EVALUATION TRIALS OF
BERTRAM HYDRO LAUNCHES

November/December 1974

- INTERIM REPORT -

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BACKGROUND ON "HYDRO" LAUNCHES

The four 25ft. Bertram launches of the Hydro series are fibreglass cabin cruisers, built at Canoe Cove, B.C.,in 1970-71 and delivered to the Bedford Institute on April 5th 1971. The launches saw service during 1971 and 1972 mainly with the C.S.S. Kapuskasing and C.S.S. Baffin but did not prove to be entirely suited for use with East Coast survey parties. This fact, coupled with engine troubles and electrical problems, caused the four launches to be prematurely retired and they were not put into service during 1973.

In December 1973 the four Hydro launches were deemed to be unsuitable for operation in the Atlantic Region and they were transferred to the Central Region at the Canada Centre for Inland Waters, Burlington, Ontario. On one of the launches the original 190 h.p. diesel engine was removed and replaced by a 245 h.p. O.M.C. inboard-outboard gas engine. This produced satisfactory test results with the anticipated work load, and the other three launches were similarily re-fitted. In June 1974 the launches were sent to the Lake Winnipeg survey party but it was found that when fitted with the required load of electronics and other equipment none of the boats was able to produce the desired operating speed, seemingly having a top speed of about ten knots. All four of the launches developed major engine trouble within one or two days, and they were returned to the C.C.I.W. Other C.C.I.W. craft were, however, available locally,thus enabling the survey to continue.

Due to this less than satisfactory performance during the past field season, one of the Hydros was fitted with twin Volvo 170 h.p. inboard-outboard gas engines in place of the single 245 h.p. O.M.C. engine. Tests proving satisfactory, the other three craft are now being similarily re-engined, with this mechanical program being coupled with an extensive testing and investigation program in order to find and resolve any other problem areas with these boats before they are again put into service on hydrographic field survey work.

## THE EVALUATION PROGRAM

The testing program was basically designed to determine primarily the boat's maximum safe load and whether or not the power available were sufficient that she would work efficiently with this load on board, with an integral part of this aspect being to find the working range of the present full load of fuel. The other main point was to record the launch's speed at various engine speeds and to determine the best working speed. The tests were also designed to find out what would happen if the boat were to be loaded in an extreme fashion such as putting all the weight forward or all the weight aft, and also to determine the optimum weight distribution. The tests were going to be run under various weather conditions to find the difference in speed and fuel consumption between calm and rougher weather.

Another very important point was that the results of all these tests were to be recorded and distributed as widely as possible so that everyone concerned would know what would happen if, for example, the propellors were to be changed, or whether extra fuel tanks would have to be installed and if so where best to put them. These tests would undoubtedly produce interesting and valuable results, but most of the value would be lost if the test records were not complete or did not receive wide distribution.

The main purpose, then, of this Interim Report is to let everyone know the results of our first series of tests, which were run on the Hydro III, and to give all concerned the opportunity of commenting on the results and perhaps suggesting additional tests in time to incorporate them into the Spring testing program.

Due to the limited time available before the approach of winter weather these trials have been neither as complete nor as exhaustive as planned, but they have been adequate to produce data of sufficient quantity and quality to indicate the capability of the Hydro launches and to reach some conclusions on their usefulness.

When weather permits, the same full series of tests (with the exception of the overloading) will be run on another Hydro launch with, hopefully, the addition of experiments with different propellors and also with and without trim tabs. These present fuel consumption trials were each run over a twenty minute test period, but when time permits the future fuel consumption trials will be over longer periods - probably forty minutes or an hour.

As each boat becomes available in the spring it will be put through an abbreviated form of these same tests to ensure that all is as it should be, as well as to record the results for future reference, and before being sent out into the field it is planned that each boat will have one or two full days running as an endurance test.

WEIGHT OF LAUNCHES

At the conclusion of the 1000 lb. series of tests the launch was weighed, and the total weight of the boat in this condition was found to be 8700 lbs. The launch Brock was weighed at the same time and her weight, in operational condition with radar, sounder, and some equipment on board was found to be 8400 lbs.

| | | | | |
|---|---|---|---|---|
| Total weight of launch and contents | | : | | 8700 lbs. |
| including : | Ballast wt. of | : | 1000 lbs. | |
| | 122 gals. fuel | : | 1100 lbs. | |
| | Total contents | : | | 2100 lbs. |
| | Weight of empty launch | : | | 6600 lbs. |

If necessary, this weight can be reduced by a further 200 lbs. by removing the 3 Kw generator before shipment by road or rail.

EVALUATION TRIALS OF HYDRO III WITH 2000LB. PAYLOAD

Tests of launch Hydro III with its new twin Volvo 170 engines on November 7th and 8th were made with ballast of 2000 lbs. on board in addition to the new 3Kw generator and full fuel tanks. The ballast consisted of one 750 lb. railroad wheel and assorted lead weights which could be moved around. The fuel used during the trials came from small auxiliary tanks which were frequently topped up and are included in the ballast weight. The railroad wheel was not moved during the trials, being placed on deck close aft of the cabin door, but the moveable weights were shifted as necessary.

