CHANNEL POWER CABLE SURVEY (1960)

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IHB Note. — The following article, sent to us by the English firm *Underseas Ltd.*, is likely to be of interest to Review readers.

Before laying the Channel Power Cable in the summer of 1961, the Central Electricity Generating Board wanted to be sure that the two cables would not encounter any obstructions such as wrecks which could damage them, necessitating costly repairs and incurring some loss of prestige in a venture that will have considerable publicity and political importance.

The course that the power cables are due to take is from Dungeness, due magnetic east to the point where the depth of water at MLWS is 16 fathoms, thence to a point close to the Colbart Buoy where the cables from Boulogne will be joined. It is because this will be an Anglo-French enterprise that the otherwise undesirable feature of a join in the cable at the mid-point is being tolerated.

During the war as many as 16 petrol pipelines were laid from the area around Dungeness to the French coast near Boulogne and all operated unaffected by underwater obstructions. However, the Admiralty were unable to guarantee that all the wrecks in the area had been charted and no one could be sure that any structures at present covered by sand might not uncover at a later date, thus bringing the cables in contact with possibly damaging edges. Therefore it was decided to carry out a survey of the cable route, and half a mile either side to allow for laying errors, which would discover any ferrous structures above or below the sea bed, and to combine this survey with a profile and report on the structure and material of the sea bed by visual inspection.

The author's firm, Underseas Limited, secured the contract for the survey and the initial fitting out of the craft intended for the survey took place in June, 1960.

A glance at a chart of this part of the Channel between Dungeness and the Colbart Bank will show that the main harbours are all nearly twenty miles away from the middle point of the cable route and comprise Folkestone, Dover, and Boulogne. The small harbour of Rye is the closest, but suffers from the disadvantages that it almost dries out at low water, has a difficult entrance in an onshore wind, and is relatively poorly lighted.

FIG. 1. — Section of British Admiralty Chart L(D5)2451 showing Decca lanes and cable route superimposed.

The requirement of any craft used during this survey was that it should be fast, to take advantage of any calm weather, seaworthy enough to ride out the expected bad weather, and able to carry the necessary instruments and personnel for the survey. Furthermore, the radius of action should enable the craft to remain continuously underway at full speed for at least 24 hours. It was not considered essential that the craft should have accommodation while large scale plotting could be carried out more conveniently ashore, particularly as the cost of the operation had to be kept as low as possible. These considerations led us to adapt an inflatable craft of the type used for amphibious operations and constructed by Messrs. R.F.D., of Godalming. While this inflatable boat eventually had to be abandoned for the survey because of the electrical interference caused by the large power source required for the Decca equipment, some space has been devoted to describing the layout as we feel that with the transistorized equipment the advantages of this type of survey boat will eventually lead to its displacing the conventional launch. Certainly this experiment has proved most worthwhile for subsequent operations. The craft was fitted with a canopy which completely enveloped it from bow to stern and which turned the inside into a warm, even hot, dry space in which to stow and operate the instruments.

Power was obtained from a 40 h.p. Johnson outboard engine mounted on the transom, and an emergency engine, a 40-plus Seagull, was also carried alongside the main engine. The big engine gave the fully loaded craft a top speed of 30 knots in calm water. At sea under actual operating conditions 10-12 knots and 7 ½ knots into a choppy head sea and force 4 wind were obtained.

Into the working space, 3 feet wide by 11 feet long by 3 ½ feet high, was crammed a Decca survey receiver, track plotter, decometer, Ferrograph *Offshore* echo sounder (recording), 1 KW petrol generator, AC/DC rotary converter, Gray magnetometer, 30 gallons of fuel, and three men.

The first hint that there might be inherent faults in the set-up was given when we found difficulty in eliminating the interference on the Decca despite the use of a large earth plate two feet square.

