

# Where Admirals Fear to Tread

by Christopher Hook

If ever you invent the better ship than the ship, you will find that the big problem will be that solicitors will laugh so loudly and long that they will never be able to write a sensible contract for you. As a result you will never get paid for your work.

When, after the Annapolis demonstrations to some 150 top Pentagon Naval and Air Force brass, I was informed that the Navy was interested in the HYDROFIN but that I would have to sign a contract on the basis of my US Patents with a shipyard that was acceptable for secret Naval work, this contract question became, for me, of primary importance. As it turned out, very few shipyards on the East Coast showed any interest since they all already had Navy contracts except one yard in Miami.

Among the hundreds of names on my visitors' book at the New York Boat Show of January 1951 I had that of Sandy Holt of Greenwich, Connecticut, and when Navy support became certain he invested some survival money, became my partner and together we went hunting for a yard by means of a methodical series of demonstration outings from Greenwich with a fishing boat for the guests. After a few such week-ends we had collected a number of: suggestions and a film, was sent to Miami with the offer of a visit.

Miami is the end of the inland waterway from New York and shortly before Christmas the private fishing boats and larger yachts start to arrive. As they mostly have some repairs to be done, this gives rise to a highly seasonal repair business of hauling out, repairing bent propellers, etc. Yards engaged in this work are hard put to it to find work in the long and hot summer months and a Naval hydrofoil contract was extremely attractive.

The area was ideal for the work but first of all we were faced with the problem of a simple marine repair yard and medium machine shop without a scientist in sight. On the face of it the idea that from this place some modern marine Concorde would grow was simply ridiculous and the owners were themselves perfectly well aware of the problem. Again it was a matter for the US Navy to solve and solve it they did.

Under American Law, proposals relating to the expenditure of public money have to follow the form of supposedly being open to public bidding, so the first step was to invite representatives of all large marine companies to a technical briefing at the Navy Dept and among such firms the owners of the Miami Yard found themselves in rather astonishing company since the biggest names in America were there — but only for the form. Everybody who was in the know was aware of the fact that it would have been totally impractical to give the Navy contract to any firm other than the one that I had selected and designated by our royalty contract and consultation agreement.

The next step was the granting of a study contract to the yard that would enable it to collect together a suitable team of aerodynamicists and draughtsmen. A Naval observer

was appointed to an office inside the yard and an area was cordoned off as "RESTRICTED AREA" which would exclude even a US Navy Admiral if he did not have the "need to know" about this particular programme.

Our contract with the yard stipulated the payment of a 5% royalty on all business brought to the yard by Hook & Holt relative to the Hook Hydrofin patents and also that, in order to substantiate the amounts, the firm was to produce its books for the scrutiny of our chartered accountant. It was the latter, perfectly normal clause which was to be our undoing as I shall relate.

After the Naval Architect George Crouch (well known for the Crouch formula) and myself had written a preliminary description of incidence control as opposed to emerging fixed incidence hydrofoils (the former having been the type that I had pioneered and brought to the USA) the work on the study contract started in earnest. Since we had not foreseen this we could collect no payment at all for about the first six to nine months and we had to start in at once to earn money from conversion sets and the building and exporting of the "Icarus type".

All the theoretical work was based on practical training of each designer in the art of piloting with the use of the Red Bug and the Icarus which were constantly on tap for clients and Naval officers alike. It was during this period that Yohai Ben Nun, a Naval student at MIT under Prof. Manning, came to Miami and was enthusiastic about the Hydrofin for Israel. He was later to become chief of the Israel Navy and his exploits are described in the Sunday Times of June 25th.

Had it not been for this early contract with the Israel Navy the whole hydrofoil programme would probably have flopped because the cost of the first Z drive appeared to be quite prohibitive. The project put out to tender in the USA only drew one estimate of \$120,000 for designs alone. This was far too much even for the US Navy at that time. The plan for two different types of Landing Craft to be built to the same Z drive system collapsed and only the Hydrofin was chosen because of its superior ability in following waves. A Landing Craft was, by definition, a following wave type and this excluded the Vee foil right at the outset.

