PLUME CRUISE 3/KM0612 CRUISE REPORT
ADDENDUM TO THE UNOLS REPORT FORM

Gabi Laske, Chief Scientist

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Cruise Date:	April 12 - May 11, 2006
Ship:	R/V Kilo Moana, U. Hawaii
Master:	Rick Meyer
Chief Scientist:	Gabi Laske
Marine Technicians:	Tim Mc Govern and Kuhio Vellalos

PERSONNEL

Ship Crew

Name	Function
Rick Meyer	Master
Eric Shoenberg	Chief Mate
Steve Haugland	2nd Mate
Lix Scanland	3rd Mate
Tim McGovern	Marine Technician
Kuhio Vellalos	Marine Technician
Thomas Perry	AB
Warren Miller	AB
Dave Spurgin	AB
Roger Rios	AB
Craig Harvey	AB
Todd Dessault	AB
Shawn Lindenmuth	Chief Steward
Donnie Cabanizas	Steward
Jan Sobelewski	Steward
Joe Heise	Chief Engineer
Richard Webster	1st Engineer
Todd Meeker	2nd Engineer
Ted Kane	3rd Engineer
Rob McDonough	Oiler
Tai Tung	Oiler
Willy Reyes	Oiler

Science Team

Name	Affiliation	Function
Gabi Laske	SIO	Chief Scientist
John Collins	WHOI	co-PI/WHOI OBS lab manager
Martin Rapa	SIO	OBS Development Engineer
Ernest Aaron	SIO	OBS Development Technician
Ken Peal	WHOI	OBS electronical Engineer
Vic Bender	WHOI	OBS Engineer
Rob Handy	WHOI	OBS Technician
Jim Ryder	WHOI	OBS Technician
Dayanthie Weeraratne	DTM/CIW	Scientist
Colin Hogg	Univ. College Dublin, Ireland	Watch Stander
Billy Landuyt	Yale Univ.	Watch Stander
Marlene Messina	WHOI	Watch Stander
Peter Drews	Univ. Hawaii	Watch Stander
Alison Hindley	SIO	Watch Stander

Two co-PIs were on the science team, Gabi Laske and John Collins. John Collins is also the lab manager of the WHOI OBS pool. We had 6 observers who worked in 4h–shifts and were responsible for keeping a watch log and logs for instrument deployment and other experiment related activity.

DESCRIPTION OF SCIENTIFIC OBJECTIVES AND ACHIEVEMENTS

Passive Seismic OBS Deployment

The primary objective of this cruise was to deploy 39 passive seismic OBSs (ocean bottom seismometers) which comprise the second array of the Hawaiian PLUME experiment (the red dots in Figure 1). This second array will record distant earthquakes for a year. Its large aperture of nearly 1000 km will allow us to conduct a thorough surface wave analysis to study the lithosphere/asthenosphere system of the swell. It will also allow us to perform deep–reaching body wave tomography and a comprehensive receiver function study that will address the question of a deep or shallow origin of the Hawaiian plume. The deployment of the OBS array was the main objective of this cruise. We also anticipated to retry the rescue of three lost instruments of the first array.

For the three planned rescue attempts at site #9, 16 and 25, a rescue beacon was lowered at the initial drop location on a winch to within a few 100m meters of the ocean floor. Evaluation of the survey data from the first deployment cruise last year indicates that instruments can drift by as much as 1km on the way from the sea surface to seafloor. The lowering beacon repeatedly sends release commands to the instruments. While the burnwire on the instrument package is active, the instrument is unable to acknowledge commands to the Edgetech acoustic deck box in the lab. We therefore do not know if and when an instrument receives a release command. From our

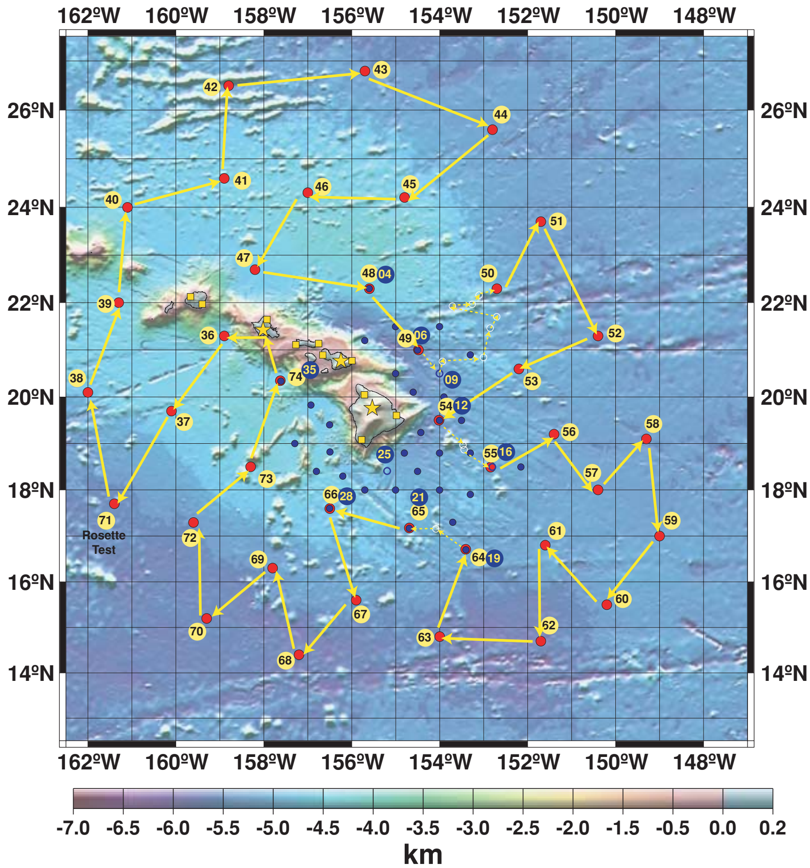

Figure 1. Location map of the two PLUME arrays. Blue dots mark the recently recovered array (site numbers below 35) while the red dots mark the array the was planned to be deployed on this cruise (site numbers 36 and greater). Open blue circles mark the location of rescue attempts that were unsuccessful in January. Yellow dashed lines mark anticipated transects for targeted multibeam survey.

experience with the rescue of a WHOI instrument at site #15 in January 2006, we have the impression that the beacon has to be close to the instrument (i.e. near the seafloor). During our rescue attempts, the beacon remained at depth for 2-3 burn cycles of about 10min each, before it was raised again. We then waited for a period that corresponds to the longest known rise time after the last release command from the rescue beacon at maximum depth. Watch standers looked out for the flags or the strobe lights and the bridge personnel listened for radio signals. At none of the three sites did we find evidence that the instrument surfaced. The rescue attempt typically required the full 6.5h that were alloted in the cruise plan.

Due to OBS–related technical problems, we occupy only 37 of the 39 proposed sites. Sites #56 and #64 were not deployed and sites #57 and #65 were moved to even out station coverage. At site #42, we tracked WHOI instrument SN05 (SN: serial number) successfully to the ocean floor and we conducted a roughly 3 km wide acoustic survey around it. About 3/4 through the survey, we abruptly lost contact. There was some initial disagreement on how to proceed. The OBS operator suggested to disable the instrument (though without acknowledge of receipt from the OBS) and move on to the next site as the instrument was ”likely working normally, with a weak acoustic system”. The chief scientist suggested to try a rescue attempt and reoccupy this site with a backup instrument. The rationale behind this was two-fold: 1) the site is the only one located in the Musician Seamount area and may hold crucial clues on lateral differences in lithospheric structure. The chief scientist insists on having an operating station there. 2) The OBS may work or not but the abrupt termination of communication was worrisome. Two of the most likely scenarios for the abrupt instrument failure are imploding glass balls (in which case we would not retrieve the instrument successfully) or failing batteries at cold temperatures. The likelihood to get this instrument back, and find out why communication stopped, would then diminish with time. This instrument was successfully deployed last year and no problems were reported other than a malfunctioning strobe light and radio (both for locating the OBS once it surfaced). We initially steamed away from the site but then returned after then consulted WHOI OBS engineer Vic Bender supported the chief scientist’s suggestion to try a rescue attempt. We then deployed a rescue beacon that was lowered on a winch to within 200m of the seafloor. The rescue attempt lasted 7h, without success. Since this site is crucial to our deployment and there is little chance to recover the instrument next year, we deployed a second instrument. The preparation for this instrument started 11h after we came on site. The total time spent on this site was 15h, which is significantly longer than the 4.7h we had budgeted. The unsuccessful recovery attemp prompted to test the batteries for the WHOI accoustic systems after they have been chilled for some time in the ship’s freezer.

