Seafloor geodetic observation based on technologies of AUV and submarine cable transponder

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Institute of Industrial Science, University of Tokyo has launched a project supported by the Japan Society for the Science Promotion as the Grants in Aid for Scientific Research. In this project, we are aiming at developing new-generation seafloor geodetic observation system that conquers difficulties inherent with the current system. Central idea of this project is to utilize techniques of underwater robot (Autonomous Underwater Vehicle, AUV) and submarine cable to make measurements in place of using the research vessels.

In the first three years of the project, we had dedicated ourselves mainly to the development of the on-board system which should be installed on an AUV. The development and deployment of a submarine cable transponder are the most important aims in the last half of the project. The development of the submarine cable transponder has been carried out with great efforts of JAMSTEC. New seafloor transponder is one which can be connected to a submarine cable by wet-mate connectors. Power is supplied through submarine cable and then the new seafloor transponder will be a permanent reference station for seafloor geodetic survey. Submarine cable can supply accurate GPS time (1pps) and clock to the transponder as well as power. The new cable transponder can realize acoustic ranging between sea surface and bottom with much higher accuracy than the current system.

Submarine cable observatory off Toyohashi (Tokai-SCANNER) in central Japan is located on the source region of the huge repeated earthquakes. It has been developed by JAMSTEC and used for long-term geophysical monitoring. This is the submarine cable system to which we planned to connect the transponder. Installation of the transponder on the observatory was done with the operations of JAMSTEC's ROV KAIKO and R/V KAIREI in September 20, 2008.

Ranging measurements were carried out in order to understand whether the installed transponder system works well or not. The AUV r2D4 was used as a sea surface platform. The survey line was designed as a square having 1 nm long side and its center was at the position of the submarine cable transponder. The r2D4 had revolved along the line at the depth of 0.7-1.0m. Acoustic ranging to the seafloor transponder was repeated at the interval of 20 sec during the r2D4 cruised. We obtained healthy waveforms of the ranging signals. It was confirmed that the submarine cable transponder works well.

Analysis for the data acquired at the experiment using the new system is being carried out. We will report the overview and the current performance of new seafloor geodetic observation system based on the data analysis in this talk.