Thanks to the Israel project (which I was to fill only some years later and from a European base) information was available on Italian wartime Z drives of small size and a builder in Italy was located. This firm designed, built, tested and delivered the first Z drive for a large hydrofoil at a cost of well under half the American firm's estimate for the paper only!! There was to appear, however, a very serious snag that a little clear thinking could have so easily eliminated.

To understand what happened I have to return to the time when the Office of Naval Research had been "sold" on the new platforming type of hydrofoil as demonstrated by me with Stanley Reed's help and Navy finance through Dr Todd. Even Naval scientists are in considerable difficulties where "ADMIRALS FEAR TO TREAD" and one can say that nobody can sell the abstract idea of the better ship than the ship to any Navy

and certainly not to any Congressman. Any such scheme has to be heavily disguised as a specific project with military value that conventional ships cannot fill.

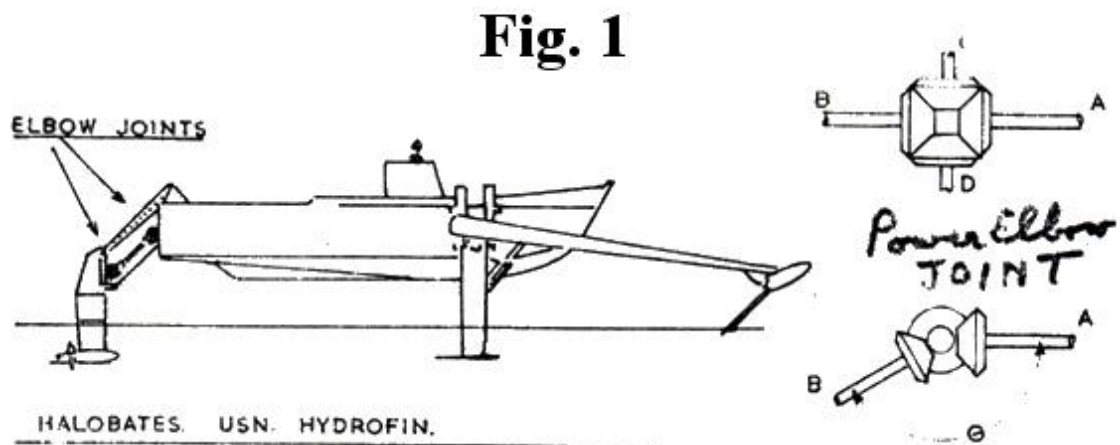
Rightly or wrongly at the time, the Landing Craft seemed to be the only naval use that could be explained in simple enough terms to pass the Naval Appropriations Committee, the stepping up of the speed from nine to forty knots seeming to guarantee a saving of life of enormous proportions. But the next step is: what do we do about retraction?

If we stop 100 yds off shore and proceed to a lengthy retraction operation clearly all the advantage of speed is lost and more. Inevitably therefore this line introduces in-flight retraction of incidence controlled foils on struts and Z drive while transmitting 650 hp; a monstrous complication which has been called, notably by Vickers, "a mechanical monstrosity that lost support for Hook despite the fact that the craft operated entirely in accordance with the USN requirements".

Due to endless problems, that boat had become far too costly to be seen within miles of any beach and I can now explain why:

Both the LCVP hull and the Hall Scott engine were specified by the Navy and this fixed the power/weight ratio at a level which, for a non-planing type hull, dictated that take-off could only be done with legs and Z drive retracted as for beaching. With legs extended, the accumulated hull, strut and foil drags would render this impossible.

The Italian firm, due to over-confidence, neglected to build any working model and assumed the perfect working of a fallacy, namely that a differential type elbow joint could be extended under power (Fig 1).



Input and output shafts are A and B respectively, while C and D are contra-rotating transfer gears. The mounting allows the angle  $e$  to vary and when fixed the revs of A and B are equal for equal ratio gears. A little thought will convince the reader that if  $e$  varies there will be some change of angular position between A and B and any model would, in fact, have demonstrated this. It follows that under load this change can only

be made by the retracting mechanism which, not having been designed for this, failed to move the joint so that take-off was rendered impossible.