With most of the weights aft (freeboard aft 22") the speed at 4600 R.P.M. was 16.2 knots, and the boat was found to be difficult to handle due to the bow being too high and thus overly sensitive to sea and wind forces.

With most of the weights forward (freeboard aft 30") the speed at 4600 R.P.M. was 17.4 knots, but with the weights thus distributed the boat's bow tends to dig into the sea when slowing down, possibly causing the boat to be flooded if caught in a sea.

With the weights distributed more amidships, the speed at 4600 R.P.M. was still 17.4 knots, and the safety and handling of the boat were much improved. The best trim was found to be with freeboard of about 27" aft and 32" forward. The speed and consumption test runs were made with the weight so distributed, with the consumption trials being each over a twenty minute period.

These tests were run on calm waters where the launch planed easily and handled well with the 2000 lb. payload with neither the hull nor the engines showing any signs of being overloaded.

During tests on November 13th in rougher weather, with a wind of 17 knots and waves 12"-18" high, the launch rode comfortably at all angles with the wind, though some spray came over the coxswain when going across wind due to the wind catching the bow wave, however, later with the same wind force and waves of 2 to 3 feet the boat was sluggish, slower to respond to controls, and quite unsafe in the event of breakdown. Heavy spray came over the whole boat when heading into or across the wind, and when backing into the sea some waves slopped on board. It was also apparent that with this 2000 lb. payload it is virtually impossible to check the oil in the outdrive units due to the screw-head tops of the dipsticks being awash even in calm water. Also, with this load on board the boat creates a heavy wake at operating speeds.

RESULTS OF HYDRO III TESTS ON NOVEMBER 7th & 8th.

Full fuel tanks (122 gals. gasoline), new generator, anchor, fire extinguisher, small magnetic compass, three lifejackets and two men. Ballast of 2000 lbs. distributed.

| R.P.M. | BREAKWALL IN SECONDS | SPEED IN KNOTS | CONSUMPTION GALS PER HOUR | ENDURANCE IN HOURS | RANGE IN MLS |
|---|---|---|---|---|---|
| 3000 | 124 | 8.1 | | | |
| 3500 | 108 | 9.3 | 9.0 | 13.5 | 126 |
| 4000 | 82 | 12.3 | 11.4 | 10.7 | 131 |
| 4300 | 69 | 14.5 | 13.2 | 9.2 | 134 |
| 4500 | 63 | 16.0 | 13.8 | 8.8 | 141 |
| 5000 | 51 | 19.7 | (Short periods only) | | |
| 5200 | 47 | 21.4 | (Maximum R.P.M.) | | |

Note above comments on boat being unsafe with this load on board.

EVALUATION TRIALS OF HYDRO III WITH 1500 LB. PAYLOAD

Tests of launch Hydro III on November 18th and 19th were made with ballast of 1500 lbs. on board in addition to the new generator and full fuel tanks. The ballast consisted mainly of various lead weights which were placed to simulate actual field operational conditions. See the diagram for the weight distribution during these trials. This loading arrangement was found by earlier experiment to give the best trim for safety and handling, with a freeboard of about 34" forward and 28" aft, when at rest.

The tests were run twice: once over calm waters and again in rougher weather. Note that although the speeds were generally a little higher with the 12"-18" waves, the fuel consumption was also higher, thus reducing the range. The consumption trials were each over a twenty minute period.

With this 1500 lb. payload, the launch handled really well during these tests with no effort required to hold a steady course, and good response to the controls. During the rougher weather tests in 2 ft, waves moderate to heavy spray came over the boat when angled into the wind due to the wind catching the bow wave, but even when working in 4 ft. waves with quite heavy spray coming over the boat, she handles well and responds readily to the controls.

When moving at operating speeds with this payload, the launch creates a moderately heavy wake which, at a distance of about 80 ft, results in a 4 ft. wave action on a wall, though at 150 ft. this effect reduces to a 2 ft. wave action.

NOTE :

All the speed trials are based on the time to pass along the C.C.I.W. breakwall, which is a measured distance of 1700 feet. Each speed run was done twice, then meaned.

RESULTS OF HYDRO III TESTS ON NOVEMBER 18th & 19th

Full fuel tanks (122 gals. gasoline), new generator, anchor, fire extinguisher, small magnetic compass, three lifejackets and two men. Ballast of 1500 lbs. distributed as shown in diagram.

November 18th. Wind 12-15 kts. Waves 12-18", Freeboard F)34" A)28"

| R.P.M. | BREAKWALL IN SECONDS | SPEED IN KNOTS | CONSUMPTION GALS PER HOUR | ENDURANCE IN HOURS | RANGE IN MLS |
|---|---|---|---|---|---|
| 3000 | 118 | 8.5 | | | |
| 3500 | 96 | 10.5 | | | |
| 4000 | 77 | 13.1 | 11.4 | 10.7 | 140 |
| 4300 | 67 | 15.1 | 12.7 | 9.6 | 145 |
| 4500 | 60 | 16.8 | | | |
| 5000 | 47 | 21.4 | (Short periods only) | | |
| 5250 | 45 | 22.4 | (Maximum R.P.M.) | | |

