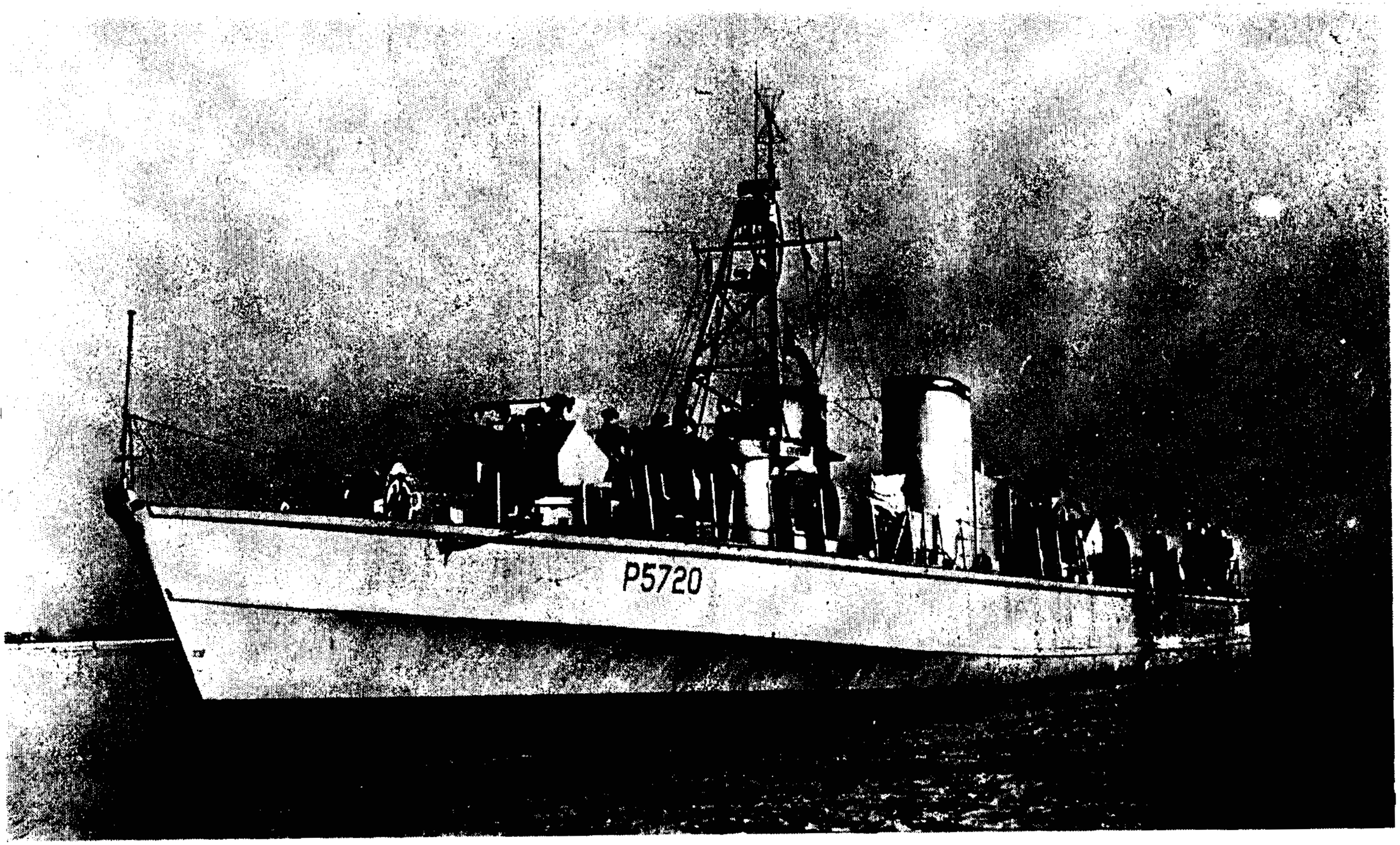


H.M.S. "BOLD PATHFINDER"

FAST PATROL BOATS

BY

COMMANDER (E) A. E. HOLLAMBY, M.I.Mar.E., R.N.

