EVALUATION TRIALS OF BERTRAM LAUNCHES

NOVEMBER 1974 - MAY 1975

J.H. WELLER

ACKNOWLEDGEMENTS

On a project like this, one needs a great deal of background information, personal comments and advice, and I owe thanks to many people for their help. In particular, I must thank Phil Corkum at Headquarters, "Sandy" Sandilands and Graham Richardson (Pacific) and Ross Douglas (Atlantic) for their help.

Some of my information came from files, and I am very grateful to the conscientious person (unknown) who made such a good job of keeping files on Hydro III and IV. These files were transferred with the launches in February 1974 and made my job very much easier. Would that all launch files were kept that way.

Many field reports contributed some background information:

Central Region:	1966	E. Brown, "Bertram 25 ft. Launch"
	1967-68	Final Field Reports, Georgian Bay Survey
	1969-71	Final Field Reports, Lower St. Lawrence
	1972	Final Field Report, James Bay Survey
	1974	D. Pugh, Report on CSL BRUCE
	1974	Final Field Report, Lake Winnipeg Survey
Pacific Region:	1967	B.M. Lusk & T. McCulloch, "Evaluation of CSL BELUGA"
	1968-74	Final Field Reports, CSS WM. J. STEWART
	1970-73	Final Field Reports, CSS PARIZEAU
Atlantic Region:	1971	P.L. Corkum & G.R. Douglas, Launch Reports
	1971	Launch Reports, CSS KAPUSKASING
	1972	Launch Reports, CSS BAFFIN
	1974	A.L. Adams & D.D. LeLievre, Launch Reports
	1975	G.R. Douglas, Resumé of Atlantic Bertram Experience

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SUMMARY

From a beginning in 1966, the three Regions of the Canadian Hydrographic Service have all used the 25 ft. Bertram planing hull as the basis for a high speed survey launch. This was with the intention of helping to increase production and perhaps lower the unit cost of our hydrographic survey work by taking advantage of the high speed possibilities of our new survey techniques.

The Central Region, Pacific Region and Atlantic Region have all used these 25 ft. Bertram launches, but with remarkably different results. These different results have had widely different reactions, even to the extent of having some of these launches written off completely while others - virtually identical - are considered as being almost the ideal hydrographic survey vehicle.

The reason for this present evaluation program for the Central Region's 25 ft. Bertram launches was to investigate the problems that seemed to be associated with this type of launch in general, and the four Hydro launches in particular. This meant doing a complete study of their individual performance to try to pinpoint any faults or areas of weakness. These would then be rectified or acknowledged to ensure that these very expensive launches would be used to the best advantage in coming years.

CENTRAL REGION EXPERIENCE

Nine years ago, early in May 1966, the Georgian Bay survey party at Tobermory took delivery of two new 25 ft. survey launches - the BRANT and the BITTERN. These were fibreglass cabin cruisers, based on the very popular Bertram hull and powered by twin gas engines.

The launches in use by the Canadian Hydrographic Service at the time were the aging 26 ft. and 31 ft. wooden launches capable of working at speeds of around 7 or 9 knots. These speeds, however, did not seem adequate when contemplating the possibilities of modern survey equipment, and the purchase of these two new 25 ft. Bertram launches was part of a long stride into the future for the Canadian Hydrographic Service. These new launches were capable of 24 knots. They were spacious and attractive boats for our hydrographers, and the Canoe Cove Marina boat builders were incorporating several features into the standard Bertram Express Cruiser hull to meet our specifications.

Due to the Georgian Bay survey work being done with sextants at a scale of 1:25,000 or larger, the sounding speed was generally kept down to about 11 or 12 knots. This was, however, still 3 or 4 knots faster than the other launches, and in fairly calm waters these new launches could get to the survey area at greater speeds thus saving a lot of time. In rougher weather these new launches pounded considerably, but even when forced to reduce speed they were still faster and much drier for the personnel than the old launches, and thus more comfortable.

During that first season, the BRANT and the BITTERN recorded 510 and 560 hours of operation respectively, but throughout the season they were tormented by mechanical troubles. The launches were powered by twin 120 h.p. gas inboard/outboard MerCruisers with MerCruiser stern drives, and most of the engine troubles were experienced early in the season, but then later in the season the stern drives were having major problems and were apparently wearing out.

The following year, the two Bertrams were used in the offshore areas of the Georgian Bay survey and operated much more satisfactorily than in the previous year, and were well suited to the work. With their high speed on this Mini-Fix survey and their better seaworthiness their performance was very good, and compared with that of the older launches, their production and performance were remarkable. That year, moreover, the gas engineer had taken a preparatory MerCruiser course which gave him valuable knowledge and self-confidence. This saved the party the problems associated with having to rely on the help of local mechanics and this probably helped towards the low incidence of engine troubles.

In 1968, another 25 ft. Bertram - the BRONTE - joined the Georgian Bay survey, and the three launches performed very well. There were the usual minor mechanical matters, but no major breakdowns.

The Lower St. Lawrence survey party, in 1969, had five Bertrams in addition to eight other craft: the BRANT, BITTERN, BROCK, BRONTE, belonging to the Central Region, and the DUNLIN which was a similar launch from the Atlantic Region powered by a single Chrysler 300 h.p. inboard/outboard engine. This year there was a tremendous amount of engine trouble on all these launches, with the older MerCruiser engines on the BRANT and BITTERN proving marginally less unreliable than the newer twin Volvo 150 gas inboard/outboard engines on the BROCK and BRONTE. The Chrysler engine on the DUNLIN operated well at first, but later developed valve trouble and became unserviceable.

In 1970, the four Central Region Bertrams continued with the Lower St. Lawrence party and again were plagued with engine and outdrive problems. The Volvo 150/200 units in the BROCK and BRONTE were replaced with Volvo 170/250 assemblies, but still there were mechanical troubles. Total down time was 10% for the two MerCruiser launches and 50% for the two Volvo engined launches, though this seemed to be largely due to salt water corrosion on engine blocks and the steel shafts.

Due to this dismal record, the Volvo engines were stripped from the BROCK and BRONTE and replaced with the MerCruiser 160 engines. These engines performed much better, and gave a top speed of around 30 knots during the 1971 season.

In September of 1970, the hulls of the two older Bertrams began to disintegrate after their four seasons of hard use and required strengthening, and after this hull overhaul the BRANT and BITTERN were fitted with single

Volvo 220 h.p. diesel engines. This was an experiment in reliability, but the speed was now down to 17 knots, and the shaft and rudder assembly was now more vulnerable.

During the 1972 field season, the two diesel Bertrams - BRANT and BITTERN - worked with the James Bay party and proved themselves to be very seaworthy even in seas of state 5, though difficult to steer in a following sea. The diesel engines gave little trouble, but the working speed of 12-15 knots was quite a reduction from their original 24 knots and the 30 knots of the BROCK and BRONTE.

THE CENTRAL REGION FLEET OF 25 FT. BERTRAM LAUNCHES

NAME	BUILT	FUEL	ENGINES	HORSEPOWER
BRANT	1966	diesel	single Volvo TMD70	220
BITTERN	1966	diesel	single Volvo TMD70	220
BROCK	1968	gas	twin Mercruiser 165	330
BRONTE	1968	gas	twin Mercruiser 165	330
BRUCE	1968 *	diesel	single Cummins 370	320
HYDRO I	1971 **	gas	twin Volvo 170	340
HYDRO II	1971	gas	twin Volvo 170	340
HYDRO III	1971	gas	twin Volvo 170	340
HYDRO IV	1971	gas	twin Volvo 170	340

* - the BRUCE was lengthened in 1973 and is now a 31 ft. launch.

** - the four Hydro launches were transferred from the Atlantic Region in 1973 and 1974.

PACIFIC REGION EXPERIENCE

In 1967, the Pacific Region of the Canadian Hydrographic Service acquired the 20 ft. Bertram launch BELUGA. She was assigned to the survey party working in the Tuktoyaktuk area so that tests could be run under operational conditions as an evaluation exercise. The results showed that the launch made quite a good sounding vehicle and was capable of operating for hours on end at high speeds in sheltered waters, but at such speeds in rougher conditions, the launch was uncomfortable due to pounding.

The 25 ft. Bertram launch PETREL was bought in 1968 and was used that year with the survey ship WM. J. STEWART. The launch had little down time that first season and was well liked by the field personnel, but the following two seasons were marred by many mechanical breakdowns. The original Volvo Penta twin 95 h.p. diesel engines being apparently worn out after only the two or three seasons use, they were removed and replaced by a single G.M. V6 353 (210 h.p.) diesel engine in 1971. This engine has worked well with little engine trouble being recorded since then.

A second 25 ft. Bertram was delivered in 1969. This was the BARRACUDA. She was promised in March but was not ready in time and was finally picked up from the builders by the WM. J. STEWART on April 15th en route to the survey area. The launch was plagued right from the beginning with problems. The engines, steering, hydraulics, electrics, exhaust, starters, throttles and couplings all gave trouble and finally necessitated two trips back to the builders and a total of 24 days down time during that first season. The next two seasons, the BARRACUDA had more engine breakdowns, and the twin 95 h.p. engines were finally removed and replaced by the single V6 353 G.M. engine which has since given little trouble.

The PETREL and BARRACUDA have seen service each year since then, and continue to operate with the survey ship WM. J. STEWART, working at speeds of about 15 knots.

In 1970, the Pacific Region took delivery of four more 25 ft. Bertrams: the BOLD, BRAVE, BRISK and BRIGHT. They were acquired for use as survey launches in Arctic waters with the survey ship PARIZEAU, and were built with a heavier skin of fibreglass and slightly larger cabins.

These launches performed well in the Beaufort Sea survey, generally working at speeds of 15 or 16 knots for two 8 hour shifts each day. The launches were usually lowered each morning and lifted on board the ship each evening, which is when routine maintenance and any necessary repairs would be carried out. That first year there was no down time because of engine trouble, but the windows were prone to fall in under the slightest pressure, the steering wheels would come off, and the rudders and rudder stocks bent and broke easily. These problems, however, were largely solved and the launches gave "excellent service throughout the season".

The rudders and rudder stocks gave more trouble the following year, but in 1971 and 1972 the four Arctic launches generally gave good trouble-free service working with the PARIZEAU. The survey programs of 1973 and 1974 called on them to do little intensive survey work, so there are few comments on their performance since 1972.

PACIFIC REGION FLEET OF 25 FT. BERTRAM LAUNCHES

NAME	BUILT	FUEL	ENGINES	H.P.
PETREL	1968	Diesel	G.M. V6 353	210
BARRACUDA	1969	Diesel	G.M. V6 353	210
BOLD	1970	Diesel	G.M. V6 353	210
BRAVE	1970	Diesel	G.M. V6 353	210
BRISK	1970	Diesel	G.M. V6 353	210
BRIGHT	1970	Diesel	G.M. V6 353	210
JAEGAR *	1974	Diesel	G.M. V8 555	240

* - The JAEGAR is nominally a 25 ft. Bertram hull, but it has a greater freeboard and is a larger launch.

ATLANTIC REGION FLEET OF 25 FT. BERTRAM LAUNCHES

NAME	BUILT	FUEL	ENGINES
DUNLIN	1966	Gas	twin 115 h.p. Mercury Outboards
WILLET	1966	Gas	single Chrysler, inboard-outboard
GODWIT	1966	Diesel	single Cummins 555, V-drive
JAEGAR	1966	Gas	single Chrysler with Jet-drive

ATLANTIC REGION EXPERIENCE

The Atlantic Region of the Canadian Hydrographic Service purchased four Bertram launches in 1966. These were the DUNLIN, WILLET, GODWIT and JAEGAR. They were originally supplied with twin Volvo diesel inboard-outboard engines but these drive units were not at all reliable, and because of this the launches achieved little success in the first few years. In 1969, the Volvo diesel engines and drive units were replaced with a single Chrysler V8 gasoline engine and outdrive, but although these units were more successful, there was still room for improvement.

The four Hydro launches arrived at the Bedford Institute in 1971 but they gave a lot of trouble. In 1973, they were deemed to be quite unsuitable for Atlantic Region use and they were transferred to the Central Region. Their story is given separately in more detail.

In 1972-73, more or less as a last effort to get more reliability from these launches, a number of changes were made in the propulsion systems.

The GODWIT was fitted with a Cummins 555 and a V-drive. This launch has since been very reliable and has been fully successful with the exception of the vulnerability of the propeller.

The JAEGER was fitted with a Hamilton Jet coupled to a Chrysler gas engine. This has proven quite successful but the engine is not reliable and the boat is not manoeuvrable at slow speeds.

The DUNLIN has had the inner hull and some of the flotation removed. It has been fitted with a pair of 115 h.p. Mercury outboard motors and the results have been quite good. This launch is extremely good in sheltered waters.

The WILLET, fitted with the Chrysler inboard-outboard unit, is presently on loan to the Defence Research Establishment, Atlantic.

In each case, these launches are being utilized on shore based establishments. They have not been used on a ship since 1968 due to the problems encountered in handling.

BACKGROUND ON HYDRO LAUNCHES

The four launches of the Hydro series are 25 ft. Bertram cabin cruisers, very much like all the others. They were built of fibreglass by Canoe Cove Marina, B.C., in 1970-71 and were delivered to the Bedford Institute on April 5, 1971. They were intended for use as survey launches with the survey ship BAFFIN, but it was found that they could not readily be hoisted with her davits without some hull modifications to the launches, so for the 1971 season three of them were assigned to work with the survey ship KAPUSKASING, with Hydro IV being assigned to a shore party.

For two or three months, the four launches performed fairly well, but they turned out to have some potentially serious disadvantages. It was found, for instance, that the launches were difficult to bring alongside a ship for hoisting in anything but calm weather, and they were very awkward to hoist aboard due to being so light and fragile. Their lifting hooks, moreover, were not suitable for the job and were difficult and dangerous to use.

