



# What Price Hovercraft?

TRENDS IN FIRST COST OF OVERWATER PASSENGER TRANSPORT

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ONE OF THE MOST important factors affecting the overall cost of any form of transport is the first cost of the vehicle. Profit margins are sensitive to changes in first cost, so that it is not surprising that potential operators of new craft attach great importance to the capital required. During the past year interest in the first cost of air-cushion vehicles has become intense. Now that practical passenger-carrying craft have been demonstrated, the question "How much will they cost?" comes quickly to the fore. It is important at this stage to be very careful with the use of adjectives such as "cheap" or "expensive," since these words imply assessment on some comparable basis. Unfortunately these words are often used without any reference to a basis of comparison, such as the transport capabilities of the craft in question.

It seems, therefore, that there is a need to set down some of the underlying factors which appear to govern first cost in order that the cost of Hovercraft may be judged in relation to other forms of overwater passenger transport. It is hoped that, in so doing, the data presented will assist future estimates of likely first costs. It is still too early for ACV prices to have become established as firmly as those of aircraft, but the underlying factors which have a direct bearing on price do permit the general trends to be predicted.

If we consider first cost as simply the price to pay for a craft to achieve a certain work output—defined as the carriage of its design payload at its design still-air cruising speed (this we might call the potential work-capacity)—then it would be reasonable to suppose that, as the product (payload × speed) increases, first cost would also increase by virtue of increase in size and/or power. This is indeed so, and, for a given form of transport, the pay-

load-ton × knots is a factor having a dominant influence on first cost. It is also apparent that horsepower per ton-knot goes some way towards accounting for variations in first cost per ton-knot.

To examine the basis of first costs, this article considers first costs of civil passenger aircraft, helicopters, Hovercraft, hydrofoil boats and day-service passenger ferry boats. Whenever possible prices are those quoted during the years 1961 and 1962.

## Aircraft First Costs and Basic Price Trends

More price information appears to be available on aircraft than on any other form of mass transport. To some extent, therefore, aircraft costs permit a better idea of trends to be obtained than do other forms of transport.

The most general practice for assessing first cost has been to consider the cost per unit weight of structure and engines, or of equipped or gross weight.

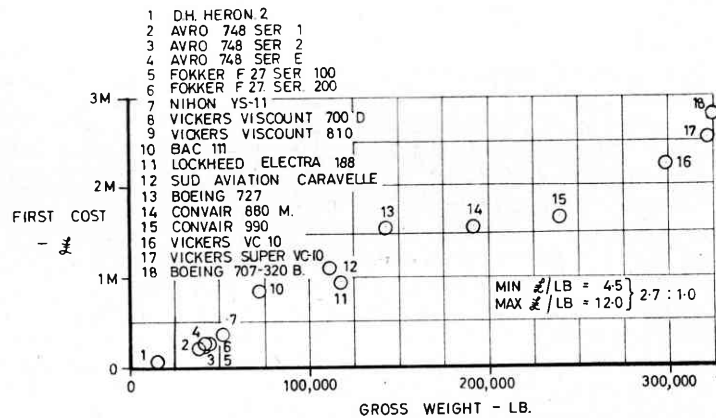
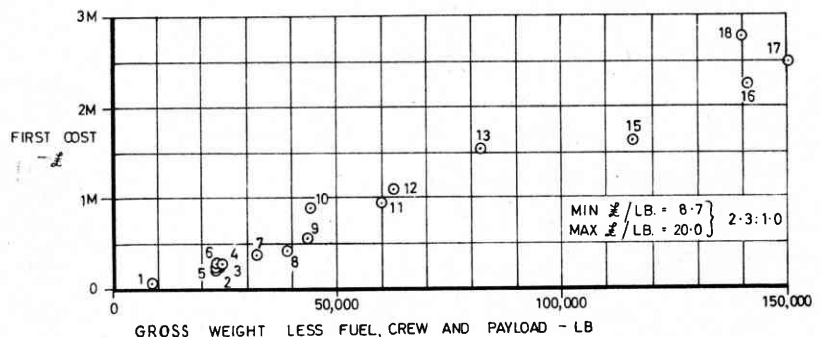