The Problem

Recent references in the press to a F.P.B. which, it is understood, will be one of the fastest yet built, brings back some of the atmosphere of romance associated with actions at sea in the olden days when individual initiative meant so much in the conduct of the fight, which was always at close quarters. The majority of F.P.B.'s crew, when in action, are on deck and in visual range of the enemy, unlike their opposite numbers in other naval vessels who are conducting, by means of various gadgets, surface long range or undersea warfare remote from the targets of their weapons.

In the case of F.P.B.s, although the intimate nature of an action still exists as of old, the time factor is very very different. Whereas before there was usually plenty of time to clear lower deck and give three rousing cheers when within earshot of the enemy (which to say the least of it was rather disconcerting to him) before going to Action Stations, the F.P.B. is usually within lethal range of the enemy before being in a position to act offensively. Therefore the necessity for speed is of the utmost importance, the ability to get in an attack and away as fast as possible, the faster the better.

Again, taking into account air reconnaissance and the desirability for an element of surprise, to have a measure of success F.P.B. operations must be carried out during the hours of dusk, night and dawn, therefore time is a limiting factor. As the time is fixed the range will be fixed accordingly to the speed of the craft. If, for example, we assume 12 hours as the period available for a base-back-to-base operation then a 50-knot craft would have a 300 miles radius there and back and a 25-knot craft half this range. If it is desired to keep the craft in a particular area for a number of hours then the range will decrease accordingly.

Evidently from all aspects because there is a time limit, the requirement must be for the maximum continuous speed possible, so the reader may well think ' Why cannot a F.P.B. be designed to do 100 knots, or more like some of the high speed racing boats?', and the answer is they cannot for the following reasons.

A high speed racing boat is designed with a hull suitable for enclosed waters and big enough to carry the machinery, the coxswain and sufficient fuel to carry out the speed trials. When we consider that in a 70-ft. F.P.B. one ton on the displacement will make a difference of about two knots at say 50 knots, it leaves very little to the imagination to assess the penalties on speed of the weight necessary to provide—

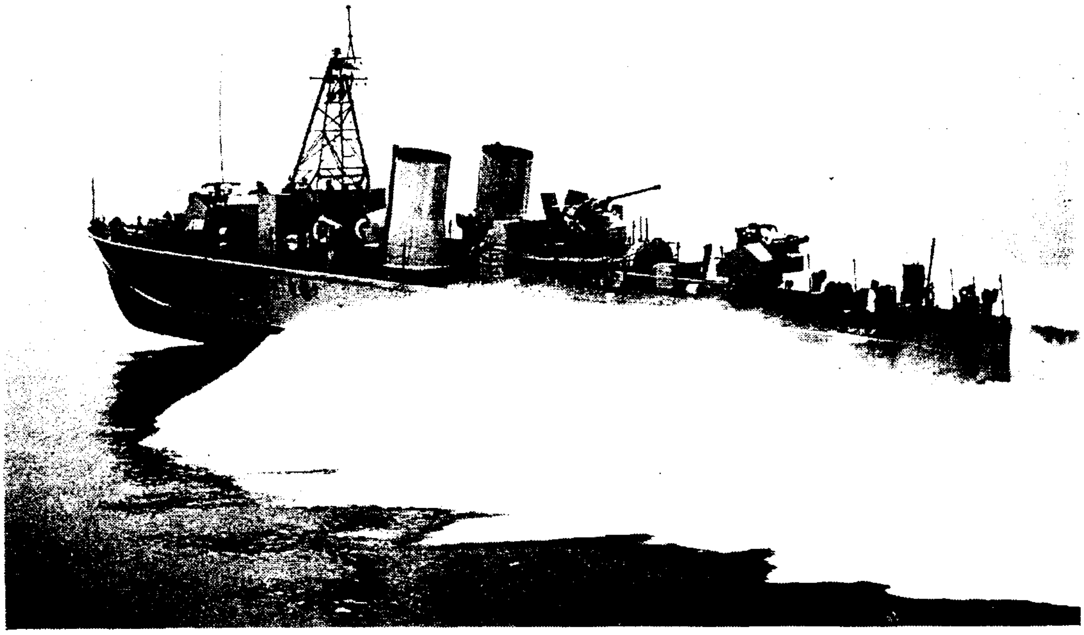
(*a*) A hull strong enough to stand up to rough sea conditions,