Another design weakness was that the propeller/rudder/shaft assembly was very vulnerable, making the launches quite unsuitable for work inshore or in shoal areas due to the ever present fear of fouling fishing nets or lobster pot lines, and the danger of damage in the event of grounding. There was no protection from such hazards, and the launch would have to be raised by the ship to clear any entanglements, while groundings which were an everyday event for the older wooden launches were quite an adventure for these new boats: in sandy areas a grounding meant that the launch propeller dug a hole, thus leaving the launch "hung up", and in rocky areas damage to the A-strut was inevitable.

A major problem was the power plant. The engines did not have quite sufficient power, and maximum revs were always necessary to keep the launch planing. This meant that the launches could plane happily only in fairly calm waters and in any chop at all they pounded quite noisily, but any speed reduction meant that the launch would plough through the waves in a very uncomfortable way with every wave coming over green. This power problem was, of course, compounded by the need to carry extra batteries (about 200 lbs.) due to the failure of the converters powering the survey equipment.

There was another big disadvantage that had not really been prepared for: all the field personnel were accustomed to handling only displacement launches, but these new boats were designed as planing craft and required an entirely different type of handling. In a cross-wind, for example, the displacement launch ploughs along in the same straight line as before, though somewhat wetter, whereas these new craft needed to be steered with a large leeway allowance. The launch personnel, however, had so many other problems and so many other things to watch for with these new boats that they could not easily spare the necessary time and energy to learning from scratch the totally different handling characteristics of this new type of launch.

That first season the four Hydro launches gave the field men a lot of trouble. Two of them had major engine breakdowns, and all four of them were found to have many "original installation" defects and small leaks which were annoying and caused a great deal of unnecessary work for the maintenance staff. These defects were comparable with those which had caused the Pacific Region's launch BARRACUDA to be returned to the builders, and were entirely the fault of the boat builder.

The next season the launches gave more trouble: in addition to time lost due to normal wear and tear and routine servicing, three of the four launches had major down time. Hydro I lost 24 days due to grounding damage and V-drive problems; Hydro II lost a month or more due to a cracked cylinder block; Hydro III lost over a month due to her oil pressure problems; and Hydro IV had a steering gear difficulty which needed frequent attention.

These troubles coupled with their poor performance, their low speed, and the annoyance of their many small leaks culminated in the four launches being prematurely retired as being quite unsatisfactory from every viewpoint, and none of them was used for survey work during 1973.

In June, 1973, the launch Hydro II was transferred to the Central Region at the Canada Centre for Inland Waters, Burlington, Ontario, where it was overhauled and the original 190 h.p. diesel engine was removed and replaced by a 245 h.p. inboard/outboard O.M.C. gas engine. This produced satisfactory test results with the anticipated work load, and when Hydro I arrived in November, it was similarly re-engined. In December, 1973, the Hydro launches were deemed to be unsuitable for operation in the Atlantic Region, and the remaining two were transferred to the Central Region and were also fitted with the 245 h.p. O.M.C. engine.

In June, 1974, three of the Hydros 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 necessary operating speed, seemingly having a top speed of about nine knots. This meant that the launches could do nothing but "plough" through the water.

All three launches suffered major mechanical breakdowns after only three or four days work, but another CCIW craft was available locally which enabled the survey to continue until the charter of a more suitable vessel could be arranged. The Hydro launches were then returned to the CCIW for a decision on their future.

Such a dismal performance during the 1974 survey season indicated that the engine in use was quite inadequate for the launch under operational conditions. One of the Hydros was therefore fitted experimentally with twin Volvo 170 h.p. inboard/outboard gas engines in place of the single 245 h.p. O.M.C. engine, and preliminary tests proving satisfactory the other three Hydros were then similarly re-engined. This time, however, the mechanical program was to be coupled with an extensive testing and investigation program in order to find and resolve any other problem areas with these boats before they were again put into service on hydrographic field survey work.

THE LAUNCH EVALUATION PROGRAM

The testing part of the evaluation program was basically designed to determine firstly the boat's maximum safe load, and secondly, the power and reliability performance of these new Volvo engines with the maximum safe load and with typical work loads. The big question was whether or not these Hydro launches could be made to work efficiently with the maximum load on board, and whether or not the present fuel tanks would give an adequate working range.

Similar tests were to be run with the other Central Region Bertram launches for comparison and also to help resolve their own trouble areas. Despite their apparently enormous potential in our modern hydrographic survey work, all these launches have given both Ship Division and the Hydrographic field staff a lot of headaches. This had come to the point where these launches were sometimes accepted only with reluctance by field parties, due to their bad reputation. It was hoped, however, that this evaluation program would find and resolve any basic problems so that these expensive high performance launches could be used to the best advantage in years to come.

A major part of these tests 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 rough weather.

A 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 propellers were 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 tests were done in two parts with the first series of trials being run with Hydro III in November and December, 1974, before the other three launches were fitted with the new engines. Due, however, to the limited time available before the approach of winter weather, the first series of trials was neither as complete nor as exhaustive as planned, but the results were 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.

An Interim Report was issued in January to let everyone know the results of that first series of trials, and to give all concerned the opportunity of commenting on the results. Many comments were received, and some of the suggestions were incorporated in the second series of tests, and others have been a help in writing this Report.

In January, we heard from the Volvo Penta agents of a new type of propeller for these engines we were using. This new propeller was claimed to increase performance by about 10%, and all the trials in the second series of tests were run using the new propeller, with remarkable results.

Winter weather continued into April, so our spring testing program was late getting going and one or two tests - such as detailed experiments with trim tabs - had to be dropped from the program. With this minor limitation, however, the tests were satisfactorily completed on April 23, 1975 and the launches were accepted with renewed hope by their respective field parties.

NOTE: Throughout these trials the speed runs were based on the time to pass along the CCIW breakwall, which is a measured distance of 1700 feet. Each speed run was done twice, then meaned.

The launches all had full fuel tanks during these trials, and the fuel consumption runs were each done over a twenty minute test period using small auxiliary tanks.

EVALUATION TRIALS OF HYDRO III WITH 2000 LB. 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 3 Kw 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. The original standard type 14 x 17 propeller was used for these trials.

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. Later, however, 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 AND 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. Propeller used: standard type 14 x 17

R.P.M.	SPEED IN KNOTS	CONSUMPTION GALS. PER HOUR	ENDURANCE IN HOURS	RANGE IN MILES
3000	8.1			
3500	9.3	9.0	13.5	126
4000	12.3	11.4	10.7	131
4300	14.5	13.2	9.2	134
4500	16.0	13.8	8.8	141
5000	19.7	(short periods only)		
5200	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. The standard 14 x 17 propeller was used.

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.

<u>NOTE</u>: All the speed trials are based on the time to pass along the CCIW 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 AND 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. Standard 14 x 17 propeller was used.

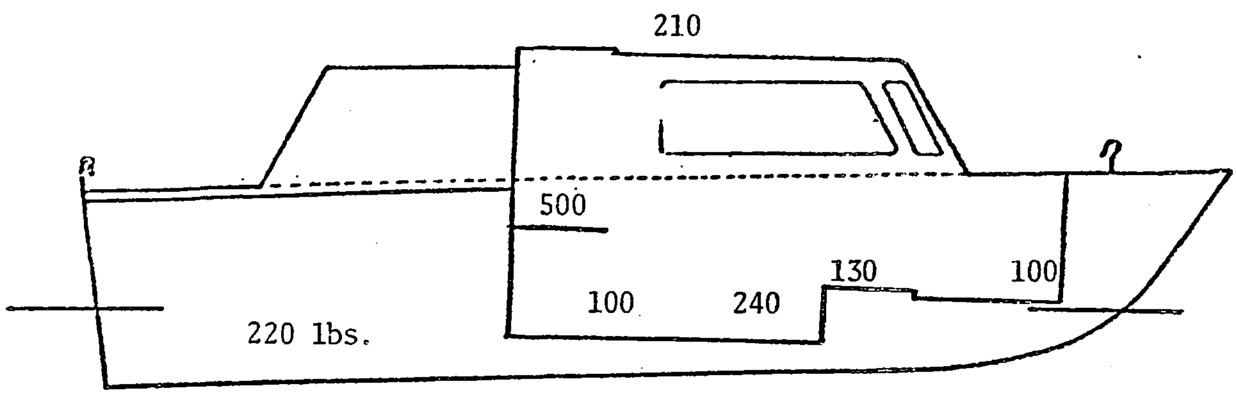
November 18th. Wind - 12-15 knots. Waves - 12-18". Freeboard: F) 34" A) 28"

R.P.M.	SPEED IN KNOTS	CONSUMPTION GALS. PER HOUR	ENDURANCE IN HOURS	RANGE IN MILES
3000	8.5			
3500	10.5			
4000	13.1	11.4	10.7	140
4300	15.1	12.7	9.6	145
4500	16.8			
5000	21.4	(short periods only)		
5250	22.4	(maximum R.P.M.)		

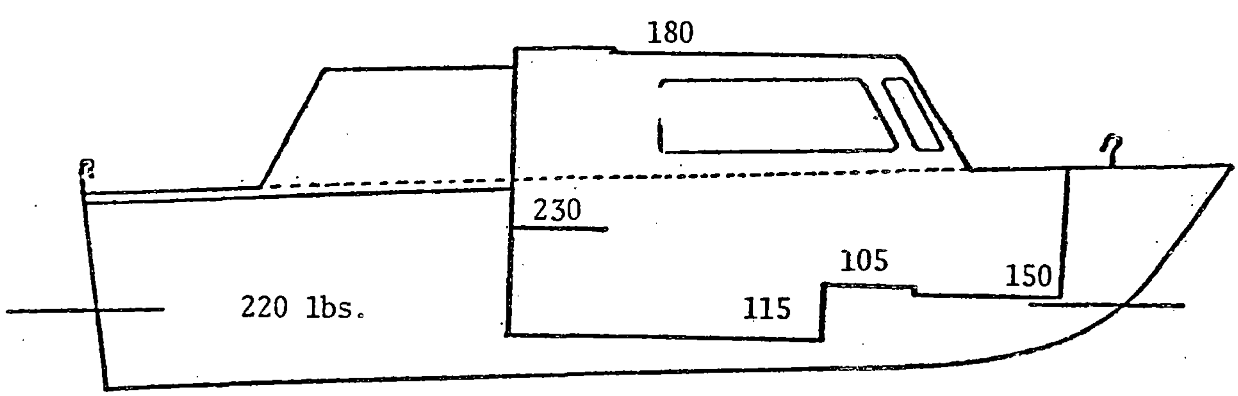
November 19th. No wind, misty, calm waters. Freeboard: F) 34" A) 28"

R.P.M.	SPEED IN KNOTS	CONSUMPTION GALS. PER HOUR	ENDURANCE IN HOURS	RANGE IN MILES
3000	8.4			
3500	10.2	8.1	15.1	153
4000	12.8	9.8	12.4	159
4300	14.8	12.3	9.9	148
4500	17.1	13.1	9.3	159
5000	21.0	(short periods only)		
5350	22.9	(maximum R.P.M.)		

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.

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 propellers 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 AND 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. Standard 14 x 17 propeller used.

Wind 10-12 knots, waves 6-12". Freeboard: F) 35" A) 28"

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

R.P.M.	Speed in Knots			
3000	1) 8.4	2) 8.4	3) 8.5	4) 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.

THE NEW PROPELLER

During the first series of tests the launch performed really well. Fitted with the twin Volvo 170 h.p. inboard/outboard gas engines, the Hydro III was running very happily at 17 or 18 knots with a 1500 or 1000 lb. payload, and she was handling well at these speeds.

There was, however, one problem: to run at these speeds where the launch was planing well with a little spare power, it was necessary to run the engines at high R.P.M. all day. In the Interim Report, I blithely suggested cruising all day every day at 4300 or even 4500 R.P.M., but then some people who know more about engines that I do, told me that we were heading for trouble: these were not like outboard motors and they would not last long running continuously at such high R.P.M. This was equivalent to driving a family car on the highway at 90 m.p.h.: the engine would run well for awhile, but not for long.

Then in January with the second batch of engines, the Volvo dealer sent us a different type of propeller. This was their "high performance" propeller, and it was claimed to increase performance by 10%. It was still technically a 14 x 17 propeller, but it had a much larger blade area, with a blade 7¾" wide instead of 6¼", and it looked quite different. The two propellers are shown side by side in the photograph on page 59 .

The second series of tests was run in April using the new propeller and the results were remarkable: speeds in the working range were increased by 20% or even 30%. The fuel consumption was increased, but an interesting point here is that the range at the various speeds is the same with the two different types of propeller, even with the big difference in R.P.M. Strict consumption comparisons, however, should only be drawn between the two 1000 lb. load sets of tests. These were both run with the outdrive legs in the middle position, but the earlier consumption runs were done with the outdrive legs in the forward or "maximum down" position.

One important point here is that the maximum all-out R.P.M. was now reduced from about 5300 to about 4900, which meant that the engines were now working better.

RESULTS OF HYDRO III TESTS ON APRIL 12, 14 AND 15, 1975

Full fuel tanks (122 gals. gasoline), generator, anchor, small magnetic compass, fire extinguisher, 4 lifejackets and 2 men on board. Tests using new modified (wide area) propellers. Wind: 5 kts. Wavelets: 4" - 6"
Freeboard: F) 34" A) 27"

Ballast of 1500 lbs. distributed.

