

Workshop Report for *Scientific Drilling* (In Press)

3D Seismic Reflection Imaging Workshop 2005 – Opportunities for IODP Site Survey Collaboration

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The capability of the U.S. academic marine geoscience fleet will be significantly improved with the addition of the research vessel R/V *Marcus G. Langseth* in 2006. The *Langseth*, which until recently was collecting commercial quality 3D seismic data for WesternGeco (as the *Western Legend*) will provide seismic acquisition capabilities well beyond those currently available to US scientists by allowing the systematic collection of high-quality 3D seismic data in a wide variety of environments globally. To date a small number of 3D seismic data acquisition cruises have been run in the US academic community using single streamer vessels acquiring 3D grids by multiple closely spaced lines. 3D data acquisition by this method is very inefficient and limitations such as minimal streamer navigation cause data quality to be less than desirable. The *Langseth* will make it possible for the academic community to acquire 3D seismic data in a time efficient manner and comparable in quality to industry exploration.

In the commercial sector the introduction of 3D seismic acquisition is credited with being one of the advances in technology that produced the three most significant increments in oil field discovery rate in the last fifty years. Best practices for 3D seismic data acquisition are now well understood and available in extensive literature, and processing software for 3D data is now readily available, very stable and there is a large body of experience in the exploration industry on the processing and analysis of 3D data sets. With the acquisition of the *Langseth* the academic sector is poised to take advantage of these developments and gain a similar major advance in scientific discoveries. At the same time, because of the very limited experience in our community with the 3D approach many scientists are not fully apprised of the range of new problems that become accessible to study with the 3D approach.

Against this background, a group of 91 scientists from around the world gathered at Lamont-Doherty Earth Observatory on September 8-10 to discuss 3D Seismic Reflection Imaging. The workshop, funded by the U.S. National Science Foundation, emphasized the great breadth of the new and emerging areas of scientific inquiry that can be tackled uniquely using 3D imaging, including high-resolution approaches, and discussed possible 4D applications as well. The questions explored included those fundamental to mid-ocean ridge studies, continental margins, and Integrated Ocean Drilling Program (IODP) objectives.

A series of presentations by academic and petroleum industry speakers focused on how successes in the petroleum industry might be used as models for academic research. Numerous examples of 3D images were presented to show the level of detail that can be achieved for defining the morphology and evolution of slope, channel, and deep-water sedimentary environments as well as structurally complex regions. State-of-the-art seismic interpretation software was used to demonstrate how quickly and accurately horizons and faults can be interpreted from 3D seismic cubes. Other industry speakers illustrated the recent advances in 4D surveys and improvements in marine acquisition that allow better deghosting of source signatures.

Several academic speakers discussed lessons learned from academic 3D seismic programs in accretionary prisms and spreading centers, and introduced the use of seismic reflection data in the relatively new field of seismic oceanography. Because academic surveys have recently encountered challenges in obtaining clearances and permits, a summary was presented to make everyone aware of the permitting requirements, lead times required to obtain permits, etc. An associated presentation focused on new results relating to seismic sources and their effects on marine mammals. In addition, recommendations and requirements for 3D site surveys for the new IODP were discussed.

Major goals of this workshop were to inform academic marine scientists of the capabilities of the R/V *Langseth* and to educate them on how to design 3D surveys on the *Langseth*. Presentations by LDEO marine office personnel and a half-day seismic acquisition “clinic” achieved these goals by presenting details of the *Langseth*’s acquisition capabilities and how they can be used to acquire fully-imaged 3D data volumes.

A concluding half-day panel discussion focused on new opportunities for 3D seismic acquisition and ways to make the broader academic community aware of our new capability to acquire 3D seismic data. Many workshop attendees felt that a new “paradigm” for 3D acquisition/interpretation is necessary to ensure the long-term health and growth of the field.

The workshop agenda, including a list of participants, can be accessed at: <http://www.ldeo.columbia.edu/events/workshops/3Dseismic/index.html>

As a follow-up to discussions at the workshop, we would like to point out the opportunities for diversifying funding sources and expanding the community through international cooperation. Specifically, the IODP has already seen an increased need for 3D seismic surveys in support of riser drilling on the new Japanese drilling vessel *Chikyu*. A large commercial 3D seismic program has been jointly funded between the U.S. NSF and the Japanese ship operator, Center for Deep Earth Exploration (CDEX). Only a single riser drilling proposal for *Chikyu* has been recommended for scheduling to date, but many more are either being considered now or will be considered in the future. Each riser hole will require 3D data and CDEX hopes to continue jointly funding these 3D programs. This should be seen as an excellent opportunity for joint collaboration with Japanese scientists.