(*b*) Armament,

(*c*) Accommodation which entails length, and thus more hull weight,

(*d*) Fuel sufficient for the endurance.

In the early stages of the design of a F.P.B., the procedure is the same as that for all other fighting units. Certain requirements are fixed and thereafter a compromise must be worked out. (The sum total of the requirements of the Departments always exceeds the available weight and space in the projected craft.) Let us take a purely arbitrary example based say on a F.P.B. of similar



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H.M.S. "BOLD PIONEER" ON TRIALS

size to those built in the Second World War. Now for considerations of quantity production, available building slips and speed of construction, the length of the boat will be determined, and for our purposes let us say 70-ft with a displacement of 55 tons. Now this weight must be apportioned out into three main requirements—

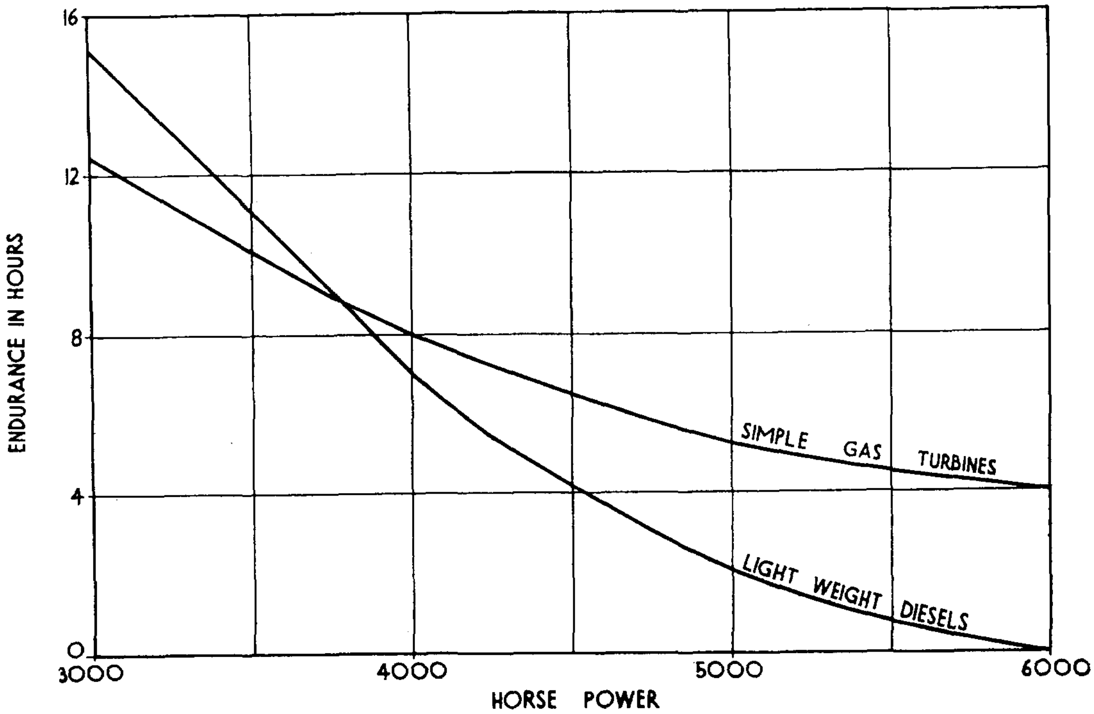
(i) Hull and accessories,

(ii) Machinery and fuel,

(iii) Armament,

bearing in mind the fact that (i) and (ii) are only the means of providing transport for the actual weapons which are needed for fighting. Let us assume that the armament and hull weight absorbs 35 tons. Then the Engineer-in-Chief's problem is to provide machinery and fuel to meet the required speed and endurance within the limit of 20 tons. A point to remember is that the higher the power the higher the fuel consumption, if the power is doubled the fuel consumption will be doubled. If the power is doubled the speed is *not* doubled, as the speed-power curve will conform to somewhere between a square and a cube law ; however the problem must be to get as much power into the craft as possible consistent with the requirements for endurance.

From the aspects of weight and space limitations, there are only two possible forms of propulsion, light weight I.C.E.s or simple gas turbines. Due to the fire risk, gasolene engines are not favoured, but in the absence of suitable I.C.E. and gas turbine units, they would have to be used. For the purpose of this exercise, let us assume that we have available light weight diesel machinery and suitable simple gas turbines of whatever power we may require. It is evident from this assumption that the consideration will be purely theoretical, but it will bring out clearly the influence of endurance on the power that can be installed.