R.P.M.	Speed In Knots		Consumption Gals. Per Hour	Endurance In Hours	Range In Miles
	Legs For'd.	Legs Mid.			
2500	8.2	8.2			
3000	8.8	9.2			
3500	11.7	12.4	9.8	12.5	155
4000	16.8	15.4	11.6	10.5	162
4300	21.0	19.4	13.2	9.2	178
4500	22.6	22.9	14.2	8.6	197
4850 *			Short Periods Only		

Ballast of 1000 lbs. distributed. Freeboard: F) 35" A) 28"

2500	8.2	8.1			
3000	9.3	9.3			
3500	12.7	12.1	9.5	12.8	155
4000	17.4	15.9	10.9	11.2	178
4300	21.2	20.6	12.2	10.0	206
4500	23.2	22.4	13.7	8.9	199
4900 *			Short Periods Only		

These consumption trials (over 20 minute test periods) were run with the outdrive legs in the middle of three positions.

See next page for comparisons with earlier test results.

* - R.P.M. limited during running-in period.

PROPELLER COMPARISON TESTS WITH HYDRO III

Tests were run using the standard 14 x 17 propeller and the new wide blade 14 x 17 propeller. The outdrive legs were in the forward (maximum down) position for all these runs. Weather was calm throughout. Speeds are given in knots.

R.P.M.	1500 lb. Ballast		1000 lb. Ballast	
	Standard Propeller	Wide Blade Propeller	Standard Propeller	Wide Blade Propeller
2500		8.2		8.2
3000	8.4	8.8	8.4	9.3
3500	10.2	11.7	10.3	12.7
4000	12.8	16.8	15.0	17.4
4300	14.8	21.0	18.0	21.2
4500	17.1	22.6	19.4	23.2
5000	21.0		22.4	

Consumption comparisons with 1000 lb. ballast.

R.P.M.	SPEED IN KNOTS				CONSUMPTION Gals. Per Hour		ENDURANCE IN HOURS		RANGE IN MILES	
	Legs For'd A	Legs For'd B	Legs Mid. A *	Legs Mid. B	A	B	A	B	A	B
3500	10.3	12.7	10.2	12.1	8.3	9.5	14.8	12.8	151	155
4000	15.0	17.4	13.1	15.9	10.2	10.9	12.0	11.2	156	178
4300	18.0	21.2	16.8	20.6	11.6	12.2	10.5	10.0	176	206
4500	19.4	23.2	18.5	22.4	12.5	13.7	9.8	8.9	181	199 C

NOTES:

A - standard propeller. *Wind 10-12 knots, waves 6" - 12"

B - wide blade propeller. Weather was calm.

C - these figures are included only for comparison. These engine speeds are too high for continuous running.

SPEED AND WEATHER TRIALS OF HYDRO IV

Preliminary testing of its new twin Volvo 170 engines giving satisfactory results, the Hydro IV spent April 17th on an all-day run on Lake Ontario with ballast of 1000 lbs. distributed, and the outdrive legs in the middle position.

During the 9 hour day, the launch ran 5 hours at speeds of 12 to 14 knots and for 3½ hours at 15 knots, consuming a total of 80 gallons of fuel. This compares with a consumption of 72 gallons for a similar 9 hour run with Hydro III on April 16th with the legs in the forward position.

On April 18th, two sets of speed trials were run with the launch ballasted with the 1000 lb. load, one set being run in calm waters and the second set under rougher conditions. These two trials were run with the outdrive legs in the middle position, and on April 23rd, for comparison, two sets of trials were run with the outdrive legs in the forward position, one with the 1000 lb. payload and the other with 1500 lbs. Weather was calm.

The launch handled easily throughout these tests and performed well, though under the rougher conditions more power than usual is required to maintain the working speed: above about 4100 R.P.M. the engine is working too hard for sustained operation, and 4500 R.P.M. was virtually the maximum attainable under these conditions.

R.P.M.	Speed in Knots			
	1500 lbs.	1000 lbs. Ballast		
	A)	B)	C)	D)
2500	7.8	8.0	8.0	7.7
3000	8.6	8.8	8.8	8.6
3500	11.6	12.5	12.3	11.9
4000	16.2	17.7	17.7	16.9
4300	20.3	21.4	21.2	20.6
4500	22.5	23.2	23.6	21.9
MAX.	26.0 (4850)	27.0 (5000)		(4500)

TEST CONDITIONS

A&B - outdrive legs in forward position

C&D - outdrive legs in middle position

A,B&C - weather calm

D - weather rougher: 20 kt. wind, 12-18" confused chop

7 lbs / gallon.

COMPARISONS OF THE FOUR HYDRO LAUNCHES

The evaluation trials of the four Hydro launches were concluded on April 23, 1975. The various tests were made as much as possible under the same conditions of weather and load distribution, which, in the case of Hydro III and IV, meant adding extra weight to compensate for the weight of the generator which had been removed in preparation for the field season's requirements. The weight loaded for these trials was also adjusted as necessary to allow for the weight of the various items of equipment already installed.

Hydro I and II have been fitted with light-duty canopies of plywood and fibreglass to protect the coxswain from the elements. These canopies were made with minimum inside headroom so as to reduce the windage area for fear that there would be a reduction in performance, but the test results indicate that adding the canopy has had little effect on performance, so in future we can raise these canopies to give standing headroom inside without fear of any appreciable reduction in speed.

Launch Hydro II is appreciably faster than the other three launches, which is probably because of the different type of bottom paint. On this launch the bottom has a hard glossy finish, but this is, however, liable to foul with weed growth faster than the usual type of bottom paint and may need monthly cleaning to maintain the faster speed.

The engine manufacturer recommends a working speed of about 4000 R.P.M. This gives a speed of 16 to 19 knots (depending on the weight carried and the amount of fuel) and unless the weight is distributed too near the stern, the launches plane happily at this speed. Top speed (the "Red Line") should be considered as being 4500 R.P.M., and to ensure prolonged active life, the engines must not exceed this.

These new Volvo 170 engines with their 280 outdrive units performed very well throughout this second series of tests with no hint of trouble. The launches handled well at all speeds and responded readily to the controls, steering easily and manoeuvring well at both high and low speeds.

RESULTS OF HYDRO LAUNCH TESTS ON APRIL 12-23, 1975

Full fuel tanks (122 gals. gasoline), generator, anchor, small magnetic compass, fire extinguisher, 4 lifejackets and 2 men on board. Tests are using the new modified (wide blade) propellers with outdrive legs in the forward (maximum down) of the three positions.
Weather conditions were calm throughout.
* - the R.P.M. of Hydro III limited during "running-in" period.

Ballast of 1500 lbs. distributed. Freeboard: F) 34", A) 27"

R.P.M.	HYDRO I	HYDRO II	HYDRO III	HYDRO IV
2500	7.9	8.0	8.2	7.8
3000	8.7	8.6	8.8	8.6
3500	11.4	11.9	11.7	11.6
4000 work speed	16.1	17.1	16.8	16.2
4300	20.3	21.0	21.0	20.3
4500 top speed	22.5	23.3	22.6	22.5
±4850 max. R.P.M.	24.7	26.5	*	26.0

Ballast of 1000 lbs. distributed. Freeboard: F) 35", A) 28"

R.P.M.	HYDRO I	HYDRO II	HYDRO III	HYDRO IV
2500	7.9	7.9	8.3	8.0
3000	8.8	9.4	9.3	8.8
3500	12.1	13.0	12.7	12.5
4000 work speed	17.6	18.5	17.4	17.7
4300	21.1	22.3	21.2	21.4
4500 top speed	23.0	23.8	23.2	23.2
±4900 max. R.P.M.	25.3	28.0	*	27.0

FUEL CONSUMPTIONS DURING TRIALS

Comparisons 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 the 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 following 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 12% this is a good indication (two out of three occasions) that something is wrong.

The consumption, endurance and range figures were all extrapolated from comparatively short test periods of twenty minutes, but the figures generally compare well with each other and have been confirmed by the results of the later all-day endurance runs.

The speed and consumption test runs were all done with the tanks full of fuel, which is a weight of about 1100 lbs., so as the fuel is used during the day, the weight on board will become less. This will, in practice, mean that the speed, endurance and range for the launch over a 9 hour day will all be better than the test results indicate. Any such reduction in the consumption, however, would be balanced by the consumption of the 110 V. auxiliary generator, if this is in use. The generator is fed from the main gas tanks and uses about 10 gallons of fuel over a nine hour day.

During all day runs with the 1000 lb. payload, the gas consumption over the 9 hours at speeds of 3500 - 3800 R.P.M. (12-15 kts.) was found to be 72 to 80 gallons. Over 9 hours at speeds of 3800 - 4200 R.P.M. (15-20 kts.) consumption was found to be about 100 gallons, plus ten gallons for the generator.

These all-day runs were with the new wide-blade propellers.

HYDRO III FUEL CONSUMPTION COMPARISONS OVER A 20 MINUTE PERIOD

			R.P.M.	SPEED	CONSUMPTION	
					PORT	STARBOARD
With Normal 14 x 17 propeller						
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
			4000	13.1	1.65	1.75
		Nov. 28	4300	16.8	1.93	1.95
			4500	18.5	2.05	2.1
With Wide-Blade 14 x 17 propeller						
Full Load:	1500 lb.	April 14	3500	12.4	1.58	1.69
			4000	15.4	1.85	2.00
			4300	19.4	2.18	2.22
			4500	22.9	2.38	2.34
Part Load:	1000 lb.	April 14	3500	12.1	1.60	1.55
			4000	15.9	1.85	1.77
		April 15	4300	20.6	2.04	2.02
			4500	22.4	2.27	2.30

ENGINE TROUBLES DURING NOVEMBER TRIALS

During these consumption trials, there were four occasions worth noting:

a) on 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. (old type propeller) the boat 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 noteable 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 symptom was a 300 R.P.M. drop in the maximum attainable engine speed, which was attributed to the colder weather. 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.

On two of 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 much lower than expected as the "rooster tail" is closer to the stern.

It seems that these engine problems were teething troubles as the engines were new with only the testing hours on them, and the camshaft failure was the one-in-a-thousand casting defect. Considering the amount of engine trouble we had experienced with only twenty hours of work with the one launch, we were quite worried about the reliability of the engines and the prospect of a whole season of headaches. During the second series of trials in the spring, however, there was no hint of engine trouble of any kind with all four launches running for thirty or forty hours each.

WEIGHT OF LAUNCHES

At the conclusion of the 1000 lb. series of tests, the launch Hydro III 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.

CHANGE OF TRIM WITH SPEED

"Optimum performance with a deep vee boat cannot be achieved in a bow down position and all efforts must be made to keep the bow high." - Clark Scarboro, Engineering Dept., Canoe Cove Marina Ltd.

There has been considerable misunderstanding concerning planing launches and the attitude of the launch when travelling at speed. Many boats such as our 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, acts a little 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. The stern measurements are a bit deceptive as they are made to the water level at the sides of the stern, and at some speeds this is in a trough which gives the launch an exaggerated nose-high appearance. When the Bertram is "up on the step", however, the bow does not drop down, but instead the stern has risen the few inches from its trough and the bow remains some 30" higher than when at rest.

Freeboard Measurements for Hydro III in 1000 lb. condition

Speed	Bow	Stern	Mean Rise	Actual Rise
at rest	35"	28"	0	0
8.4	42"	25"	+2"	-3"
10.2	55"	22"	+7"	0
13.1	61"	20"	+9"	+3"
16.8	64"	21"	+11"	+8"
18.5	65"	21"	+11½"	+11"

NOTE: The "freeboard" figures given here are not technically freeboards as such but are the measurements at the bow and at the sides of the stern, from the water surface to deck level or gunwale.
The "Actual Rise" figures were with Hydro IV at similar speeds and are included here to show the effect of the boat's stern in its trough.

SOUNDING SPEED ERRORS

As can be seen in the Change of Trim Table, our Bertram launches rise several inches from rest to working speeds. The "Actual Rise" figures were obtained by passing close to a breakwall light pole at the various speeds and sighting on it, and they refer to the transducer position on the launch.

Comparisons of the Actual Rise figures show that the transducer starts rising at about 10 knots, and at working speeds the transducer is about 11 inches higher than when at rest. With the Bertram launch BRONTE this figure was found to be 8 inches.

While doing hydrographic survey work, we generally do Bar Checks to set or check our sounders two or three times each day, but we do these Bar Checks, of course, with the launch at rest. By using planing launches and making no allowance for any transducer rise, we could in effect be building an error into our soundings. In shallower areas this inaccuracy could be appreciable, so perhaps a "sounding speed" correction should be considered when reducing our soundings for inking on the Field Sheet.

During this evaluation program, the "transducer rise" trial was run with Hydro IV and with the BRONTE as being typical of the Bertrams, but perhaps this aspect of all our sounding launches could be studied later as a separate project. It may be that a similar two or three decimetre sounding error exists with others of our sounding launches.

HYDRO IV

R.P.M.	Speed	Rise	
2500	8.0	-3"	
3000	8.8	-2"	
3500	12.5	+3"	
4000	17.7	+11"	work speed
4500	23.2	+11"	
4900	27.0		Max. R.P.M.

BRONTE

R.P.M.	Speed	Rise
2000	7.9	-2"
2500	9.9	0
3000	15.8	+5"
3500	22.9	+8"
4000	27.8	+9"
4400	29.6	+10"

NOISE LEVELS IN THE LAUNCHES

Our survey launches are noisy. This is something all field hydrographers have been aware of for a long time, and we have come to dread the long hot noisy days, but we have learned to live with the problem.

During this series of tests we had the use of a noisemeter, and readings were taken on each launch to see what sort of noise levels we were having to live with for ten hours a day, six days a week. The figures were disturbing, though not unexpected. The noisemeter agrees with the field hydrographer that our launches are noisy. In fact, the figures show that our launches are too noisy. Not one of the launches tested had a noise level at working speeds that was tolerable for ten hours a day under the Canada Labour Code.