Fig 1 Variation of the first cost of passenger-carrying aircraft with gross weight

Fig 2 Variation of the first cost of passenger-carrying aircraft with gross weight, less fuel, crew and payload



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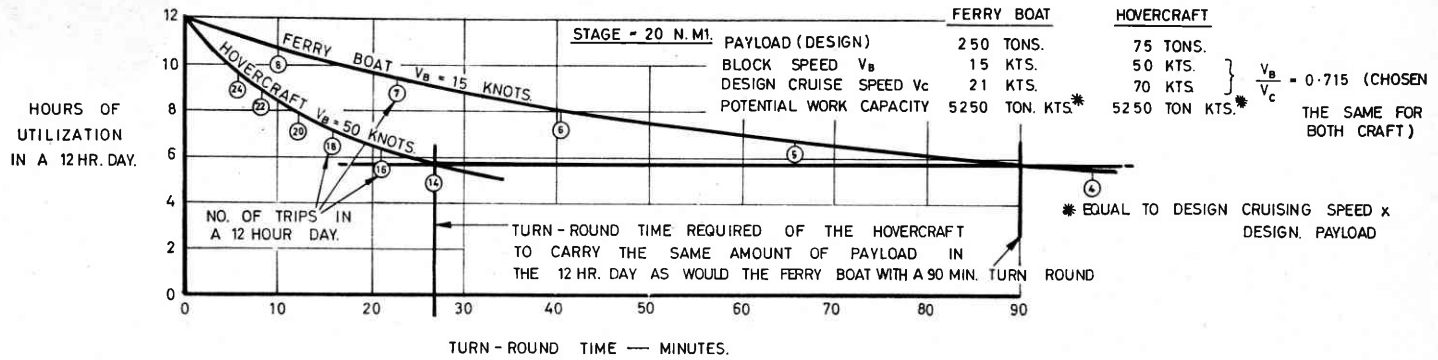


Fig 3 Comparison of the effect of turn-round time on utilization and number of trips for a ferry boat and a Hovercraft each having the same potential work capacity

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This approach, however, provides a result with very limited meaning when comparing various forms of transport. Cost per unit weight gives no direct information on what value for money is being obtained, in terms of transport capability; it is perhaps most useful as a manufacturing cost index. Fig 1, from the data in Table 1,\* shows prices for various passenger aircraft plotted against gross weight. There is certainly an increase with increase in weight; but the scatter is large, reflecting a variation in £/lb from 4.5 to over 12.0, or a spread of 1.0 to 2.7 on the minimum value. Fig 2 shows the same prices plotted against gross weight less fuel, crew and payload. A similar result is obtained; but, as would be expected, a reduced variation: 8.7 to 20.0 £/lb, a spread of 1.0 : 2.3.

These variations mean that the estimation of first cost using an assumed value of cost per pound of weight can only be very approximate, although individual classes of aircraft would show less variation. It is worth emphasizing at this point that one is usually more interested in what a craft will do in terms of transport capability than in

how much it will weigh. Comparisons of cost per unit weight between various forms of transport can produce misleading impressions of relative costs, since no account is taken of the speed factor or the actual weight of payload carried.

The approach adopted in this article is based on the potential work capacity of the craft concerned, i.e., capacity payloads in conjunction with design cruising speeds. In practice there may well be a different relationship between the potential and actual work capacity for the various craft concerned. Factors such as wind and sea states; runway lengths, heights and temperatures; sea and air traffic-control restrictions and noise-level restrictions will all affect this relationship. Another major factor

controlling the relationship of work-capacity to work done is turn-round time in relation to stage length and block speed. Turn-round time assumes progressively greater importance as craft speed increases.

Fig 3 goes some way towards illustrating this situation for two types of craft having the same potential work-capacity: a 21kt ferry boat carrying 250 tons of payload and a 70kt Hovercraft carrying 75 tons of payload. Both craft have 5,250 ton-kt of potential work-capacity.

Assuming the craft are to operate over a 20 n.m. stage, it is seen that, if the turn-round time for the ferry boat is 90min (this is a typical current figure for some ferry services), the Hovercraft turn-round would have to be held down

\* The tables will be published in Pt 2 of this article—Ed.

