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Japan Agency for Marine-Earth Science and Technology

Test Run of New Crawler Vehicle Demonstrated Excellent Capabilities on Complex Ocean Terrain ~ Results by Next-generation Deep-Sea Exploration Technology ~

Introduction

A remotely operated vehicle (ROV) equipped with a new crawler system -- developed by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC)-- has successfully completed a test run on the soft sand of the ocean bottom and rocky reefs, demonstrating its promising capabilities in ocean floor surveys and sampling. These types of are usually difficult to navigate with the ROV. The new crawler system is being developed as part of the "Next-generation Deep-sea Exploration Technology," which is pursued as one of the key technologies of national importance.

Researchers will further develop this technology for practical use and make contributions towards the advancements of marine science and technology in the nation.

Background

Remotely operated vehicles are expected to serve as a powerful tool in deploying ocean bottom observatories and collecting sediment samples, which provide indispensable information in understanding global environmental change and the Earth's crustal movements. The use of ROVs on surfaces of complex ocean topography, however, requires a new propulsion system that allows for quick and flexible mobility. Crawler treads have long been considered promising mobile tools for travel on the ocean floor, but conventional crawler vehicles could not efficiently cope with soft sediments, sloping surfaces, or hilly undulations.

Development of propulsion system

The new system was developed by mounting new equipment (360-degree rotatable flippers, and extendable/retractable crawler units ([*1](#))) onto an existing crawler unit. To cope with the influence of buoyancy and the force of water resistance while operation, vertical thrusters were equipped to vertically increase the vehicle's weight-in-water and to change the center of gravity, thus providing more stable runs.

Results

The experiment of the new crawler system was conducted from November 24th to the 28th, 2010, in waters off the coasts of Kohama-jima island and Kuroshima island in Okinawa. This followed a preliminary set of function tests from September to October the same year, off the coast of Goza, Mie Prefecture. The thruster assisted, flipper-type crawler vehicle was operated on

a seabed with irregular surfaces, which encompasses the soft sandy bottom, and hilly or steeply sloping (more than 30 degrees) rocky bottoms. The results showed runs with greater stability and improved maneuverability of the vehicle even on the rough surfaces.

Future studies and perspectives

Researchers are applying the new crawler system to a larger platform and verify its mobile performance and capabilities towards practical use in ROVs.

The study confirmed the advantages of the thruster-assisted technique, which generates downward force to increase the vehicle's weight in water and change the center of gravity, thus keeping a horizontally even posture in water. The technique can be used to stabilize the seafloor reaction force from the ground while sampling, and will allow for vertical sampling of sediments at any given point on the complex topography, which had not been possible with conventional ROVs and deep-sea boring machines.

JAMSTEC will further promote technology development for ROVs thus allowing them to survey and collect samples from any desired area. This will contribute to, not only advances in marine science and technology, but also to the nation's marine and energy resources development.

***1. Extendable and retractable crawler**

Four 360-degree rotatable, flipper-type crawlers are fitted inside the normal-type crawlers. The front and rear crawlers can extend and retract so that the vehicle is able to travel on surfaces with complex topography with more ease.