One of the acoustic units of the SIO OBSs failed the deep–sea ’rosette’ test. The fear was that we would not be able to retrieve this instrument next year once deployed. For unknown reasons, the lithium batteries of one SIO datalogger discharged during shipment from SIO to Hawaii. We therefore could not deploy all SIO OBSs and lost another site in our array. One SIO instrument had to be deployed without operating radio because the radios of two packages did not work (for technical details see below).

Due to a medical emergency evacuation, and subsequent time constraints, we had to rearrange the stations in the southwestern part of our array. While this allowed us to deploy the remaining 6 sites on our cruise, some sites anticipated to provide baseline data for the deep ocean may now be located too close to the edge of the swell though they will still provide valuable data.

Collection of Seafloor Mapping Data

A secondary objective was to perform multibeam surveys on transits between stations that fill in crucial holes still existing in publicly available bathymetry maps and/or databases. This was not proposed in the original proposal to NSF. However, during cruise preparations it became evident that detailed seafloor data are not readily available for our study area, especially not in the area of this second, far-reaching deployment. Prior to the first deployment cruise somewhat more than a year ago, the chief scientist was handed a detailed version of the USGS map by

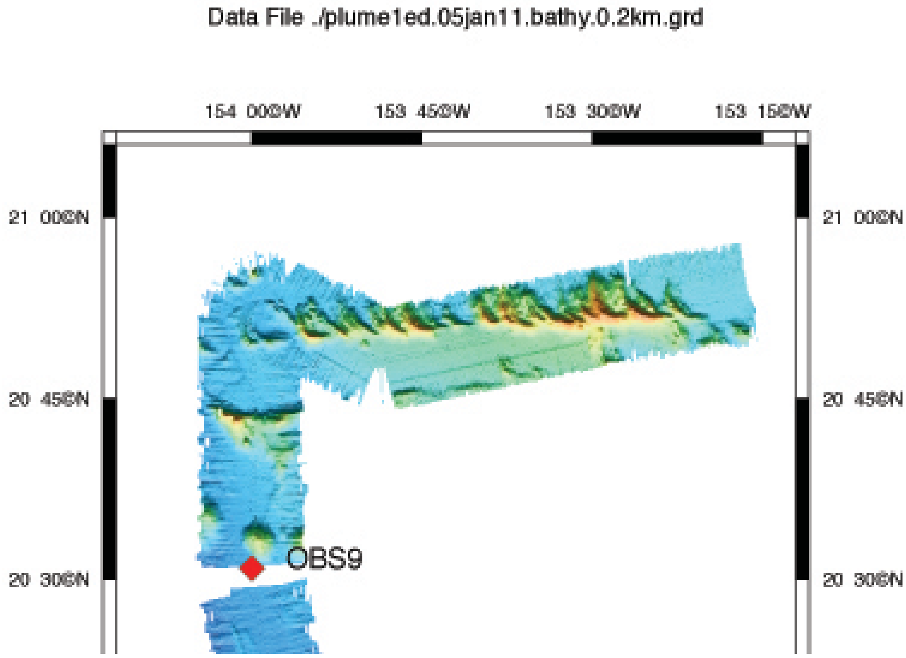

Figure 2. Map of the seabeam survey of the northern escarpment of the Maui fracture zone collected on last year's deployment cruise on the Melville. This year's cruise plan included to map the southern escarpment.

Barry Eakins. We have no access to the data nor an electronic version of this map. The USGS web site then said that the data of the original map would be released within a year. This announcement has now disappeared. In the meantime, Eakins provided a pdf file of an updated map though the plotted area jure barely covers the first PLUME deployment. We have no access to the data as the database allegedly contains classified and otherwise restricted data. The best easily accessible dataset to–date is the data provided at the NGDC. To within roughly 1 degree of the islands, detailed bathymetry data are available (on a scale of a few arc seconds), but outside of this the only data available are 2min data derived from the Smith and Sandwell satellite altimetry/shiptrack map. GEBCO sells maps on a 1 minute scale but inspection of samples of this map, and comparison with the Sandwell map, discouraged us from purchase. After many increasingly frustrating discussions with Sandwell, we now realize that the assumption Sandwell used (crust is isostatically compensated everywhere) to derive bathymetry, is invalid in many places around Hawaii, but this does not appear to be public knowledge. Also, erroneous combination of satellite altimetry and ship track data created artifacts in the map. For example, significant parallel streaks exist to the southeast of the Hawaiian islands (see Figure 1). These streaks are roughly parallel to the plate motion direction and cover a part of the ocean around Hawaii where the swell is missing. It is very tempting to search for a geodynamical model to explain these streaks in conjunction with the missing swell. Only after talking to Sandwell did we learn that these streaks are artifacts from combining satellite with ship track data. There is no mentioning of this on the NGDC website, nor on his own web site. We realize that the Hawaiian mapping group has an extensive database but this dataset, to our knowledge, also is not publicly available and does not cover our second deployment. Since seafloor data collected on UNOLS vessels eventually become public, our data will be available to other researchers and this secondary objective of ours will have a broader impact to the community at an earlier stage than the delivery of the OBS data to the IRIS-DMC.

An area of interest was the Maui Fracture Zone. On our first deployment cruise last year, we had mapped the northern part (Figure 2). In Eakins' map a year ago, the Maui FZ was not mapped and we were told that nobody really believed it existed east of the islands. The original cruise plan for this cruise allowed for mapping the southern Maui FZ and a pair of unmapped seamounts to the southeast of Hawaii. Our multibeam data show that, within our study area, the Maui FZ does not have a significant southern escarpment.

Other targets developed during this cruise and were mapped as time for detours became available: we mapped targets in the Musician Seamount area (e.g. Beethoven Ridge), the Northern Arch Volcanic Field, the Molokai Fracture Zone, the Clarion Fracture Zone, various seamounts and an apparently unnamed terminated fracture zone north of the Clarion. We also identified an intriguing "chain of four seamounts" east of Hawaii near 20°N, just south of site #53 (Figure 1). The strike of this chain is roughly parallel to the plate motion direction and we attempted to map the larger two seamounts. Both of these show up clearly in the Sandwell map. The gathered multibeam data show a flat bathymetry in the area so we must assume that anomalous features are buried beneath sediments. The evaluation of ship gravity data is ongoing.

Adequacy of the R/V Kilo Moana for OBS cruises

Before this cruise, a major point of contention between the ship operators and the OBS labs has been how easy and feasible it is to use the Kilo Moana for OBS deployments and recoveries. The chief scientist has been made aware through hear-say that there are some general reservations (one could say, even hostility) in the OBS community against the KM. One point that is raised is how the KM was procured/introduced into the UNOLS fleet, i.e. that initial funds/contracts came primarily from the Department of Defense. The chief scientist doesn't quite understand this argument because it is her understanding that the Navy also owns other UNOLS vessels, e.g. the R/V Melville. Also, the KM replaced the Moana Wave, which was a UNOLS vessel and was decommissioned before the KM was purchased. A major point of contention, then, appears to be the KM's unique double–hull design. It is felt that OBS recoveries in particular are not feasible on this vessel, or at the very least, are very cumbersome and require too much time. On our cruise, we had the chance to gain our own experience at three sites where recovery attempts failed on our January cruise on the KOK. Unfortunately, our rescue attempts failed again. Since both OBSIP groups were on board, the captain saw this cruise as an opportunity to refute some of the reservations against using the KM for recovering OBSs. A "mock recovery" demonstrated near the end of our cruise is described in detail in the next section. The chief scientist has had numerous discussions with the SIO OBS lab about OBS recoveries on this vessel while the WHOI OBS lab declined to discuss the matter in detail. At least the SIO OBS crew is aware of a OBS recovery demonstration on the KM to NSF. However, the chief scientist has the impression that a resulting memo did not convince the OBSIP people that recoveries can be done on the KM without risk that is significantly higher than on other ships. There is also the perception that recoveries on the KM last longer than on 'regular' ships because the backing down on instruments takes longer than an along–side approach. An impression that also appears to exist is that the demostration was done in the ship operator's backyard, in still waters, with equipment that does not adequately model a real OBS. Perhaps, the community needs to be educated better on what the Hawaiian "backyard" entails. Only colleagues who are familiar with the waters around Hawaii may know that the Kaiwi Channel, in which the demonstration occurred, and the Alenuihaha Channel are notorious for rough and dangerous sea states. After our own "mock recovery" the chief scientist and the OBSIP people now have different opinions on the value of the KM for OBS cruises. There are significant advantages to use this vessel for a research cruise in general, and the ship crew and OBS operators appear to disagree on the risks entailed in recoveries. The chief scientist prefers to go out on this vessel next year but the OBS people still feel that recoveries are not feasible on this vessel and the risk that instruments can be damaged during approach is too high. Both OBS teams feel that "backing down" on an instrument, as is done on the KM, is not a good idea.