Of the launches tested, the four Hydros were the best, with figures just within the limits for an eight hour day without hearing protection (see the Canada Labour Code noise table), but others of our survey launches have a working-speed noise level which is tolerable for no more than 4 hours per day without protection.

One answer to this noise problem is to supply acoustic headsets for everyone who works with our launches, but in my opinion this is not the best solution. The prospect of having to wear acoustic headsets all day to avoid headaches, dulled senses, and prematurely aged hearing, is not good for morale.

In an effort to reduce the engine noise level, the inside walls of the engine compartment and cabin of Hydro IV were sprayed with polyurethane foam insulation to a thickness of 1" - 2", but noisemeter readings showed little improvement at working speeds over the other launches, though the noise level at top speed (4500 R.P.M.) is reduced by about 5 decibels.

The figures in the following table were obtained during the 1000 lb. trials, with the legs in the forward position, i.e. the working condition. Tests showed that with the 1500 lb. load or rougher weather, the figures are increased throughout by about one decibel. Having the generator running adds one decibel at lower speeds but makes no difference over 3000 R.P.M.

NOISEMETER READINGS ON BERTRAM LAUNCHES

These figures were obtained in calm weather with 1000 lb. payload and in working condition. The actual readings in each case were obtained at headlevel at the coxswain's position and in the cabin.

R.P.M.	Average Speed	HYDRO I		HYDRO II		HYDRO III		HYDRO IV	
		Cox'n.	Cabin	Cox'n.	Cabin	Cox'n.	Cabin	Cox'n.	Cabin
2500	8.0	78	77	78	76	75	78	75	76
3000	9.0	83	83	85	81	81	83	80	81
3500	12.6	86	86	88	84	84	85	85	83
4000 work	17.8	89	89	90	88	86	88	87	87
4300	21.5	91	90	92	90	87	90	86	87
4500 top speed	23.3	92	92	94	90	87	92	86	87
4900 ± max.	26.7	95	94	96	95	--	--	--	--

R.P.M.	Speed	BRONTE	
		Cox'n.	Cabin
2000	7.9	84	81
2500	9.9	89	85
3000	15.8	90	88
3500 work	22.9	94	92
4000	27.8	96	95
4400 Max.	29.6	98	95

R.P.M.	Speed	BRUCE	
		Cox'n.	Cabin
1200	8.0	84	85
1600	10.9	89	91
2000	15.9	91	93
2400 work	21.7	94	95
2750 Max.	24.6	96	96

CANADA LABOUR CODE

Canada Noise Control Regulations, amendment, 30 January, 1973

Maximum Permitted Noise Exposure at Worksite

Column 1 Sound Level in Decibels	Column II Maximum Number of Hours of Exposure per Employee per Work Day
more than 87 but not more than 90	8
more than 90 but not more than 92	6
more than 92 but not more than 95	4
more than 95 but not more than 97	3
more than 97 but not more than 100	2
more than 100 but not more than 102	1.5
more than 102 but not more than 105	1
more than 105 but not more than 110	0.5
more than 110 but not more than 115	0.25
more than 115	0

EXHAUST FUMES IN LAUNCHES

On two occasions during the few days that the three Hydro launches were operational on Lake Winnipeg in 1974, a man on board was overcome by exhaust fumes. On one occasion the man fell unconscious, and in the other instance a man became sick. This was a very serious matter, and the exhaust method of these new Volvo 170/280 engines virtually eliminated the fumes danger, but to help cabin ventilation an additional ventilator has been installed on each cabin top.

During this testing program there was only one instance of exhaust fumes being noticed by those on the launch. The engine exhaust gases are led out below the waterline through the outdrive legs, and generally this is a very efficient way of removing the fumes. On November 19th, however, while Hydro III was towing a 21 ft. Monark boat across Hamilton Harbour, almost exactly the same conditions occurred as had been experienced on Lake Winnipeg. The maximum attainable engine revs. were reduced by 400 R.P.M., exhaust fumes rolled forward over the transom into the cockpit, and the engines sounded laboured. Within the thirty minutes of the passage across Hamilton Harbour, at least two of the three persons on board had developed headaches, the third man reporting having had a headache all day.

This condition was virtually an overload condition, caused by the downward effect on the stern of towing the second launch. It would appear, then, that the conditions on the launches on the Lake Winnipeg survey were caused by a similar overloading of the smaller engines that were installed at the time.

With these more powerful Volvo 170/280 engines, this engine overloading should not happen again, except perhaps in the event of an artificial overload such as when towing another vessel. Any weight loaded on board sufficient to overload the engine would be a dangerous overload of the vessel itself as even the 2000 lb. payload which was found during the testing program to be an overload of the launch, did not develop any overload symptoms in the engines.

EVALUATION TRIALS OF LAUNCH 'BROCK'

When the 25 ft. Bertram launch BROCK became available on November 25th, a series of speed and fuel consumption tests was started similar to the trials run with Hydro III.

The fibreglass BROCK, built in 1968, is powered by twin Mercruiser 165 h.p. inboard/outboard gas engines and was equipped basically the same as she had been during the field season, being fitted with Radar, R.P.S., radio, sounder and assorted items of equipment. In this condition, with full fuel tanks, she was found to weigh 8400 lbs. Another 300 lbs. ballast was added, bringing the total weight on board (electronics, equipment, ballast) to about 850 lbs. and the total displacement weight of 8700 lbs. was then the same as that of the Hydro III during the 1000 lb. series of trials.

The BROCK has a permanent shelter built onto the cabin and over the cockpit which protects the coxswain from the elements, but in certain other respects the BROCK seemed to be inferior to the Hydro. The BROCK was found to be less manoeuvrable than the Hydro, generally less easy to steer, and with a larger turning circle. Noise could be a bit of a problem as the engine noise seems to reverberate around inside the cab, though a little more insulation would solve this problem. The cab presents quite a large additional area for wind resistance which was found to reduce the speed by about 100 R.P.M. when heading into a 10-15 knot wind at working speeds, but this seems to be a very small price to pay for the better working conditions provided by this shelter from rain, wind and spray.

The coxswain who was working with the BROCK last year reports that he had little major trouble, and on only one occasion did he have to limp home on one engine which he says was due to the starboard outdrive leg seizing up. He also reports having run the engines flat-out for some hours on occasion with no ill effects, however there was some difficulty with manoeuvring due to the starboard engine sticking in gear, and there were also problems due to having to keep high R.P.M. on the starboard engine to maintain an adequate 24 volt supply for the survey equipment.

It seems that there may be some physical problem with the gear shift controls to the starboard outdrive unit as the hydrographer working with the launch this year mentions that the control cables parted early in the season and gave more trouble later on, making it more difficult to change gear. During these trials there was more trouble with the starboard gear shift, which was found to be due to the cables having parted again.

A second series of trials was started with an additional 500 lbs. of lead ballast on board, but this series was not completed because in my opinion this launch, with the deeper open deck, was overloaded in this condition.

RESULTS OF 'BROCK' TESTS ON NOVEMBER 25TH AND 28TH, 1974

Full fuel tanks (122 gals. gasoline), 850 lbs. of electronics, survey equipment and ballast, and two men on board.

Wind 10-12 knots, waves 6-12"   Freeboard: F) 38" A) 27"

R.P.M.	SPEED IN KNOTS	CONSUMPTION GALS. PER HOUR	ENDURANCE IN HOURS	RANGE IN MILES
2000	8.6			
2300	11.7	9.3	13.1	153
2600	16.1	11.1	11.0	177
2900	20.8	13.2	9.2	192
3200	24.3	15.8	7.7	188
3500	26.5			
3650	28.0	Maximum R.P.M.		

EVALUATION TRIALS OF LAUNCH 'BRONTE'

The 25 ft. Bertram launch BRONTE was built in 1968 and is powered by Mercruiser inboard/outboard gas engines. During these tests, one engine was 160 h.p. and the other 165 h.p., but the 160 engine has since been removed, and the launch is now powered by twin 165 h.p. Mercruisers.

The launch has an aluminum cab built on to the cabin structure to protect the coxswain and the open cockpit from the elements, and is virtually identical to the launch BROCK.

These trials on May 1st were run with full fuel tanks and a load of 1000 lbs. distributed, with the Noisemeter readings being taken at head level.

The launch handled quite well at the higher speeds, but the steering is very stiff which makes low speed manoeuvring difficult and slow. During these tests manoeuvring was made even more difficult for the coxswain due to the starboard engine stalling when changing gear.

The noise levels at working speeds are high and it is therefore necessary to provide protective headsets. This is particularly important for the coxswain as the noise level of 94 decibels is tolerable for no more than 4 hours per day (Canada Labour Code, 1973) without hearing protection. During these tests we were not using headsets and after two hours of tests both men on board had ringing heads and a distinct "flattened" feeling.

As with the BROCK, the BRONTE has the deeper open deck and in my opinion would be overloaded if she were to be used in open waters with a 1500 lb. payload, so she was not tested with this additional 500 lbs.

RESULTS OF 'BRONTE' TESTS OF MAY 1, 1975

Full fuel tanks (120 gals. gasoline), anchor, fire extinguisher, small magnetic compass, 3 lifejackets and 2 men on board.

Ballast of 1000 lbs. distributed.

Weather: calm, smooth waters Freeboard: F) 39" A) 26"

R.P.M.	Speed in Knots	Noise in Dbs.	
		Coxswain	Cabin
2000	7.9	84	81
2500	9.9	89	85
3000	15.8	90	88
3500 work speed	22.9	94	92
4000	27.8	96	95
4400 max. R.P.M.	29.6	98	95

Fuel consumption at 3500 R.P.M. was found to be 13 gals. per hour, which gives an endurance of 9 hours and a range of 206 miles.

The BROCK and BRONTE are virtually identical, with the exception of the 5 h.p. difference in engine power. Both use the normal 17 inch propeller that is standard for the outdrive units, so there is no obvious explanation for the big difference in engine speed. The working range, however, is almost the same for the two launches.

EVALUATION TRIALS OF 31 FT. LAUNCH 'BRUCE'

The BRUCE was built in 1968 as a 25 ft. Bertram launch and has been in service by us with twin Volvo Penta 6 cylinder 150 h.p. gas engines. As an experiment, the BRUCE was lengthened by 6 ft. in 1973 and is now a 31 ft. launch powered by an 8 cylinder Cummins 320 h.p. inboard diesel engine with single screw. The launch was used on field survey work in 1974 and has since received some modifications based on that field experience.

These trials on April 25th were with full fuel tanks and loads of 500 lbs., 1000 lbs. and 1500 lbs. distributed. The weather was calm for these tests, but we plan to run a further series of trials in rougher weather for comparison.

The handling characteristics of the BRUCE are not good, but once a coxswain learns the limitations of the launch these can be lived with. It is, for example, difficult to dock the launch port-side-to (due to the left-handed prop.), but she docks easily starboard-side-to. The launch answers the helm well at low speeds (up to 1600 R.P.M.) but at higher speeds the turning circle is huge. The launch steers much better, however, with the heavier test loads.

Under certain conditions (e.g. when the launch goes astern), some water washes over the stern and enters the open deck space. I suggest that a low raised coaming such as that on the NUCLEUS (the 34 ft. Nelson craft) be built around the three sides of the open deck, joining up at each side with the cabin structure. This coaming would have the effect of increasing the freeboard by its height (about 6 inches) and would prevent the water that washes along the cabin sides in rough weather or over the stern when reversing from entering the boat.

RESULTS OF 'BRUCE' TESTS ON APRIL 25, 1975

Full fuel tanks (170 gals. diesel), anchor, small magnetic compass, fire extinguisher, 3 lifejackets and 2 men on board.

Weather: calm

R.P.M.	SPEED IN KNOTS			NOISE IN DBS.	
	500 lbs.	1000 lbs.	1500 lbs.	Coxswain	Cabin
1200	8.0	8.0	8.0	84	85
1600	11.5	10.9	9.6	89	91
2000	17.0	15.9	14.6	91	93
2400	22.5	21.7	20.2	94	95
Max. R.P.M.	25.7 (2800 RPM)	24.6 (2750 RPM)	22.9 (2600 RPM)	96	96

	R.P.M.	TURNING CIRCLE (feet)	
		Port	Starboard
<u>1000 lbs.</u> Payload	2400	400	1800
Freeboard: F) 37" A) 24"	2750	550	1850
<u>1500 lbs.</u> Payload	2400	200	1500
Freeboard: F) 36" A) 23½"	2600	350	1650

EVALUATION TRIALS OF LAUNCH 'BRANT'

The BRANT and the BITTERN were built in 1966 and are virtually identical. They are both 25 ft. fibreglass Bertrams and are powered with single Volvo 220 h.p. diesel engines.

On May 28, 1975, the BRANT was tested with full tanks in light condition, then with 1000 lb. ballast and 1500 lb. of ballast. During these trials the BRANT handled easily and responded well to the controls, but in comparison with the other Bertrams the speed was very disappointing and not acceptable for a planing hull with our work load.

Results of BRANT tests on May 28, 1975

Full fuel tanks (90 gals. diesel), small compass, 3 lifejackets, fire extinguisher and 2 men on board. Loaded as indicated.

Weather: sunny and calm

R.P.M.	Speed in Knots			Noise in Dbs.	
	Light	1000 lb.	1500 lb.	Cox'n.	Cabin
1800	7.7	7.7	7.7	86	86
2100	9.2	8.4	8.2	88	89
2400 work	12.7	11.3	10.9	90	93
2500± max. R.P.M.	14.0 (2520)	12.3 (2500)	11.4 (2480)	90	93

Fuel consumption at 2400 R.P.M. with 1000 lb. is 6½ gals. per hour, which gives an endurance of about 14 hours and a range of about 155 miles under these conditions.

