, and the whole ship team did an excellent job to keep the engines and everything else running for us.

20) Rating of the research vessel and its installed equipment: no rating

**SUGGESTIONS OR COMMENTS REGARDING THE VESSEL AND ITS INSTALLED EQUIPMENT:**

The rating of the vessel is difficult. We planned to use a global class ship and, of course, the KOK then rates below average. For a ship of her class, the KOK may be a fine ship. However, we encountered some technical problems which are discussed below.

\* 12 kHz transducer: Apart from an assortment of cranes and winches, both OBS teams prefer to use the ship's 12 kHz hull transducer for communication with the OBSs. Both OBS teams have been repeatedly disappointed by the performance of the hull transducers. On a cruise on the R/V Melville last year, the hull transducer was too noisy and we ended up using a WHOI over-the-side transducer to survey the location of the OBS once it reached the ocean floor. On the R/V KOK, we were unable to use the hull transducer altogether because it has a built-in transformer that was incompatible with our Edgetech deck units. We did not know this until we boarded the ship. The problem of using an over-the-side transducer is that the ship cannot maneuver while the transducer is in the water, in order to avoid the cable getting tangled up in the ship screw. Naturally, the deployment of the over-the-side transducer costs valuable ship time. The WHOI group therefore developed a towed-fish transducer that was used on this cruise. This transducer hangs from a crane while deployed and allows the ship to move slowly. We were able to use this transducer throughout nearly the entire cruise, but near the end the cable got ripped out of the transducer due to increased tension during a roll. We then had to resort to the more traditional over-the-side transducer. From our experience on this and last year's cruise, we think it advisable to the OBS teams to pack several transducers of their own and not rely in the hull transducer, though the latter is clearly preferred.

\* RDF: I am not entirely sure where the responsibilities lie for the Radio Direction Finder, that helps locate a surface instrument, especially a low-lying instruments (such as the WHOI OBSs) in fog. Clearly, the OBS groups should have communicated with the ship operators, either directly or through the chief scientist, prior to the cruise about the frequencies that needed to be covered by the RDF. The OBS teams, on the other hand, expect that a variable RDF is part of the equipment a modern ship routinely has.

\* winches: At 4 of our 35 sites, we had to deploy a rescue beacon on a wire that was lowered from one of the ship's winches. The beacon's job was to send release commands to the instrument on the way down. Ideally, we would have liked to deploy the rescue beacon as close as possible to the ocean floor but not on it. For a reason that I don't completely understand (I may have misunderstood something), the wire reached only to 4500-4800m.

\* deck space: we had originally anticipated problems with the deck space. NSF therefore granted us extra days to unload part of our equipment halfway through the cruise. Since we lost time for the delivery of a new RDF, we had to abandon the port-stop idea. The ship provided enough space to distribute all the SIO instruments around, once they were on deck. There was also space for the two 20-foot OBS containers, plus some space needed for the recovery. One container was the WHOI lab van, which is absolutely necessary for operations. There really is no other option for this group to function. The other van was the container for the recovered and disassembled OBS packages. While this container takes up valuable space, it actually saves space because the disassembled instruments are stacked into it. Without it, we definitely would have had to go into port. The limited deck space is further constrained by the fact that rails for the submersible PISCES run through the middle of the deck. This left us only one option how to arrange the two containers: on top of the rails, throughout the aft hangar and deck. The recovered SIO instruments were then put on the port side and recovery was performed from the starboard side. The space left for recovery was just barely enough. While the height-wise compact WHOI instruments were heaved gracefully on deck, by five people who have done this a thousand times before, the SIO instruments swayed quite a bit. One reason surely was because the volunteers didn't react quite fast enough when they should have fastened the tag lines, but the limited deck space (a leg of the aft A-frame was also in the way) did also not allow us to step back to lengthen the tag lines appropriately. We have discussed this problem for future deployments. The swaying could perhaps be lessened by adding more handles to the instrument frame to allow for a lower-lying hook-up. Also, volunteers should probably be trained better prior to the first recovery.

