Mission-Specific Platforms

for the Integrated Ocean Drilling Program

BY DAN EVANS, GILBERT CAMOIN, DAVID MCINROY, AND ALISTER SKINNER

Since the inception of the Deep Sea Drilling Project (DSDP) and during the Ocean Drilling Program (ODP), scientific ocean drilling has been almost wholly confined to outer-shelf water depths or greater, and there was no capability to drill in ice-covered waters. Consequently, a wide range of targets and environments were inaccessible to scientists. As a clear scientific demand developed to obtain cores from more difficult environments, coring platforms other than those traditionally used by DSDP and ODP were required to achieve scientific goals.

Consequently, during planning for the Integrated Ocean Drilling Program (IODP), the inclusion of mission-specific platforms (MSPs) was an important new development. Within the IODP structure, MSPs were to be provided to the program by the European Consortium for Ocean Research Drilling (ECORD), a group of 16 European countries and Canada. To implement the drilling on their behalf, ECORD appointed an ECORD Science Operator (ESO) comprising a consortium of the British Geological Survey, the University of Bremen, and the European Petrophysics Consortium led by the University of Leicester.

As the name implies, MSPs are contracted individually for each expedition dependent on the requirements to achieve its scientific goals (e.g., see Moran et al., this issue). Although shallow-water drilling is new to the international academic community, drilling in this environment has long been carried out by industry and other scientific institutes, so that considerable expertise exists in this field. However, drilling in ice-covered waters had not been successfully accomplished, perhaps largely because there was no infrastructure or funding to mount a concerted effort.

To date, two MSP IODP expeditions have been implemented; these serve as examples of the types of coring that can be achieved, whilst further expeditions are planned for the future.

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Figure 1. The *Vidar Viking* drilling in the Arctic ice, with the Russian nuclear icebreaker *Sovetskiy Soyuz* in the distance. Photo taken from the *Oden*. Photo credit: D. McInroy © IODP.

Figure 2. The *DP Hunter* drilling off Tahiti, with the Seacore R100 rig installed. The same rig was used for the ACEX expedition to the Arctic, but without the addition of the piggy-back system. Photo credit: I. Pheasant © IODP.

ARCTIC CORING EXPEDITION

The first MSP expedition was IODP Expedition 302, known as the Arctic Coring Expedition (ACEX) (see Moran et al., this issue). ACEX posed a considerable logistical and technical challenge to ESO. Planning personnel determined that it was necessary to put together a fleet comprised of a powerful lead icebreaker, preferably nuclear powered (the Russian nuclear vessel, *Sovetskiy Soyuz*, was selected); a second vessel that could serve as another powerful icebreaker and as the main base for the scientific party (the Swedish diesel-electric icebreaker *Oden* was commissioned); and a third vessel capable of drilling in Arctic ice. Finding an appropriate third vessel was a particular challenge—there were no icebreakers equipped for drilling. The vessel chosen was the *Vidar Viking*, an anchor-handling vessel that also serves as a Baltic icebreaker in winter (Figure 1) (also see Figure 2 in Moran et al. [this issue]). However, to equip this vessel for drilling, it was necessary to install a 2-meter-diameter moonpool. The selected drilling contractor, Seacore, assembled a drilling rig and associated equipment onto the bare deck in just six days. At the end of the successful expedition, the vessel was returned to its former condition. To complete the fleet and help assemble the fleet and assist with other logistics such as helicopters and ice management, ESO enlisted the help of the Swedish Polar Research Secretariat (SPRS). ACEX took place as planned during the short Arctic time window of 2004.

TAHITI SEA LEVEL

Following the successful Arctic experience, the next MSP expedition (IODP Expedition 310) was to the tropics to drill coral reefs in shallow water around the island of Tahiti. The drilling vessel employed was the *DP Hunter* (Figure 2). The ship was normally used for diving support and thus had a large moonpool. Again, Seacore assembled their rig and equipment onto a bare deck. A piggy-back drilling system was installed for this expedition as this was considered the optimum set-up for obtaining good recovery of corals (Figure 3).

The expedition was carried out in autumn 2005. Excellent core recovery was achieved at a total of 37 holes in three transects on different sides of the island. In addition, spectacular borehole logs were obtained by the University of Montpellier utilizing slimhole equipment. A total of 632 meters of reef core was retrieved from between 40 and 120 meters water depth; these cores probably cover most of the last deglacial sea-level rise from about 20 to 6 ka before present, the scientific target for this expedition. The recovery of *in situ* pristine shallow-water corals and annually banded massive corals at all drilling depths suggests that the three major scientific objectives of the expedition should be achieved:

1. To establish the course of post-glacial sea-level rise.
2. To define sea-surface temperature and salinity variations during the last de-

Figure 3. The piggy-back drilling system employed on the *DP Hunter*. The API drillstring is run to the seabed so that the rooster box (a platform suspended above the deck) becomes heave compensated (i.e., it does not move up and down with ship motion). Using the mining rig that is located on the rooster box, a narrower drillpipe is then lowered inside the API pipe and is used to recover the core. As the mining rig is heave compensated, it can obtain high-quality cores even in significant swell conditions. Excellent downhole log data were also obtained by running the tools from the rooster box. Photo credit: A. Skinner © IODP.

glaciation when insolation, sea level, and atmospheric CO_2 levels were different from today.

3. To analyze the impact of sea-level and environmental changes on reef development during the last deglaciation.

FUTURE DRILLING

These first two MSP expeditions in IODP have clearly demonstrated the value of the addition of this new coring facility to the scientific community. Exciting new insights have been obtained into the Cenozoic history of the Arctic Ocean, and a high level of refinement to the global post-glacial sea-level curve and related environmental changes in the Tahiti region can be anticipated.

An expedition to study Neogene sea-level changes and their influence on the development of the shelf off New Jersey is planned for 2007. Other highly ranked proposals that may be implemented are further coral drilling in the Great Barrier Reef and a study of hydrogeology off New England. These expeditions will require a range of different platforms and drilling techniques. MSPs have the flexibility to use the most appropriate methods for each project.

With the combination of the Japanese riser drillship *Chikyu* (see Curewitz and Taira, this issue), the U.S.-funded scientific ocean drilling vessel, and MSPs, scientists now have the facility within IODP to drill targets in any water depth and in any marine environment, opening exciting new possibilities for understanding Earth systems.