These tests were run using the 19 x 19 propeller.

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 slightly, 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 generally 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, boat hook	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 and Communications

	WT. (LBS.)	VOLTS	AMPS	DIMENSIONS
Lambda Power Supply	79	110	3+	19x18x6
2 heavy duty batteries	150			
	229			
Arma-Brown Gyro	44	24	8	14x13x11
motor generator	111			16x13x10
junction box, etc.	23			11x10x5
gyro repeater (each)	10			12x10x5
	188			
VHF radio converter	8			12x6x6
Clipper II	14	12	15	13x10x5
Raytheon 50	12	12	5	15x12x4
Comco, with remote spk.	7	12	2	14x8x3
H.F. radio, CH-25	26	24	7½	14x11x7
Antenna tuner, CH-25	9			14x11x7

	WEIGHT (LBS.)	VOLTS	AMPS	DIMENSIONS
a) Navigation (con't.)				
Kelvin Hughes Radar	52	24	14	26x18x13
17-9 transmitter unit	35			25x16x8
scanner 6ft or 4ft	103			6'or4'x22
motor alternator	48			12x9x7
	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			18x16x8
power supply	42			18x16x8
scanner 4 ft.	83			48x20x13
	236			
Decca radar, 101	33	24	7½	18x13x13
power supply	16			13x10x5
scanner 42" & trans.	80			26x15x12
	129			
b) Sounders				
Raytheon, portable	41	12	5	17x15x9
battery, 12 V car type	45			12x9x7
	86			
Kelvin Hughes (var.)	86	24	4	19x14x11
transc. & power supply	22			14x12x6
transducer	30 (approx)			
	138			
Edo 9040	54	24	5	20x14x10
transducer	30			8" diam. x 5
	84			
Ross, chart display	32	24	8	21x14x6
transceiver	21			19x16x7
power supply	19			19x14x6
transducer	14			9" diam. x4
	86			
Atlas Deso 10	56	24	5	19x18x8
transceiver	39			19x16x9
transducers (pair)	27			10" dia. x5
	122			

	WEIGHT (LBS.)	VOLTS	AMPS	DIMENSIONS
c) Survey Positioning Systems				
Motorola RPS display	6			12x8x3
range consol	31			20x18x6
multiplexer	40	24	5	20x18x6
scanner (or use radar)	80	24	6	48x20x13
equipment rack	36			30x21x16
cables, etc.	4			
	197			
Mini-Fix receiver	30	24	4½	19x13x9
buffer box	8			19x4x3
left-right indicator	7			15x10x7
	45			
Decca receiver 6f	30	24	7	
transceiver	50 (approx)			
digitizer	32			19x14x9
	112			
Mini-Ranger display	25	24	2	19x19x5
transceiver, etc.	12			9x6x6
	37			
Hydrodist master	44	12	7	19x19x19
power pack	7			10x7x6
left-right indicator	13			
dish antenna (in box)	28			19x19x9
	92			
d) Data Logging Systems				
HAAPS				
digital coupler DC211	22	110	4	19x14x9
tape drive, Kennedy 1600	41			19x12x12
sounder digitizer	14			19x14x6
equipment rack	36			30x21x16
second rack	36			30x21x16
printer HP5050B (option)	45	110	1	19x18x9
	194			

d) Data Logging Systems

INDAPS (con't.)	WEIGHT (LBS.)	VOLTS	AMPS	DIMENSIONS
power supply	36	110	4	19x10x7
computer	30			19x18x7
C.A.T. power supply	17			19x9x6
mag. tape DC 300 A	14			19x15x6
multiplexer	23			19x15x9
sounder digitizer	14			19x14x6
printer & controls	16			19x17x7
equipment rack	80			42x24x22
	230			

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 DE719, portable	86
	Kelvin-Hughes	138
	Edo 9040	84
	Ross	86
	Atlas Deso 10	122
Positioning:	Motorola R.P.S.	197
	Mini-Fix	45
	Decca 6f	112
	Mini-Ranger	37
	Hydrodist (Master)	92
Data Logging:	INDAPS	230
	HAAPS	194

REQUIRED WORKLOAD FOR MODERN HYDROGRAPHIC SURVEY WORK

Boat equipment and third man		500 lbs.		500 lbs.
Nav. & communications	(Raytheon VHF)	472	(Comco VHF)	467
Radar	(Decca 101)	129	(Voyageur)	123
Sounder	(Ross)	86	(Edo)	84
Positioning System	(Mini-Fix)	45	(Mini-Ranger)	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.

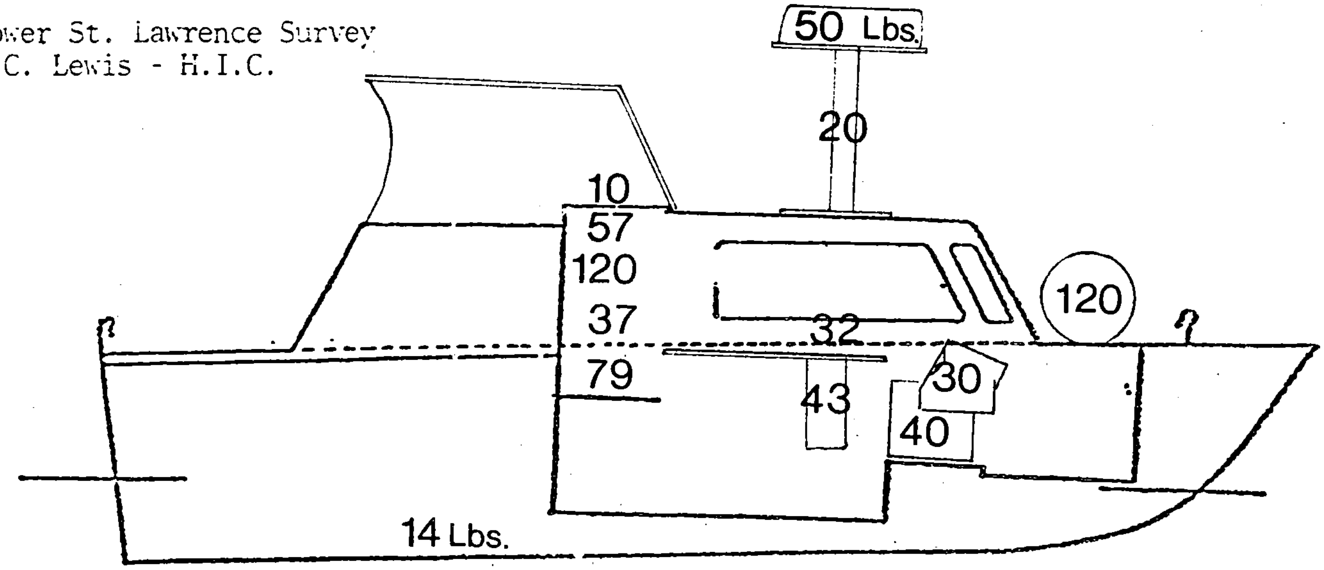
Boat equipment and third man		500 lbs.		500 lbs.
Nav. & communications	(Clipper II)	474		474
Radar	(K.H. 17-9)	238	(Decca 2-17)	236
Sounder	(Atlas)	122	(K.H.)	138
Positioning System	(Decca 6f)	112	(R.P.S.)	197
Data Logging	(HAAPS)	194	(INDAPS)	230
REQUIRED PAYLOAD:		1640 lbs.		1775 lbs.

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 Mini-Ranger to the high of 197 lbs. for the R.P.S., though this latter figure could be reduced by using the Radar scanner (on an either/or basis) if compatible, or the lightweight omni-directional antenna - with the attendant loss in range - instead of the rotating scanner.

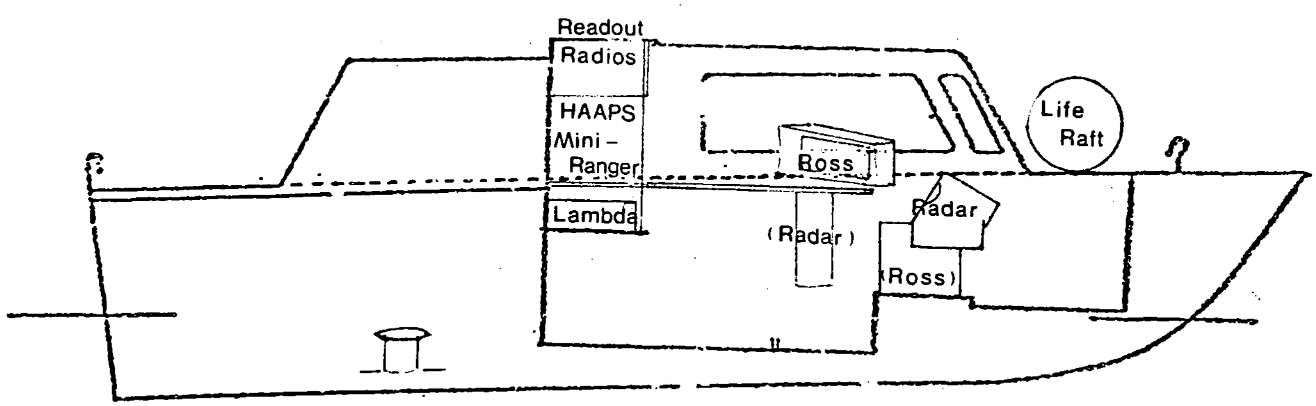
The differences in weight of the various batteries now available should also be noted. The Lambda battery charger needs a pair of batteries (for the 24 Volts) and the weight of these can vary from 45 lbs. to 140 lbs. each, depending on the size. The standard car battery may, however, not have enough 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 are a mean figure, such as a heavy duty car battery.

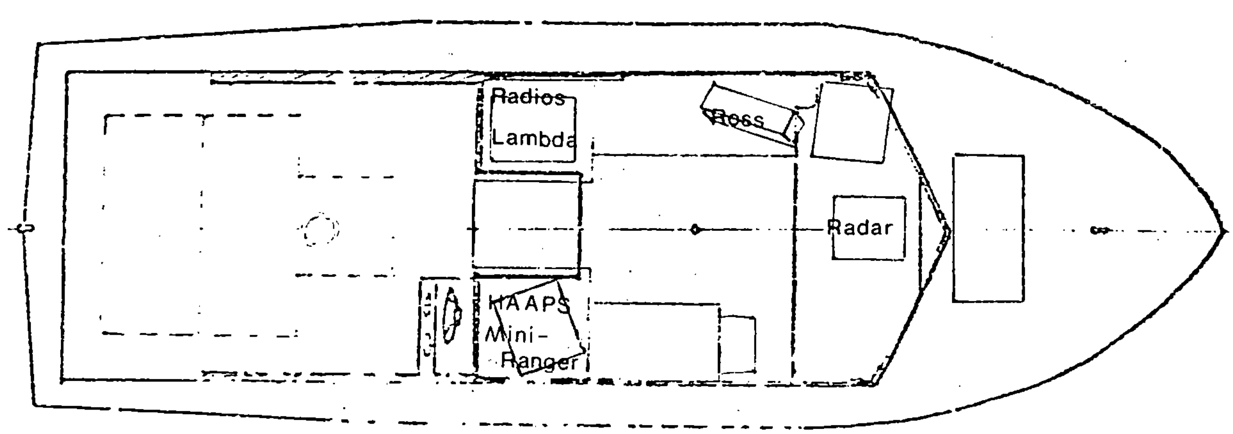
Equipment Layout, Hydro I and II, 1975 Field Season

Lower St. Lawrence Survey
R.C. Lewis - H.I.C.



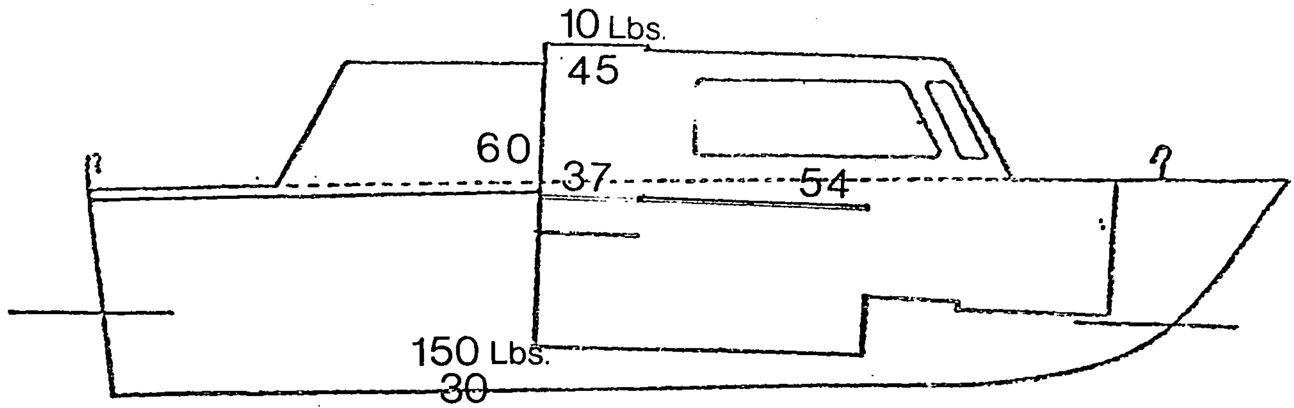
Power	:	110 v. Generator, 24 v. Lambda Converter, 12 v. Engine Generator
Radar	:	Voyageur V
Sounder	:	Ross 200A
Positioning	:	Mini-Ranger
Data Logging	:	HAAPS
Radios	:	CH-25, Clipper II
Total Weight	:	750 lbs. including Bar Check, Transducer and Liferaft



