SHALDRIL Phase II Report: Executive Summary (Holloway, Apr 1999)

The SHALDRIL Committee requested a review of available geotechnical/mining/drilling contractors who offer equipment suitable for a shallow penetration (50-150 m sub seabed) coring program in and around Antarctica. This is the second of two reports requested and prepared for the SHALDRIL Committee. The first report dealt with the available drilling rigs or systems to work in water depths up to 1000 m. The second study reviews additional portable drilling equipment available where water depth requirements have reduced. In addition, the committee also requested a review of sampling/coring equipment that could be operated with various size drill pipes available for these drilling rigs. The combination of pipe and drill-rig rating is only part of the variables making up the total equation of depth rating. Other factors affecting depth ratings include the size and complexity of the riser, as well as the location of the rig onboard the vessel.

Ten contractors responded to the RFP for the reduced operating scenario proposed for a shallow drilling program off Antarctica. Three distinct types of operations were presented as options for performing the drilling/sampling/coring objectives outlined by SHALDRIL Committee. These options include a) a geotechnical drilling rig with or without a riser, b) a mining type core rig with a riser, and c) a sea floor corer. The overall time required performing coring and sampling operations is very similar for all three drilling methods presented. Deck-mounted drilling rigs and support equipment is more easily accessible and repaired than the remote and highly complex, sea-floor-coring device. All of the companies had equipment that was at least in one stage of design or had already been manufactured and was awaiting testing. Several contractors had equipment that was essentially ready to be mobilized pending preparation and shipment to the port of mobilization.

Two of the systems proposed in the previous report (i.e., PROD and the Marine Resolution) were not completed or field-tested at the time the report was issued. Nearly two years have elapsed since the Phase I Report was issued. At the time of this second report, the PROD System is still under development and the Marine Resolution has had an initial field test.

These two systems were compared to eight additional responses from various contractors responding to the second round of RFPs. The methodology is still somewhat divided between the use of a small mining-type rig and a more purpose-built geotechnical drilling rig. Four of the contractors responded with a riser approach whereas five proposed to use conventional drill pipe in lieu of a riser. The remaining contractor proposed a sea-floor-coring device (PROD).

One contractor (Fugro) proposed to mobilize an entire geotechnical drill ship to Antarctica. Despite the relatively high initial mobilization cost, this option offers several advantages over the installation of portable drilling equipment on the deck of the *N.B. Palmer*. It provides a "turn key" approach to the alternative logistics involved in mobilizing equipment on a vessel of opportunity. The geotechnical-type drilling rig scenarios offer more sampling and coring options, in situ testing, larger sample size, better hole characteristics, the use of drilling fluids to stabilize and clean the bore hole, and the ability to penetrate deeper than the sea floor coring device. It also offers a proven track record and one which results are almost insured due to the wide range of sampling/coring options available. It is a more expensive option if undertaken without other parties to share the mobilization/demobilization costs. In many situations this is an

attractive alternative, especially if the timing of the program (i.e. 5-month window) is somewhat flexible with the schedule of the vessel. Allowing the vessel and/or other drilling contractors to stage or market other work in the general area or during the transit would spread the cost of mobilization over several clients

Cost estimates were prepared for a single 45-day leg and two 45-day legs performed back-to-back. The two-leg option significantly reduces the day-rate costs when the initial mobilization/demobilization is spread over a larger period. Individual contractor costs for both scenarios, as well as total programs are included in this study. The total program costs were used as a basis for comparing the vessel-supplied (Fugro) option to that of the *Nathaniel B.Palmer.* In addition to the ten drilling contractors being reviewed, three logging contractors are identified, along with their costs for the same field program.

Also included in this report is a separate document discussing Aluminum Drill Pipe for Shallow Water Operations. Investigations into the use of aluminum drill pipe (ADP) suggest that only marginal weight savings are seen in shallow water and that utilization will be limited to only a few portable rigs capable of handling the API drill pipe.

Seacore Ltd. is the highest-ranked drilling contractor of the ten responding. Seacore has proposed to design and build a drill rig named the C-20 specifically for work off the *N.B. Palmer.* This rig offers the widest range of versatility while maintaining the ability to sample soft sediment as well as diamond coring. Seacore's costs fall in the middle of the range of estimates proposed by all the contractors and provide a good average as to what probably should be expected to conduct a study of this nature. Seacore brings to the table many of the desired qualities necessary in selecting a contractor for a multi-year program. The ability to develop in-house, drilling systems that meet the specific requirements of a client, a proven track record, and a low overhead are all items which place Seacore above the rest of the field. Several of the other reviewed contractors offer near similar experience levels or abilities but fall short of the combination that Seacore can provide. Seacore offers tried and proven techniques that center on simple mechanical and hydraulic concepts

If Geo Drilling's compensation systems and riser work as design, they may be a viable alternative to Seacore's proposed drilling set-up. Geo Drilling is the highest-ranking contractor using a mining-type rig. Geo Drilling is also less expensive than Seacore Ltd. and is not limited to the 1968 ft (600m) water depth that Seacore Ltd. has placed on their riser system. Geo Drilling offers a lightweight riser concept that should perform adequately in water depths exceeding other contractors and will require less time to install as well as replace should an incident occur with the DP system. A riser study (estimated $30,000) is highly recommended before the Geo Drilling rig (Marine Resolution) is selected.