Fig 4 Variation of the first cost of passenger-carrying aircraft with potential work capacity based on capacity payload and design cruising speed

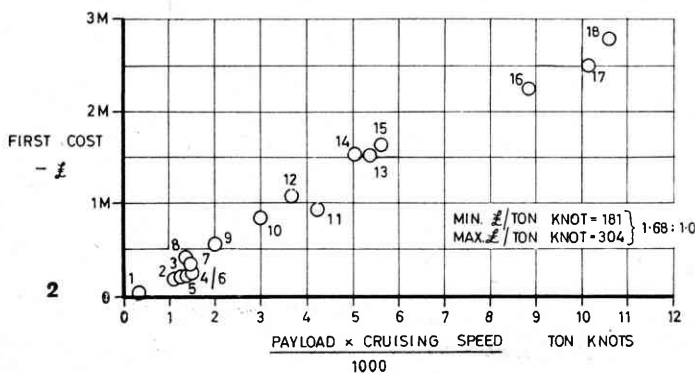
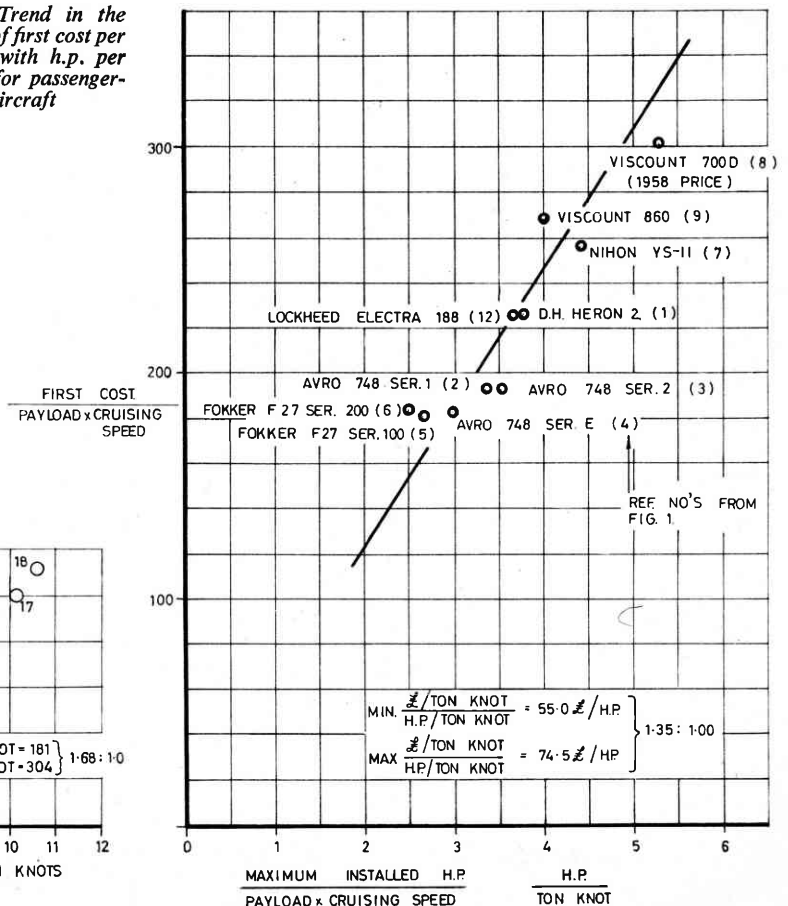


Fig 5 Trend in the variation of first cost per ton knot with h.p. per ton knot for passenger-carrying aircraft