November 19th. No wind, misty, calm waters. Freeboard F)34", A)28"

| R.P.M. | BREAKWALL IN SECONDS | SPEED IN KNOTS | CONSUMPTION GALS PER HOUR | ENDURANCE IN HOURS | RANGE IN MLS |
|---|---|---|---|---|---|
| 3000 | 120 | 8.4 | | | |
| 3500 | 99 | 10.2 | 8.1 | 15.1 | 153 |
| 4000 | 79 | 12.8 | 9.8 | 12.4 | 159 |
| 4300 | 68 | 14.8 | 12.3 | 9.9 | 148 |
| 4500 | 59 | 17.1 | 13.1 | 9.3 | 159 |
| 5000 | 48 | 21.0 | (Short periods only) | | |
| 5350 | 44 | 22.9 | (Maximum R.P.M.) | | |

EVALUATION TRIALS OF HYDRO III WITH 1000 LB. PAYLOAD

On November 22nd tests were started with a 1000 lb. payload distributed as shown in the diagram, but these tests were not completed due to engine trouble which was diagnosed as being a manufacturing defect in one camshaft.

On November 27th with the malfunctioning starboard engine having been removed and replaced with a completely new unit, the Hydro III was again available and the series of evaluation trials was continued. The starboard engine being new we were, of course, not able to test the speed at 5000 R.P.M. (the top permitted speed for short distances i.e. the "Red Line") nor for the all-out top R.P.M., being limited to 4800 R.P.M. until the engine has been run in for 20 hours and had some adjustments, but within this limitation the tests were satisfactorily concluded on November 28th.

The fuel consumption figures found during this 1000 lb. series of tests are not strictly comparable with those found in the earlier trials as the outdrive legs during this set of trials were in the middle one of the three working positions instead of the forward or "maximum down" position. The three holes are spaced barely an inch apart but as can be seen in the figures the lower cruising speed (at 4000 R.P.M.) is reduced by 1.9 knots and the highest working speed (at 4500 R.P.M.) is reduced by 0.9 knot.

Moving a weight of 110 lbs. forward by a distance of 10 ft. alters the trim by 2" but has little effect on the speed or handling, however, any further reduction in the forward freeboard would tend to increase the amount of spray in rougher weather.

Experiments with the trim tabs showed that their effect is to raise the stern rather than lowering the bow as is generally thought, and doing this raises the propellors too near the surface. This causes slip and cavitation even when running straight courses, and on turns the effect is very marked. When trim tabs are installed on these launches they should perhaps be the permanently set type, with any necessary adjustment being made with a wrench at the beginning of the season, but the drag caused by the attachment bolts may well cancel out any slight benefit that might be gained by their use.

RESULTS OF HYDRO III TESTS ON NOVEMBER 27th & 28th.

Full fuel tanks (122 gals. gasoline), new generator, anchor, fire extinguisher, small magnetic compass, three lifejackets and two men. Ballast of 1000 lbs. distributed.

Wind 10-12 knots, Waves 6"-12"          Freeboard F)35"  A)28"

| R.P.M. | BREAKWALL IN SECONDS | SPEED IN KNOTS | CONSUMPTION GALS. PER HOUR | ENDURANCE IN HOURS | RANGE IN MILES |
|---|---|---|---|---|---|
| 3000 | 120 | 8.4 | | | |
| 3500 | 99 | 10.2 | 8.3 | 14.8 | 151 |
| 4000 | 76 | 13.1 | 10.2 | 12.0 | 156 |
| 4300 | 60 | 16.8 | 11.6 | 10.5 | 176 |
| 4500 | 54 | 18.5 | 12.5 | 9.8 | 181 |
| 4800 | 47 | 21.4 | present max. R.P.M. | | |

| R.P.M. | SPEED IN KNOTS | | | |
|---|---|---|---|---|
| | 1) | 2) | 3) | 4) |
| 3000 | 8.4 | 8.4 | 8.5 | 8.3 |
| 3500 | 10.3 | 10.2 | 10.3 | 10.2 |
| 4000 | 15.0 | 13.1 | 13.3 | 12.9 |
| 4300 | 18.0 | 16.8 | 16.8 | 16.4 |
| 4500 | 19.4 | 18.5 | 18.5 | 18.0 |

Test Conditions:

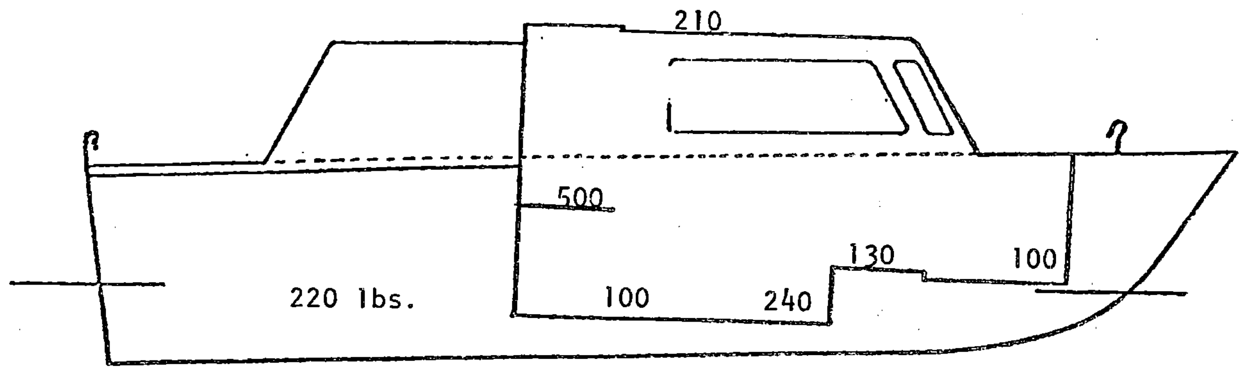
1) Outdrive legs in maximum down position.