It is just this kind of mistake which wrecks a project because it sounds like a bad excuse for an invention that does not work. For the Navy the whole thing is highly embarrassing so that complete secrecy is essential. In fact the drive could only be made to work by removing one transfer gear (C or D) but now the power was concentrated on one small shaft instead of two, and the whole mounting twisted out of shape. This in turn was only stopped by the messy process of spraying steel onto the whole joint and blowing it up like a snowball.

The arms were twice the normal Hydrofin length because of the vertical retraction and admirals would prefer to die rather than be seen within the State of Florida. It was this state of affairs that incited the firm to start experiments on sonic beam incidence signals in order to "keep Washington happy". The team that had been collected were faced with close down and more experiments seemed to be the only solution. Finally the firm went bankrupt, for which unfortunate outcome I cannot feel any personal responsibility under the circumstances, because Sandy and I were left to try and recover the royalty for our six years of work if we could.

I offer the story of how we failed as a horrible warning to the "Lemmings of the Brain Drain".

Although my initiative in developing the fully-submerged hydrofoil as a private venture in Britain and taking it at my own expense to the USA for adoption by the US Navy has triggered off a programme that the Daily Telegraph estimates at \$200,000,000, it is nevertheless fantastic to note that Sandy's initial small investment in dollars that stopped me from having to come home to final disaster was totally lost.

In 1946-49 hydrofoil manufacture in Britain was rendered totally impossible by Board of Trade and Admiralty refusals of all permits to build and/or for materials, so that an escape to the USA was a sine qua non. No company could work without materials and even the permit for some small off-cuts of ply for the RAE tank test model was refused.

After the Shackleton intervention and the H of C meeting in the office of the Hon J. Dugdale, the Admiralty had agreed to watch demonstrations but had refused to lift the ban on permits. A task of Sisyphus. I went to Germany to ask the Vertens family for advice and they suggested a sale to the USA! This would in fact solve the permit problem since any dollar payment at that time automatically produced materials but how to sell an as yet still unproved system to any financier in America? The miracle happened and we did just that. From film of the now worn out HN.4 I obtained a New York order for the Red Bug for the Boat Show, but the letter of credit stipulated a delivery time of one month: a totally impossible task, but I was used to impossible tasks by that time! We failed to deliver, of course, but we got a permit on the mere presentation of the dollar letter of credit and Red Bug was born. Again we failed to make it run on a second-hand one-cylinder motor-bicycle engine and chain drive to the

air prop, but I had contacts in Paris, so I left with the BUG minus engine and a Flying Flea four-cylinder two-stroke AVA was mounted at St Maur in the spring of 1950. After some runs on the Marne, the French Navy asked for Toulon demonstrations and a warship put to sea from Toulon (the Somali) to watch. These were highly successful and provided some good advice, namely to get to the USA as fast as possible and to waste no more time in poverty-stricken Europe. The LIFE pictures were taken at the same time and appeared at the time of the "King's Story" and thus prepared my reception later in New York.

The Churchill interest had, of course, ceased on Admiralty assurances that they would watch demonstrations, which they then proceeded to decline to do! The French were right: and how!

The extreme need to go to America offered, however, no solution to the problem of how to survive or get paid. In Miami the Canadian Consul General had invited me to the Surf Club to meet Charles Kettering, the well-known inventor of the self-starter and Chief of Research of GM. After demonstrations to Kettering, he had congratulated me on having obtained a Navy contract and had assured me that my troubles were over: They had not begun!

The study contract had brought us nothing as we have seen. The half-scale Landing Craft measurements boat was a subject of argument. They were building what I failed to produce, namely the boat for the sea measurements and so, as a tool to prove my case, surely we could hardly expect a 5% royalty could we ... In exchange for a straight \$600 in lieu, we were given solemn promises that if the contract for the full-sized Landing Craft were to follow, then there would be no further argument about the 5%.

Sinister joke. Who has ever heard of no argument over a royalty?