Figure 4. A snapshot during the same recovery as shown in Figure 3. The instrument swayed significantly and just barely missed the hull. One of the tag line holders is a WHOI engineer that came repeatedly to the help of the SIO OBS group who was short in deck experienced personnel.

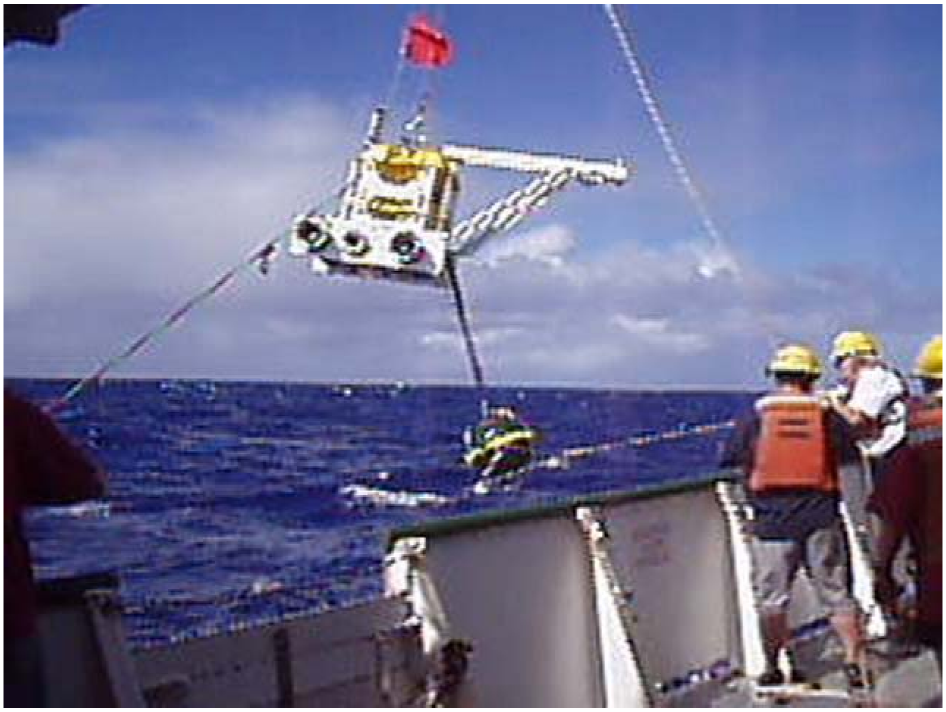

Figure 3. Arrangement of tag lines during the recovery of an SIO OBS on the January 2006 cruise on the KOK. The main line is attached to the crane to lift the instrument. One line is attached near the top of the instrument to limit swaying. This line would be more effective if attached near the bottom of the instrument. Lacking loops on the frame currently inhibit this option. A third line holds the seismometer cable to avoid that the seismometer bangs into the hull.

OBS ”MOCK RECOVERY” ON THE R/V KILO MOANA

Before this cruise, both OBS groups have had major reservations to use the KM for OBS cruises, especially when recoveries are involved. A major point of contention appears to be the KM’s unique double–hull design. The OBS groups summarize the disadvantages as follows: 1) not enough deck space on the main deck to deploy/recover 40 OBSs; 2) OBSs are difficult to recover, due to the ship’s high freeboard and awkward maneuverability associated with the double–hull design. Point 1) is discussed below in the section on ”ship and ship crew”.

The Freeboard Issue

According to the SIO web site the freeboard on the Melville is 12ft. The chief scientist has no recovery experience on the Melville but recovered instruments on the Moana Wave (whose freeboard was almost certainly below that) and the KOK (whose freeboard is probably compatible with that of the Melville, but likely a little less). The freeboard of the KM is somewhat difficult to assess. The published value on the U. Hawaii web site (under the ”Handbook link”) of 50 ft is almost certainly wrong. From a picture showing a person on the aft deck, the chief scientist estimates the freeboard to about 16-18ft. After discussing this matter with the ship crew, she now knows that the freeboard can vary significantly because changing the ballast in the hulls prior to coming on site for a recovery can lower the aft deck significantly. At 25 ft, the ship crew uses significantly longer fishing poles than the OBS groups usually do to hook up their instruments. Also, the KM crew does the hook–up and does not leave this task to unexperienced volunteers on which the SIO OBS team heavily depends. The high freeboard therefore does not necessarily lengthen or increase the risk of a recovery.

Along-side versus Stern Recoveries

Another point of contention then is the fact that recoveries are done from the stern and not from the side. On a ”regular” vessel the instrument is approached from the starboard side and at least 3 people need enough room on deck to maneuver with fishing poles for the hook–up of the instrument (Figure 3). To recover an SIO OBS, one line hooks up into the center bail on the top of the frame. After a successful catch, the line is then attached to a small folding crane (e.g. HIAB folding crane). A second pole hooks up anywhere on the instrument to stabilize the instrument during lift out of the water. This is most easily done in metal frame near the top that holds the main bail. The WHOI OBSs have handles to hook up near the bottom of the package for stability while the SIO OBS to-date have no handles. A third pole fishes for the seismometer chain or frame once the instrument package is lifted out of the water. This is a very crucial process. If done too late or the other tag line is not held snug enough, or the ship rolls, the instrument package can sway singificantly and the seismometer can bang into the ship's hull. This can destroy the seismometer, the most expensive component of the OBS package. During the recovery on the KOK this occurred several times. For example, during the recovery shown in Figure 3 the instrument package swayed significantly before the hook-up of the seismometer and came dangerously close to the hull (Figure 4). Nevertheless, we are not aware of actual resulting equipment damage because of this. The handles on the WHOI OBSs turned out to be too small to allow for an easy hook–up. The group therefore redesigned the handles between the January recovery and the April deployment. The SIO OBS group is aware that handles near the bottom of the instrument package would significantly reduce the risk of swaying and potential damage but they have not yet found the time to add these handles.

Recovery in this way is not possible on the KM because the aft deck is too short. Recovery is therefore done over the stern and the retrieval is done through the A-frame (or U-frame) crane rather than the small side crane. Instead of approaching alongside, the ship backs down on the instrument. While the deployment can be performed with a small folding crane, the recovery is actually done with the A-frame. During both deployment and recovery, the life lines have to be removed to move the instruments off and on deck. Apart from experienced OBS personnel, only ship crew members handle tag lines and fishing poles. This should decrase the risk for both, inexperienced volunteers falling off the ship as well as dangerous swaying of instruments due to improperly handled tag lines in rough seas. The chance that the instrument could bang against the hull while it is swaying during recovery is nearly zero. Even in somewhat rough seas, the stern does not appear to roll as much as that of other ships and there appears to be no chance that the seismometer can bang into anything during recovery, unless the ship experiences an unusually high pitch. When the instrument is first hooked up, its tag line is attached to the A-frame crane and then moved somewhat away from the stern, but still close enough so that a second hook can catch the seismometer chain. After this is done, the instrument is moved further from the stern, lifted up (Figure 5d) and moved on deck. This last process probably lasts less than 20 seconds. Details on the recovery follow.

The "Mock Recovery"

The captain expressed a wish to demonstrate to the two OBS teams how a recovery is done on the KM and the chief scientist agreed that this is a great opportunity for all involved to gather first–hand experience. Both OBS teams were extremely sceptical but agreed to observe the recovery. Since one of the SIO OBSs could not be deployed due to the lack of vital spare parts this unit was used for the mid–night mock recovery (Figure 5a), after the last OBSs was deployed at site number #74. The group provided the frame, floats, strobe light, (non-operational) radio, flag and DPG sensor. The anchor was not attached so that the instrument would not sink. Furthermore, the datalogger, battery bottle and acoustic unit were removed to prevent major loss in case of an unsucessful recovery. For the same reason, the seismometer as the most expensive component also stayed on deck. Instead, a large shackle was attacked to the 4-5 ft long plastic strap that links the seismometer to the frame upon recovery. The strobe light was operating but the inability to receive a radio signal in somewhat busy seas was a reason for some concern. The captain also requested to attach an additional small floating device on a long rope near the main bail of the OBS (Figure 5a).