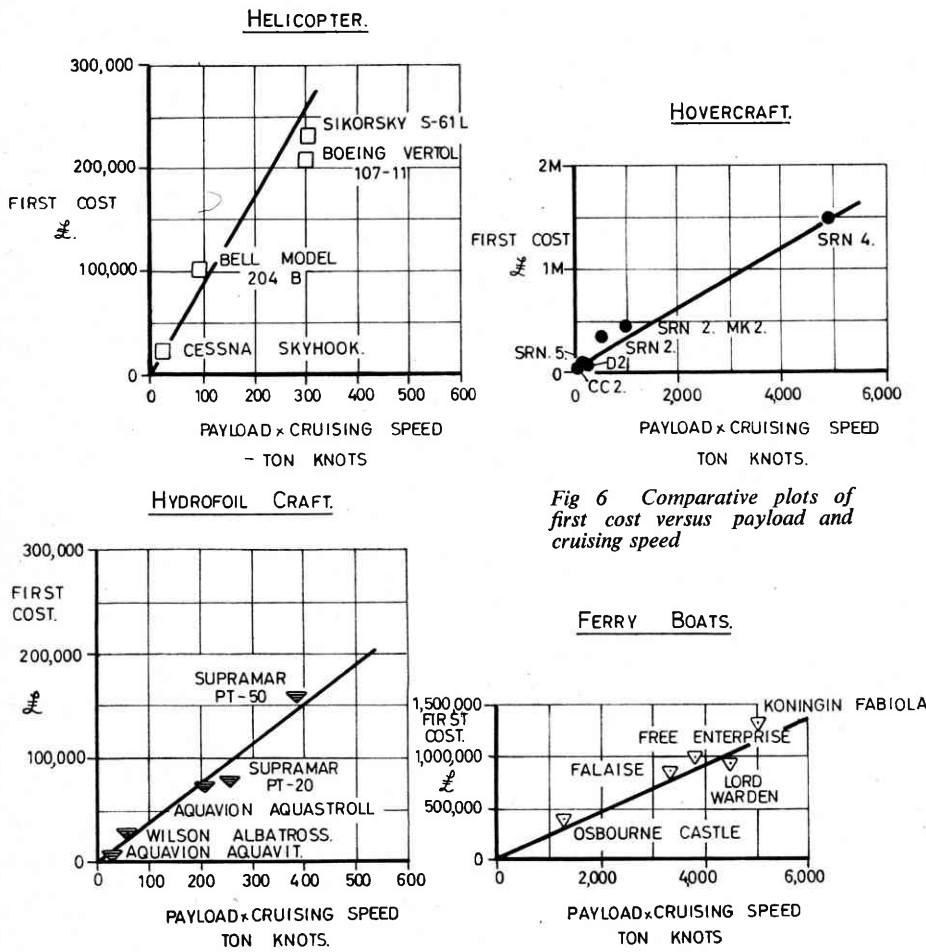


Fig 6 Comparative plots of first cost versus payload and cruising speed

to only 27min (0.30 × 90min) in order to obtain the same utilization, and hence the same actual work done over the 12hr day—assuming, in addition, that the load factors for the two craft are the same. Since the payload of the Hovercraft is 0.3 of that of the ferry boat, to secure a turn-round time of 27min would not appear at all difficult. In fact much shorter turn-round times appear possible for this size of Hovercraft, and it looks as if in the type of comparison made above between a ferry boat and a Hovercraft we may find that, for the same potential work capacity, the actual work done by the Hovercraft will exceed that of the ferry boat.

In the example above, the ratio of block speed to cruise speed has been kept the same for the two craft. There may well be a difference in practice depending upon harbour entrance restrictions, channel depths, sea and wind conditions. Moreover, not only is the Hovercraft capable of doing at least the same amount of work (ton-miles) as that of the ferry boat (for the same potential work capacity) but also the trip time is cut to less than a third and the frequency of service offered is increased to more than three times that of the ferry boat. As will be shown later, it can be expected that these two craft, each having a potential work capacity of 5,250 ton-kt, could be expected to have approximately the same first costs,

