A LIGHT-WEIGHT, TOWED, OSCILLATING BODY FOR OCEANOGRAPHIC MEASUREMENTS

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Some disadvantages of existing oscillating measurement fishes are overcome by using a double-cable system to reduce weight, increase portability, and create a stable measurement trajectory.

Les inconvénients des poissons oscillants sont réduits par l'utilisation d'un système à deux cables qui diminue le poid, facilite la mise en oeuvre, et stabilise la trajectoire.

Since 1974, SACLANTCEN has developed oscillating fish for continuous space/time measurements of ocean variables *[1]* and has used one in conjunction with satellite sensors for a synoptic ocean survey *[2]*. The principal design requirement was a cheaper, more portable system than commercially available. This was achieved by using a separate cable for the oscillating movement — thereby lightening the moving load — and by reducing towing speeds.

The system (Fig. 1) consists essentially of a sensor-carrying fish that is automatically oscillated up and down a weighted main cable streamed behind the ship. Vertical oscillations are obtained by paying in and out a light-weight electro-mechanical cable from an electronically-controlled winch on the ship's stern. The winch responds to feedback from a pressure sensor on the fish and can oscillate the fish between any depths above 300 m. Setting the oscillating speed to correspond to the towing speed (1 to 1.5 m/s) creates a 45° zigzag trajectory in the vertical plane; separate controls allow the raising and lowering speeds to be matched precisely. The electro-mechanical response is then set to create smooth or sharp peaks in the zigzag trajectory.

The fish (Fig. 2) is finned and pivoted so that it responds to the changing movements and thereby keeps the sensors, which are as far forward as possible, out of any turbulent motion. The sensors measure the water's temperature, conductivity, and speed

as functions of pressure (depth). Data are frequency-multiplexed along the secondary cable to the ship, where they are digitized and contour-displayed in real time on the ship's computer. They are also stored digitally on magnetic tape. Filtering takes account of the ship's pitching and of the mismatching in space and time of the conductivity and temperature contours caused by different time responses.

A prototype was successfully used in the Gulf of Lions during the AIM and COBLAMED experiments (Oct 75 - Sep 76). The present model was used in June 1977 in the Gulf of Cadiz to observe ocean variabilities in conjunction with satellite observations *[2]*. An example (Fig. 3) from the latter survey shows potential temperature contours recorded between 120 m and 170 m.

1. DE STROBEL, F., and HUBBARD, R. SACLANTCEN CP-19, 1976: 8.
2. CAIRNS, J., and TOMA, L. SACLANTCEN SM-120, 1978.