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TOWED ECHOSOUNDERS FOR PARALLEL SOUNDING

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In the *International Hydrographic Review*, Vol. XLIV (2), July 1967, there appeared an article by Commander I. ENGELMANN, Royal Danish Hydrographic Office, describing the progress that Office had made with towed echosounders, and giving particulars of the relatively small equipment designed for motor launches.

During the past few years the technology of towed echosounders has been improved. The small equipment has been abandoned, and larger equipment has been developed for use by coastal minesweepers.

The trials with the new equipment started in 1971, and after several years of problems concerning the stabilization of floats and the strength of towing cables, the system was finally deemed operational in 1975.

The towed equipment now consists of four floats fitted with transducers, the set of four plus the ship's unit comprising a sounding array. Its use allows five parallel sounding lines, spaced (in the Danish case) at 50-metre intervals, to be run simultaneously. The ship can tow the floats at a speed of up to 8 knots, and the array is especially suitable for long sounding lines.

As must be expected, certain operational restrictions or delays are involved in the use of the system. For example, as the array requires a tow depth of 6 metres it is only utilized outside the ten-metre depth contour. Further, the accuracy required for the shallow depths found in Danish waters has limited the use of this array to Seastate 3 or below, but in deeper waters it should be possible to employ it in as much as Seastate 5. Finally, a 180° turn will take approximately 15 minutes, and streaming or recovery of the gear requires approximately 20 minutes. However, the efficiency reflected in obtaining five sounding lines rather than just the one which results from the use of only the transducer mounted in the hull of the ship more than compensates for any of these operational constraints in use of the array.

DESCRIPTION OF THE EQUIPMENT

Floats

The floats are the standard No. 4 floats (length 3.70 m, diameter 0.70 m) used in minesweeping (fig. 1). They are of fibre glass, and have been modified to include a watertight socket on the top surface with a 30 kHz transducer fixed by a short strut to the underside of the float. The idea adopted at the first trials of having the transducer actually built-in to the bottom of the float was dropped, because excessive water turbulence attenuated the signal.

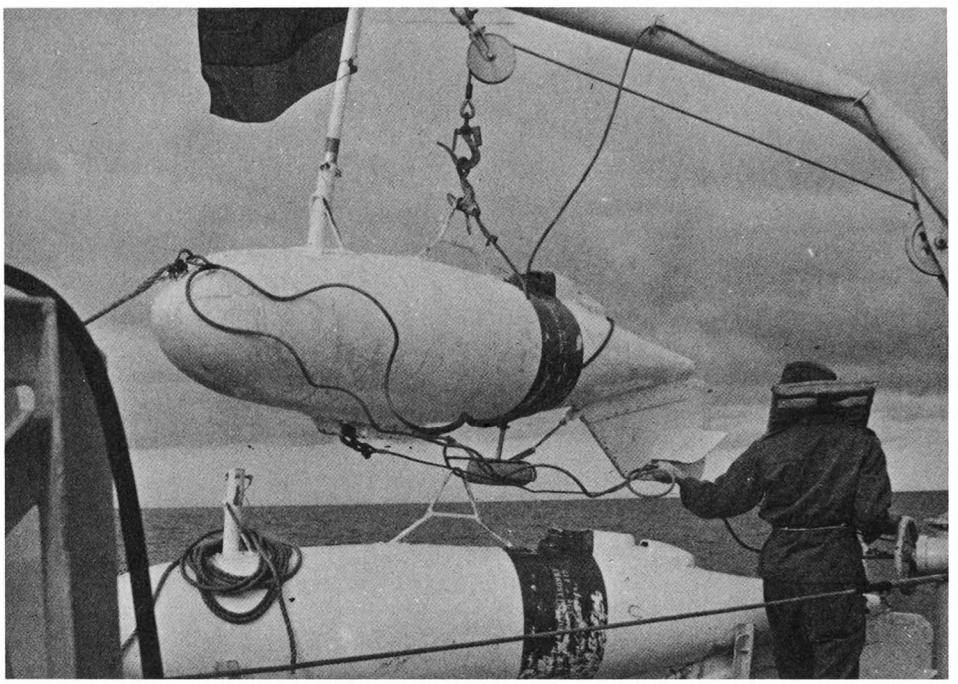

FIG. 1. — Outer starboard float prepared for launching.

Otters

Two No. 4 otters (1.10 × 1.20 m) beneath the outermost floats keep them, and thus the array, in position. The other two floats are stabilized by a GBT depressor which is a small depressor used in minesweeping with hammerboxes.

