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Deep-Sea Research at Ifremer — Technology for Scientists and Science for Engineers

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ABSTRACT

This presentation focuses, on one hand, on some tools and techniques that are being developed for the scientific investigation of the deep layers of the oceans, of the floor surface and of the subfloor soil, and, on the other hand, on the basic research in robotics, materials and mechanics necessary to the design of these tools. Within the first category, several ongoing projects are reviewed. The PASISAR project aims at deployment of Very High Resolution seismic from a deep-tow system and deals with the associated equipment and processing techniques. Benthic laboratories are considered from the point of view of their deployment, supply, operation and recovery, and four possible concepts are investigated within the framework of a European project. An integrated survey system, aiming at depths up to 6000 m, is prototyped for the simultaneous recording of bathymetry, floor images, soil samples and characteristics, and seismic measurements within the French joint research industry project IMBAT. Numerous studies are also conducted to support the use of acoustics as an investigation means, on the well-known aspect of bathymetry, but also for the thermometry of the ocean climate. A number of specific tools and sensors, meant to operate in deep sea, may also be mentioned: flexible core sampler, dissolved oxygen sensor, temperature and pressure station for the ODP wells, not forgetting the specific 50-ton claws which enabled the recovery of 17 tons of silver coins from the sunken Liberty Ship *John Barry* in 2300-m water depth in the Oman Sea at the end of 1994. Much equipment requires advances in basic research before it can be built. For instance, Ifremer intends to build a ROV for 6000-m water depth. This stirs applied research and prototyping activities in the fields of teleoperation and robotics using the VORTEX experimental robot to test mechanical parts and software. Analysis of prerequisite technologies for AUVs has led to European projects, focused on the three basic technologies of use of carbon-fiber for pressure-resistant vessels, underwater autonomous positioning systems, and command-control problems for maneuvering in regions where the ocean floor is severely uneven. Data transmission, either by cable or by acoustical means, also requires specific studies, in fatigue mechanics and in acoustics and signal processing and compression.

TOOLS AND TECHNIQUES FOR SCIENTIFIC INVESTIGATION

At present, scientists provide most of the demand for deep-sea investigation, although some needs also appeared during the last decade, such as the preparation for oil and gas exploration, or surveys prior to cable or pipe layout.

Deep-Tow VHR Seismic

Detailed sea-bed geology (stratigraphy, faulting, lateral facies variation) of the deep-water seabed is being explored, both for scientific purposes, such as a better insight into marine sedimentary processes and tectonics, and for the preparation of offshore industry developments. In order to obtain the required data, we are faced with new technological challenges.

This sort of investigation is typically performed using Very High Resolution (VHR) seismic techniques, with the frequency of the source signal above 500~Hz and penetration deeper than 300~m. However, conventional seismic technology, with source and streamer near the surface, is not suitable because the geometry of the source-reflectors-receiver system does not allow for the requested resolution level. (See Fig. 1.)
The problems to be overcome are:

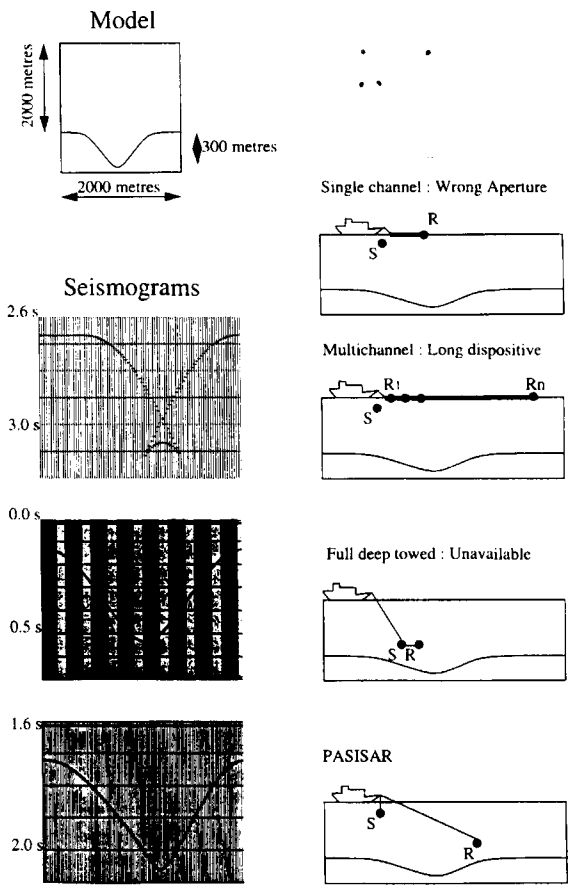

Fig. 1 Comparison of seismic systems

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