A SIMPLE JB-TETHERED ROV FOR DUMAND

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Abstract: Current ROV/AUV developments make it possible to seriously reconsider earlier proposals to have a dedicated ROV for servicing the DUMAND array. It would be necessary to develop a useful ROV/AUV for under approximately $300K in order to make the proposal attractive. This might be done by adapting a commercial mini-Rover type of tethered vehicle for 5 km pressures, and employing an unused JB port as the tether connection. Limited lift/thrust forces are sufficient if a leveraged linear actuator is used to extract or insert connectors.

In the mid-70s, DUMAND proposals included a dedicated ROV (remotely operated vehicle) garaged at the DUMAND site[1]. At that time the expense of developing a state-of-the-art ROV for this purpose was prohibitive. By the mid-90s, the situation has changed radically. While ROVs for abyssal (>1000 m) depths are still relatively rare and expensive, a wide range of vehicles developed by academic and commercial organizations are available. ROV development has been stimulated by the needs of the oil industry as well as military demands for a safe minefield clearing system following the Gulf War.

The primary task for a DUMAND dedicated ROV would be insertion and removal of JB connectors (for strings and responders) as well as inspection of string components. ROVs are normally controlled from a surface ship, but for 5 km depths the umbilical weight and length would be prohibitive, and issues of cost and availability of a suitable surface vessel would reduce the value of the ROV. However, unlike most ROV users, we already have an ideal tether port at our underwater site: the JB, which provides 600 MBd data rate and up to 5 kW of electrical power per connector. A suitable ROV could be connected to a spare port on the JB by one ATV dive and thereafter handle routine maintenance operations, including new-string insertion, dead-string removal, responder connection, and OM inspection.

The Benthos MiniRover is an example of a small, low-cost ROV which has had widespread adaptation. The MiniRover is basically a small electronics can with thrusters, carrying a video camera and lights, intended for moderate-depth inspection work. Some users bolt the basic Benthos product onto a frame carrying attachments adapted to their particular needs. Fig. 1 shows a photo from a recent Benthos newsletter illustrating one such application[2].

This type of small ROV does not have the carrying capacity for a manipulating arm, nor the thrust needed to remove or insert one of our JB connector pairs. However, with the existing JB design, we could arrange a bracket attachment to snag the connector's tee handle, and a simple linear actuator could provide the necessary thrust by pushing against the JB frame. Fig. 2 illustrates a

conceptual design for a mini-ROV suitable for DUMAND using contemporary models. The ROV maneuvers to insert its slotted connector-grabber on the connector tee fitting, and then rises an inch or two to engage its movable strut behind the front bar of the JB frame. Note that the slotted flange permits relatively easy insertion while allowing either a push or a pull. A linear actuator on the connector flange provides the necessary thrust. The ROV pulls itself toward the JB while grasping the connector tee (for insertion, reverse for removal).

This approach does not involve significant development of a new capability, but rather adaptation of an existing commercial system to our requirements. Since junction boxes and wet-mateable connectors are a common element in ocean science and engineering projects, the development of an ROV with the ability to service a JB would be of general interest. We plan to pursue this option with our APL and industrial contacts, with a view to preparing an ONR proposal for a collaborative development effort. Future versions of DUMAND could have JBs designed to simplify ROV use. The DUMAND-III JB could be designed specifically for servicing by low-capability ROVs, with appropriate fittings and grab bars. A simple acoustical homing system has been used by UW/APL with great success for a free-swimming AUV and would help reduce the need for operator skill[3]. Since a video camera (fixed relative to the ROV) is basic to our application, a visual target would allow us to use simple autohoming techniques via image processing.

References

1. e.g., W. Walker, Proc. DUMAND 1980 Deployment Workshop, A. Roberts, ed., p. 97.

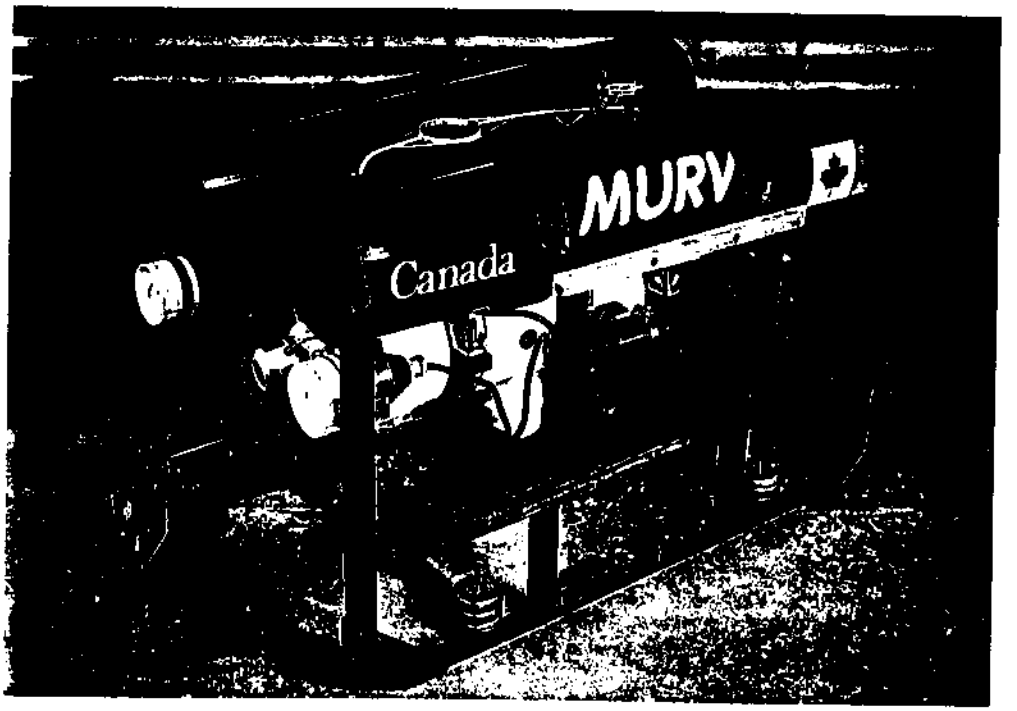
2. Benthosaurus (Benthos, Inc. newsletter), 3/94.