2),3)&4) Outdrive legs in middle position.

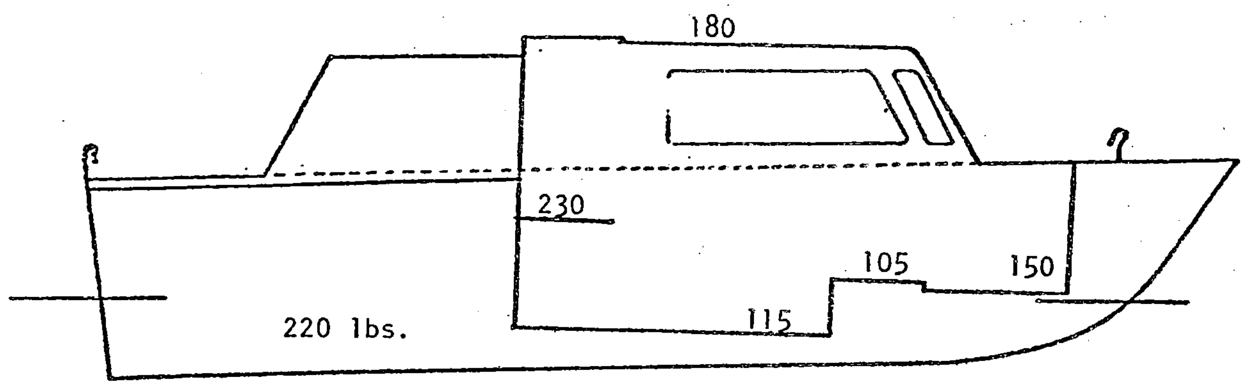
3) Weight of 110 lbs. moved forward a distance of 10 ft.

4) Same as 3) in waves of 2 ft.

# WEIGHT DISTRIBUTION DURING HYDRO III TRIALS




Total Ballast 1500 Lbs. Freeboard Forward 34", Aft 28"




Total Ballast 1000 Lbs. Freeboard Forward 35", Aft 28".

In this condition, total weight of boat and contents (including full fuel tanks) was found to be 8700 Lbs.

## FUEL CONSUMPTIONS DURING TRIALS

Comparison of the fuel consumption figures of a pair of matched power units is always interesting, and in the case of the twin Volvo 170 h.p. inboard-outboard gas engines mounted in the Hydro III this was sometimes found during these trials to be the first or even the only tangible indication that all was not well in the engine compartment. As can be seen in the figures in the table, the fuel consumption over a twenty minute test period is generally the same for the two engines, and when the difference is more than about 10% this is a good indication (two out of four occasions) that something is wrong.

## HYDRO III FUEL CONSUMPTION COMPARISONS OVER A 20 MINUTE PERIOD

| | | | R.P.M. | SPEED | CONSUMPTION PORT | CONSUMPTION STAR | |
|---|---|---|---|---|---|---|---|
| Overload : | 2000 lb. | Nov 8 | 3500 | 9.3 | 1.6 | 1.4 | a |
| | | | 4000 | 12.3 | 1.9 | 1.9 | |
| | | | 4300 | 14.5 | 2.2 | 2.2 | |
| | | | 4500 | 16.0 | 2.3 | 2.3 | |
| Full Load : | 1500 lb. | Nov 18 | 4000 | 13.1 | 1.85 | 1.95 | |
| | | | 4500 | 12.3 | 2.6 | 2.9 | b |
| | | Nov 19 | 3500 | 10.2 | 1.4 | 1.3 | |
| | | | 4000 | 12.8 | 1.6 | 1.65 | |
| | | | 4300 | 14.8 | 2.05 | 2.08 | |
| | | | 4500 | 17.1 | 2.2 | 2.15 | |
| | | Nov 21 | 4300 | 11.8 | 2.1 | 2.15 | c |
| | | Nov 22 | 4300 | 14.2 | 2.05 | 2.45 | d |
| Part Load : | 1000 lb. | Nov 27 | 3500 | 10.2 | 1.45 | 1.3 | e |
| | | | 4000 | 13.1 | 1.65 | 1.75 | |
| | | Nov 28 | 4300 | 16.8 | 1.93 | 1.95 | |
| | | | 4500 | 18.5 | 2.05 | 2.1 | |

During these consumption trials there were five figures worth noting:

a) November 8th. There was no apparent reason for this 14% difference in consumption between the two engines.