Several of the contractors proposing the smaller mining-type rigs may be capable of working in the relatively calm, ice-free water in the Ross Sea and at bargain prices. However, if the SHALDRIL program is a long-term program and one to grow into deeper water, these concepts may not be suitable when combined with rougher sea states or the need to offer additional drilling options such as casing off a hole. Geo Drilling comes closest to having a set up which will be able to work under the cold weather environment that will be seen in Antarctica. Their set-up is

specifically designed for cold weather, diamond-coring operations. It may also offer the only real alternative to the larger, heavier drilling equipment being proposed by Seacore Ltd. Geo Drilling's equipment is already designed to work in water depths surpassing the Phase I requirements as well as all the other drilling contractors. This coring system most closely resembles that of the Cape Roberts Program.

Most of the drilling contractors will require a minimum of two to three months to prepare equipment prior to shipping. Approximately two months should also be allowed for shipping the gear to the mobilization port. Eight to twelve weeks should be allowed for contract negotiation, discussions with vessel owners, naval architect reviews, riser analysis (if required) and sorting out the details of how the actual program will be operated. Some of these activities can occur simultaneously while some may be totally independent. Table 50 in the Phase II report provides the reader with a crude time line as to possible lead times that may be necessary in order to take advantage of a drilling window beginning with a vessel mobilization in January, 2001.

The SHALDRIL committee also requested a more detailed review of the installation costs associated with installing a moon pool through the hull of the *Nathaniel B. Palmer.* These costs include the materials and preparation of the vessel and travel costs for sending a crew to Chile to perform the work. These costs, plus ABS & USCG charges, gas freeing, cleaning and certifying the modified fuel tank, and shipping the material to Chile produce a total cost ranging between $175,000 and $200,000. The first figure is for a moon pool up to 36 in. (0.9 m) in diameter and the second figure is for a moon pool up to 42 in. (1.07 m) in diameter. In order to allow as much flexibility as possible for the selected contractor, installation of a 42 in. (1.07 m) diameter moon pool is recommended. Several of the drilling contractors still prefer to cantilever their rigs over the side of the vessel.

Dynamic Positioning (DP) equipment ranged from $245,000 for the minimum upgrades using non-releasable beacons to $440,000 for hull-mounted equipment with releasable beacons. Based on these figures, a commitment of $420,000 to $640,000 (for DP and moon-pool installation) will be required before any consideration can be given to positioning a drilling rig on the deck of the *N.B. Palmer.* The moon pool installation costs do not come into play if the seafloor-operated corer is the selected method for SHALDRIL work or the rigs deployed in a cantilever mode. Although DP upgrades are not required for the PROD option, these modifications are recommended.

Costs for an 45 day leg range from $700,000 to $1,265,000. These estimates include mobilization/demobilization and field costs. They do not include vessel day rate, vessel modifications (e.g. DP, moon pool installation) or logging operations. Logging operations estimates averaged $80,000 for a standard suite of geophysical/geochemical logs.

The initial selection of the contractor is an important step in developing a drilling program for Antarctica. Experience gained by the drilling contractor can be used to develop specialized techniques and equipment needed for this particular environment. Therefore, the contractor selection should be based on experience, suitable and robust equipment, as well as reasonable cost. Technology advances will require equipment to be constantly updated, maintenance/upkeep

of the equipment may become an issue along with supplies, spare parts and different contractors preference for specific items. While purchasing may appear advantageous for such equipment, it opens many doors of responsibility and liability when an operator is not the owner of the equipment. Drilling equipment should be leased from a contractor in place of an outright purchase especially for the first year of operation. Possibly a lease, with an option to buy, might be a consideration once a drilling system has been designed/developed around specific operating conditions/environment. NSF will need to be committed to carrying out the staged development of coring and sampling programs for Antarctica for the overall program objectives to succeed. Selecting a single contractor who has the ability, interest, technology and versatility to move forward as the program grows will insure SHALDRIL/NSF the most economical means to reach the long-term goals of this program.