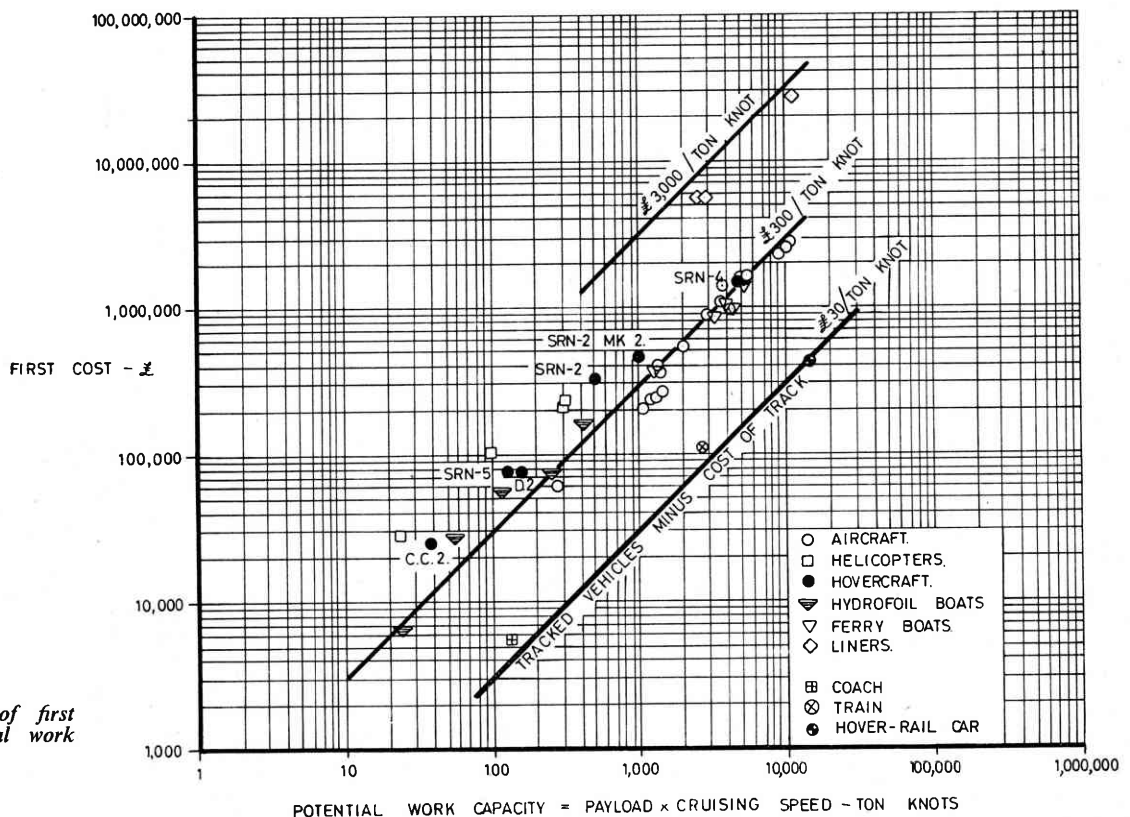


Fig 7 Dependence of first cost on craft potential work capacity

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but the faster craft is obviously giving a much improved service in terms of speed and frequency of operation. It is also worth noting that, for any transport craft, decreasing turn-round time will, in putting up utilization, reduce the number of craft required to do a given job. The capital required for purchase of craft will correspondingly decrease.

The percentage scatter shown in Figs 1 and 2 for first cost expressed on a £/lb basis is appreciably reduced when first cost is expressed on a £/ton-knot basis (Fig 4). A variation is £/ton-knot (which we might call specific first cost) of from 181 to 304 is incurred, a spread of 1.0 to 1.68 on the minimum value. If we now consider the power required to obtain the ton-knot output, it is found, for the piston-engine and turboprop aircraft, that the trend of the scatter may be accounted for by the installed horsepower per ton-knot. Figures for cruising powers are not always available, so for the purpose of determining this trend maximum take-off powers have been used, i.e., maximum installed power.

Taking into account horsepower per ton-knot, we obtain the result shown in Fig 5 in which the relationship of cost per ton-knot to horsepower per ton-knot is apparent. The degree of scatter is again reduced, though this time only the piston and turboprop aircraft are plotted. The parametric variation is between 55.0 and 74.5, i.e., a spread of 1.0 : 1.35. The variation which remains within this graph, and which would be met with all the vehicles discussed in this article, may be due to such factors as: number of aircraft produced or to be produced (break-even number); use of new or well-developed engines; share of design and development costs; possible government subsidy behind prices; import duty; date of price quotation; standard of equipment and seating; efficiency of the manufacturer; and the profit margin.