b) On November 18th with 4500 R.P.M. the boat's speed was equivalent to about 3800 R.P.M. and the engines had a slightly "deeper" or labouring sound. Fuel consumption on both engines was higher than expected, with the starboard engine using about 12% more than the port engine. Each engine has three carburetors, and adjustments to these and to the tappets solved the problem.

c) Again, on November 21st with 4300 R.P.M. the boat speed was down to the equivalent of about 3650 R.P.M., but on this occasion, although the fuel consumption was up slightly there was no notable difference between the two engines, and carburetor adjustments seemed to solve the problem.

d) On November 22nd the fuel consumption on the starboard engine was 20% higher than on the port engine, but in this case the only other symtom was a 300 R.P.M. drop in the all-out top engine speed, which was attributed to lower ambient temperatures. Further investigation by the mechanic revealed that one valve rocker was moving much less than the others, thus indicating a problem with the camshaft. The remedy in this case was to replace the entire engine on warranty.

e) On November 27th with a new starboard engine the fuel consumption figures were 11% different for no apparent reason.

It is assumed that these engine troubles are teething problems, as the engines are new with only the testing hours on them. On the three occasions noted above where the engines needed attention, having a water speed indicator on board would have given the coxswain a more immediate warning of trouble, but in practice it is instantly obvious when the speed is considerably lower than expected as the "rooster tail" is closer to the stern.

## CHANGE OF TRIM WITH SPEED

There has been considerable misunderstanding concerning planing launches and the attitude of the launch when travelling at speed. Many boats such as the Botved 21 ft. launch travel very nose high until they reach planing speeds, then when the speed is high enough i.e. when the launch has climbed its own bow wave, the bow drops down and the launch travels in a horizontal attitude. This attitude is often known as being "up on the step". The Bertram launch such as those in the Hydro series, however, acts quite differently as the following figures show. When moving at slow speeds the bow rises a few inches due to the shape of the hull, then as the speed increases so does the height of the bow. As can be seen from the figures, then, the bow does not drop down as the boat planes but rises slightly with higher speeds.

The "freeboard" figures given here are not technically freeboard figures as such but are the measurements at the bow and at the sides of the stern, from the water surface to the deck level or gunwale.

### FREEBOARD MEASUREMENTS FOR HYDRO III IN 1000 LB. CONDITION

| R.P.M. | SPEED | BOW | STERN |
|---|---|---|---|
| At Rest | 0.0 | 35" | 28" |
| 3000 | 8.4 | 42" | 25" |
| 3500 | 10.2 | 55" | 22" |
| 4000 | 13.1 | 61" | 20" |
| 4300 | 16.8 | 64" | 21" |
| 4500 | 18.5 | 65" | 21" |

WEIGHT OF BOAT EQUIPMENT

Determining that the launch performs satisfactorily at 17 knots with a payload of 1500 lbs. is only half the exercise. Just as important is to find how much weight the boat has to carry to be of use in our hydrographic survey work, and to this end each item of electronic equipment and each piece of boat equipment was listed and weighed. The list below of the boat requirements gives typical figures in the case of the bar check, hand lead etc. as these vary, but the weight of the inflatable life raft is a "best" figure as this can vary from a low weight of 45 lbs. for a four man flat-pack version to a high of 240 lbs. for an eight man type canister with its cradle. The list does not include the two extra fifty pound anchors that many coxswains like to take along "just in case", for the launch weight during trials included the standard Danforth type anchor and its line.

There were two men on board during all the trial runs, but for safety reasons there is always a third man on board during survey operations even though his services may otherwise not be required, so his weight must be taken into consideration.

| | | |
|---|---|---|
| Bar Check | 80 | lbs. |
| Tool Kit, First Aid Kit | 50 | |
| Inflatable Life Raft | 60 | |
| Distress Flares Kit | 15 | |
| Lifejackets (4) | 20 | |
| Fire Extinguisher | 20 | |
| Hand Lead and Line | 20 | |
| Rubber Fenders (4) | 25 | |
| Oars, Boathook | 10 | |
| Shoal Buoy and anchor | 20 | |
| Total of Gear: | 320 | lbs |
| Third man | 180 | |
| Total | 500 | lbs |

WEIGHT OF ELECTRONIC EQUIPMENT

The major unknown has often been the electronic part of our equipment, and in the last few years with the advent of electronic positioning systems and data acquisitioning this unknown has become larger and increasingly important. The electronics may be grouped under five main headings:

a) Navigation and Communications
b) Sounder
c) Survey positioning system
d) Data logging system
e) Data processing system

The fifth group (data processing) has not been included in the following list as the equipment available locally is presently in use, and such systems generally require more space and weight capacity than is available on small launches such as the Hydros.