To lower the tow cables into the water near the ship, and also to stabilize the streamed equipment, another No. 4 otter — independently towed on 20 metres of wire and attached by chain to a fisherman's block on each of the cable pairs — is used as a depressor. Figures 2 and 3

illustrate the floats in towing position, and figure 4 pictures the near-ship stabilizing otter rigging.

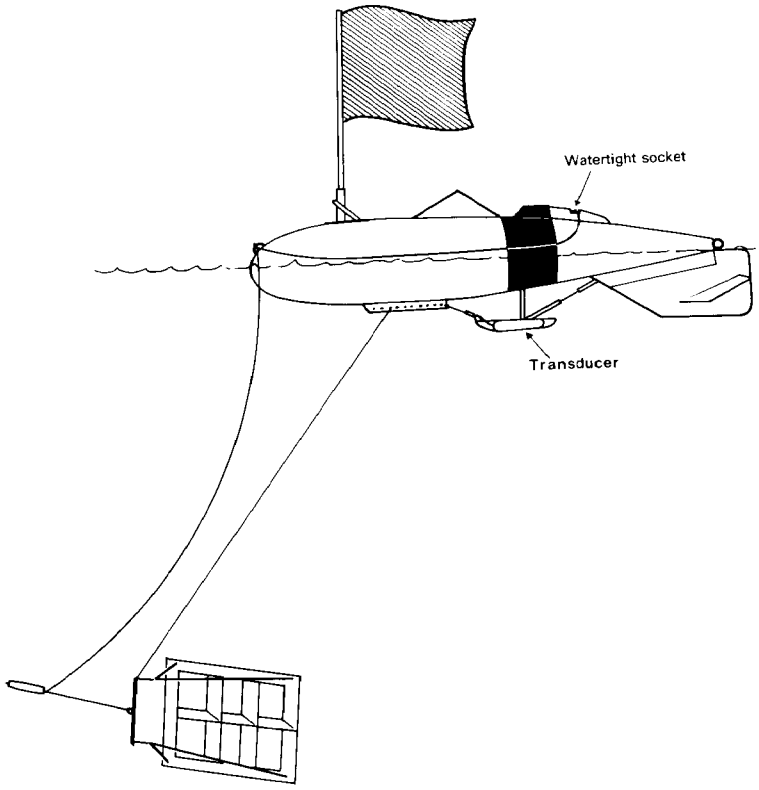

FIG. 2. — An outer float.

Tow cable

There is a separate tow wire for each float, but the two wires to each side are seized together and form a single catenary.

The tow cable is a 12 mm steel wire enclosing a 4-core conducting cable. The starboard tow wires are laid right hand, the port ones left hand, and with the ship underway hydrodynamic power helps to hold the wires up in the water.

The longest tow cables are 250 m in length, and the shortest 180 m. Float placement depends on tow cable length and ship's speed. With the lengths and the float positions as shown in figure 5 the distance between sounding lines will be 50 metres, representing the placement during the 8-knot towing operation standard for the Danish survey. Sextant angles can be used to ensure that the floats are in proper position. If another sounding speed or different sounding line spacing is required, the cable length must be changed. Little research on that subject has been done during the development of the towed system, and no graphs of cable length versus speed have been devised. However, some help can be obtained from a mine-sweeping manual.

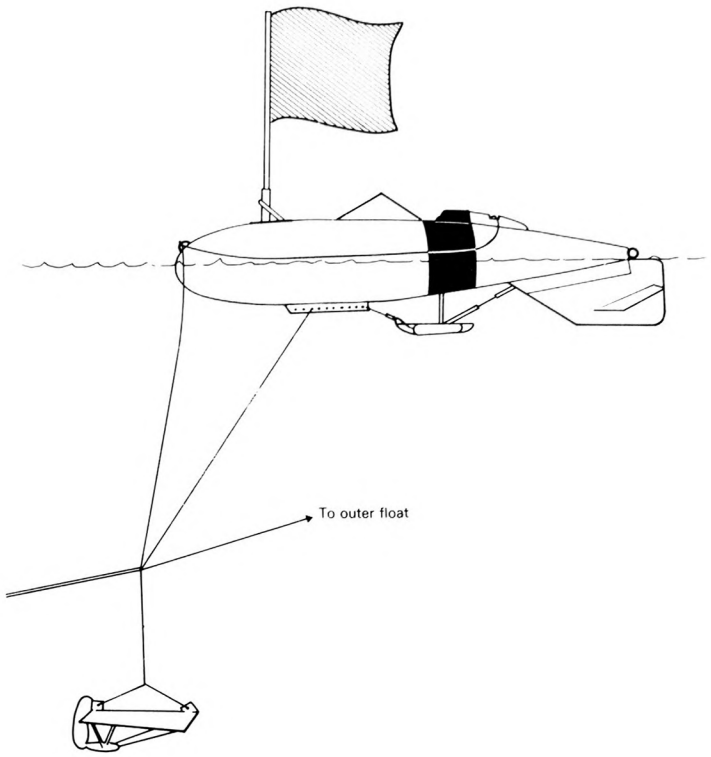

FIG. 3. — An inner float.

