Development of unmanned seafloor geodetic observation system based on technologies of underwater robotics and seafloor platform

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【Outline of survey】

It is essential to measure crustal deformation around the seafloor focal region in order to understand the mechanism of the big interplate earthquake. Several observational methods to detect directly the subsea crustal deformation have been proposed and developed. Institute of Industrial Science, University of Tokyo, has been developing a method for precise geodetic measurement on the seafloor in corporation with Hydrographic and Oceanographic Department, Japan Coast Guard. The seafloor geodetic observation network along the Japan island arc has been established based on the method. We have visited the areas where the seafloor reference points were installed repeatedly by research vessels in order to make measurements. Annual cruise schedule of research vessel makes it difficult to change the daily schedule of the research vessel to meet our demands such as to avoid bad sea conditions while conducting observations and to have suitable GPS satellite conditions. This research project is 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 and seafloor platform to make measurements in place of using the research vessels. Combination of underwater robot and seafloor platform make it possible to conduct the observation with selecting favorable condition of sea and GPS satellite distributions, to make much more frequent observations and to enable flexible planning of observation in response to sudden geodetic events. New observation system under development will provide us much clearer image of mechanism of big interplate earthquake in ocean trench region than the ones provided by the current seafloor geodetic observation system.

【Expected results】

Utilization of underwater robot in seafloor geodetic observation will provide us opportunities of observation under favorable conditions and then we can have observational data of higher quality. Utilization of seafloor platform in the observation will provide opportunities of observation in any point in the ocean. The new system that employs the combination of the underwater robotics and the seafloor platform techniques will give us not only clear images of mechanism of the big interplate earthquakes but also the images of the dynamics of the earth, that have been prevented from looking inside by the existence of the ocean. We are expecting further development by linking the newly developing system with the optical fiber cables deployed on the seafloor and the satellite communication buoy system. It will be possible to expand the area where the geodetic observations cover if the linking is realized, and this will contribute for new understandings of the dynamics of the whole Earth. Also, near real time acquisition of data will be possible and the system would also be suitable for monitoring earthquakes and tsunamis in order to mitigate disasters.

【References by the principal researcher】

・A. Asada, and T. Yabuki, "Centimeter-level positioning on the seafloor," *Proc. of the Japan Academy*, 77, Ser.B, 7-12, 2001.
・A. Asada, and T.Yabuki, "Progress in the Long-term seafloor geodesy on the Kumano trough," *J. Geography*, 110, 529-543, 2001b (*in Japanese*).

【Term of project】 FY 2005 - 2009	【Budget allocation】 84,100,000 yen

【Homepage address】 http://unac.iis.u-tokyo.ac.jp/