Power requirements and dimensions of the electronics are also essential items of information, and are included in the list for reference.

| a) Navigation & Communications | WEIGHT (lbs) | VOLTS | AMPS | DIMENSIONS |
|---|---|---|---|---|
| Lambda Power Supply | 79 | 110 | 3+ | 19x18x 6 |
| 2 Heavy Duty Batteries | 150 | | | |
| | 229 | | | |
| Arma-Brown Gyro | 44 | 24 | 8 | 14x13x11 |
| Motor Generator | 111 | | | 16x13x10 |
| Junction Box etc. | 23 | | | 11x10x 5 |
| Gyro Repeater (each) | 10 | | | 12x10x 5 |
| | 188 | | | |
| VHF Radio Converter | 8 | | | 12x 6x 6 |
| Clipper II | 14 | 12 | 15 | 13x10x 5 |
| Raytheon 50 | 12 | 12 | 5 | 15x12x 4 |
| Comco, with remote spk. | 7 | 12 | 2 | 14x 8x 3 |
| H.F. Radio C.H. 25 | 26 | 24 | 7½ | 14x11x 7 |
| Antenna Tuner, CH 25 | 9 | | | 14x11x 7 |

| | WEIGHT (lbs) | VOLTS | AMPS | DIMENSIONS |
|---|---|---|---|---|
| a) Navigation etc. (Cont'd) | | | | |
| Kelvin Hughes Radar | 52 | 24 | 14 | 26x18x13 |
| 17-9 Transmitter Unit | 35 | | | 25x16x 8 |
| Scanner 6ft or 4ft | 103 | | | 6'or 4'x22 |
| Motor Alternator | 48 | | | 12x 9x 7 |
| | 238 | | | |
| Voyageur V Radar | 30 | 24 | 6 | 21x13x11 |
| Transceiver | 43 | | | 21x13x10 |
| Scanner 42" | 50 | | | 42"x15 |
| | 123 | | | |
| Decca Radar, 2-17 | 72 | 24 | 9 | 25x20x18 |
| Transceiver | 39 | | | 18x16x 8 |
| Power Supply | 42 | | | 18x16x 8 |
| Scanner 4ft. | 83 | | | 48x20x13 |
| | 236 | | | |
| Decca Radar,101 | 33 | 24 | 7½ | 18x13x13 |
| Power Supply | 16 | | | 13x10x 5 |
| Scanner 42" & Trans. | 80 | | | 26x15x12 |
| | 129 | | | |
| b) Sounders | | | | |
| Raytheon, Portable | 41 | 12 | 5 | 17x15x 9 |
| Battery, 12V car type | 45 | | | 12x 9x 7 |
| | 86 | | | |
| Kelvin Hughes (various) | 86 | 24 | 4 | 19x14x11 |
| Transc. & Power Supply | 22 | | | 14x12x 6 |
| Transducer | 30(approx) | | | |
| | 138 | | | |
| Edo, 9040 | 54 | 24 | 5 | 20x14x10 |
| Transducer | 30 | | | 8"diamx5 |
| | 84 | | | |
| Ross, Chart Display | 32 | 24 | 8 | 21x14x 6 |
| Transceiver | 21 | | | 19x16x 7 |
| Power Supply | 19 | | | 19x14x 6 |
| Transducer | 14 | | | 9"diamx4 |
| | 86 | | | |
| Atlas, Deso 10 | 56 | 24 | 5 | 19x18x 8 |
| Transceiver | 39 | | | 19x16x 9 |
| Transducers (pair) | 27 | | | 10"diamx5 |
| | 122 | | | |

| | WEIGHT (lbs) | VOLTS | AMPS | DIMENSIONS |
|---|---|---|---|---|
| c) Survey Positioning Systems | | | | |
| Motorola RPS display | 6 | | | 12x 8x 3 |
| Range Consol | 31 | | | 20x18x 6 |
| Multiplexer | 40 | 24 | 5 | 20x18x 6 |
| Scanner (or use Radar) | 80 | 24 | 6 | 48x20x13 |
| Equipment Rack | 36 | | | 30x21x16 |
| Cables etc. | 4 | | | |
| | 197 | | | |
| Minifix Receiver | 30 | 24 | 4½ | 19x13x 9 |
| Buffer Box | 8 | | | 19x 4x 3 |
| Left-Right Indicator | 7 | | | 15x10x 7 |
| | 45 | | | |
| Decca Receiver 6F | 30 | 24 | 7 | |
| Transceiver | 50(approx) | | | |
| Digitiser | 32 | | | 19x14x 9 |
| | 112 | | | |
| MiniRanger Display | 25 | 24 | 2 | 19x19x 5 |
| Transceiver etc. | 12 | | | 9x 6x 6 |
| | 37 | | | |
| Hydrodist Master | 44 | 12 | 7 | 19x19x19 |
| Power Pack | 7 | | | 10x 7x 6 |
| Left-Right Indicator | 13 | | | |
| Dish Antenna (in box) | 28 | | | 19x19x 9 |
| | 92 | | | |
| d) Data Logging Systems | | | | |
| INDAPS | | | | |
| Power Supply | 36 | 110 | 4 | 19x10x 7 |
| Computer | 30 | | | 19x18x 7 |
| C.A.T. Power Supply | 17 | | | 19x 9x 6 |
| Mag. Tape D.C. 300A | 14 | | | 19x15x 6 |
| Multiplexer | 23 | | | 19x15x 9 |
| Sounder Digitiser | 14 | | | 19x14x 6 |
| Printer & Controls | 16 | | | 19x17x 7 |
| Equipment Rack | 80 | | | 42x24x22 |
| | 230 | | | |

d) Data Logging Systems (Cont'd)

| | WEIGHT (lbs) | VOLTS | AMPS | DIMENSIONS |
|---|---|---|---|---|
| H A A P S | | | | |
| Digital Coupler DC 211 | 22 | 110 | 4 | 19x14x 9 |
| Tape Drive, Kennedy 1600 | 41 | | | 19x12x12 |
| Sounder Digitiser | 14 | | | 19x14x 6 |
| Equipment rack | 36 | | | 30x21x16 |
| Second rack | 36 | | | 30x21x16 |
| Printer HP 5050B(option) | 45 | 110 | 1 | 19x18x 9 |
| | 194 | | | |

