DIVISION OF FISHERIES
DEPARTMENT OF AGRICULTURE
NEW SOUTH WALES

KAPALA CRUISE REPORT NO. 89

Report on trials with the ROV DART conducted during Cruise 84-05

in April 1984.

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1. OBJECTIVE

To assess the application of a remote controlled observation vehicle the DART in fisheries research.

2. INTRODUCTION

In 1982, the compact two man submersible, Platypus, owned by Platypus Marine Surveys Pty. Ltd., was chartered for a series of trials to evaluate the suitability of this type of craft in those areas of fisheries research where SCUBA diving is restricted by factors such as depth, endurance, safety, and poor visibility. A series of dives were conducted on the artificial reef site near Sydney and the results were published in Kapala Cruise Report No. 82. Platypus was found to have serveral disadvantages including restricted vision, poor manoeuvrability, limited navigational capabilities, and low speed. In addition, Platypus had to be towed to the operational area on a launching platform, and her launching and recovery required calm sea conditions. Ultimately additional trials including planned dives to observe towed nets were cancelled when full certification for deep-diving was not obtained for Platypus.

Consideration was therefore given to chartering a remote operated vehicle (ROV). ROV's are used extensively by the oil industry and other operators for pipeline and rig inspection, salvage, construction, monitoring, and diver support.

As the New South Wales Department of Public Works had successfully used the locally available ROV DART for a seabed survey associated with the planned Sydney underwater sewage discharge scheme, DART was chartered to test its application in fisheries research.

The owners subsequently offered free of charge the larger and more elaborate ROV TREC for additional trials.

3. SPECIFICATIONS

The ROV's DART (Deep Access Remote Television) and TREC (Tethered Remote Camera) were chartered from Commercial Diving Services Pty Ltd., Dapto, New South Wales, owned by Messrs Keith and Neil Johnson. During the trials, the ROV's were operated by Keith Johnson.

3.1 DART (Fig. 1)

Dimensions: 1000 x 650 x 550 mm

Weight: 75 Kg

Operational depth: 366 m

Max. operational speed: 3.5 knots

Generator: 5 kVA

DART was equipped with twin headlights and a black and white video camera with pan, scan and remote focusing facilities. It could also be fitted with a 35 mm still camera and strobe flash.

Four electrically driven thrusters provided manoeuvrability, enabling the DART to move ahead, astern, sideways and vertically, or simply to hover. It was also fitted with steel runners for travelling over the sea bed.

The control console was sited on the support vessel, and DART was manoeuvred with a joystick via an umbilical cable (Fig.2). The console included video monitors and recording facilities. The depth and heading of the DART were shown on the video monitors.

3.2 TREC (Fig. 3)

This was a much larger and more costly robot weighing about 200 kg. It was similar to the DART but in addition had an articulated arm equipped with a claw, and a colour video camera. It is designed to operate down to about 1800 m. The TREC had only recently been acquired by the owners and was still undergoing proving trials.

4. TRIALS

4.1 Artificial Reef Site

The first trial was at night in calm conditions at the artificial reef site to the north of Sydney Harbour. A sunken vessel was located by Kapala using sonar and marked with a dahn buoy fitted with a flashing light.

During the first dive, difficulties were experienced in locating the wreck because the position of the DART at the start of the search was uncertain. All subsequent descents were made by directing the DART down the marker buoy mooring line onto the target.

The wreck of the barge Verdier was examined in detail and very good video pictures were received of the hull and fittings.

The manoeuvrability of the DART was demonstrated by the operator piloting the vehicle around and into the barge. A few fish including yellowtail and morwong were observed, but visibility was restricted to the 3 m zone illuminated by the underwater lights.

DART was also operated on the seabed alongside the Verdier. It rode easily over the bottom on its skids and manoeuvred well. The current was quite strong and some difficulty was experienced in heading DART into it. The pictures transmitted back to the monitors showed clearly the sand-ridges on the seabed, but no fish were seen.

The following day the ex-Sydney Harbour ferry Dee Why was located and buoyed by departmental diver John Matthews. The Dee Why was then thoroughly examined by the DART for about two hours. Underwater visibility was estimated at about 10 metres. The wreck was covered with marine growth and schools of fish and individual fish were observed hovering close to or just above the vessel. The species observed included rubberlip and red morwong, yellowtail kingfish, wrasses, mado, sweep, snook, teraglin, and small unidentified bait fishes.