The instrument was deployed near 11pm on May 10, a few hours before our cruise would end. The weather and sea state was very different from that of only a few hours earlier. During the week prior to the deployment, wind speeds were often below 20knts and seas were calm. On the day before, wind speeds were mostly around 15 knts and reached 20 knts only for 2 hours or so in the early afternoon on the day of the mock recovery before winds died down to less than 5 knts in the evening (7pm). Reluctance among OBS personnel to deploy and observe increased signficantly and there was concern that the OBS groups could not be convinced by a recovery attempt in calm seas. However, winds picked up rather quickly and approached the 20 knt–mark near 9pm, with gusts approaching 30 knts. Seas picked up accordingly. The roll and pitch of the ship was about 2.5 times stronger than in the afternoon but did not quite reach values that we encountered during the deployment of site #37 near the beginning of our cruise when the roll was larger by another factor 2. The swell was down from about 12ft near

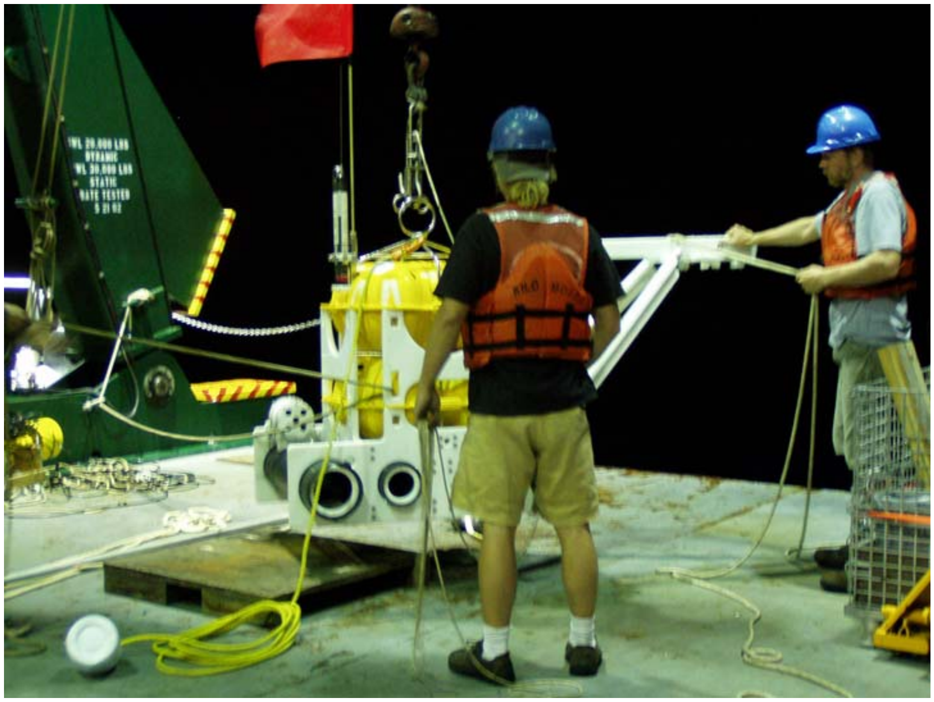

Figure 5a. The SIO OBS package during deployment for the mock recovery. The in package included the flag, strobe, radio (not functioning) and DPG sensor. The missing expensive seismometer was replaced by a large shackle to mimic realistic conditions. Also missing was the datalogger, battery bottle and acoustic unit. The ancor was not attached to make sure that the instrument would not sink. The two SIO OBS personnel held the tag lines.

the beginning of our cruise to about 8ft now though some waves were significantly higher. One wave drenched people on the stern and spray reached the 01 level. There is some disagreement on whether this was entirely due to the fact that the ship had an ”odd” position to the wave.

The instrument was deployed from the stern in the same way that all the other instruments were deployed (Figure 5b,c). The KM then steamed away about 1.5 nm. In the existing sea state, the strobe was still visible but not every single flash was seen from the 01 level. Since the instrument had no working radio, we did not want to steam away further. There was some delay in getting the aft control station set up for the recovery. Control from the aft rather than the bridge would shorten recovery times and make recovery safer. The ship's approach to the OBS appeared rather slow but this may have been deceptive due to the lengthy preparation of the aft control station. We started recording the recovery time between ”instrument first seen on surface” and ”instrument on deck” when the ship crew gave the signal that they started the approach. In order to stay objective, the chief scientist as well as the OBS development engineer Rapa monitored the time. When the KM closed in on the instrument the ship was controlled from the aft and backed up on the instrument. The time between releasing the pelican hook upon deployment and getting the instrument close enough to attempt the first hook–up was 35 min.

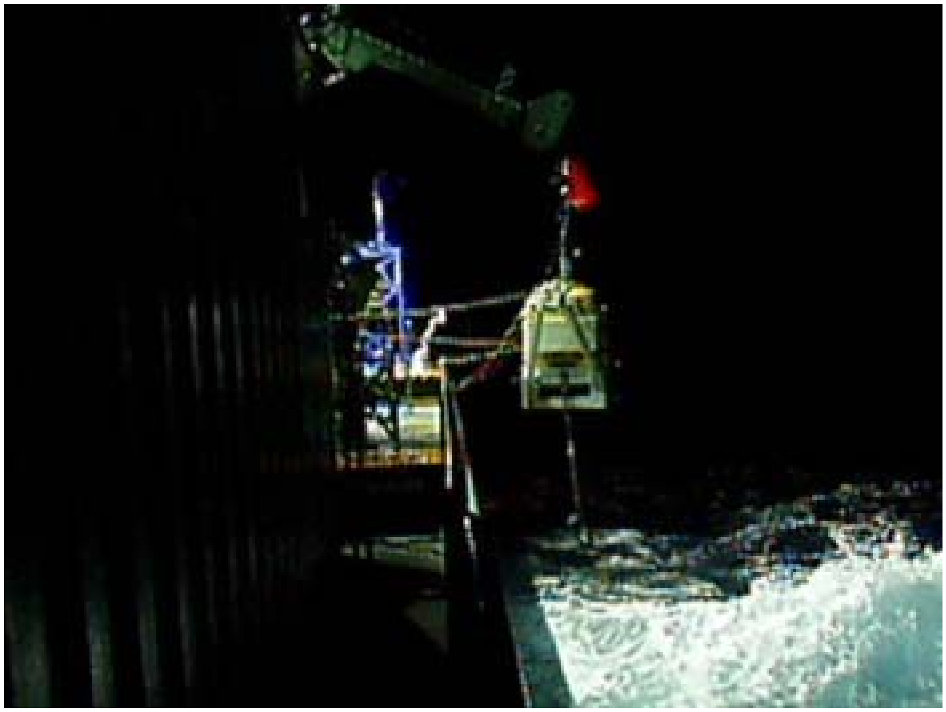

Figure 5b. The SIO OBS package during deployment. A folding crane lifted the instrument from the stern. During regular deployments, the seismometer (mimicked by a large shackle) is attached to the arm of the frame.

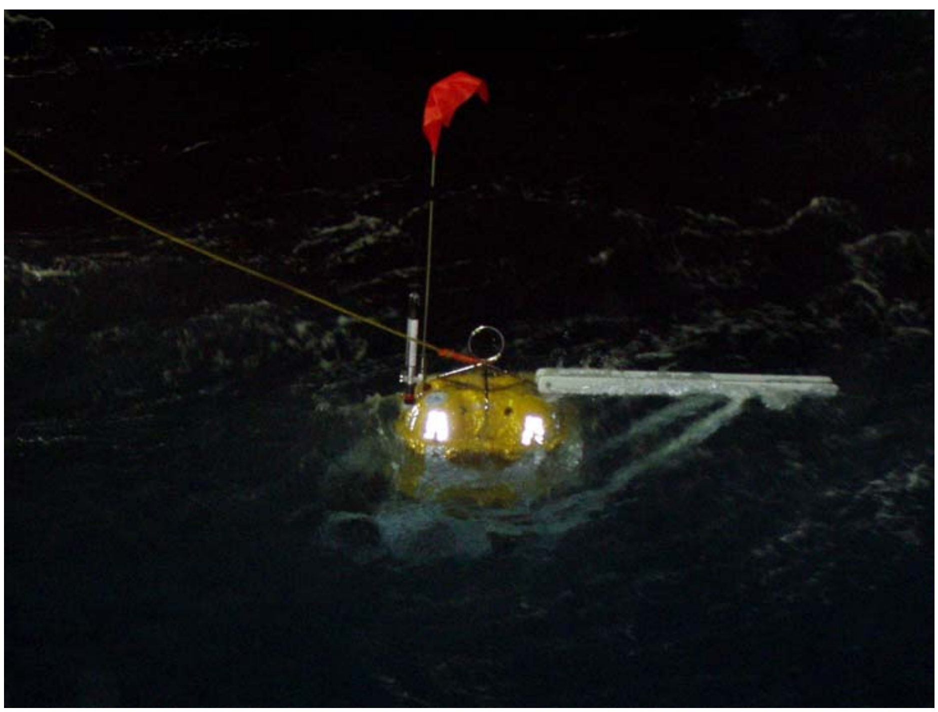

Figure 5c. The SIO OBS package during deployment. Shown is the instrument in the water moments before an an additional floating bottle, provided by the crew and attached to the instrument for additional safety measures, was thrown overboard. Note the movement of the flag in the wind.

