PERFORMANCE OF *LM GOULD*

In general the LM Gould performed better in ice than we had all anticipated. Captain Mike Terminel was able to cut into new ice of 68" at 5-6 kts consistently and sometimes thicker new ice (up to 10")
for brief periods of time. This gave us the opportunity at least of approaching if not reaching our intended area of operation and if we were a month earlier we would likely have succeeded in reaching the Larsen Ice Shelf area. Manueverability and keeping station was a somewhat different issue that was partly solved by some mid-cruise adjustments in bridge operations. However in thick, multi-year ice and even slushy first year ice the Gould has difficulty maneurvering and certainly and understandably can not cut far into such ice. Thus we were blocked in three attempts to reach targets. Once for the South Orkney Islands mooring recovery, and twice when we attempted to navigate around James Ross Island (to the east via Admiralty Sound and to the west via Prince Gustav Channel).

EQUIPMENT

Smith McIntyre Grab

This is a standard tool for seafloor sediment sampling and it is important to maintain the working grab in good condition. Some years ago a new Smith McIntyre Grab sampler was acquired and built of stainless steel. We did not use this sampler because our past experience has not shown the grab to function adequately. Instead we relied on the "old beat up" grab which has a more consistent record of reliable trips and good sampling. Yet the old grab needed some significant repair work while at sea, which while not slowing down our work did present itself with unsafe working conditions prior to making the repair. It is highly recommended that the sampling equipment such as this be brought up to standards in PA prior to departure. The space and mechanical capabilities should be there in the PA wearhouse to upgrade, test, and repair such equipment prior to sailing. Port calls are not the best time to do this as the cargo tasks are more or less overwhelming upon the MT staff. Specific issues with the Mac grab are:

1) making sure the safety mechanism is functional

2) making sure the trip mechanism operates smoothly

3) clean and regrease all moving parts.
4) sand blast and repaint all surfaces
5) repair cover/lids and replace current solid plates with stainless screen mesh (this would recover the original concept of the doors functionality in allowing the sediment water interface to be collected in an undisturbed fashion when the grab is placed upon the seafloor, yet retaining the baffling effect need upon retrieval).
6) Restring 318" wire rope and reterminate cable loops.
7) Sharpen or file jaw fitting to assure tight closure.

It should also be noted that the functionality of the new stainless Smith McIntyre grab be evaluated. The time is quickly approaching when it will be needed, it should be a well

working system before we are forced to use it. My only experience with it, in 1998, demonstrated some issues related to its inability to trip upon contact with the seafloor.

Kasten Core

The kasten core is a fine mechanism to retrieve undisturbed cores of fine grained sediment of 3 to 6 m in length. We were pleased with the maintenance and functionality of the barrels for the core but there are pressing issues with the core catchers. As requested three replacment core catchers were provided in PA for our cruise. But these were not manufactured to original specifications. T he core catcher mechanics are absolutely critical to the functionality of the system. We in fact had only one proper core catcher with which to work and it was not properly fitted for the 6 m barrel. Specific aspects of the core catcher are:

1) flappers that are made of thin stainless steel. The new catchers were made with thick stainless stock. The thin steel is need so some flexibility in the flappers is maintained AND so the flappers can be bent inward along their centers in order to catch the mud and provide proper closure upon core retrieval.
2) The flipper mechanism built into the new core catchers is an inoperable design in the sediments which we core. This mechanism may indeed prove workable in very soft oozes but the silty muds and diamicts we typically target, will not be sampled properly by such a core design.
3) Lead weights were again an issue. Most of these remain on the NB Palmer and we only had one full set of 12 weights with which to work. The weights are used for the triple core as well and we typically have to change the number deployed depending upon the sediment. We had three core heads but only one set of weights so if we had lost a core, we could not continue to place proper mass upon the replacement.
4) New sets of stainless screws are needed. All threads need to be cleaned of grit and a non carbon lubricant such as silicon needs to be applied. Sets of replacement plates that are custom fit to the existing barrels need to be provided, or at least three or four that can be drilled to fit a gap if needed.
5) A dedicated large miller swivel needs to be provided within the box of pins and ties for the kasten core.
6) Large slip pins are needed to fit the barrel fasteners, which themselves need to be duplicated. Only one set of large barrel pins was available. Large stainless washers are needed in quantity (2 dozen), it was surprising not to find these in the fittings drawers of the MT shack.
7) Most critical was the lack of a collar weight which is needed to provide stability to the bottom of the core upon decent to the seafloor. One had to be manufactured from the two lead weights, again depleting the very limited replacement stock we had to work with. The original collar weight is properly designed to rest just above the core catcher and is held in place by sturdy rope bridals. These need to be provided and or manufactured before each cruise because of the need to use non binding rope, which rots with time.