That evening a comparative night dive lasting about two and a half hours was carried out on the Dee Why. As noted for the first night trial, the lights on the DART illuminated a small area, which made piloting the DART around the Dee Why difficult and placed considerable strain on the operator. Very few fish were sighted.

One trial was conducted with the ROV TREC but this was aborted because a fault in the video camera could not be rectified.

4.2 Fish Aggregating Devices (FAD's)

The Division of Fisheries has been attempting to develop successful FAD's with the assistance of a grant from the Fishing Industry Research Trust Account. Several designs incorporating a variety of mooring systems were tested but in most instances the working life of the FAD's was very short. This was probably because of the need to site the FAD's within commercial shipping lanes at the edge of the continental shelf and the strong currents and rough seas that often occur in this zone.

A cylindrical spar buoy with a rope mooring was developed to minimise the effect of both ship strikes and weather, and anchored in 130 m of water off Sydney.

The purpose of the trial with the DART was to determine if it could be piloted down the mooring

line of the FAD to examine splices, shackles and other components that are subject to wear. To eliminate any possibility of entangling the ROV, no fish attractors were attached to the FAD. The tests were conducted under ideal conditions and in two seperate dives the pilot was able to steer the DART down the mooring line to about 100 m, which is well beyond normal SCUBA diving range. Deeper diving with the DART was not possible on this occasion without modification to the ballasting arrangement on the umbilical cable. Despite the absence of an attractor on the FAD, fish were seen at the splices in the mooring line where long rope-strands had been left.

4.3 Observation of Trawl Gear in Action

In order for the DART to scan the trawl gear with its video camera, it had to be positioned in front of the net and towed backwards. As the behaviour of the DART in this mode was unknown, it was decided as a safety precaution to tow the trawl in midwater.

A 21 metre headline Boris box trawl net was towed in midwater at a depth of about 20 m with the netsonde cable from the self tensioning winch attached to the centre of the headline. The DART was attached to the netsonde cable using bridles forward and aft to provide stability. The forward bridle was secured to the cable with a snatch block and the aft one to a running shackle. The DART was then allowed to run down the netsonde cable to the net. The umbilical cable was paid out manually and loosely secured with plastic cable ties to the netsonde cable. Underwater visibility was excellent and very sharp television pictures were obtained of the net. The thrusters were ineffective in altering the attitude of the DART but the romote pan, scan, and focusing facilities of the camera provided clear pictures of various sections of the net. The field of view could be varied by hauling the DART back up the cable or driving it closer to the net. In addition, it was possible to view the net from above by varying the slack on the netsonde cable.

The trial demonstrated that the DART or a similar vehicle could be used for this type of gear observation. However the DART is more sophisticated than necessary as the lateral and vertical thrusters cannot be used while the DART is secured to a cable. Because the DART has to be sent down a cable to a pre-selected point on the gear it is not as versatile for observation purposes as a diver, or one of the newer remote controlled towed vehicles employing Magnus rotors for manoeuvrability. However, the trials did demonstrate that with the use of a low light camera, the DART was capable of making detailed

observations at depths and in light conditions impossible for a diver.

5. SUMMARY

The trials demonstrated the high degree of manoeuvrability of the DART, both on and above the seabed. It was effective for surveying the artificial reef wrecks during daylight, but at night the range of vision was inadequate.

It was demonstrated also that a ROV could be used for examining the FAD's and observing trawl gear in action.

6. ACKNOWLEDGEMENT

Funds for chartering the ROV were made available through the Fishing Industry Research Trust Account.