No attempt has been made in Fig 5 to include the jet aircraft, since no satisfactory thrust-to-power conversions can be made. Nevertheless, it is interesting to note in Fig 4 that the average cost per ton-knot for the jets tends to be above the average for the propeller-driven types for the sample chosen.

A crude equivalent to installed maximum horsepower, based on maximum static thrust in conjunction with design cruising speed, was tried for the jet aircraft; but this failed to produce any trend at all. This may be due to dealing with too small a sample containing extreme cases, or, conversely, the apparently good correlation shown for the piston and turboprop aircraft may just be fortuitous.

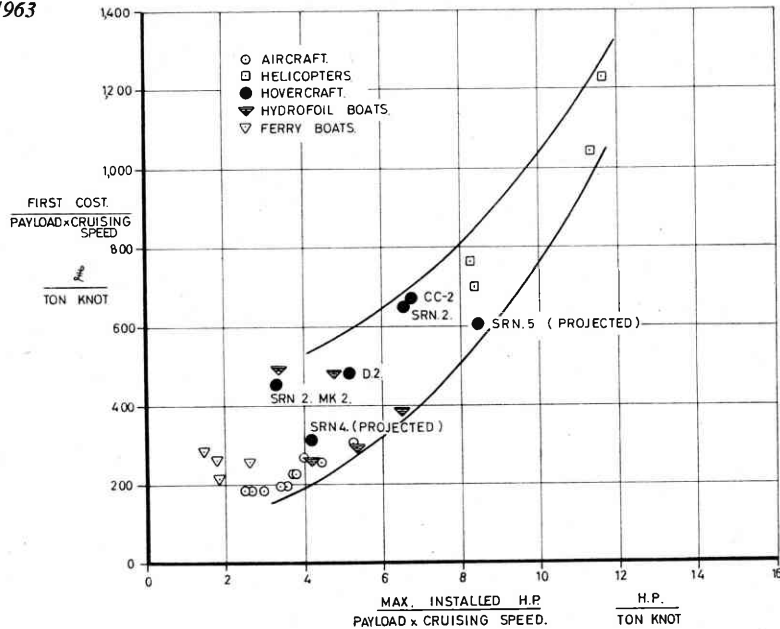


Fig 8 General trend in specific first cost for five types of over-water passenger-carrying craft

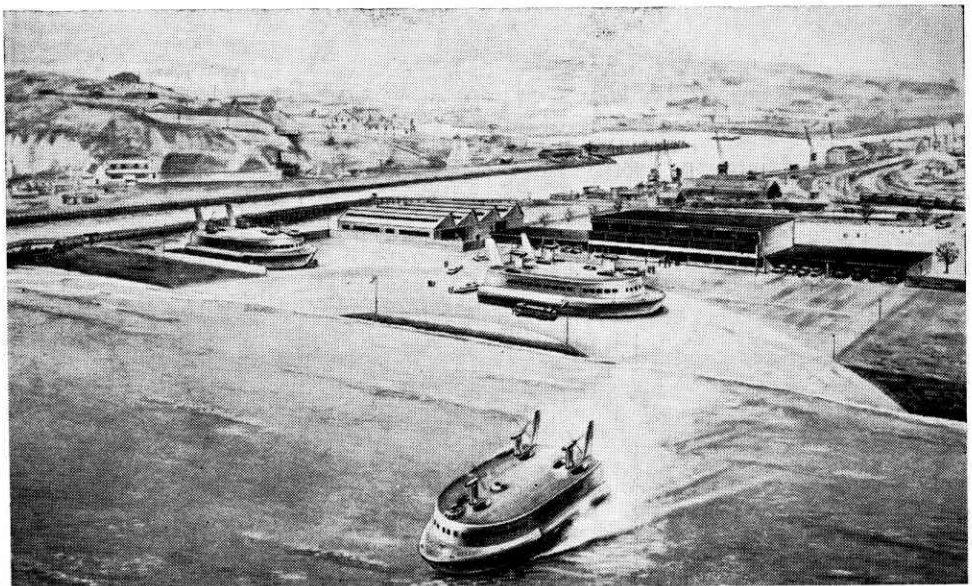
**First Cost Trends**

Having established these trends for aircraft it is now to be expected that similar trends may be obtained for helicopters, Hovercraft, hydrofoil boats and ferry boats. Fig 6, based on data from Tables 2, 3, 4 and 5, shows first cost for these craft plotted against payload times cruising speed. It is apparent that the same relation is found as for aircraft; and, further, that the costs per ton-knot for the smaller peripheral-jet Hovercraft and helicopters are similar, while the hydrofoil and ferry-boat costs appear to be at lower levels. This difference is clearly shown in Fig 7 where costs for all types of craft are plotted together.\* This plot also brings out the fact that the projected SR.N4 has a cost

