Expanded interferometry sonar with synthetic aperture for seafloor bathymetry mapping

Akira Asada[1]; Tamaki Ura[2]

[1] IIS; [2] I.I.S., Univ. of Tokyo

http://unac.iis.u-tokyo.ac.jp/

A new designed Autonomous Underwater Vehicle r2D4 for operation to 4,000 meters was built for the purpose of seafloor mapping on the oceanic ridge having hydrothermal activity in July 2003. An expanded interferometry sonar with operating frequencies of 100 kHz was installed on the AUV for highly resolve bathymetry mapping, not to mention backscatter imaging. In effect, the interferometry sonar is simply composed of three hydrophones, which are arranged at intervals of three-fold and thirteen-fold wavelengths in the L-shape at each side, in addition to a side scanning sonar Klein System 2000 with operating frequencies of 100 kHz and 500 kHz. It explains features of low cost and low power consumption. An initial survey test of the AUV was carried out up to 500 meters deep off Ryotsu port of Sado Island in July 2003. In advance of the sea test of the AUV, a test of the interferometry sonar with the barge had been carried out. L-shape array of hydrophones enables us to make a phase difference measurement with high resolution and successfully. It follows that detailed swath bathymetry was brought about. Consequently, a seafloor mapping was carried out to reveal the detail topography on the top of Kuroshima knoll in the vicinity of Okinawa islands in December 2003. The AUV is installed with the PHotonic Inertial Navigation System (PHINS) , which provides inertial navigation and motion measurements of the AUV. Furthermore, since the AUV is able to move underwater very stably along planed courses, it is a proper platform in materializing the synthetic aperture of the side scanning transducers. We have been devoting ourselves to processing the observation data. As a result, the synthetic aperture technique was very useful for improvement of the seafloor bathymetry mapping as expected.