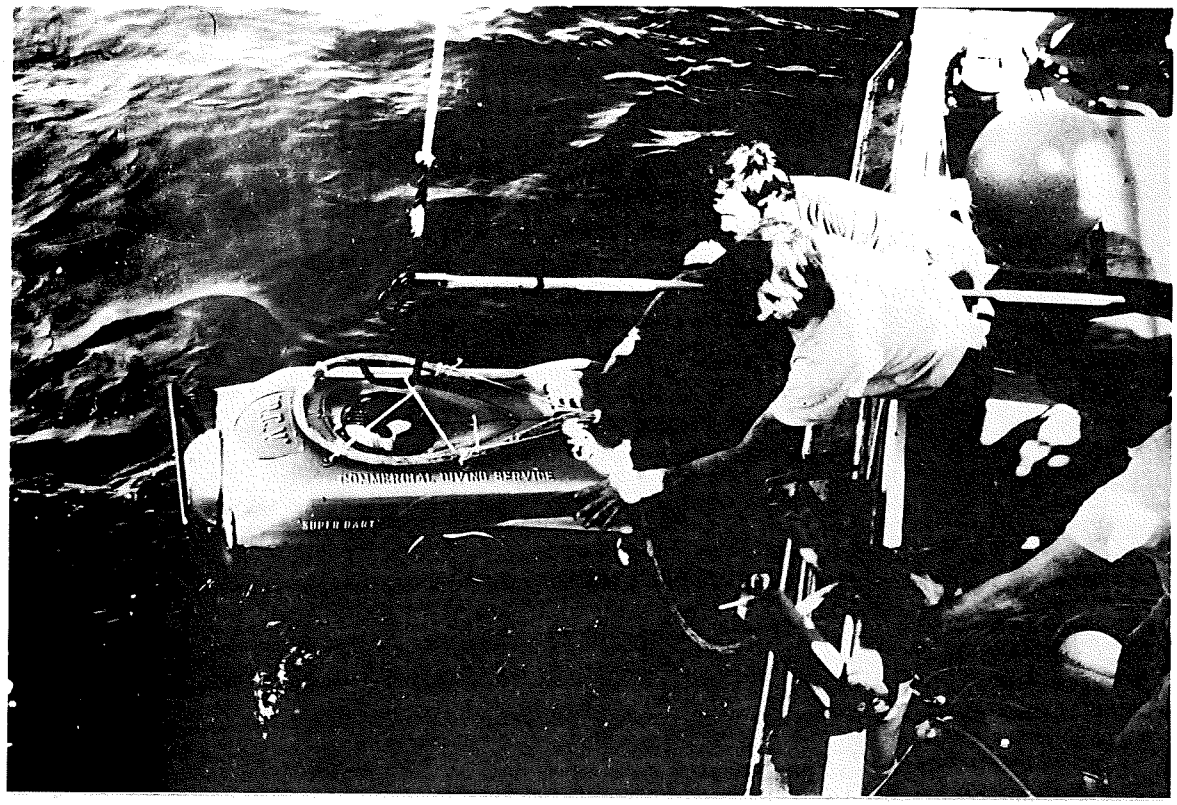

Figure 1: The DART being launched from Kapala. The downward and side thrusters, and the seabed runners can be seen.