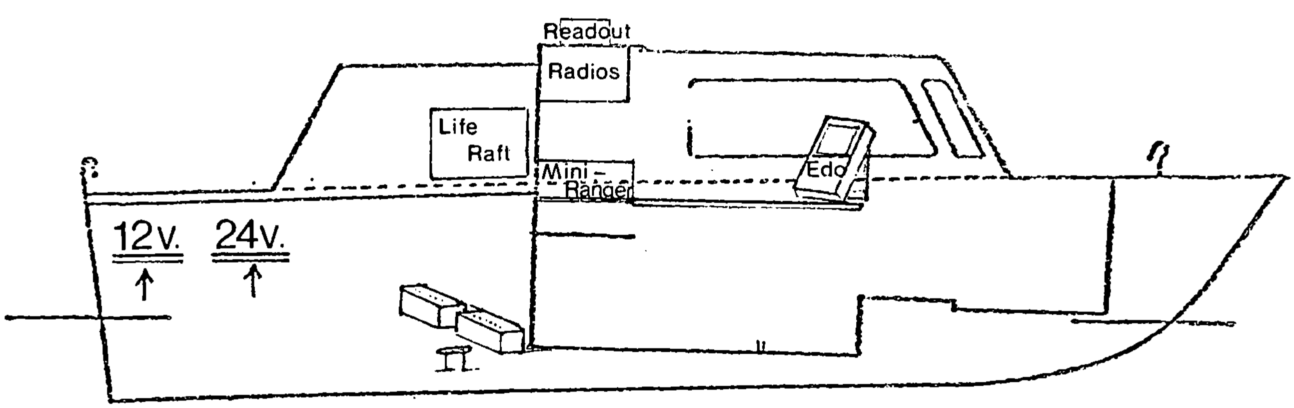


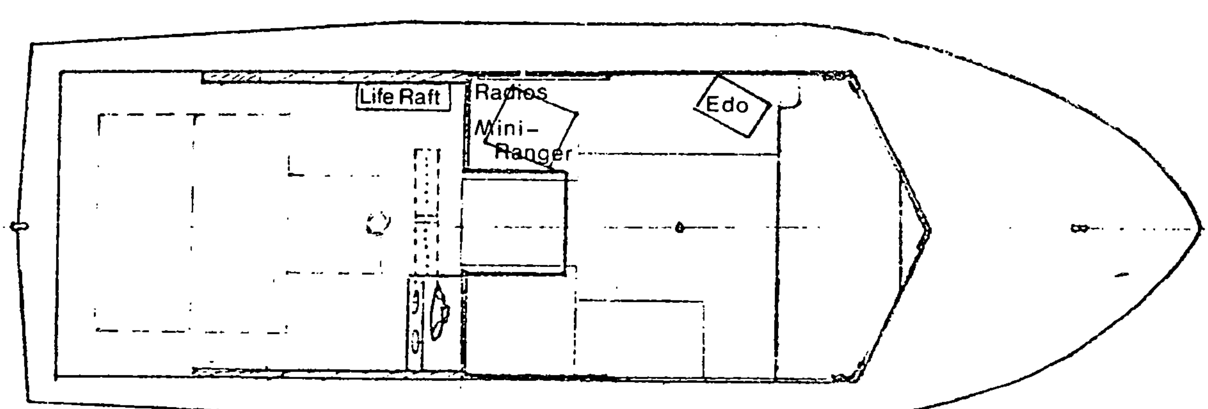
Equipment Layout, Hydro III, 1975 Field Season

Thunder Bay Survey
K.G. Hipkin - H.I.C.



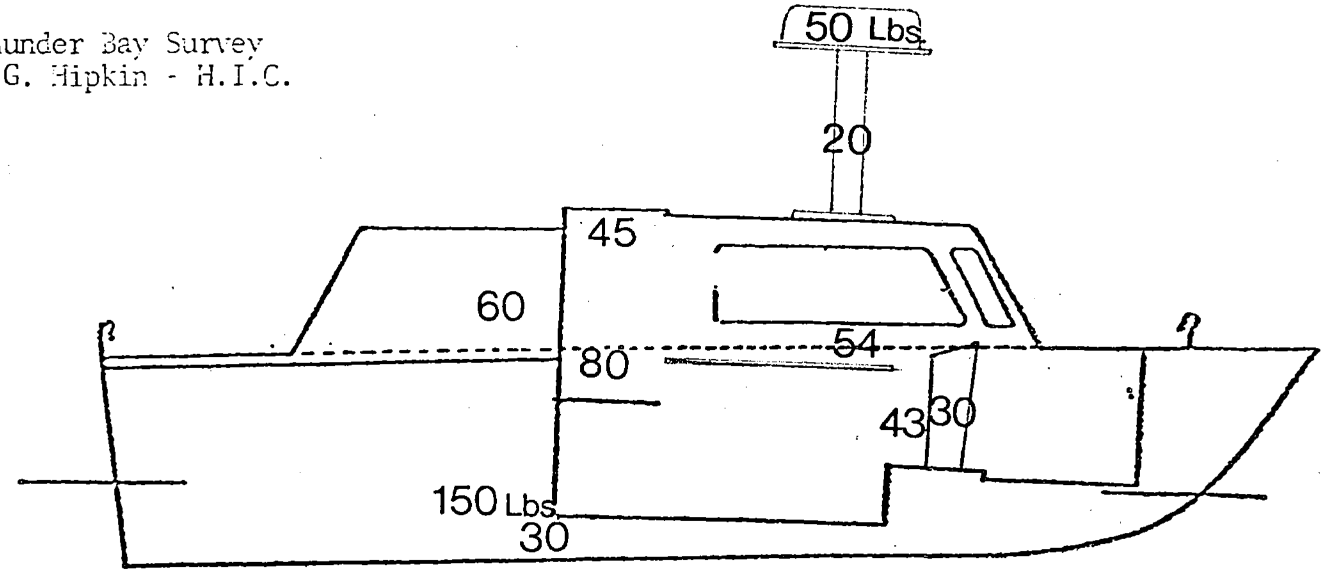
Power	:	12 v. Engine Generator, 24 v. Engine Generator
Sounder	:	Edo 9040
Positioning	:	Mini-Ranger
Radios	:	Comco, CH-25
Total Weight	:	450 lbs., including Bar Check, Transducer, Liferaft, but less 200 lbs. due to removal of auxiliary generator



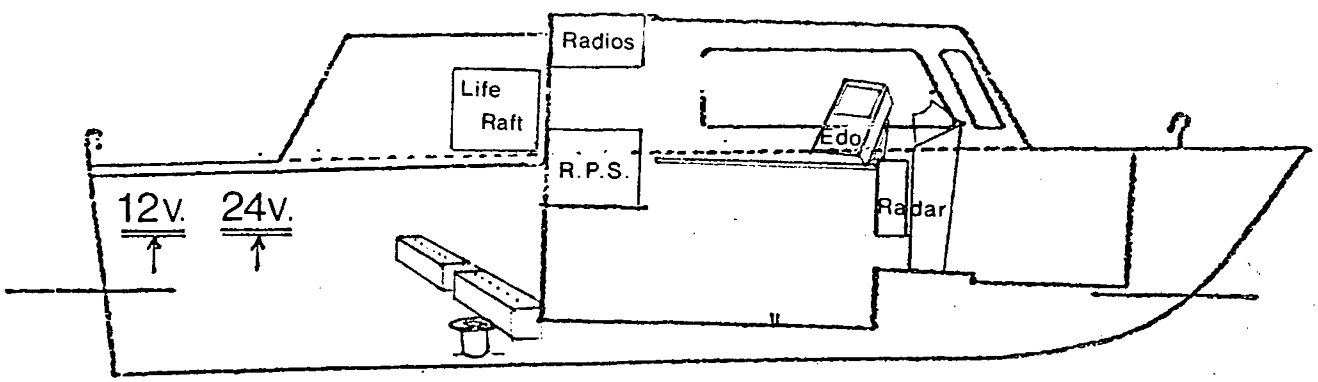


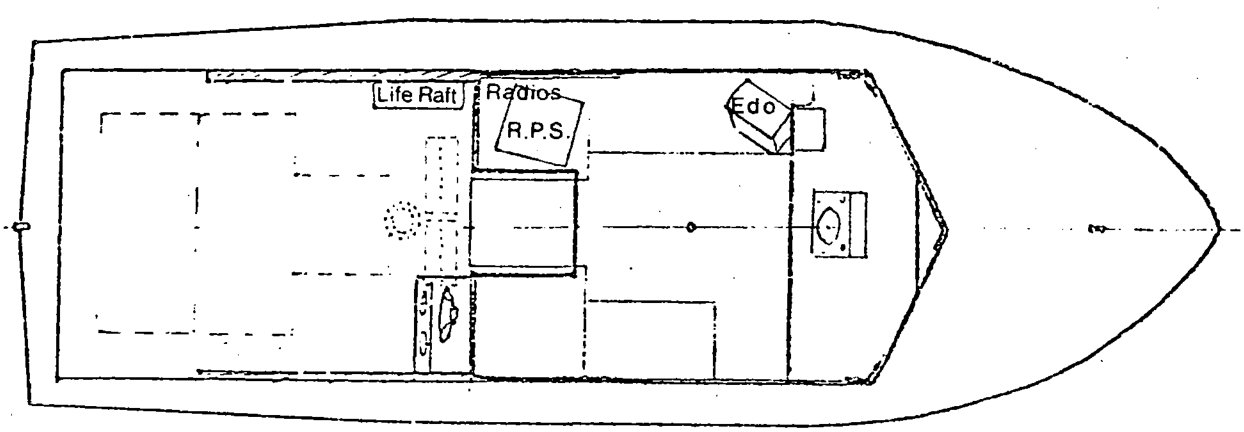
Equipment Layout, Hydro IV, 1975 Field Season

Thunder Bay Survey
K.G. Hipkin - H.I.C.



Power	:	12 v. Engine Generator, 24 v. Engine Generator
Radar	:	Voyageur V
Sounder	:	Edo 9040
Positioning	:	Motorola R.P.S.
Radios	:	Comco, CH-25
Total Weight	:	650 lbs. including Bar Check, Transducer, Liferaft, but less 200 lbs. due to removal of auxiliary generator





CONCLUSIONS AND RECOMMENDATIONS

These trials with the various Central Region Bertram launches have shown quite clearly that the Volvo 170 h.p. inboard/outboard twin gas engines were a suitable choice for the four Hydro launches, for even when the launch was dangerously overloaded the engines performed well, but without seeming to be overpowerful for the launches on the rare occasions when they are run in a light condition. The twin MerCruiser 165 h.p. engines on the BROCK and BRONTE give the launch a little more speed, but the MerCruiser outdrive system is more complex than the Volvo outdrive and has given a lot of trouble in the past.

The twin Volvo engines with their 280 outdrives have not yet been in use by us for long enough for us to be sure that they have the reliability that we need in our hydrographic survey work, but up to the time of writing this report all four of the Hydro launches have been in use on the field parties with no down time, and three of the four launches have been working 9 hours a day, 6 days a week.

Three of our nine Bertrams have single diesel engines, but of these only the BRUCE (extended in 1973, and now a 31 ft. launch) has the necessary speed. The BRANT was found to have a working speed of only 11 knots, which is not adequate. With a different propeller, however, she has been reported as doing 17 knots on an earlier occasion. The BITTERN was not tested, but is virtually identical to the BRANT with very similar speeds.

The evaluation trials have shown that with full fuel tanks the Hydro launches cannot safely work with an additional load as great as 2000 lbs., but with a payload of 1500 lbs. the launches handle safely and easily with a working speed of about 17 knots at 4000 R.P.M. This gives an endurance of about 10 hours and a range of about 170 miles. There is an auxiliary gas powered generator on board to supply 110 V. for the HAAPS or INDAPS equipement, if installed, with the fuel coming from the main tanks. If this generator is in use, therefore, the endurance is reduced to about 9 hours and the range to about 155 miles.

During the Evaluation Program, all the trials were run with full fuel loads of 122 gals. (the gas powered launches) which weighs about 1100 lbs., and as the fuel is used the weight on board becomes less. 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 load, as long as the 1500 lbs. is not exceeded.

Because the weight on board becomes less during the day as the fuel is burned, in practice the speed, endurance and range over a day's run will all be a little better than the test results indicate. For example, the launch setting out in the morning with the maximum payload of 1500 lbs. and working at 17 kts. on 4000 R.P.M. will, by lunch time, in effect be in the 1000 lb. condition, working at 17½ knots, and by late afternoon the launch will be virutally "light", working at 18½ knots with the same 4000 R.P.M.

One problem with the Bertram 25 ft. launch has been excessive spray coming over the exposed control position. The amount of spray is as nothing when compared with the amount of water that sprays over the old wooden displacement launches, but from a modern comfort viewpoint it is considerable. The BRANT and BITTERN have tried dual controls with a wet-weather position inside the boat but this was found to introduce visibility problems due to the coxswain's low height-of-eye above the water level, and the windshield wipers not being adequate to keep the windows clear.

During this past winter, Hydro I and II were fitted with light-duty canopies of plywood and fibreglass with large perspex windows. It was feared that these cabs would increase wind resistance and have an adverse effect on performance, so they were made with minimum headroom inside. It was found, however, that the addition of these canopies had little effect on speed and performance, so in future these cabs can be raised to give good standing room inside.

Due to their greater weight, the formation of the hull, and the nose-high attitude at speed, the Bertrams 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. It was found that the Hydro launches were much better than the other Bertrams tested as the turning circle at speed is smaller, the launch is easier to control, and it is more comfortable in choppy waters and less noisy. The BROCK and BRONTE, however, have the advantage of having the more spacious cab over the steering position, though this seemed to add to the noise level for the coxswain due to reverberation inside the cab.