The use of a large Miller Swivel is recommended despite the occasional cramping of the shackles and swivel upon the cores top bar (loop) upon retrieval. If a smarter (as opposed to dumber) set of shackles and a shorter but more robust swivel were used this

problem can be avoided. A swivel is needed in order to prevent the core from twisting upon pull out, which for a square barrel core would be difficult. It also keeps the core from spinning on the line prior to the moment of penetrating the seafloor hence enabling greater length of core from being recovered.

SCUD Camera

This was the one instrument that provided the most frustration during our cruise. It is a simple design that has proven itself over the years. Yet the video electronics proved troublesome and
unreliable during LMG04-04. No replacement parts were available for:

1) the lights
2) the batteries
3) the video camera itself
4) the laser lights

It is high time that the SCUD video camera undergo semi-annual maintenance including replacement of batteries, overhaul of electronics, and checking o-rings, seals and sleeves. The video footage we have recovered from the seafloor has been an invaluable aid in understanding depositional processes, however it's a time consuming station and takes the dedication of the entire ship's capabilities four up to four hours. Such an expensive investment of time should not go to waste because of minor, inexpensive maintenance issues on site. Because the lights on the system generate a great deal of heat the system can not be turned on manual since the delay in placing into the water would burn out the lamps. Some procedure needs to be developed to overcome this problem, perhaps a water tight switch on the outside of the housing.

One easy improvement is in the type of ballast weight that is employed to keep the scud housing neutrally buoyant. On our cruise the ballast weight caught on rough bottom and broke the line causing the camera to float out of sight of the bottom. A different type of anchor should be used, a heavy elongate anchor, perhaps with vinyl coating would be ideal. This way proper balance is kept with the towed **SCUD** and the likelihood of catching, even on rough, bottom is minimized. An anchor like this could easily be fashioned out of lead or purchased through a marine supply house. The vinyl coating would also lessen friction if the anchor did indeed purchase the bottom briefly. The anchors used by the MTs were lead donuts or diving weights tied together with a rather large loop, ideal sort of snare for a boulder.

BENTHOS Still Camera

Although the system still provides usable and high definition still images of the seafloor, the technology is there to collect close to real time photos. The images are needed to help evaluate depositional process and would be even more useful if a digital
format is adopted so that the collection of the images could be evaluated as a guide to further sampling in the field. Without replacing the system there still needs to be a standardized set of maintenance procedures. The largest problem is the lack of consistent ballast, as the weights employed in this fashion change from cruise to cruise. The weights help in balance and thus prevent the camera from tripping. The camera takes a picture and flashes every time momentum is shifted on the trip wire. This causes expensive use of film and a guessing game essentially every time the camera is deployed in order to figure out how many exposures are consumed. It also drains the

batteries. Other problems arise when the compass breaks, this has happened several times over the last couple of years and a spare compass needs to be on the ship. **NOT RIGGED PROPERLY!!**

Triple core

This is not a standard coring system but has proven itself effective in soft sediments. It provides a triplicate of the sediment water interface down to about a meter. The core works best when there is a maximum amount of weight added to it in order to allow the three core tubes to properly penetrate the sediment. We were reluctant to use it in this fashion during LMG04-04 because of the lack of replacement weights. It uses the standard kasten core head (and weights) as a support for the triples core tubes and plates. The largest problems are the ineffective core catchers which are the standard stainless steel ones used for the jumbo piston core. There needs to be a variety of core catchers available such as soft plastic ones right on up to the more rigid stainless steel ones. This is especially easy to provide as there are standard manufacturers of core fingers, catchers that are inexpensive. There should be no excuse for not having a variety of them on board and ready to use. Standard maintenance of this system would include a sand blast and repaint every year, replacement of rubber flappers.