SUMMARY OF ELECTRONICS

| | | WEIGHT IN LBS. |
|---|---|---|
| Lambda, Supply & Batteries | | 229 |
| Gyro with one repeater | | 188 |
| Radios : | Using Clipper II | 57 |
| | Using Raytheon 50 | 55 |
| | Using Comco | 50 |
| Radar : | Kelvin Hughes 17-9 | 238 |
| | Voyageur V | 123 |
| | Decca 2-17 | 236 |
| | Decca 101 | 129 |
| Sounder : | Raytheon, DE 719, Portable | 86 |
| | Kelvin Hughes | 138 |
| | Edo 9040 | 84 |
| | Ross | 86 |
| | Atlas, Deso 10 | 122 |
| Positioning : | Motorola R.P.S. | 197 |
| | Minifix | 45 |
| | Decca 6F | 112 |
| | MiniRanger | 37 |
| | Hydrodist (Master) | 92 |
| Data Logging : | I N D A P S | 230 |
| | H A A P S | 194 |

## REQUIRED WORKLOAD FOR MODERN HYDROGRAPHIC SURVEY WORK

| | | | | |
|---|---|---|---|---|
| Boat equipment & third man | | 500 lbs | | 500 |
| Nav. & communications | (Raytheon VHF) | 472 | (Comco VHF) | 467 |
| Radar | (Decca 101) | 129 | (Voyageur) | 123 |
| Sounder | (Ross) | 86 | (Edo) | 84 |
| Positioning system | (Minifix) | 45 | (MiniRanger) | 37 |
| Data logging | (INDAPS) | 230 | (HAAPS) | 194 |
| | Required Payload : | 1462 lbs | | 1405 lbs |

This is a "best" condition. Should the launch be required to work with other equipment the weight figures are much greater.

| | | | | |
|---|---|---|---|---|
| Boat equipment & third man | | 500 lbs. | | 500 |
| Nav. & communications | (Clipper II) | 474 | | 474 |
| Radar | (K.H. 17-9) | 238 | (Decca 2-17) | 236 |
| Sounder | (Atlas) | 122 | (K.H.) | 138 |
| Positioning system | (Decca 6F) | 112 | (R.P.S.) | 197 |
| Data logging | (HAAPS) | 194 | (INDAPS) | 230 |
| | Required payload : | 1640 lbs | | 1775 lbs |

One important point to note is the marked differences in weight between the various electronic positioning systems, from the low of 37 lbs. for the MiniRanger to the high of 197 lbs. for the R.P.S., though this latter figure could be reduced by using the lightweight omni-directional antenna - with the attendant loss in range - instead of the rotating scanner.

The differences in weight of the various batteries now available should also be noted. The Lambda battery charger needs a pair of batteries (for the 24 Volts) and the weight of these can vary from 45 lbs. to 140 lbs. each, depending on the size. The standard car battery may, however, not have enough capacity, while the largest battery is needlessly large and heavy, and may in fact be the cause of the Lambda burning out. The figures used in the above lists is a mean figure, such as the truck or bus battery.

## CONCLUSIONS AND RECOMMENDATIONS

These tests of Hydro III with its new twin Volvo 170 h.p. inboard-outboard gas engines have shown quite clearly that these engines are a suitable choice, for even when the launch was dangerously overloaded the engines performed well, but without seeming to be over powerful for the boat when in light condition.

This preliminary series of tests has also shown that with full fuel tanks the Hydro launch cannot safely work with an additional load as great as 2000 lbs, but with a payload of 1500lbs the launch handles safely and easily, with a top working speed of about 17 knots (at 4500 rpm) and under these conditions the endurance is about 9 hours, giving a range of about 150 miles.

With the smaller payload of 1000 lbs. and full tanks the top working speed at the same 4500 rpm increases to 18½ or 19½ kts, the endurance is nearly ten hours, and the range 180 to 190 miles. These figures are all extrapolated from comparitively short test periods of twenty minutes, but the test results generally compare well with each other, and are probably reliable.

The trials were run with full fuel loads of 122 gallons of gasoline which weighs about 1100 lbs. and as the fuel is used the weight on board becomes less, so in practice the speed, range and endurance over a day's run will all be better than the results indicate. For example, the launch setting out in the morning with the maximum payload of 1500 lbs. and working at 17 knots on 4500rpm will by lunch time in effect be in the 1000 lb. condition, working at 19 knots with the same 4500 rpm.