Appendix

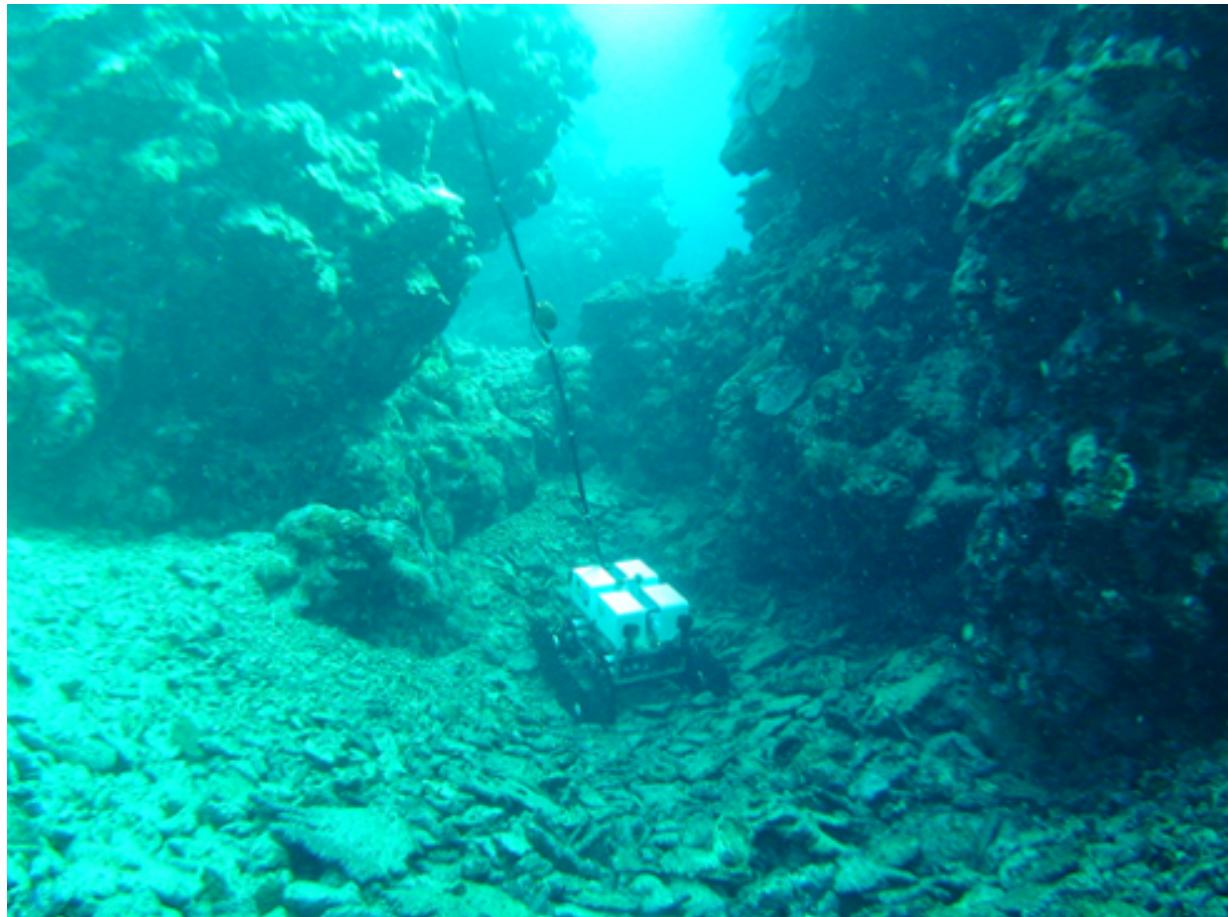


Photo 1

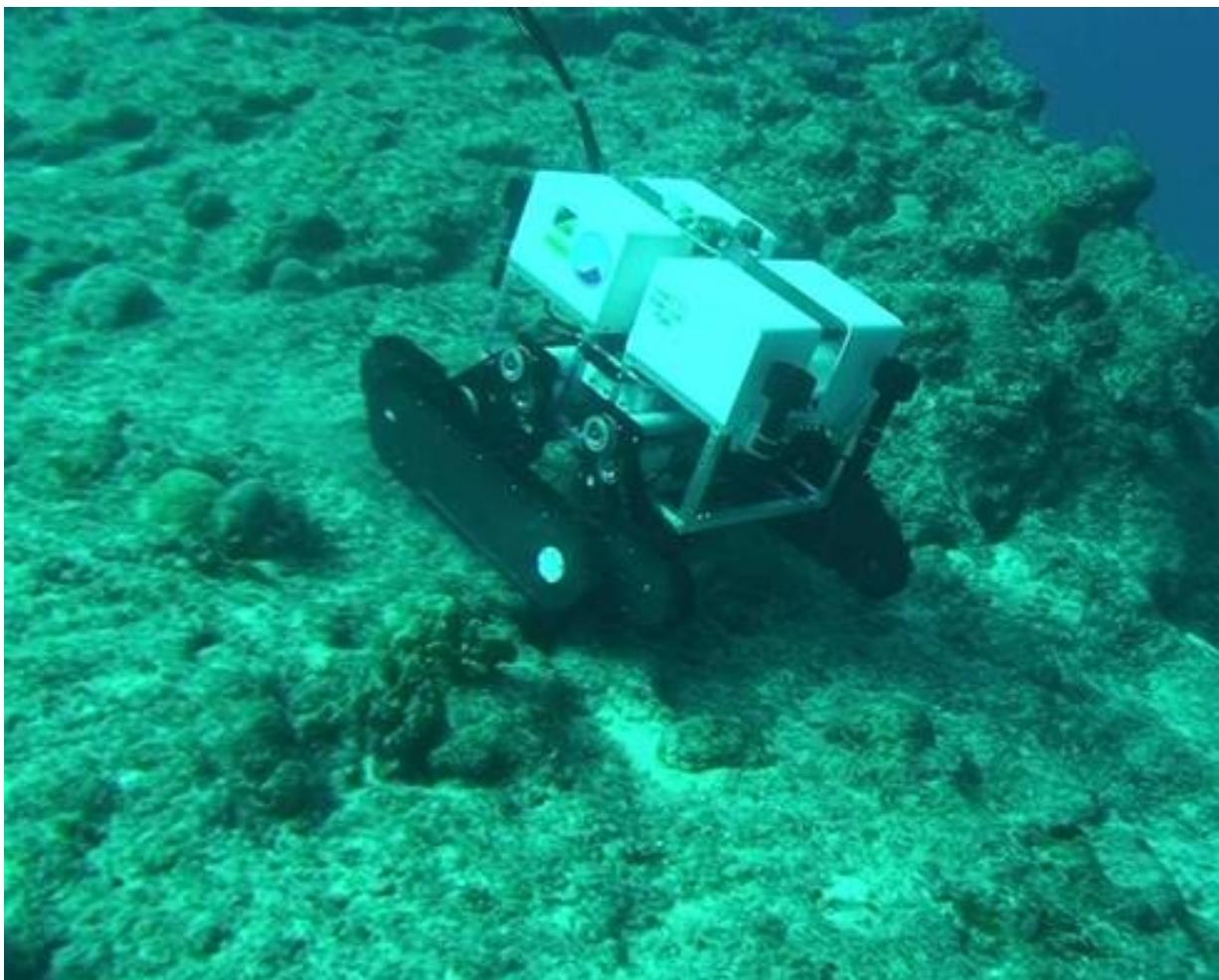


Photo 1 and 2: ROV with the new crawler system on the rugged ocean floor

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