CTDT

We encountered no major problems using the ship board CTD system because the Lamont Doherty Group trouble shot the unit prior to our use and the equipment is extremely well maintained. It gets heavy use by multiple investigators and so has a good maintenance schedule. However we would like to see a short path length (deep rated) transmissometer added to the instrumentation. We have used a SEATECH 10 cm path length unit for some time but that unit recently failed and SEATECH is no longer in business. Wet Labs makes a 10 cm path length but it is not rated for water depths greater than 600 m. Raytheon should be able to find a supplier or have a unit custom made. A 10 cm path length is crucial in working in fjords and bays because the longer path lengths are often maxed out by the suspended sediment in the water column. We have decades worth of data from a similar system and it would be nice to be able to continue collecting the same kind of information in the future. Of course the timely return of post-cruise calibration standards would be nice, in the past we have had to go calling and begging for these numbers.

12 kHz Pinger

We needed the use of a pinger for the SCUD video sled and the CTD. While one was always available it might easily not have been the case had the two failed us, as they have in the past. Three operational pingers should be standard, not only to prevent down time if batteries are needed but also in case one is lost on a deployment.

Knudsen Chirp 3.5/12 kHz echo sounder

At best we found the Knudsen to be an adequate echo sounder for bottom records and it is true that it never failed to find us a bottom when we needed to. However detecting a sub-bottom was next to impossible with the lower frequency channel. To be honest we did detect weak reflections to depths in the sediment column of several tens of meters but these were difficult to resolve and provided no information on reflection

character other than that the sediment was extremely soft. The post collection software is a cheap program that simply allows one to redisplay a collected record with no capability to fine tune, amplify, or otherwise highlight the key reflectors, even if there were any resolved.

Acquisition of BATHY 2000W system for LM Gould

The BATHY 2000W system on the NB Palmer is far superior in all of the above respects and we emphasize that a BATHY 2000W be acquired for the LM Gould AND that the installation of the system be made from the transducers up. Replacement of existing transducers may be needed as there is currently no room in the sea chest for another array. In many respects the strength of the BATHY 2000W system is that it is built around a very sound set of transducers as ODEC if not anything else is known for excellent stability in their transducers. At minimal compatibility of the existing transducers with the ODEC-BATHY 2000W should be done while the ship is in dry dock so the sea-chest is accessible. Installation of only the deck unit (of the BATHY 2000W) after the dry dock period, only to discover some problem in transducer compatibility (including power limitations) would be an expensive mistake.

Equipment Deployment Issues

Safety has always been a must for our group given the large number of student participants and it was refreshing to see the standardization of safety previews at each shift change. However these should more directly involve the chief scientist in the briefing of each deployment, especially for the first time. Much of this is my fault and I should have been more proactive in calling these meetings, and later in the cruise they did prove helpful. Had I understood some of the experience issues with the gear I would have certainly done so from the start.

For kasten cores the stern gates should be opened in calm seas because the core is so long with that the fitting and swivels often are pulled into the block as the core is raised causing some damage to the fitting each time and concern on the part of the winch operators who are very concientous. Extra display screens are needed on the bridge so that the wire out is displayed and the stern camera can be seen.

The winch display screen is a real gem (designed by Andy Nunn) and is exactly the kind of information that we needed in the past, BUT a much larger display is needed in the Electronics Lab (or I have to get my cataracts fixed). Wipers are needed for the main window in the aft control/winch room. We had operations in pelting rain and the deck operations were difficult to see with the rain dripping down the panes. Window defroster would be a good idea as well.

The use of longer cores (such as the double barrel kasten and double barrel 4" PVC) would be and were difficult. We tried to deploy the later once and it failed to acquire any sediment having

laid down flat on the bottom by drifting off-station. Recovery if it had recovered 20 feet of mud would have been difficult still. Given the seas were encountering we did not attempt another such core. The double barrel kasten core because of its steel construction would have posed fewer than the problems but still been done with trepidation and sliding off the stern edge with the gates open. We did not use this system because the lab layouts would not accommodate such a long core except to have placed it upon a man who who the floor, an obviously unsatisfactory sampling procedure.

SAFETY CONCERNS

Although there was one trained and certified cold water diver on board there was no dive equipment. Both should be standard for any cruise in remote ice covered seas where underwater inspection of hull damage, if it takes place, is crucial. This exact scenario took place on the Polar Duke in 1992 and Langdon Quetin's group happened to be on board so the damage was easily assessed. Also if someone should become disabled in the water for some reason a dive may be the only way to reach them quickly and effectively. Hence one of the ECO, Raytheon or even Science staff should be cold water certified for each cruise. This would be easiest if Raytheon mandated a minimum number of its MPCs, MTs or MSTs take cold water diving certification. Diving equipment should be on board, maintained and close at hand. Mandating an EMT on board does little good if the person in trouble can't be reached.