GRAPH SHOWING THE EFFECT ON ENDURANCE WITH HIGHER POWERED INSTALLATIONS

Assumptions

(*a*) *Light Weight Diesel Installation*

(i) Installation Weight	8 lb/s.h.p.
(ii) Fuel Consumption	.45 lb/s.h.p./hr.

(*b*) *Simple Gas Turbine Installation*

(i) Installation Weight	4 lb/s.h.p.
(ii) Fuel Consumption	.9 lb/s.h.p./hr.

Note : Installation Weight to include all auxiliaries, and Fuel Consumption to include that required for the generators.

As stated previously for the purposes of our example, the Engineer-in-Chief has 20-tons to play with so let us plot a graph of h.p./Endurance and see what we get in the accompanying graph.

Calculations

(*a*) *Light Weight Diesel Installation*

Horse Power	3,000	3,500	4,000	5,000
Installation Weight (Tons) at 8 lb/h.p. ...	10.7	12.5	14.3	18
Weight remaining for fuel (Tons)... ...	9.3	7.5	5.7	2
Endurance (Hours) at .45 lb/h.p./hr. ...	15	10.66	7	2

(*b*) *Simple Gas Turbine Installation*

Horse Power	3,000	4,000	5,000	6,000
Installation Weight (Tons) at 4 lb/h.p. ...	5.3	7.1	9	10.7
Weight remaining for fuel (Tons)... ...	14.7	12.9	11	9.3
Endurance (Hours) at .9 lb/h.p./hr. ...	12.25	8	5.5	3.9

Analysis

(1) If a total endurance of 12 hours is required (6 hours there and 6 hours back) then with gas turbines we can install 3,075 h.p. and light weight diesels 3,325 h.p.

(2) If an endurance of 9 hours is required, we can install 3,725 h.p. using either installation.

(3) If an endurance of 4 hours is required, with gas turbines we can install nearly 6,000 h.p. as against approximately 4,500 h.p. for diesels.

Conclusions

Only the weight aspect has been dealt with here, on hypothetical assumptions for machinery weight, but the influence of only a few hours of endurance will be analogous as the fuel consumptions are typical. To attain very high speeds, very high powers are required, but in the example quoted there would appear to be no object in installing more than 4,000 h.p. as the endurance would be less than eight hours. If 4,000 h.p. gives the craft 40 knots, then the range will be 160 miles. If this is not acceptable, then bargaining must commence which may mean sacrifice of armament to gain more weight for machinery and fuel and consequent increased power and endurance. There is no mystery about high speed craft ; it is purely a question of what one is prepared to sacrifice to install higher powered machinery and thus attain higher speeds.