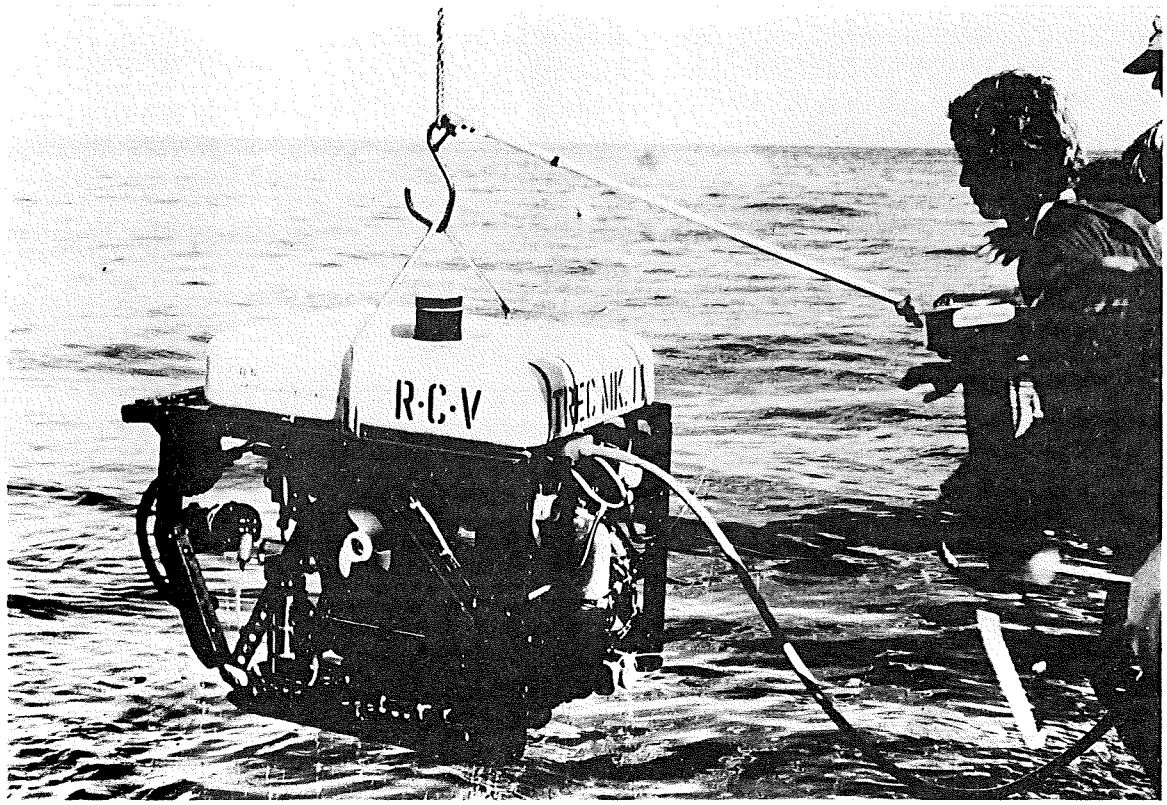

Figure 2: The TREC being lifted aboard Kapala. Side and rear thrusters, the forward mounted camera, and the umbilical cable can be seen.