For this reason, then, it is my opinion that we may consider the 1500 lbs. payload as being a working maximum rather than an "occasional"maximum work load, as long as the 1500 lbs. is not exceeded.

The endurance on full tanks is presently about 9½ to 10 hours, in loaded condition, but with the addition of two ten gallon auxiliary tanks the endurance could be increased to the more desireable twelve hours to give some margin for emergencies. These auxiliary tanks could be fitted one each side against the hull in presently unused space between the engines and the main fuel tanks, which is where the four small tanks were stowed during these trials. The empty tanks would each weigh about 20 lbs, thus not adding much weight when not used, but when the required load of electronics and other gear is less than the maximum these tanks could be filled - thus adding some 170 lbs. weight - for the greater range. I recommend that such auxiliary tanks and the filling pipes be fitted while the launches are still in the workshop for their engine refit.

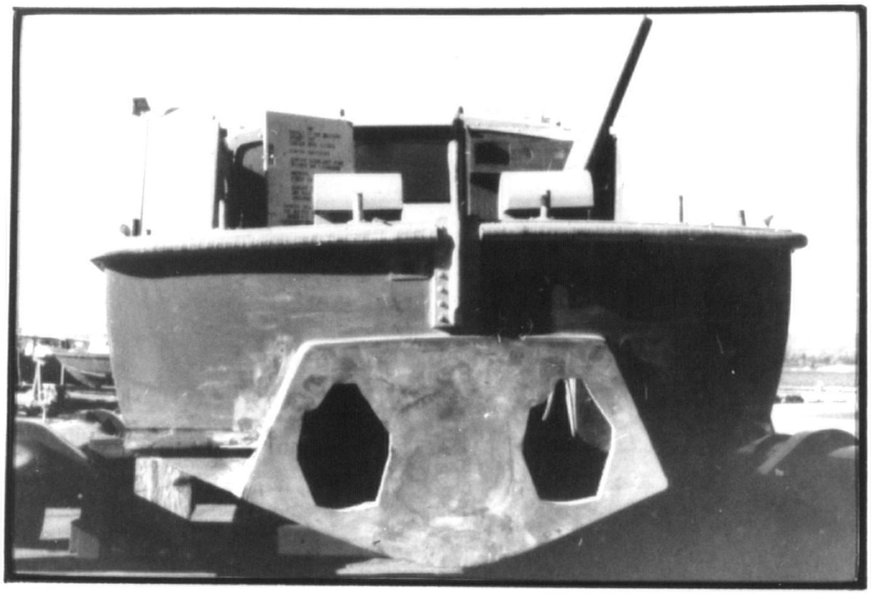
One problem with these Hydro launches has been excessive spray coming over the exposed control position. Other Bertram launches have tried dual controls with a wet-weather position inside the boat, but this introduces visibility problems. During the spring series of trials we plan to experiment with canvas or fibre glass canopies, perhaps with perspex windows.

Due to their greater weight, the formation of the hull, and the nose-high attitude at speed these launches would seem to be better sea boats than the slightly smaller Botved launch, being able to continue at speed in conditions where the Botved must reduce speed. The Hydro launch is also a much better launch than, for example, the Brock (also a 25 ft. Bertram), as the turning circle at speed is smaller, the launch is easier to control, and it is more comfortable in choppy waters. The Brock, however, has the advantage of having the cab over the steering position.

As has been mentioned earlier, this Evaluation program is one of Investigation as well as Testing, and having carried out enough testing to indicate that the new form of engines is suitable and that the launch is indeed capable of carrying the required load to work with modern hydrographic surveys, it is now planned to go deeper into the background and past experiences with launches of this type. To this end short visits to the other regions are planned to discuss the Bertrams with those who have worked with them in the past and those who are working with them at the moment. There has been a lot of general dissatisfaction with this type of Bertram, and it is hoped to ascertain whether or not this is due mainly to the previous lack of performance, or whether there are other points that should be considered.

This report, then, is purely a preliminary one designed to show the performance of the Hydro III during the first series of trials and to indicate the suitability of the launch for our hydrographic survey work.

J. H. Weller,
December 31, 1974.



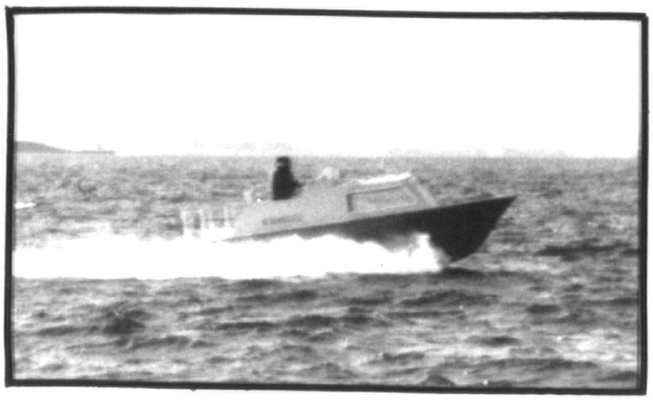
Rear view during conversion, showing holes cut for the twin engines. Hole for previous single engine has been filled.

Hydro III during trials :

At rest...

and

...At speed.



Note the nose high attitude of launch. Photo at 4500 rpm.