Figure 5d. The SIO OBS team (blue hard hats) and ship crew preparing for recovery. The yellow fishing poles are used for regular recoveries. For recoveries on the KM, much longer fishing poles (grey to the left) are provided. These are operated by the ship crew.

During preparation for the hook–up, the tag line was attached to the A-frame crane (Figure 5d). This is different from over-the-side recoveries where the tag line gets attached to the crane *after* the hook–up of the instrument. The lifelines on the stern were removed when the KM was close enough to attempt the first hook-up. It took two tries within the following 9 minutes to get the tag line hooked into the top bail by a shiw crew member using the 25-foot long pole. The A-frame then moved out somewhat to avoid that the swaying instrument would bump into the stern. The instrument did indeed sway sideways but there was never the danger that it would bump into the stern because 1) it swayed sideways and not toward and away from the stern and 2) it was too far away from the stern. Within less than a 1 minute, the instrument was out of the water and the seismometer strap secured by a second tag line (Figure 5e). The instrument was back on deck less than 1 minute later.

Both chief scientist and OBS development engineer Rapa timed the recovery time at about 25$\pm$2 min. The total time spent of the mock recovery, including a 12min deployment window, was 58 minutes. The chief scientist compared the recovery time with those recorded on the recovery cruise on the KOK in January 2006. As can be seen from Figure 6, these times are quite compatible with the mock recovery though the latter took perhaps 5 minutes longer. As far as timing is concerned with respect to other ships, the slightly longer recovery may easily be set off by significantly faster transits between stations. Another point to consider, in regard to time spent, is the fact that the aft control station apparently still needs additional set up that was not yet been completed prior

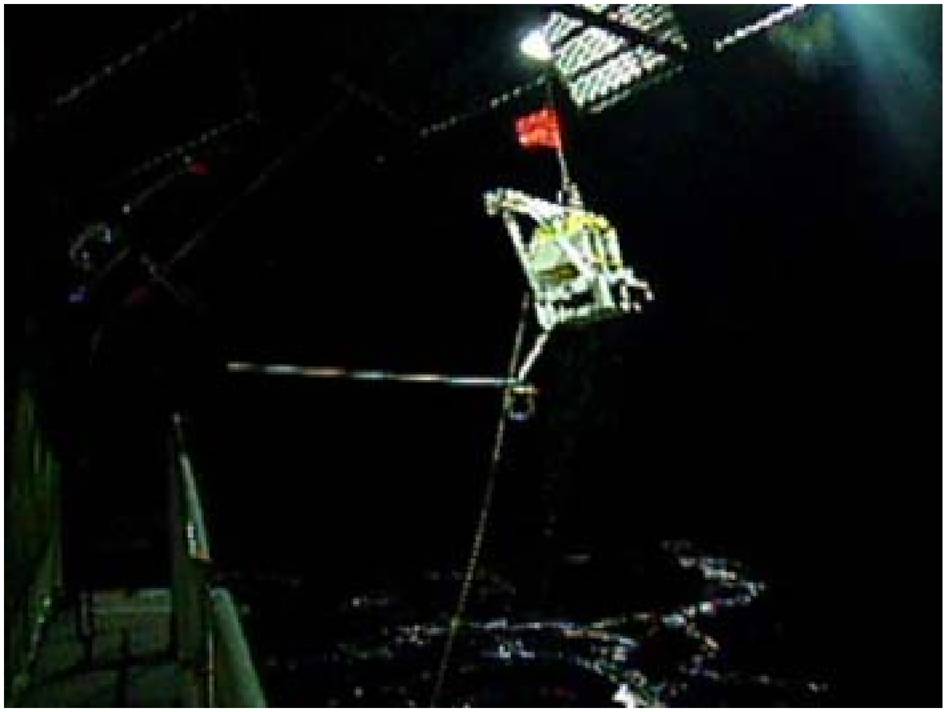

Figure 5e. The SIO OBS during recovery. After the initial hook–up, the package is lifted out of the water and moved away from the stern using the A–frame crane. Using a long fishing pole, a crew member then secures the seismometer chain. The photo shows the large shackle that replaced the real seismometer as it is attached to the seismometer chain during a real recovery.

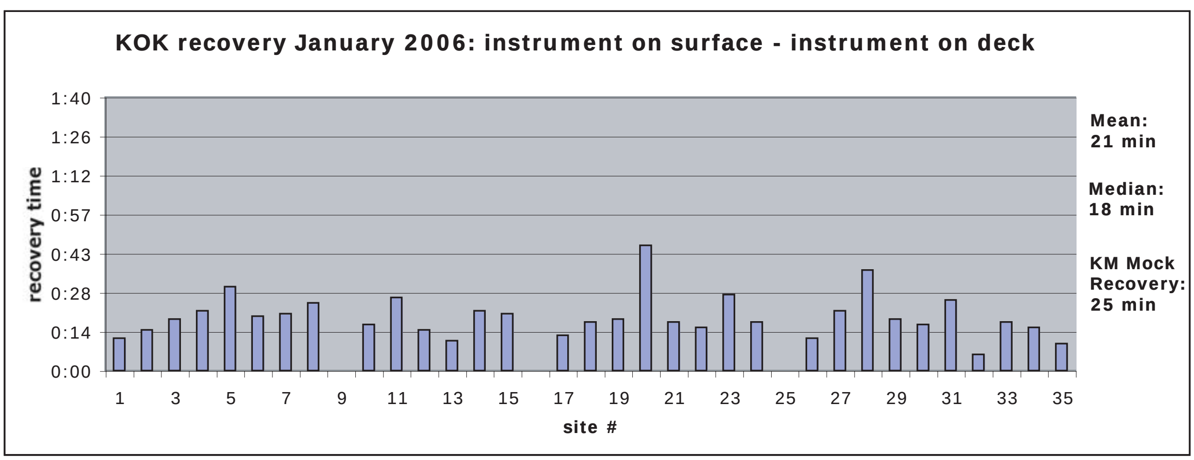

Figure 6. Recovery times from the PLUME January 2006 cruise on the KOK. Shown are times between the first sighting or audio contact of a surfacing instrument and the time when it was on deck. The instruments at site #9, 16 and 25 were not recovered. The longer times correspond to recoveries where the ship missed the instrument during upon the first approach.

to our cruise. Also, 2nd mate Steve Haugland who operated the control station was probably the most cautious person on the bridge and future recovery times may shorten. Timing therefore does not appear to be a valid issue to reject the KM as option for OBS recovery.

Due to the increased sea state, the captain decided to not demonstrate the small boat recovery. Some intial confusion about this recovery mode was clarified during discussions on deck. There was a misunderstanding that the small boat recovery was standard procedure on the KM so that even ”moderately calm seas” would severly cripple recovery attempts on the KM. During a small boat recovery, a boat with one or two crew members is lowered. The KM has two such boats. One is about 7ft long and is usually stored on the 02 level near the aft control station. This boat is primarily used in case of a small boat recovery in calm seas. In somewhat rougher seas, the larger rescue boat that is stored on the 01 level is used. The captain and crew members emphasized that the boat recovery is only used in case of broken bails on the instruments that prevent a recovery from the stern. This would be the same scenario that the groups face when recovering from any other ship. The small boat recovery is therefore no special characteristic for the KM's mode of operation.

Despite the successful mock recovery, the OBS teams maintain their reservations against this vessel. There is still concern that the approach is cumbersome, takes too long and that the instrument can be damaged during recovery attempts in rough seas. They maintain that ”backing down on an instrument is a bad idea” and poses an unnecessary risk that traditional vessels do not have. The fear is that it does not even take a very rough sea state to pin the OBS between the hulls and slam it against the underside of the aft deck or the ship if the approach to the instrument should fail on the first try. It is then also allegedly likely that the instrument could get caught in the ship's propellers, thereby destroying the ship. The chief scientist is not an expert on this topic but feels that this scenario is a bit far fetched and also lacks trust in the crew's competence. The grapevine says that the roll of the KM changes almost abruptly when sea state passes a certain threshold and that recoveries then become very dangerous. Responding to the question when such a sea state would be reached around Hawaii, the chief scientist was told that this could happen during hurricanes. These happen only rarely around Hawaii but can happen (e.g. Hurricane Dot in 1959 and Hurricane Iniki in 1992). The chief scientist wonders how other ships would fare better in such a sea state.