With the Italian gear box mistake, the costs had rocketed and these were probably mainly the responsibility of the contractor. The idea of having to pay us 5% as well on top of all that was unthinkable, yet the contract stipulated that they should. They resorted to a stratagem.

No letters were written, but we were informed that the books would not be produced because the Navy objected. We would have to accept their say so and the cited price was an even more sinister joke. The total cost was given as well inferior to the quotation of the American firm for the Z drive designs only (i.e. paper).

We consulted an attorney at once. Yes, the contract was valid but the problem was to get a judgement in a matter that came under a cloak of secrecy and national security. As matters stood, we were told, there was no hope of a judgement from any Miami court. Confirmation or refutation (direct from the Navy) of the supposed veto was essential. With either we could obtain a judgement while without a Navy letter no court case was possible. The British Consul could do or suggest nothing. We had, of course, counted

on payment and we had many outstanding bills for our conversion kit business which, should the Royalty not be paid on six years work, Sandy would again have to foot.

At this juncture Kettering again arrived at the Surf Club for his annual relaxation and we took our problem to him. "NEVER in these United States" he thundered, "will it be said that ANY FIRM will escape paying what it owes by using National Security as a foil: write me that on a page or two with the essential facts and I will place it on the table of the Secretary to the Navy and YOU WILL BE PAID IN FULL."

If Kettering was probably generally right in his statements, in this case he was wrong and National Security was used with perfect success. The Navy refused to reply and washed its hands of a "purely commercial matter". We never saw the books but we sent in a chartered accountant and obtained, at a cost of \$500, a written statement that this was refused as well as their statement of the costs they intended to include. This can be compared to a much later Navy letter giving about twice the sum as the "allowable costs", ie probably without the "snowball": a purely Pyrrhic victory.

Possibly the most curious letters of all were the refusal of the Inventors Council to help on grounds that a Royalty would only be payable should the Navy wish to build more hydrofoils of the same system: an argument that selected to ignore the fact that we had a legal contract for a specific undertaking which had been completed and paid for and in which a percentage was agreed in lieu of other payments such as, for example, a salary as was paid to all other members of the team. Under a similar line of argument there would be no need to pay for a house and it would suffice to tell one's builder that if his house gives satisfaction and other houses are required of the same type, then they will be paid for.

That the Navy would NOT want any more was ensured by the mechanical monstrosity of the in-flight retraction and the enormous length of the arms, an entirely extraneous complication of no interest to Hydrofins per se. It explains entirely the introduction of ultra sonic sensors whose cost have since caused American hydrofoils to zoom into the stratosphere and virtually cause a close down of the \$200.000.000 programme at a time when Britain is at last waking from a long sleep.

The financial loss of having worked six years in the USA for virtually no pay was such a severe lesson to me that I have been forced to adopt very special precautions against such involvement ever since. At the same time the need to evolve a new system able to dispense with the forward pointing feeler antennae and get such ideas tested without commercial involvement has involved "invention" of a new and quite peculiar type.

To some degree, what had happened to me was inevitable. The yard was known to be a long way into the red from the start and only the continued interest of the Navy over a period of years could have saved them. Unfortunately, instead of helping us to improve the appearance of the already strange-looking RED BUG and ICARUS they designed something that looked not merely strange but loathsome. It appeared that when the feeler arm system was "scientifically developed" it would produce a monster of hideous

proportions. That the proportions were a direct result of in-flight retraction was overlooked since no landing was ever tried.

The remedy (using ultra sonics) was far worse than the malady and only pushed the cost of hydrofoil craft into the stratosphere without any gain in performance: in fact a loss, since there is no longer any protection against the sea crash.

Realising that a re-think of the problem was long overdue and that I could never expect to find any commercial help to do this, I have set out deliberately to exploit the rather naughty military uses that even small craft with almost complete wave ignoring ability have to offer in several forms. The result is an entirely new approach to the mechanical signal that uses the wave power source for incidence control with damping, gain adjustment, etc, taking place inside the hull on small elements with pilot over-ride.

It is generally expected that the small navies will be far quicker to take advantage of the anti-displacement revolution than the large prestige navies which will tend to be left high and dry by the tide of change.

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