Eventually the craft was sailed from Dover to Rye from which port runs were made to develop a suitable method of using the proton spin magnetometer. This particular instrument had only been used before in site investigation and archaeological work so that it required some adaptation before being ready for use at sea from a small craft packed tight with other electrical and magnetic machinery.

One adaptation required the operator to be isolated 60 feet astern in a rubber dinghy, shrouded in canvas and jerked from wave top to wave top but *pinging* every 15 seconds. It may be of interest to note here that in 15 seconds it is possible to note a time, read four figures, and move one cramped foot. Later adaptations resulted in the production of a really efficient and robust marine instrument with a sensitivity of 1 gamma which could be operated from the deck saloon of *Nyata,* which was a great improvement for the operator. Unfortunately, as the Decca instruments had not been transistorized, they required considerable power to drive them and thus necessitated the use of a 1 KW generator which, in spite of rigorous suppression, caused so much interference that the readings constantly fluttered, making it impossible to steer accurately along the lanes, and in addition causing an occasional lane jump. At the same time the mussel beds of Rye harbour eventually took their toll and punched holes in the soft bottom of the inflatable craft so that the safety of the heavy equipment was threatened. This finally caused us to move the whole equipment across to the yacht *Nyata,* which was then chartered for the survey.

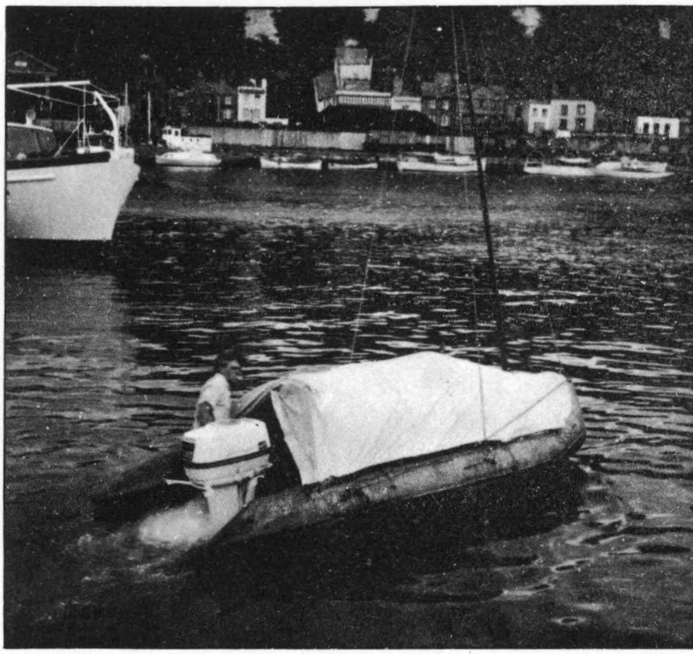

Fig. 2. — Photograph of dinghy at Dover

Here the gear was once again erected, the Ferrograph echo sounder transducer being installed whilst the craft was afloat in Dover harbour. At last, on 3 July, the first survey runs were begun and the weather deteriorated fraying tempers that were oddly assorted at the best of times.

The cable route is so arranged that it is nearly parallel to the Decca green lanes, while the red lanes cross to give a good cut. Thus the ship could conveniently be steered along the green lanes, after practice by the helmsman, while the distance along the course and the positions to start and stop each run could be accurately determined by the red lanes. As the depth of water averages 100 feet it was decided that, in the absence of any reliable information on the strength of the magnetic fields to be expected of structures that might be harmful to cables, the sensitive head of the magnetometer should be traversed across the area along lanes 100 feet apart. Meanwhile the echo sounder and track plotter ran continuously to keep an accurate track and profile. This survey scheme required the helmsman to steer to $\pm$ 0.005 of a lane width and the magnetometer to be read off every 15 seconds at the surveying speed of $5\frac{1}{2}$ knots.

