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Autonomous Underwater Vehicle for Practical Use in Ocean Observations

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ABSTRACT

In recent years it has become evident that ocean data in time and space is required to make predictions of environmental changes on earth. As one method of acquiring data, we propose a virtual mooring system using an underwater vehicle, and have developed a full-scale test-bed vehicle called "BOOMERANG" which can glide back and forth between the sea surface and the seabed collecting ocean data. Since the results of field experiment in March 2010 were satisfactory, construction on a prototype vehicle for practical use was begun in April 2010. In order to improve reliability and to enable prolonged use, the performance of various pieces of loading apparatus of the vehicle was improved.

This paper presents results of the field experiment and details of the construction of the prototype vehicle for practical use.

KEY WORDS: Virtual mooring; underwater glider; field experiment; practical use.

INTRODUCTION

In recent years predictions of changes in the environment on earth and studies on ecodevelopment have become increasingly important. Such predictions necessitate ongoing ocean data in time and space. However, construction of a conventional mooring system requires manpower and great expense. Profiling floats such as Argo floats (Roemmich et. al., 2009) cannot stay at a specific point where a continuous and long-term observation is needed because they float in the current. To solve this problem, a test-bed underwater glider for virtual mooring was constructed at the Research Institute for Applied Mechanics, Kyushu University (Nakamura et. al., 2009).

The concept of virtual mooring using an underwater glider is shown in Fig.1. The vehicle that houses various pieces of observation equipment glides back and forth between the sea surface and the seabed collecting ocean data. When the vehicle returns to the sea surface, the measured data is transmitted to a research base by a mobile phone. The vehicle then automatically checks its current position by GPS. If the position is outside the sea area of virtual mooring because of currents etc., the vehicle is controlled so that it returns to the previous area during its next dive. Diving and surfacing are repeated periodically. On the seabed, the vehicle rests for a predetermined period and power other than control equipment is shut off in order to reduce battery consumption.

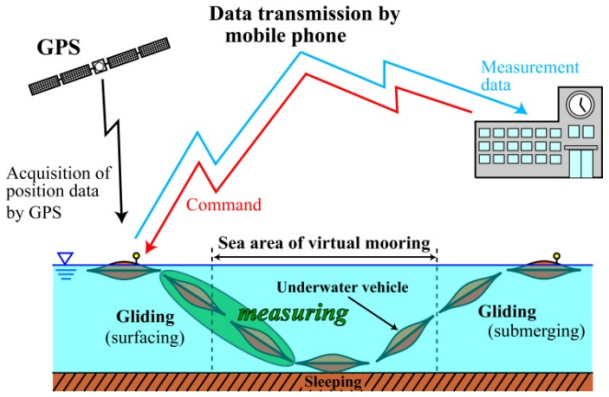

Fig.1 Concept of virtual mooring

There are already some practical use underwater gliders in the world (Eriksen et. al., 2001, Webb et. al., 2001 and Sherman et. al., 2001). However, they are cruising type gliders and their form is that of a conventional airplane. The disk type underwater glider that we are constructing has an appropriate form for virtual mooring, and can glide in any direction without turning.

Since the results of the field experiment in March 2010 were satisfactory, a prototype for practical use was constructed beginning in April 2010. In order to improve reliability and to enable prolonged use, the performance of various pieces of loading equipment of the vehicle was improved. This paper describes results of the field experiment on the test-bed vehicle and construction of the prototype vehicle for practical use.