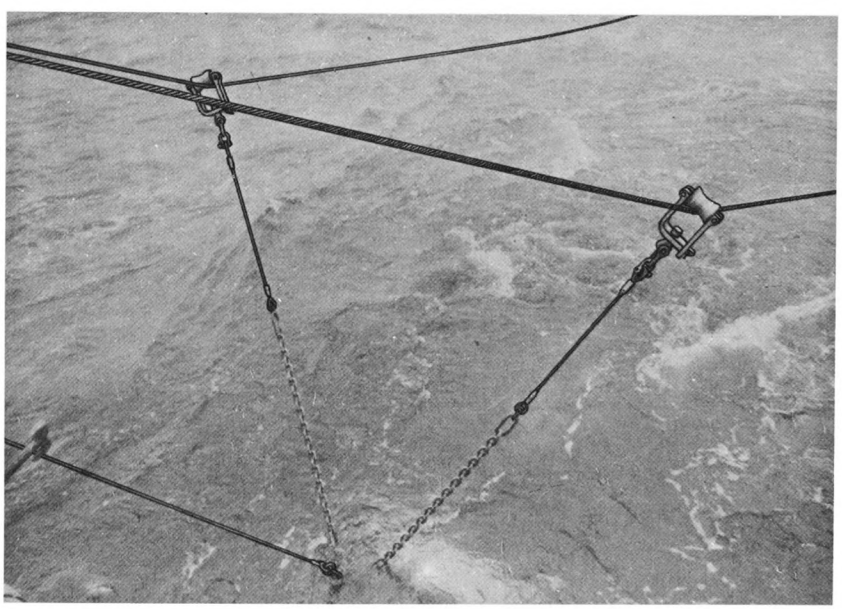

FIG. 4. — The near ship depressor being lowered in the water.

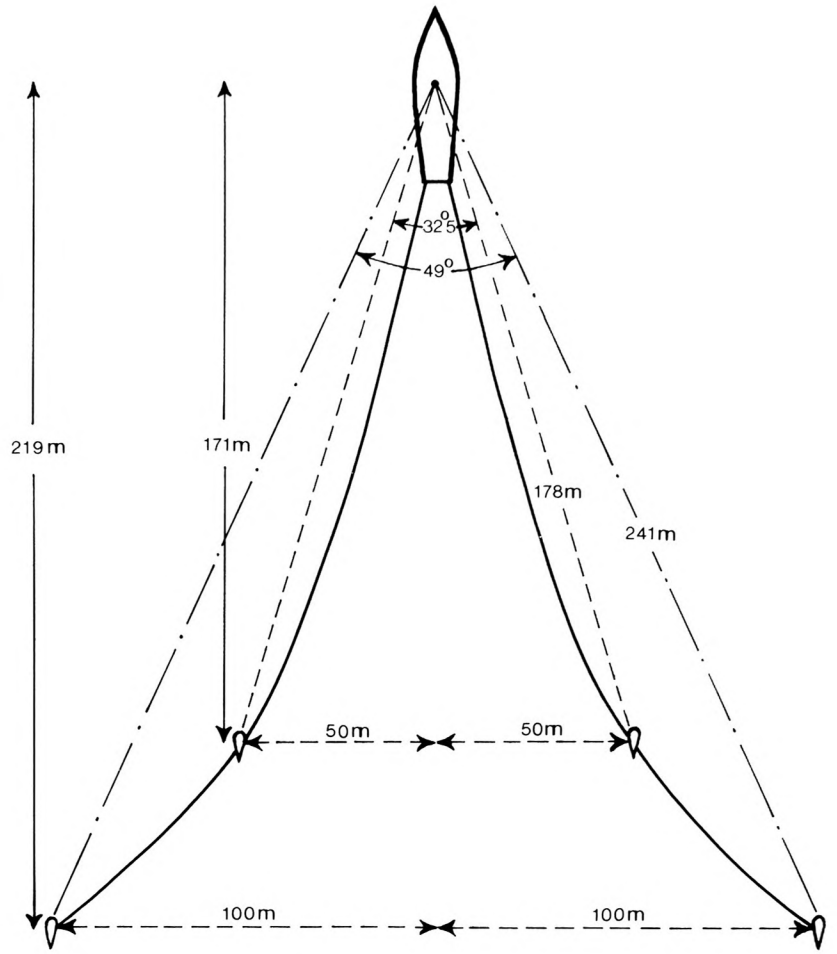

FIG. 5. — The layout of the towed echosounders.