After a few runs over known wrecks, it was found that the magnetic signal to the magnetic north and south of the wreck was so large that the lanes could be opened out to 300 feet apart. Accuracy on the part of the helmsman, and constant reading of the magnetometer were still required, however, to prevent gaps appearing in the plot and to develop gradually the curves of any magnetic anomalies. This latter point was particularly important during certain periods of the day in the northerly parts of the area, it was found that something resembling a 50 c/s interference was introduced into the readings, making identification of an anomaly difficult unless a gradual build-up of value could be plotted, which of course required frequent readings. This interference also affected the Decca.

Visual inspection of the area was carried out by towing a diver equipped with semi-closed-circuit breathing apparatus at 2 knots over the sea bed and along the Decca green lanes. At this speed the diver was comfortable provided his weight (the drag) was taken on a toggle seat and he lay horizontally behind the 1 cwt sinker secured to the fine towing wire. Dives of one hour at 110 feet could be carried out, necessitating decompression of about the same length of time. This was carried out by hanging on a weighted, marked line, below a dinghy slowly drifting. Thus the tide had no effect on the diver during these long and tedious stops.

It was found that, in this area, a visual inspection of the sea bed coupled with the echo sounder profile enabled an accurate prediction of types of sea bed to be made in other parts of the area. The type of material on the bottom did not always correspond to what had at first been thought by looking at the traces.

Surprisingly, visibility around the Colbart Buoy had an almost Mediterranean quality so that the surface of the sea was visible from 50 feet below. As the Dungeness shore was approached, however, the visibility decreased until, on the Dungeness bank it was pitch black. This is consistent with the increasing amounts of clay and silt in the water on the Northerly shore.

The results of the survey showed that the sea bed between the Dungeness and Colbart banks appeared to be a fairly symmetrical trough, the great sand dunes of the Colbart being composed of coarse sand and shell while the bank off Dungeness is of fine clay and silt. At the bottom of the banks a firm bottom of gravel and rock close to the surface of the sea bed gradually slopes away for about a mile to give place to small rolling sand ripples three or four feet high and of shallow profile. A few sharp ridges with a slope of 1/5 were found, but these were generally found on the last down tide of a sand dune and were an indication of a mobile bottom. One advantage of having a diver look at the sea bed was that a glance at the animal life found there was sufficient to identify the bottom as being mobile or relatively stable.

Only five small magnetic anomalies were found in the whole area apart from a known and charted wreck. These anomalies were too small to be investigated without a considerable diving operation and, as they are well off the cable route, were merely noted. The charted wreck known to exist just outside the area was in fact found to consist of either three wrecks or a big ship broken into three very large pieces scattered half a mile apart and all well inside the area. The slope of the curves from the