3. R. D. Light and J. Morison, Proc. Oceans '89, IEEE.

Figure 1: the MURV vehicle developed by Environment Canada from a Benthos MiniRover.

Figure 2: Conceptual design for a low-cost DUMAND maintenance ROV.

MURV Heads for Canadian Waters



FROM ENVIRONMENT CANADA, F. Henk Don, head of underwater operations, writes that the *MURV* (*Mobile Underwater Reconnaissance Vehicle*), a modified MiniROVER MKII, will be used to support scientific diving operations at the Canada Centre for Inland Waters in Burlington, Ontario.

Equipped with a two-function articulator, Imagenex scanning sonar, directional pinger hydrophone, 35 mm Benthos MiniCamera, plus a 25 pound payload capacity, *MURV* is compact enough for small boat operations yet can handle the big jobs. Tasks will include placement of sensors into bottom sediments, search and recovery of scientific instrumentation, under-ice video and sonar mapping surveys, diver observation, fish habitat surveys, chemical spill assessment, and contaminant surveys.

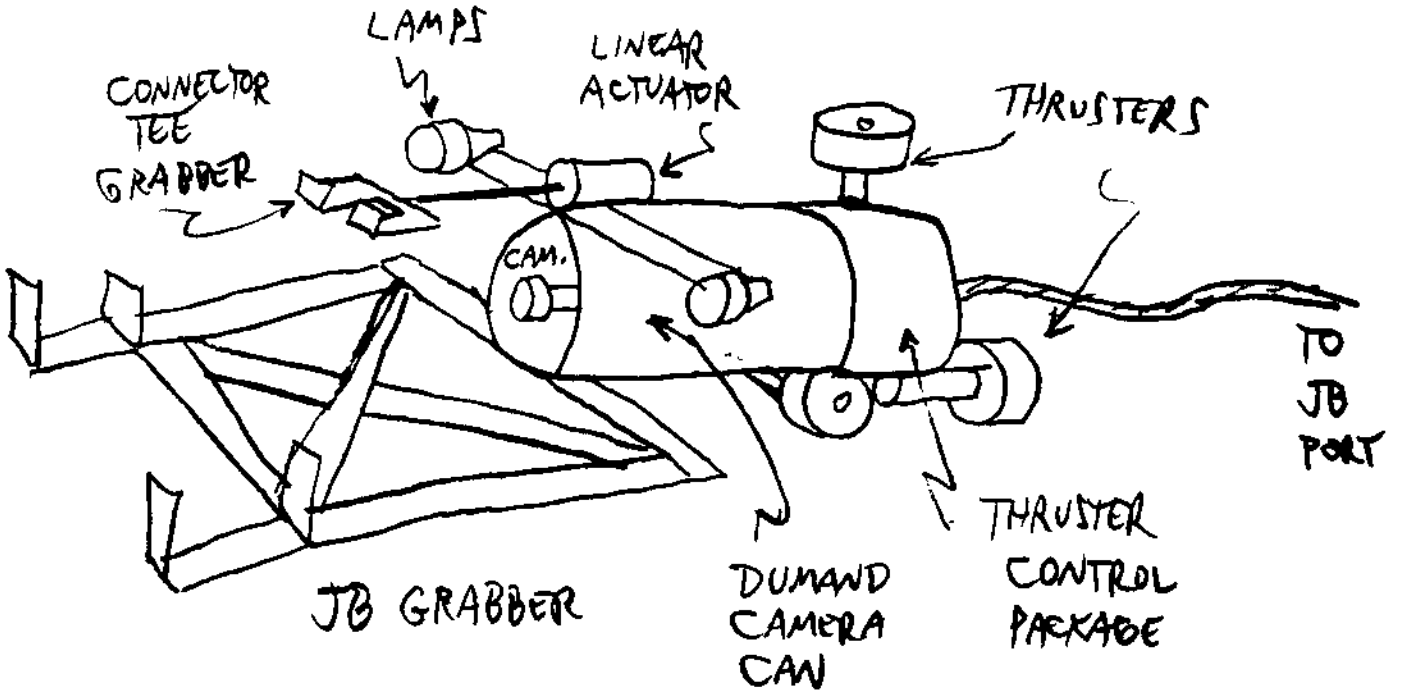


FIG. 2