Our hydrographic survey launches are noisy. During the Evaluation Program, noisemeter readings were taken on various launches at head level in the cabin and at the steering position, and the results were disturbing. Not one of the launches tested was within the Canada Labour Code's Noise Control Regulations for a 9 or 10 hour day without hearing protection. Some of our launches, in fact, barely meet the standard for a 4 hour day.

One answer to this noise problem is to issue protective headsets to everyone who works on the launches, but this seems to be dodging the issue. It is, moreover, not a pleasant prospect for our field men, knowing that they should wear a headset all day every day throughout the summer to protect themselves from dulled senses, headaches and damaged hearing.

As an experiment in soundproofing, one of the launches had the inside walls of the cabin and engine compartments sprayed with polyurethane foam insulation, but this had little effect on the noise level at working speeds. On another launch the engine housing was covered with scrap carpetting, but this, too, had little effect.

I strongly recommend that rather than blindly trying different acoustic experiments, we pay a specialist acoustic expert a consultant's fee for two or three days to have a proper acoustic diagnosis and remedial prescription for each of our survey launches. There are many different acoustic barrier materials marketed by such firms as Acoustex of Canada, Ltd., and there is no reason why we should not finally tackle this problem. If we do not lead the way in this matter, we will soon find ourselves being squeezed by public health or occupational hazard legislation and Union grievances, not to mention low morale in our field men.

Another important point that came to light during these trials is that planing launches such as the Bertrams rise more than was previously thought. Measurements on two of the launches - selected as being typical of the other Bertrams due to time limitations - showed a rise of 2 or 3 decimeters from rest to working speeds. In shallower areas, this could perhaps build an appreciable error into our soundings as inked on the Field Sheet. I recommend that a separate project be undertaken to study this aspect of all our planing launches so that if this figure is appreciable on any of our other survey launches, it could perhaps be considered as a "sounding speed correction" when reducing soundings for inking on the Field Sheet.

As was mentioned earlier, this Evaluation Program has been one of Investigation as well as Testing. Having carried out enough testing before the approach of winter weather to indicate that the new form of engines was suitable for the Hydro launches, and having determined that the launch was indeed capable of carrying the required load of electronics and survey equipment to work with modern hydrographic surveys, short visits were made to the other Regions. These were to discuss the Bertram launches with those who had worked with them in the past and those who were working with them at the moment.

Visits were made to the Pacific Region at Victoria, to Headquarters at Ottawa, and to the Atlantic Region at the Bedford Institute. The reactions to the subject of the Bertram launches differed widely. They varied from "A damn fine boat", to "They should all be burnt." The reactions to my visits differed equally widely, and varied from helpful discussions and advice, to strong suggestions that I was twisting the results of the tests and falsifying the records.

During my visit to the Pacific Region, I was able to take one of their Arctic launches out on a test run. During this run, the boat was in a "light" condition having only basic safety equipment on board and half full tanks. In this condition, she was timed both ways over a measured mile at 2800 R.P.M., giving a speed of 20 knots. This was borne out by a similar reading on the patent log. When loaded with survey gear, the operational speed of these launches is 15 or 16 knots. The engine used is a G.M. Diesel 210 h.p. single screw, but to give an extended waterline and additional lift, the launches have had an aluminum plate 24" wide added to the stern. This is bent to fit around the hull from side to side and is supported by hydraulic rams at each side. See photograph (page 63) for details. This metal "shelf" seems to have helped solve the problem of having a diesel engine in a short length of planing boat. These Pacific Region Bertrams are, however, very weight conscious: if any extra weight is added, the speed drops off considerably. This means that these launches could not be used with either of our present forms of automated data logging, due to the extra weight of the equipment, unless weight is saved somewhere else.

The Atlantic Region have their four Bertrams in use from shore establishments. The DUNLIN is particularly successful on revisory work in sheltered waterways, and is powered by twin 115 h.p. Mercury gas outboard motors, travelling at speeds up to 25 or 30 knots. Experience having shown that the 25 foot boat is too short and the planing hull not suitable for the sea and weather conditions in the Atlantic Region's offshore areas, their second generation of survey launch is the 31 foot fibreglass displacement launch. With diesel engines, these work satisfactorily at speeds of about 15 knots.

While these "Conclusions and Recommendations" were in the typing stages, one of the engines on each of the two Hydro launches with one survey party broke down. These engines were replaced with others and returned for thorough investigation. Both engines were found to have seized piston rings apparently caused by overheating. Only one water intake filter was returned intact with the engines, but this filter was clogged, which was diagnosed as being the reason for the engines overheating. A few days later the other two original engines broke down with the same overheating symptoms, and one of the engines had a piston rod break through the engine block - probably due to a manufacture defect.

On further investigation, the field party found that the outer water intakes were choked by weeds, so having found the root of the trouble, these overheating problems will hopefully not recur.

There is a temperature gauge on each engine instrument panel, but temperature fluctuations caused by water shortages may not register on these dials for long enough to be spotted by the launch personnel. The water filter, moreover, can clog in just a few minutes in dirty waters. For this reason, I recommend that all these launches be fitted with audio alarm systems to monitor oil pressure and water temperature in addition to the gas vapour sensor.

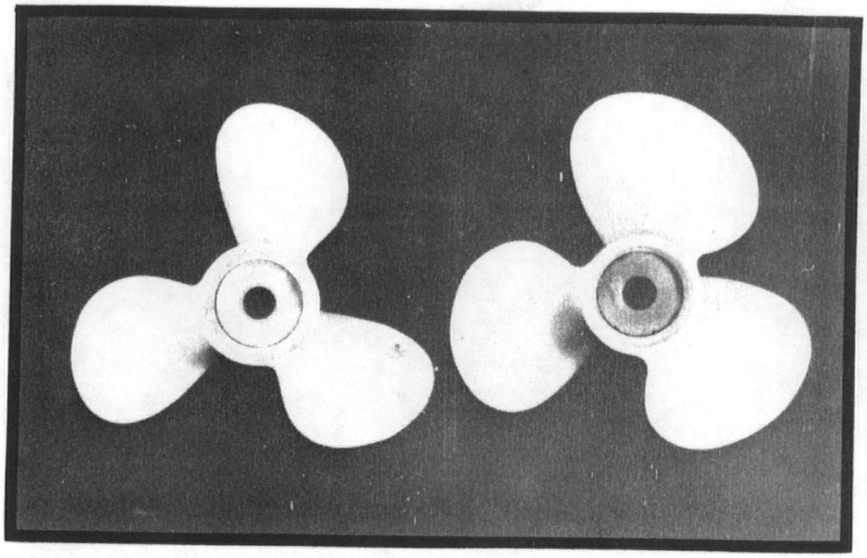
The two launches presently working on the Lower St. Lawrence have experienced a slight reduction in power from what was proven during the pre-season trials, even though the working load is only 750 lbs. In my opinion, this may be due to the bottom fouling. Weed growth may not be noticeable to the eye as the working speeds each day would keep the growth in check, but even the roughness of the roots on the hull could seriously affect the performance, and thus frequent cleaning may be necessary in some survey areas. The launches at Thunder Bay, however, have given no trouble, with the Hydrographer-in-Charge reporting them as "lots of power, roomy, comfortable, and ride well in a sea".

In conclusion then, I can report that all the field Hydrographers working with them this year are very pleased with the Hydro launches, and find them roomy and comfortable to work in. The coxswains, also, are well pleased as the boats handle well and are sensitive to the controls with little effort required to keep them "on line". We are still having some engine troubles, but this time with the lighter weight of these higher powered gas engines it does not seem to be due to the engines being underpowered for the launches, even with the heavy load of modern equipment.

Perhaps with this new lease of life, the four Hydro launches can now begin earning their place in the ranks of our successful survey craft. We have found them to be more comfortable, and with their high speed they are potentially more productive than our other launches, so now they can help us take advantage of the high speed data acquisition possibilities of our modern survey equipment and techniques, and begin repaying the vast capital expenditure that they represent.

J.H. Weller
June 9, 1975

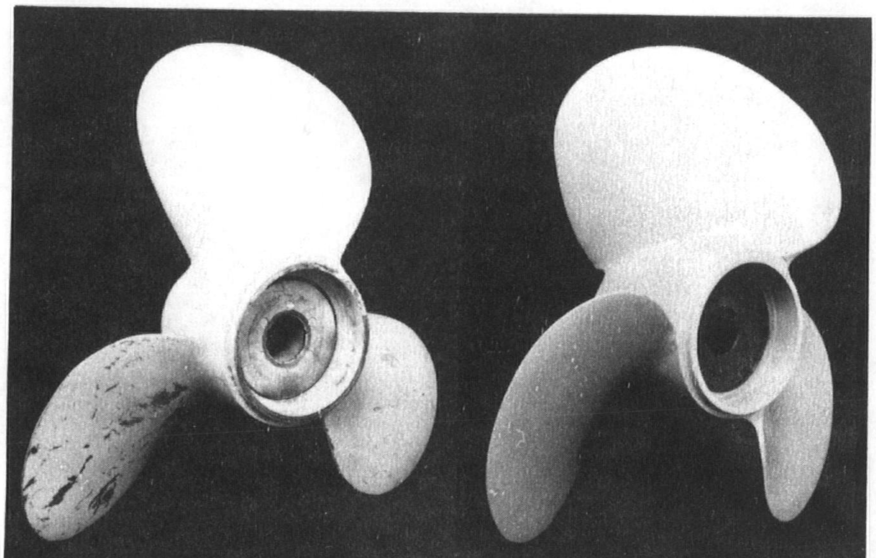
PROPELLERS: THE OLD AND THE NEW

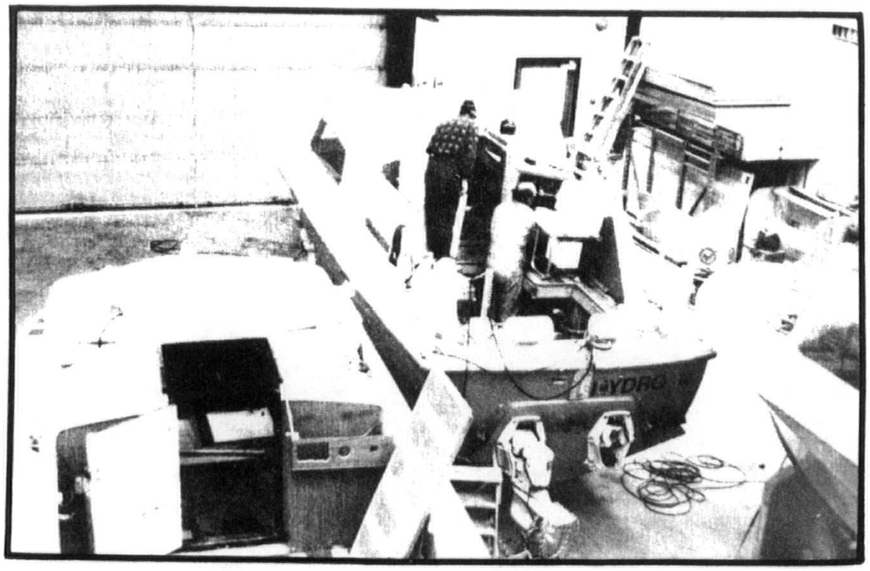


Both of these propellers are Volvo 14" x 17". The older standard propeller is on the left in both photographs. On the right is the new "High Performance" propeller.

The new propellers were delivered with the second batch of Volvo 170/280 engines and outdrives, and with the wider blade area, 20% - 30% increase in speeds at working R.P.M. was recorded.

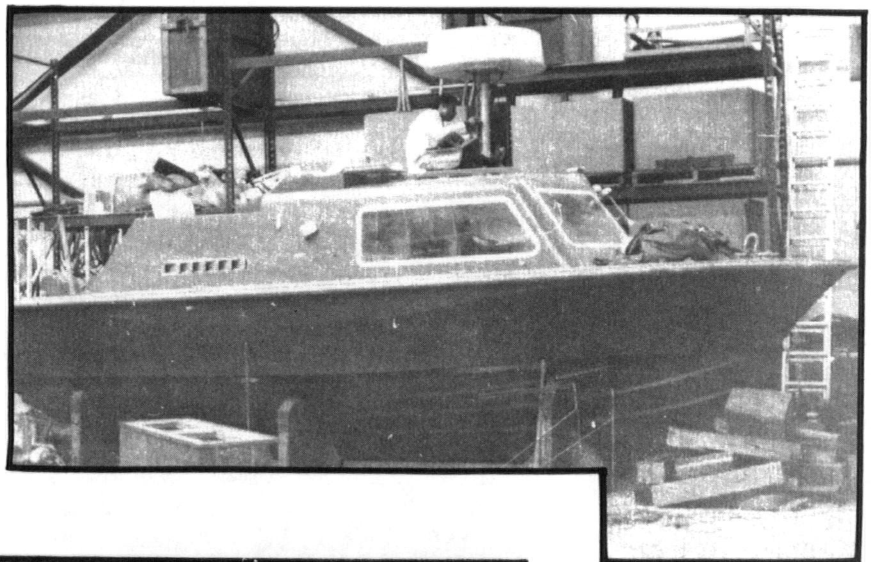
Cruising range on a tank of gas is the same for both propellers at cruising speeds of about 17 knots, but engine R.P.M. is much lower.