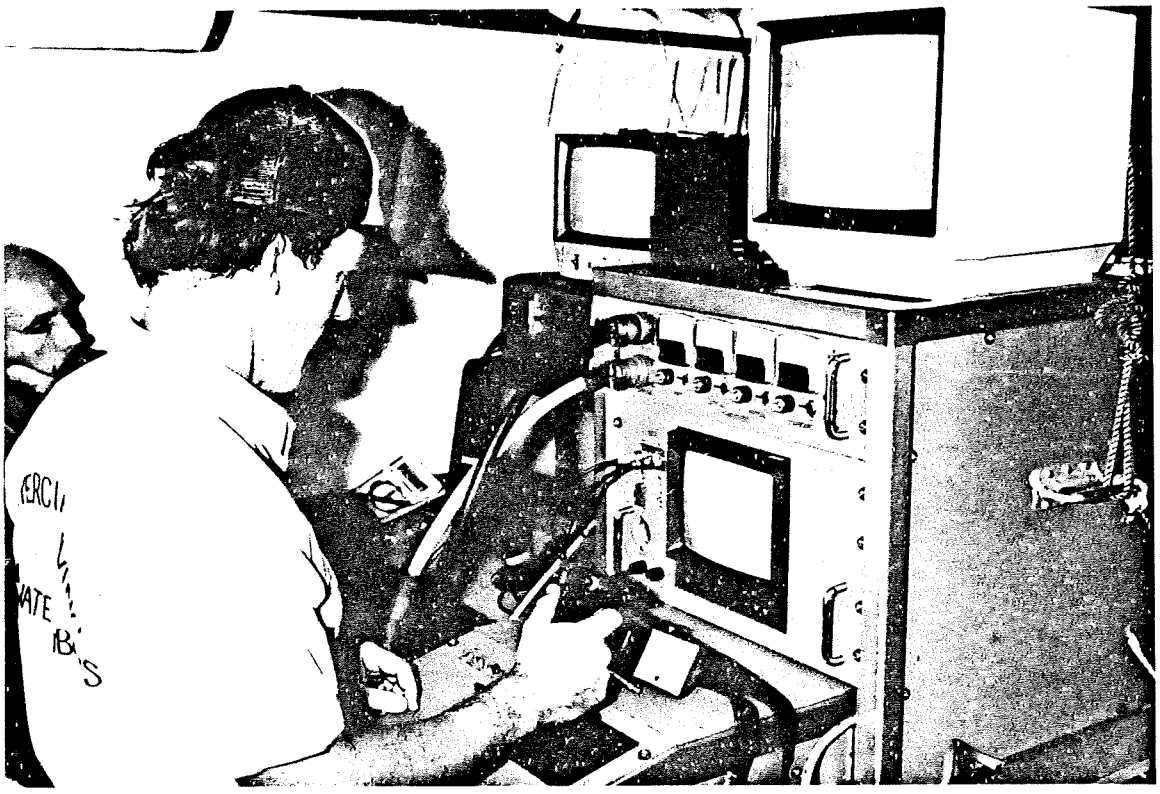

Figure 3: The operating consoles for the ROV's. Mr. Keith Johnson is seen directing the DART with the "joystick" control aided by the video monitors.

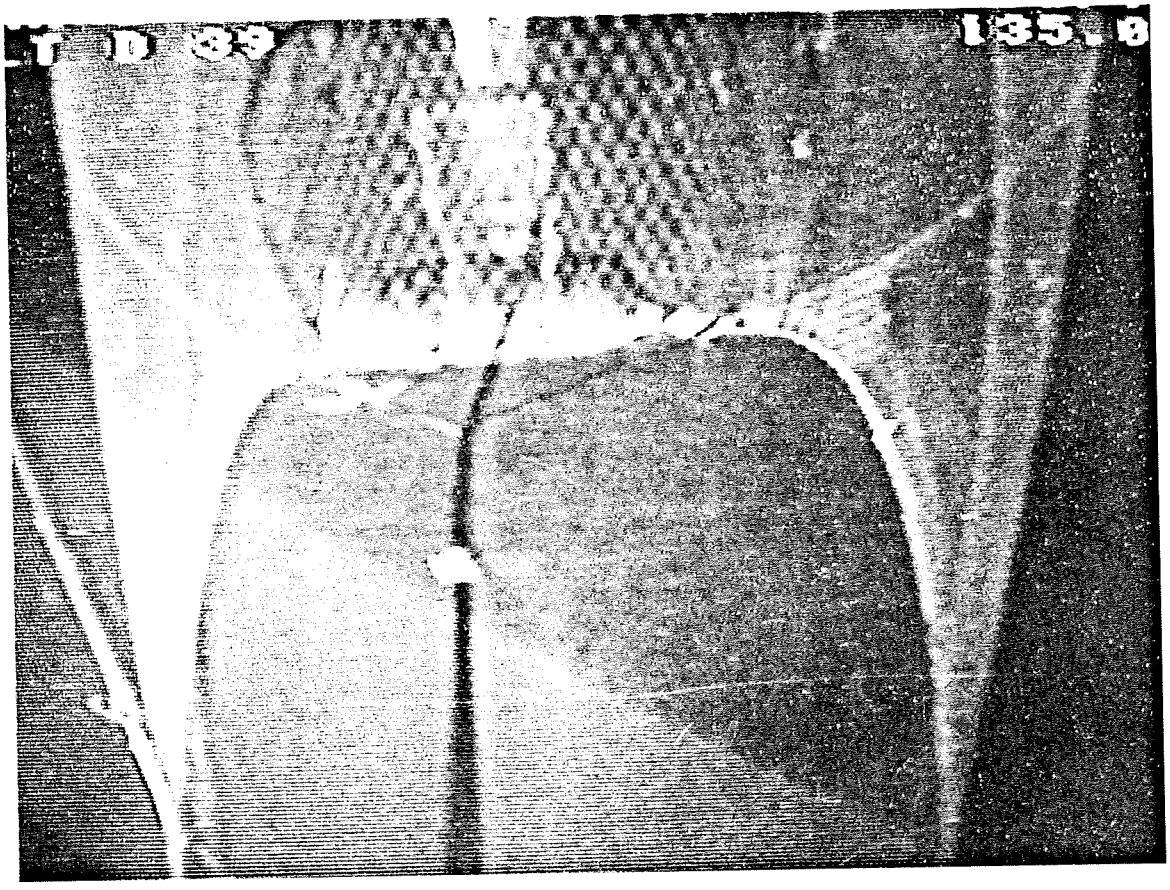

Figure 4: View from above of the Boris box net being towed in midwater. The netsonde cable to which the DART was tethered can be seen in the centre.