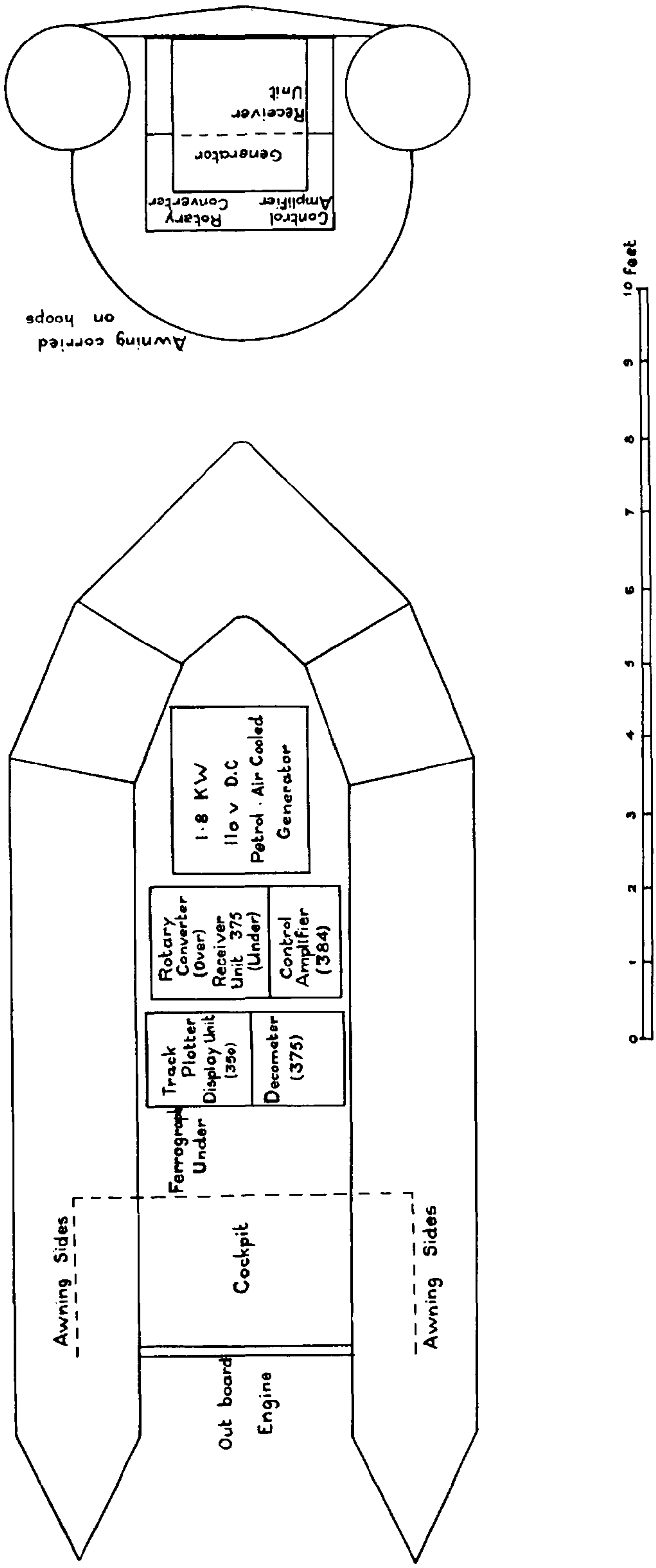

FIG. 3. — Plan of dinghy layout.

magnotometer readings shows in which direction the wreck was lying in relation to the passage of the survey vessel and gives a picture of the position of the wreck, while the echo sounder only registers a result which would require a second run over the top to be sure that it was not a dense fish shoal.

Other lessons learnt from this survey were that all electrical gear should be transistorized where possible to stand up to the rough and uncongenial conditions of marine operations, and to reduce the power requirements. The unwelcome electro-magnetic effects of large power sources are of prime importance in small craft and required special arrangements to be made even in the larger survey vessel.

An inflatable craft has a number of advantages over the traditional hard survey launch. These are greater speed, better sea-keeping qualities and the ability to use small harbours or even operate off beaches and a greater load carrying and space/weight ratio. On a couple of occasions the craft was taken up the Dungeness shingle bank and launched again after the heavier electrical gear had been dismantled. Certainly this small 15-foot craft was a great deal steadier at sea than the 50-foot yacht as it followed the slope of each sea (which is never more than 30° except when breaking) and no rolling as the result of inertia, like a deep-keeled ship, took place. But, for it to be successful in surveying with modern instruments the electrical equipment must be built with little external electromagnetic effects and low power requirements.

Finally, the diver's report is a most valuable aid to the interpretation of records, particularly if he is informed with a knowledge of the commoner animals typical of different sea beds and of the general structure of the sea bed. But, the diver cannot operate without equipment and in this instance the diving time required on the bottom was so long and the weather and tidal conditions such that only an equipment giving long endurance and light weight could be used.

The need for strong, light, efficient equipment designed for use on and below the sea is vital to the successful exploration of the sea bed and this type of survey emphasizes the amount of development we have yet to do before we can feel assured that surveying out to the continental shelves can be pursued without doubt or difficulty.