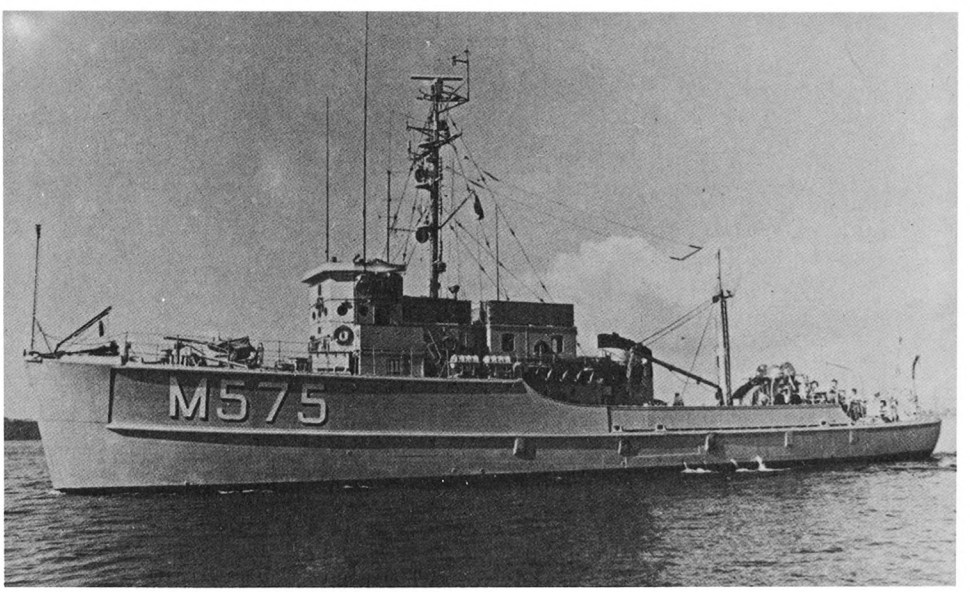

FIG. 6. — HDMS *Guldborgsund*.

Onboard equipment

The ship, H.D.M.S. *Guldborgsund* (figure 6), carries five Navitronic echosounders, i.e. one for each float, and one for the ship. A module can easily be changed in the ship's echosounder so that the frequency can be switched from 30 to 210 kHz since the ship carries transducers on both these frequencies. No interference occurs between the array's transducers.

Various positioning systems (e.g. Toran, Sea-Fix, Mini-Ranger, Decca, etc.) may be used aboard ship and, utilizing an HP 9825 A computer, a