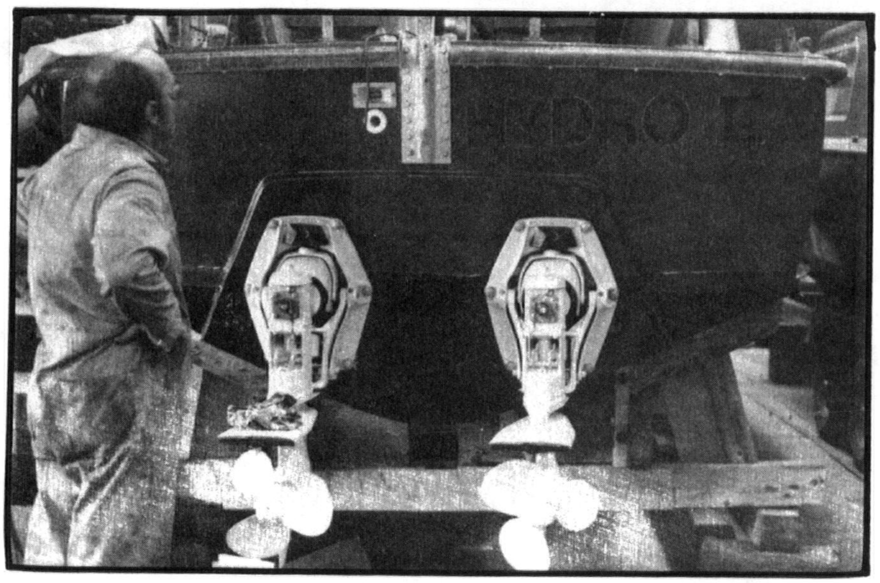




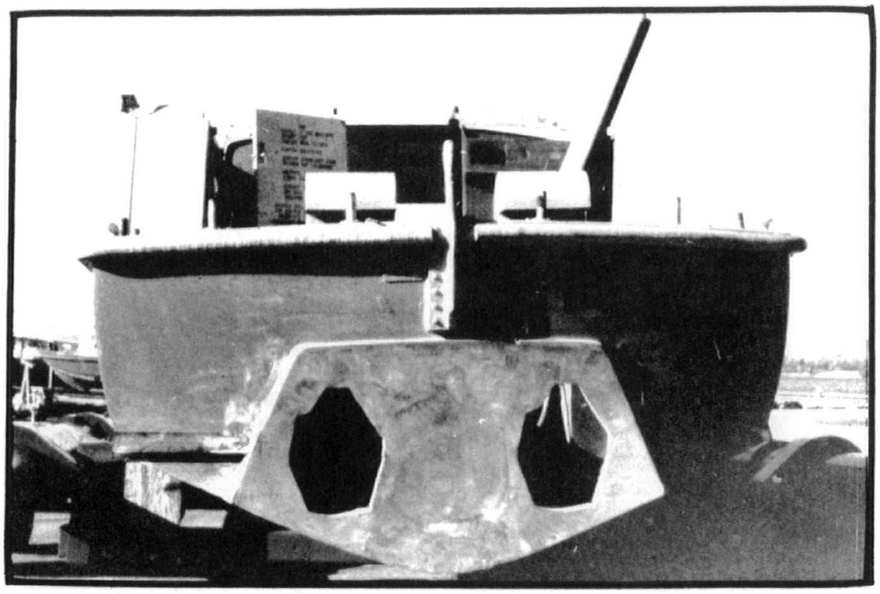
Three of the HYDRO launches in the C.C.I.W. Boatshop.

Being fitted for.......

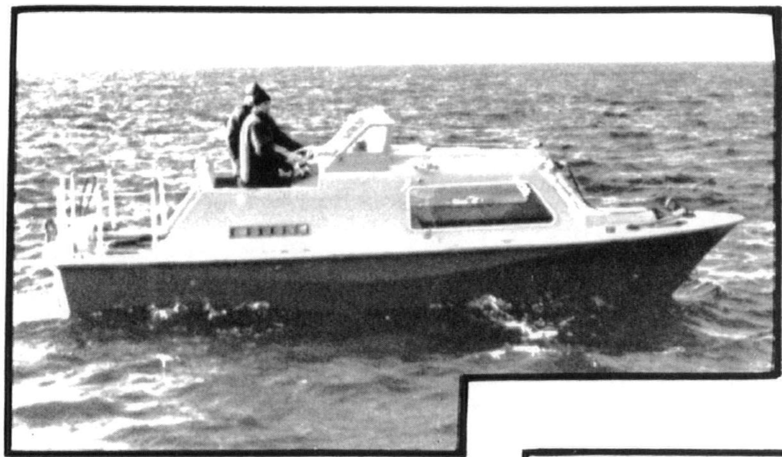




.....a new lease of life



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

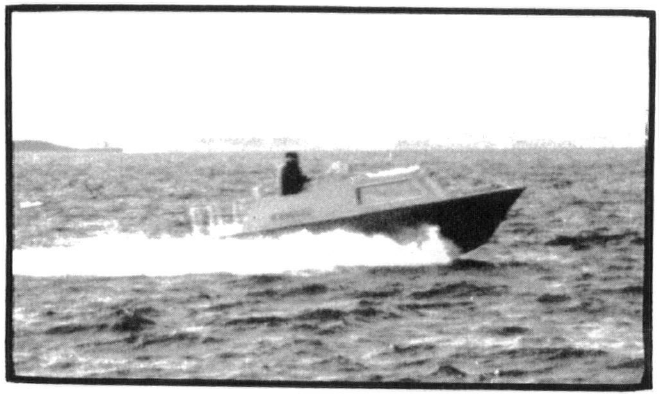


Hydro III during trials:

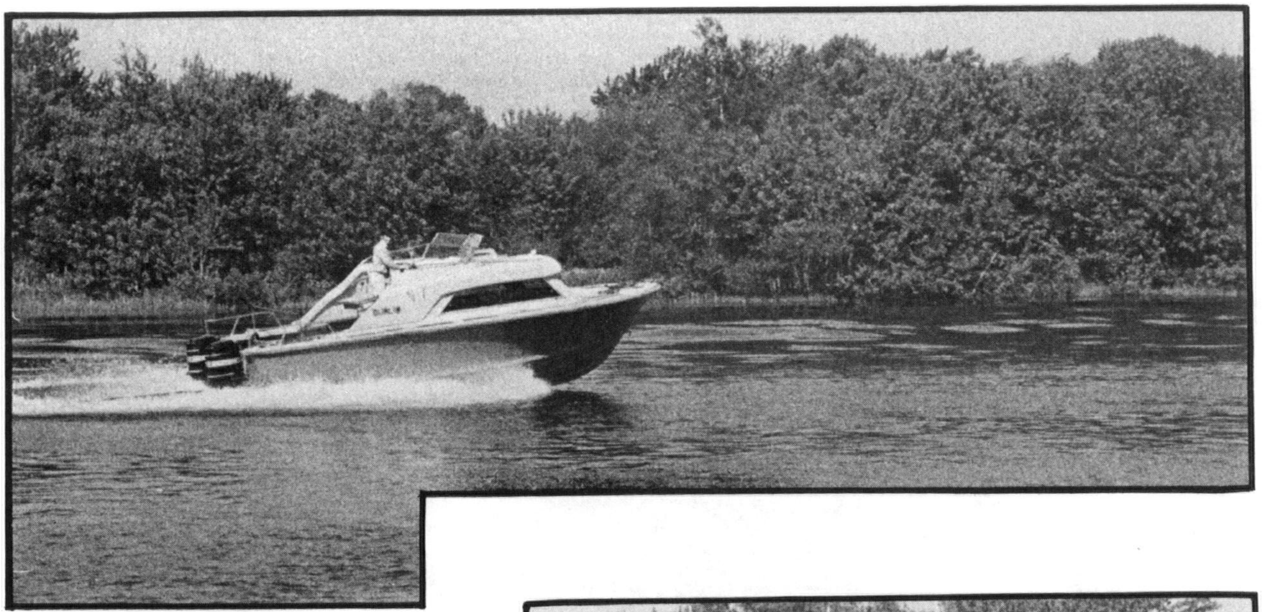
At rest ......

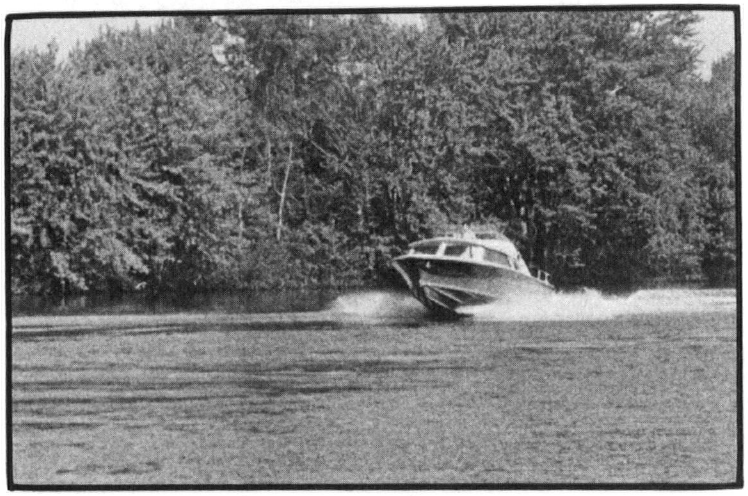
and

...... At speed.



Note the nose high attitude of launch.
Photo at 18.5 kts.

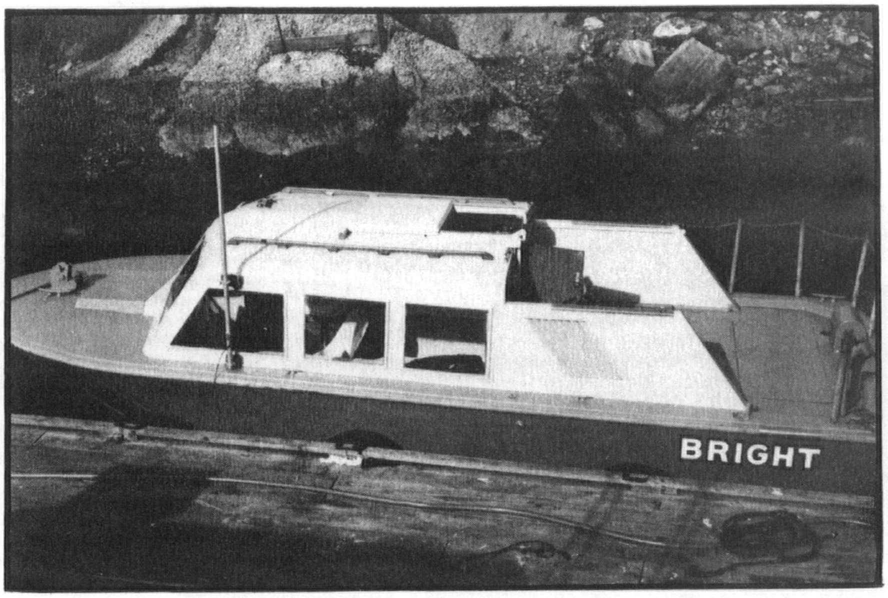




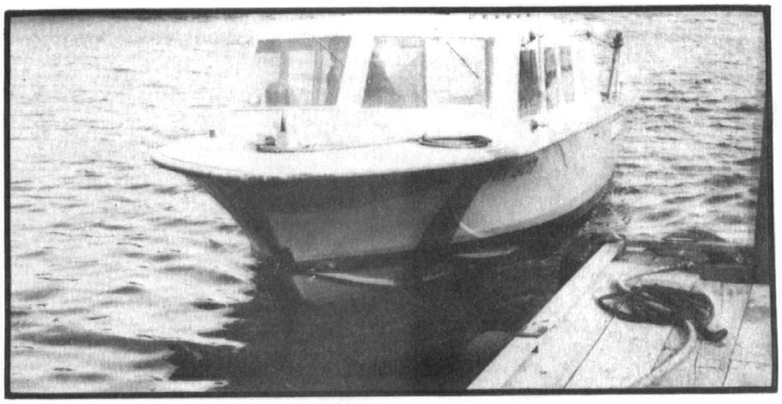
The most successfully employed
of the Atlantic Region Bertrams

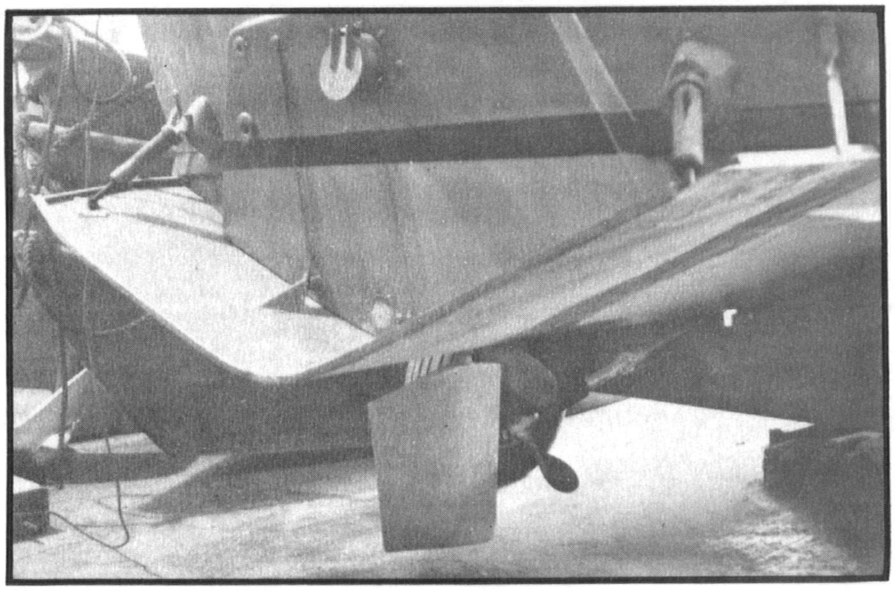
C.S.L. DUNLIN on Revisory work
in sheltered waters.

One of the Central
Region's Bertram
launches



C.S.L. BRIGHT - one of the Pacific Region's Arctic Bertrams





Close-up of the Pacific Region's Bertram stern arrangement.