As far as instrument accidents on other ships are concerned she remembers a recovery on the KOK in January 2006 in sea state that was probably a little rougher than that during the mock recovery, but not by very much. The ship approached an instrument in the usual way on the starboard side. Three people prepared to hook up the instrument. The ship approached very slowly and the first person to hook up was Cripsin Hollinshead, SIO's veteran OBS engineer. He just got ready to hook into the top bail when the instrument suddenly disappeared. A movie taken by the chief scientist suggests that the hook was about a foot away from the instrument but never touched it. The instrument was assumed lost before it resurfaced after a long while, on the other side of the ship, about half a ship's length away, and without a flag on top. The instrument was later recovered successfully but showed significant amounts of paint on the plastic frame, a clear indication that the instrument collided with the ship. The captain later confirmed that the ship got into a trough and was awkwardly hit by a wave (that we hardly noticed on the back deck) that caused the instrument to sink below the hull. The KOK is a mono–hull ship. The SIO OBS lab manager is aware of this incident and he has a copy of the movie.

SHIP AND SHIP CREW

Space Issues

The ship is commonly compared to global class UNOLS vessels and most significant numbers compare with those of the Melville (e.g. fuel capacity, range, endurance, fuel comsuption, berthing, lab space). The most obvious difference is the twin-hull design and the fact that the KM is signficantly shorter and wider. Consequently, the back deck is significantly smaller than that on the Melville. The OBS groups have therefore expressed concern that the limited space on KM's back deck would not allow the deployment/recovery of 40 OBSs. On last year's deployment cruise on the Melville, the WHOI group brought three 20 ft containers, where one of them was a fully equipped lab van. The WHOI lab van was stored on the starboard side on the main level, one constainer followed immediately after and the other was staggered on the aft deck behind the side A–frame that was moved forward. A forth van that was not ours, was near the port side of the stern. On the transit between San Diego and Hilo, the WHOI group assembled the instrument packages, including the aluminum seismometer arms, and then spread the instruments on the main deck. The SIO group typically does not bring containers and stored instruments on deck where space was available. The roughly 4x4 ft SIO seismometer boxes were stored in the main hangar. The WHOI group launched from the side near the starboard hangar, using the hydroboom on the 01 level, and the SIO group launched from the aft deck using the side A-frame. While there was ample space for the WHOI lauches, space for the SIO launches was quite tight. Since the instruments were initially spread over the entire deck, getting by was somewhat cumbersome. The aft deck of the KM is only about half as large as that of the Melville (2200 sq ft vs. 4050 sq ft). The WHOI group therefore brought only their lab van and one instrument container that was stored on the port side of the 01 level. The lab van was placed near the stern on the port side. Initial plans to store the instruments on the 01 level and then bring them down with a crane was deemed a bad idea by the captain who would not authorize associated crane operations in heavy sea state. The WHOI group therefore stacked their OBSs, without the aluminum seismometer arms, on the main deck on the port side of the staging bay. SIO instruments were placed on the starboard side of the staging bay and on the starboard side of the stern, were space was available. The center of the main deck remained completely free to allow easy operations with a pallet jack. Part of the 370–sq ft staging bay was used to store SIO's seismometer boxes. It had a pulley system mounted to the ceiling that was quite useful in moving the heavy boxes. This arrangement required less deck space but was much clearer than the arrangement on the Melville though this is a matter of taste. Above all, there was no confusing maneuvering around instrument frames and containers, significantly diminishing the risk of injury when walking on the deck. The only space–related issue may be that the WHOI group stored their two wire baskets holding instrument weights on the stern next to the A–frame. Tagliner holders often had to climb over the baskets to secure the lines to the A–frame. The chief scientist had suggested to move the baskets somewhere else but was told the group would then have to carry the weights across the deck. The baskets were therefore not moved. We had not discovered/anticipated to make use of the KMs huge scientific store room that is easily accessible from the aft deck. On other ships this storage room is usually on a different level and has no easy access once at sea.

The KM has about the same amount of lab space (2550 sq ft + conference room + library) as the Melville (2630 sq ft + library) but the layout is quite different. Most of the space on the Melville is dedicated to a main lab on the main deck. Most of the space in the main lab is taken up by structures that serve the dual purpose of table space and shelf storage space, for the current scientific team as well as future or past teams. A row of boards along the outside wall function as desks to allow the science team to set up a few computers (no more than four) or similar equipment. A shelf separates this portion of the main lab with the portion from which navigational data can be observed and the seafloor mapping equipment is controlled. There is a wet/analytical lab next door and a somewhat isolated computer lab upstairs. There is no central main lab on the KM, which we had initially thought of as a bad idea. Ideally, we would like a central lab from which all the functions relevant to our project can be overseen and/or controlled. This includes the observation of nav data, control of seafloor mapping, hook–up into the ship's GPS and 12kHz hull transducer, communication with the bridge and final instrument checkout. We had originally thought that we could perform most of our tasks in KM's computer lab upstairs but due to a software problem, the survey computer that would hook-up into the hull transducer and ship GPS was incompatible. We therefore chose to set up shop in the starboard–side lab I-1 downstairs. This lab was also closer to the back deck and all the action, which is a significant advantage. Watch logs were kept in the computer lab but then moved to lab I-1 for instrument deployment. This lab, together with the wet lab, served as OBS lab for the SIO group, while the WHOI group operated out of their OBS van as well as the port–side labs #1 and #2. The science lab was only used for printing, the chem lab not at all. The hydro lab served as the chief scientist's office, a PC provided public access to the internet, and a dart board for entertainment. In retrospect, this multi–lab arrangement may be preferable over the central main lab design of the Melville, especially on long cruises. Having several smaller labs gives people the chance to work with less distractions/disturbances, set air conditioning levels (which is a major point of contention!) and get out of each others' space.

A possible advantage of using the KM as a ship for the PLUME cruises is that cruises start and end in Honolulu.

This makes the PLUME cruises dedicated stand–alone cruises and not part of longer transects that require sharing space with other projects. Though the ship may have less space than other ships it may turn out that more space is available for our cruises.

The web site advertises the cruising and survey speed as 12 knts. During most of our cruise, regardless of the sea state (12ft swell near the beginning; 6 ft swell near the end), our cruising speed was around 12knts, sometimes higher. When heading into the trade winds, our speed dropped from above 12 knts to 11.5 knts or slightly avove. This was quite a treat from our January cruise on the KOK when cruising speeds were around 9.5 knts, almost never reaching 11 knts, but dropping to 8 knts or below against the trade winds. In January, we lost 9h on transit through the Kaiwi Channel when our cruising speed was only 6 knts or less. The sea state was probably a bit rougher in January overall but not rougher than during the first third of our cruise on the KM. For comparison, on the first deployment cruise in January 2005, the Melville cruised at around 11.7knts, occasionally passing the 12knt mark, but usually staying below it. As far as speed is concerned, the KM performed comparably to the Melville, if not better.

Computers, Networking and Seafloor Mapping

The computer lab on the 01 level is also the ship's seafloor mapping lab. The lab is equipped with an impressive modern video multi–screen system which can show everything from SIMRAD data, over nav data and video cameras to the movie that is currently played in the lounge. Such screens also exist in all the labs and staterooms, where the screen could serve as computer monitor. Every stateroom also had access to the ship's LAN. There appears to be a wireless network but the reach is not great. All science party members had a ship user account and email which had outside connection every 15min or so could be retrieved through any of the ethernet connections. Some complained about emails never reaching a recipient but this appeared to have been limited to one or two users. There was a PC with public (science and crew) internet access in the computer lab, a PC and a Mac in the library and a PC in the hydro lab. There was also a public Mac (without internet connection) in the science lab but this was never used. On the Melville, several Sun workstations and PCs are available for public research computing. There was one public Sun available to us on the KM and it was used extensively for editing multibeam data. Seeing the impressive computer lab, with many Suns for the first time the chief scientist had originally assumed that most of these Suns were publicly available. The web site says that 9 Suns are there, but these are not public! This turned out to be a clear misunderstanding and did not compromise our PLUME operations but may have compromised individuals' own research while on board. Perhaps most groups bring their own computers these days, but it would help if science parties would be made aware of limited computer resources somewhat clearer during the cruise preparation. The science team had access to three IP addresses with internet capabilities.

