

Disk Type Underwater Glider for Virtual Mooring and Field Experiment

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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 a method of acquiring data, we propose a virtual mooring system using an underwater vehicle, and have developed a vehicle which will glide back and forth between the sea surface and the seabed collecting ocean data.

This paper presents the developed vehicle and its field experiment.

KEY WORDS: Virtual mooring; underwater vehicle; gliding; control; field experiment

INTRODUCTION

In recent years, predictions of changes in the environment on earth and studies on ecodesign have both become important. Such research requires ongoing ocean data in time and space, and this has been obtained using mooring systems. However, a conventional mooring system can observe only discrete data in perpendicular space, and moreover, construction of such a system requires manpower and great expense. To solve this problem, an underwater vehicle for virtual mooring is being constructed at the Research Institute for Applied Mechanics, Kyushu University.

The concept of virtual mooring using an underwater vehicle 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 communications satellite. 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 the previous area during its next dive. The control method is described in detail in the paragraph shown later. 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 cut down on battery consumption. Horizontal movement of the vehicle is done with gliding and without thrusters (Murakami et al., 1973, Eriksen et al., 2001, Sherman et al., 2001, Webb et al., 2001 and Woolsey et al., 2002). The gliding ratio and the course of the vehicle

are controlled by moving the position of the built-in weight (see Fig.3). Depth is controlled by buoyancy adjustment equipment (see same figure) (Nakamura et al., 2007). The body form is a disk type, which is characterized by omni-directional maneuverability. The vehicle can directly glide in any directions by piloting the built-in moving weight, making a turnaround like that of a conventional airplane unnecessary.

In ISOPE-2007 (Lisbon), we presented motion simulations of the vehicle for virtual mooring and the outline of the testbed (model) vehicle "LUNA" (Fig.4) for study on control (Nakamura et al., 2007). In this paper, we report the full-scale vehicle which has been developed "BOOMERANG", and the field experimental results.

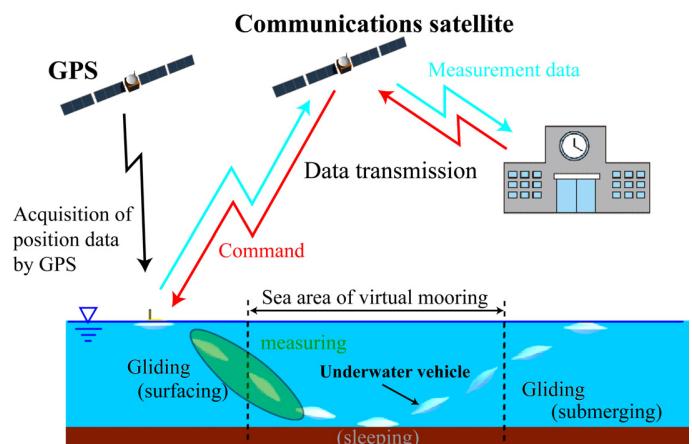


Fig. 1 Concept of virtual mooring

OUTLINE OF DISK TYPE UNDERWATER GLIDER "BOOMERANG"

The principal dimensions of "BOOMERANG" are shown in Fig.2, and a drawing of the general view and a photograph of the loading