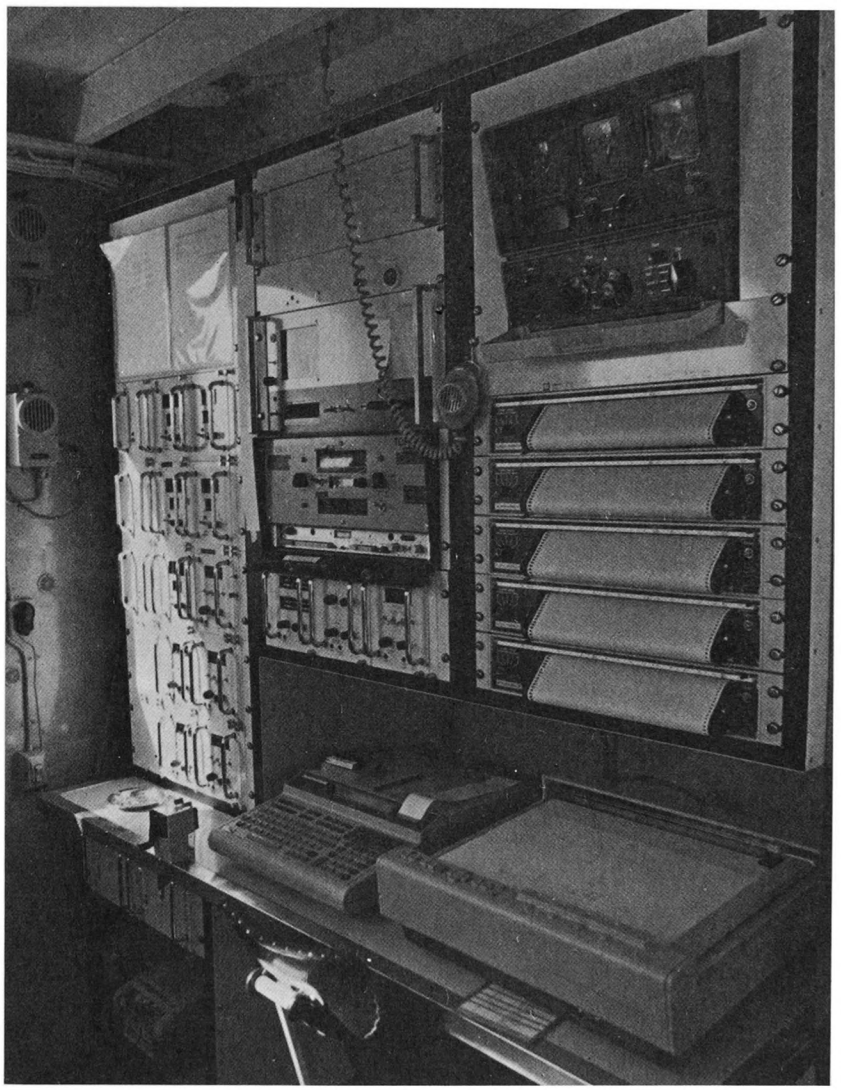

FIG. 7. — *Guldborgsund*'s rack contains :
Toran receiver (centre). Hydrographic Datahandler (above Toran receiver). Five echosounders (on left). Five depth recorders (on right). Calculator HP 9825A (on desk). Plotter 9872A (on desk). Tape station (lower left). Decca MK 21 (upper right).

Hydrographic Datahandler, a Decca Arkas Sea Track and an Autopilot, the ship can move through the lattice on a pre-calculated line, the position of the ship and all incoming depths being digitized and stored on tape. New start and finish positions are computed automatically at the end of each line. The positions of the floats and tidal corrections are calculated and incorporated in the Office plotting stage of data processing. Equipment installation in *Guldborgsund* is shown in figure 7.

A Path Guiding Unit (PGU) is installed on the bridge near the Sea Track and Autopilot. The PGU gives the Officer-of-the-Watch the following information : distance from the pre-calculated track line, distance remaining to be run along the track line, the course, and the depth.

The towed array has proved to be an effective and efficient system for long line hydrographic surveying from minesweepers. While the Danish hydrographic operations utilize also some rather sophisticated equipment for steering the ship and processing the data, a basic towed system can be utilized without such aids. As minesweeping vessels may be available in the navies of countries which are short of dedicated hydrographic surveying ships, it is thought that the promulgation of information on the towed array might be of benefit. The Danish Hydrographer will be pleased to furnish further details on the system to Member States of the IHO, upon request.

The Bureau is indebted to Mr. James DAWSON, Undersea Projects Insurance Brokers, Ltd for calling attention to reports in Lloyd's List of extensive damage to the vessel *World Horizon* in May 1978 while that ship was steaming off the South African coast. Speculation is that anomalous wave conditions to be found in the area (see *I.H. Review*, July 1974, pp. 99-129) were responsible.

The full explanation of the phenomenon, and therefore the limits of its occurrence, must await more intensive bathymetric surveys of the region, as noted by the cited *Review* article, and in Mr. DAWSON's letter to the Lloyd's List Editor reproduced below.

" Sir,

" The reports in Lloyd's List lead one to the conclusion that the vessel *World Horizon* was struck by an episodic wave. Interestingly, she was built by the same Japanese shipyard as the *Wilstar*, which suffered the same fate in the same area in 1976.

" It is patently impossible to pin-point the precise areas in which these lethal waves occur until the world's charts are black with depth markings rather than white for want of any information.

" What *can* be done, and should be done, is the linking of weather sensing satellites covering the area between Antarctic storm centres and the South Western African Coast to forecasters in South Africa responsible for warning ships of known danger areas at times that can be forecast.

" This notion has the backing of some of the leading world meteorologists, notably Dr. Harris STEWART, director of the Atlantic Oceanographic and Meteorology Laboratories, National Oceanic and Atmospheric Administration, in Florida. He emphatically endorsed the suggestion I put to him at the Brighton Oceanology Conference last March.

" It is also considered feasible by Commander Anthony WOOD, lately Royal Navy Meteorology and Oceanic Division.

" The wastage of men and ships and the cost to insurers through a total inability to forecast areas that must be avoided at certain times of year, in relation to storm power sources elsewhere, justifies the cost.

" These waves have been the cause of missing ships for centuries, and the twentieth century should be the last when forecasts are under-privileged.

" Yours etc. "

James DAWSON.

Little Stonewall, Tunbridge Wells.