\* staterooms: somewhat tight but rated ok by many experienced seagoing team members. Some unexperienced members brought too much luggage which was a challenge to store in the double-occupancy rooms (all but 4, incl. chief scientist's). There was not ethernet connection in the state room, not even the chief scientist's room. Telephones were not available in most staterooms but the chief scientist got one upon request.

\* layout: somewhat awkward. We did not really know where to set up our command center, because all lab are somewhat isolated and closed off. Ideally we would like to have some open space that is frequented by everybody in the science team. Prior to the cruise, new GPS wires were laid into the rock lab that we anticipated to use as our control center to keep the watch log, to communicate to our instruments, to communicate to the bridge and to monitor the recovery. We had to discard this option because the only connection into the hull transducer was in the tracking room behind the bridge. On the other hand, the tracking room was so far away from all the action on the main level that it was not found advisable to use the room as our control center. In addition, the only ways to access the tracking room is through the bridge or through a door from the outside. The latter is not advisable during the night, and the feasibility of the former depends on the bridge crew. Usually, bridge crews don't like a lot of traffic going through at night because of light pollution issues. Since we could not use the hull transducer, the tracking room as option for the command center was quickly abandoned. A compromise was found by using the rock lab as command center for watch standing on transit, and the WHOI OBS van during recovery. The rock lab could not be used during recovery, because there was no possibility to connect to any of the transducers used in the communication with the instruments. This was sub-optimal. In fact, it did lead to some shouting matches, due to the limited space. But it was the only viable option.

\* leisure facilities: here is a positive point. The KOK is equipped with a few exercise machines that found heavy use. In fact, exercising regularly probably saved some people from getting aggressive. Card games were provided as well as an electronic dart board in the aft hangar all of which found

very good use. Most people probably appreciated most the two lounges with the most extensive DVD collection that I have ever seen on a research vessel. Excellent laundry facility. Plenty of access to soul food was very much appreciated. We had access to and never-ending supply of ice cream, peanuts, chips and other junk food 24/7. THANKS!

\* KOK's overall performance: The KOK is relatively slow in the 15-foot seas around Hawaii,. Our average speed was approximately 8.5 knts instead of the anticipated 10 knts. The KOK rolls quite a bit, and the spaces that may be most useful to the science team (labs, conference room, lounges) are relatively loud, due to their proximity to the generators. The mess hall is ok for reading, as I later discovered when trying to escape from the noise.

Overall, I would say that the KOK disappoints a science team with high expectations for a cozy cruise on a global class ship. On the other hand, we got our basic job done, which was to recover the OBSs. Everything else (including the survey of the Maui Fracture Zone) would have been nice to have, but is probably not essential for this particular cruise. Unfortunately, we only know after we have analyzed our data whether the Maui Fracture Zone is connected to deeper-seated anomalies. In this case, a complete sea surface image would be essential to have. We plan to obtain this on our next cruise.

## 21) NUMBER OF SCIENCE DAYS LOST DUE TO:

- weather: hard to tell; compared to a global class vessel that can travel at 10 knts, the loss on transit amounts to about 30 h; this is due to a combination of 15-foot seas around Hawaii together with the relatively low cruising speed of the KOK in this kind of sea state; some of this loss was offset by the fact that we spend less time on site than anticipated.
- ship, ship-s propulsion, power, crew, etc: see above
- ship's scientific equipment: 20 h; the ship was not equipped with the RDF (radio direction finder) that the WHOI OBS group needed to track the instruments; lacking communication prior to the cruise forced a stop off-shore Hilo to take proper equipment on board.
- user provided equipment: including the instruments we failed to recover, the time lost amounts to max. 12h. 3 h were used in addition to the allotted 4.5 h at 4 sites to deploy a rescue beacon, after we failed to communicate with the instrument using a surface transducer. This time was mostly compensated by time won at other sites.

total time lost:

The total number of ship days used was 15. We arrived in port at 6pm on Jan 21 (we left the fuel dock around noon on Jan 7). Accounting for the fact that we did not have a port stop, we therefore arrived in port 6h behind the original schedule that accounted for 14 days at sea. NSF had granted us 17 days at sea to accommodate an anticipated port stop. We therefore did not use two of the days at sea that NSF granted.

sent to:

- ship operator
- PI
- UNOLS Office
- OCE program manager
- Linda Goad