The chief scientist held one, the co-PI from WHOI held the other. The third was dedicated to the public PC in the hydro lab. The IP addresses were restricted to not receive popmail in fear that spam email downloads would clog the ship's limited access. The chief scientist requested that this restriction be removed for her after explaining that spam mail (90% of all email received at the UCSD account) be removed through a web browser before downloading the real emails onto her computer. We had initially misunderstood that the PC's IP address could be shared among several users but the marine technician said that this address would be dedicated to an individual computer. With a few exceptions, the science team agreed to either use the ship's email address or check home accounts through the public computers. The PC in the hydro lab was eventually overused and the chief scientist explored other options. Eventually, we set up a wireless router that used the PC's IP address. The PC still had internet access, but so did now computers with wireless access. Wireless could be received in lab I-1, the science lab, wet lab, chem lab but not in the staging bay, back deck or on level 01.

The KM is equipped with a SIMRAD EM120 system for the deep ocean and a EM1002 for shallow seafloor mapping. The ship is also equipped with several sub–bottom echo sounder systems. Having a working echo sounder is an extremely valuable tool to pick suitable OBS drop sites. However, having unsuccessfully tried to use the 3.5 and 12 kHz echo sounders on the Melville last year, we did not initially try to use it on this cruise. On the Melville, the impression existed that the system works only at speeds around 5 knts or slower. About halfway through the KM cruise, the marine technician switched the 3.5 kHz Knudsen system on. It worked flawlessly at full speed near 12 knts for the entire rest of the cruise and provided extremely good quality data and a more detailed post-cruise analysis is underway. The SIMRAD multibeam system provided spectacular bathymetry and sidescan data which required almost no editing. Especially the edges are usually very noisy but were clean on the KM records. The operators explain that the superior data quality is not lastly due to the ship's unique hull design where the bow thruster is on the starboard hull but the mutlibeam transducer is very low in the water beneath the portside hull. Also, the ship usually slices through the water without creating significant bow waves, even in moderate swell. This creates less bubbles that could be cause for noise in the multibeam records on other ships. As far as seafloor mapping capabilities are concerned, this ship probably provides the best, or at least some of the best, data in the UNOLS fleet. The web site advertizes a beam width of up to 22km in the deep ocean that we only rarely achieved. At a depth of 5000m, we usually achieved a beam width of 17-19km but it could be as low as 14km. This may result from different sediment cover on the seafloor (e.g. mud vs exposed lava flows).

Ship Crew

The ship crew clearly stood out. From the very beginning, the science party felt very welcome, as if we had sailed on this ship before. The two marine technicians were very professional but they were by far not the only crew member who interacted frequently with the science party. After some controversy during ship scheduling whether the KM would be suitable for our purposes, the chief scientist had the impression that the crew were extra nice to this science team but was assured that this was really not the case. The crew members were very forthcoming to the science party but also functioned as a great coherent team, including bridge personnel as well as oilers. We were told that the complete crew was a crew designated for the KM, through all ranks so they probably have grown together over the years. The crew had a great sense of humor and interaction while on duty as well as off duty was a real pleasure. This is not necessarily the case for other crews. On the professional side, the crew did more than expected and what is provided on other ships. The watch standers in the science party were expected to help on deck during deployment, e.g. hold tag lines. This task was somewhat unexpectedly taken over by several members of the ship crew, during the day as well as during night time deployments. This was most certainly the best and safest option for the instruments and the project but some students complained that they did not get enough 'hands-on' experience. The WHOI group is large enough (5 individuals) to require only a crane operator and they do not let watch standers hold tag lines. On the January recovery cruise on the KOK, watch standers did indeed hold tag lines and fishing poles during recovery of the SIO OBSs. Some instruments bumped into the hull during recovery, a potential source of damaged for the $60Kinstruments, which was not lastly due to the fact that the tag line holders did not do their job properly. On this cruise, this was not an issue. The OBS personnel do not appear to realize that this was an invaluable service that is not provided on other ships. The crew also handled the medical emergency evacuation very professionally and swiftly. In fact, some appeared to have been quite excited about the chance to let the KM go at top affordable speed (15 knts) for the first time for as long as they can remember. The cruise went well and relaxed afterward despite a significant loss in science time. Again, this is not necessarily the case when dealing with other crews.

OBSIP–RELATED ISSUES

The UNOLS website does not provide for a feedback option about the operation of the OBSIP but some comments are in order. The cruise began with a somewhat rough start when several anticipated components did not work the way they should have.

12kHz transducer and GPS

It was anticipated that the OBS groups would use the 12kHz hull transducer to track the instruments to the bottom and then survey them in along a course that was roughly 4km in diameter. The connectivity between ship transducer and OBSIP's Edgetech acoustic deck units appears to be a recurring issue on every single cruise. While on the Melville, we used the ship TD initially, it turned out to be too noisy and the groups then relied on their own transducer that was lowered over the side though this option did not yield significantly better data. The other problem with this option is that the ship cannot maneuver while the TD is in the water. After discussion on how other groups deal with this problem, the WHOI group then returned to the KOK in January 2006 with a towed TD that was deployed over the side using the same folding crane that was used to deploy the OBSs. This allowed the ship to move. On the KOK, this was the only viable option after we found out that the ship's TD had a preamplifier that was incompatible with the Edgetech box. On the KM, connectivity was there and instrument tracking was planned to take place in the computer lab where watch standing and seafloor mapping was conducted. However, a difference in the format of GPS data between SIO GPS clock and ship's GPS system did not allow us to use the survey software developed by the SIO group. The SIO developing engineer was in email contact with the software developer but was unable to debug the code. It would have been good if he had come along but we were told that a very busy schedule did not allow this to happen. The groups then decided to do the tracking using the WHOI towed fish transducer (deployed from the stern) and the SIO GPS clock.

SIO GPS clock

The SIO Odetics GPS clock with which the survey was done started failing near the start of the cruise. The clock needed an unusually long time to select available satellites and lock on the location. The suspicion was originally that the antenna was not optimally located or that ship's systems would cause interferences. The SIO antenna was mounted near the ship's SEATEL antenna, while the WHOI antennas were mounted on the railing in the starboard corner of the 01 level and on the stern atop the WHOI OBS van. Both WHOI GPS systems worked perfectly. Troubleshooting was hampered by the fact that SIO and WHOI GPS clocks are not compatible so antennas are allegedly no exchangable. Moving the antenna did not improve the situation. The chief scientist suggested to move the antenna to the same corner on the 01 level in which the WHOI antenna was mounted but this does not appear to have been tried. Perhaps, the cable was too short. On the 10th day of the cruise after three SIO OBS had been deployed, the SIO development engineer notfied the chief scientist that the clock lost lock "a few days earlier" and that it had been in "recovery mode" since then. The team continued to troubleshoot but the chief scientist suspected that the failing component was the GPS clock. It was most likely ok for the most recent deployment, and allegedly does not affect the instrument surveys, but it was no longer possible to determine an accurate SIO OBS time tag, the differential between GPS clock and the internal clock of the OBS. The clock gave readings of 500ms which would have implied that the clock drifted on transport from San Diego the Honolulu by this amount, in less than a week. The engineer was ready to record this value as real. For scientific purposes, this is unacceptable, as the chief scientist explained to the engineer. The travel time anomalies caused by the plume that we seek in the mantle beneath Hawaii will be of the same order in the body wave tomography and uncertainties in the timing by this much cannot be rectified during postprocessing. The GPS clock never recovered for the rest of the cruise. During the cruise preparations, the chief scientist had suggested several times to pack a spare GPS clock and at least two Edgetech deck units. While the latter can be exchanged between the OBSIP groups and packing two units may not be essential, the GPS clocks are not and the WHOI group uses a different system to synchronize their clocks. Taking spare parts in this case is indeed essential. The chief scientist was told that the group was ”spread extremely thin” due to concurrent cruise committments and that the group would not have the $5000 to purchase and extra GPS clock. On our cruise, the group was lucky in that they could eventually find a way to determine the time tag using a WHOI GPS clock and an oscilloscope. It is probably not a good idea to rely on this type of plan B.

SIO Rosette Tests and Transducer Location

While the WHOI group tests the instrument transducer on deck, the SIO group chooses to test all transducers at the maximum deployment depth. They pack all acoustic units into a frame, the rosette, and lower it on a wire down to within 200m of the ocean floor. In the rosette, the acoustic units are arranged in 3 rows in the same horizontal order in that the units are deployed within an OBS. Only incomplete logs exist for past rosette tests. On last year’s cruise, communication failed or was spotty with transducers that were not placed in the top row of the rosette. Since it is unlikely that only the transducers in the top row are fucntioning well, it is ”common wisdom” that some kind of shadowing effect prevents the lower units from communicating with the ship properly and that transducers would function on the actual deployment. In the first deployment cruise, for which some notes on the rosette exist, the ”faulty” units were deployed despite poor results. The three instruments that were lost on the recovery all had acoustic units near the top that responded perfectly during the rosette test. During the rosette test on the current cruise, we experienced worse problems than last year. At 1000m, we established good communication to units in the top row but communication started to fail to other units. Various components (Edgetech box, transducer, labs) where swapped and components on the ship were switched off to ensure that nothing would interfere with our test. Eventually, we received more or less clear signals from all units. Perhaps, we should have stopped here but the depth at which we started losing communication was suspiciously shallow. Nearly 5h into the rosette test, the winch stopped at 4000m. Clear communication was established only to the units in the top row. Six hours into the test, at 5400m depth, units in the top row responded only after sending commands repeatedly and acknowledges from the instrument were not clear. We never established contact to the lower units. The test was completed after 10.5h (6.5h wer budgeted). It has been a point of discussion since at least last year that perhaps the location of the transducer in the SIO OBSs is far from ideal. While the SIO transducers point sideways, thereby probably creating a directivity in receiving/transmitting abilities, the WHOI transducer is attached upright near the top of the instrument package. Since the SIO OBS team was not ready to deploy instruments without a successful rosette test, we performed a second test in which all units were facing upward. This test was at 5000m depth. It was significantly shorter, only 3h, and all units but one responded at full depth. One unit did not respond until the rosette was raised to 3500m. Since our deployment sites are all below 4000m, the engineer was against a deployment. Since no spare units were available – all equipment was committed on concurrent cruises – we lost a deployment site in our array. Somewhat puzzling is the location of the SIO transducer. While the chief scientist and other PIs were told last year that the transducer is inside the package, hidden by the floats, it now turns out that the TD is attached to the acoustic pressure case and installed in the frame near the bottom of the instrument. This may have been done for technical reasons but may increase the risk of losing communication. Instruments likely settle into the sediments, potentially hampering communication if the transducer sinks into the mud. Even without sinking, suspended sediments that could interfere with communication are likely found closer to the bottom than to the top. The top of the instrument therefore appears as a natural choice for the transducer. Having witnessed such a disastrous, timeconsuming rosette test, the SIO engineer is motivated to redesign the acoustic unit so that the transducer points upright and is installed at a higher location on the instrument though this change comes too late for our experiment.

Other OBS–related Issues

For reasons unknown, a lithium battery pack in an SIO datalogger appeared to have discharged during shipment from San Diego to Honolulu. This datalogger could not be deployed because spare batteries were not available. After being asked whether spare batteries had been packed the SIO development engineer explained that these batteries are very expensive and have a limited shelf life. The lab therefore has not the resources to pack spare batteries. The SIO OBS group had originally committed 15 instruments but, due to shortness in resources, shipped only 14. One of these did not have a broad–band Trillium 240 sensor but only a Trillium 40. The Trillium 40s have not the band–width to record surface waves with high fidelity in the entire frequency band of interest. Again, shortness of resources was cited. Since we lost individual components of various instruments, components were combined to deploy 13 hopefully working units. It was only recently brought to the attention of the chief scientist that the SIO instruments had a serious design flaw that was responsible for a poor data yield: only 3 of 7 recovered instruments recorded the vertical seismometer component and the DPGs. A false jumper position on the datalogger board caused the seismometer burnwire to draw power from the same circuit as the CPU. The burn lowered the voltage on the CPU so significantly that 4 instruments reset to default recording parameters: record 2 channels at 125Hz (the setting for our deployment is 4 channels at 31.25Hz). Unfortunately, the 2 channels are the horizontal channels that are likely to be very noisy. The OBS team is sure that this problem is fixed and will never happen again, too late for this experiment. The refurbished units also have new IDE hard drives instead of the previously used SCSI drives. There is some concern that the IDE drives are not as forgiving at recording in evacuated pressure cases as the SCSI drives. The group still needs to gather evidence systematically in this regard.

The chief scientist is less well informed about WHOI instrument related issues. The group members were told that all communication has to go through the lab manager who is extremely busy. Some of the recovered instruments in January had dead batteries upon recovery. Since this also affected the internal clock it was not possible to determine the clock drift. The data of these instrument will therefore be useless to this experiment though the data may find use in other applications (e.g. noise studies or long-term studies in which a few seconds play no role). From gathering information in a few short conversations, this problem appears to have been fixed. The WHOI group also recognize some drawbacks in the design of the handles to hook up the instruments during recovery. The handles have been modified in the meantime. The instruments now have a second radio, the same that the SIO group uses. This radio is attached near the front end of the aluminum seismometer arm. On the recovery cruise in January, one WHOI instrument could only be retrieved after lowering the rescue beacon to within a few 100m of the instrument. The suspected failed part was a "cracked" transducer head, that functioned flawlessly on deck, or a faulty acoustic electronic board. While the transducer was not checked further the electronic board tested ok in the lab at home. This unit was then deployed on this cruise at site #72. The instrument was believed to be tracked to the bottom though the last reading was somewhat uncertain. The survey could not take place because communication could not be established again. We fear that this instrument experienced the same problems as on the last deployment and that we will not be able to retrieve this instrument without the rescue beacon.

SCIENCE TEAM

The science crew consisted of a number of individuals tied directly to the project (Laske, Collins), OBS personnels (Collins, Bender, Peal, Ryder, Handy, Rapa, Aaron) and personnel responsible for watch standing (Weeraratne, Landuyt, Hogg, Drews, Messina, Hindley) in 4h–shifts. Weeraratne was on last year's deployment cruise on the Melville. Landuyt was sent by the Yale co-PI Dave Bercovici. Hogg worked for two summers in Laske's group and gathered experience on a prior Scripps cruise. He is about to graduate and was invited by the chief scientist. Drews was hired by the U. Hawaii co-PI Cecily Wolfe. He was on this year's recovery cruise on the KOK. Messina married WHOI engineer Bender just before the cruise. Bender had asked for Messina to join the cruise so that she can gather sea going experience for future cruises in her deep submersible group at WHOI. Hindley was hired by the chief scientist as the only person who responded to an SIO-wide search for watchstanders. She works as a data analyst in a seismology group at IGPP. 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. Some students depend on large machines to do their research, many require hardly more than a laptop computer. For example, Landuyt brought his linux machine and finished a manuscript for publication that required moderate data analysis using Scilab and Matlab. Other arguments not to join long cruises include, of course, personal reasons. Weeraratne was responsible for editing and plotting the seafloor mapping data. Hogg and Messina helped with the editing. Landuyt and Weeraratne also helped the SIO OBS group on deck when help was needed.

In general, the group worked out well and was very enthusiastic and committed to contribute to the success of the cruise. The group also mingled well with the ship crew. We had several games on board and conducted tournaments with mixed groups. The watch standing operation ran smoothly and communication between science team and ship crew was excellent, on and off duty. Unfortunately, Messina injured her foot and required a medical emergency evacuation after treatment with antibiotics was unsuccessful. This incident somewhat disturbed normal operations temporarily as details about the injury surfaced. Her and Bender's departure did not compromise the remaining operations of the cruise. There may have been a preexisting condition that hampered a speedy recovery and the chief scientist is somewhat reluctant to invite Messina back on a future cruise. Hindley did not quite fit in. She had prior seagoing experience with the EM group at IGPP but the chief scientist was told only after we left port to be somewhat cautious. Apparently, she is somewhat inexperienced and quite naive about it. Hindley did a satisfactory job at watch standing but didn't quite bring the same interest and enthusiasm for the project. For her age of 26, she acted quite immaturely, disrespecting rules and others, including ship crew member. Her supervisor was informed about this problem and she will not come along on future cruises.

Some problems surfaced when the science account for the satellite phone was cut off. The satellite phone was then available upon purchase of calling cards. Apparently, some members overused it for private purposes. The public internet PC in the hydro lab was heavily used and internet was mostly used for private purposes. The chief scientist declines to be the judge on this issue as lengthy cruises require a good deal of personal sacrifices. But the public PC issue was a point of contention. After enquiry, the team was told that we could not have an additional IP address to remove some of the competition but was also kept under the impression that the third IP address that was dedicated to the public PC in the hydro lab could not be shared among computers. It was not until later that the chief scientist installed a wireless router herself to allow for more private machines to connect to the internet. Of course, this could potentially slow down everybody's connection to the internet but it appeared to be the only reasonable option to keep the team happy.