\* The opportunity has been taken to add some data on liners to bring out the seldom-appreciated extreme cost of putting an hotel afloat; and also a typical first cost for a motor coach and a train, and an HDL estimate for a 600-seat Hover-railcar.

per payload-ton knot on a level with aircraft and ferry boats. The reason for the grouping together of ferry boats, aircraft, hydrofoil boats and the large SR.N4 on the one hand, and smaller peripheral-jet Hovercraft and helicopters on the other, can partly be explained by considering their values of horsepower per ton-knot. Not only may this parameter account for some of the scatter for a particular type of craft, but it also accounts for some of the specific price differences between different types of craft. Fig 8 shows how price per ton-knot varies with horsepower per ton-knot for the five main types of craft considered. Each type of craft in this figure occupies a range of horsepower per payload-ton knot. For some types of craft the degree of scatter is quite marked, and only collectively does a definite trend become apparent. It is this trend which produces the scatter in Fig 7.

Installations for a 24-hour service by—referred to above—SR.N4s



Part 2

IN THE FIRST PART of this article the first cost (purchase price) of various types of overwater passenger-carrying craft was examined, and numerous factors affecting this cost considered. A series of eight illustrations showed various plots of these parameters, singly and in combination, to emphasize the importance of the product of payload times cruising speed (ton-kt) and of installed power divided by payload times cruising speed.

Over the past 25 years the installed power per payload ton-kt required by transport aircraft has been approximately halved (Fig 9). For both peripheral and sidewall types of Hovercraft, increase in size, the use of flexible structures and sealing elements and aerodynamic improvements will in general bring about reduced specific power requirements, reflecting increases in lift/drag and payload-to-gross-weight ratio. Considering the size effect alone, this arises from the air-curtain horsepower being proportional to cushion perimeter, and the resultant lift being proportional to cushion area. For instance, for a nominal circular craft of 25ft diameter and weight of 10 tons (cushion pressure, 45lb/sq ft) the air-curtain horsepower required per ton of lift per foot of hoverheight would be about 64, while a 100ft diameter craft at 160 tons (cushion pressure as before) would have a corresponding value of only 16.

This 4 to 1 reduction would, of course, be felt on a practical craft only if hoverheight remained unchanged, i.e. if hoverheight-to-diameter ratio was allowed to decrease. In practice, an increase in hard-structure clearance height with increase in size is likely, but this will most probably be accomplished by the use of flexible skirts or trunks. For the same reason that the relative power penalty of the peripheral curtain decreases with increase in craft size, so will the relative skirt-drag penalty decrease. The net result will be a reduction in specific curtain horsepower requirement. Hence we may confidently expect that as Hovercraft are developed in the 100- to 200-ton range, horsepower per ton-knot values will fall. And as horsepower per ton-

knot appears to have a direct bearing on first cost we may expect a corresponding decrease in specific first cost. Studies for a 150-ton peripheral-jet ACV† show that we may expect the cost per ton-knot to be on a level with ferry boats and aircraft.

An interesting feature of Fig 8‡ is that although the £/ton-knot values are similar for ferry boats and aircraft, the mean h.p./ton-knot values for aircraft are about double those of the ferry boats. This tends to suggest that the cost of the boats is kept up by the sheer bulk size of the craft in relation to its payload, and that the influence of the powerplant is not so great on first cost as it is for aircraft. By building in heavier structure, equipment and furnishings, the useful life of the vessel is, of course, extended; and, presumably, the correct compromise between useful life and first cost has long ago been established.

As world prices rise, the values in Fig 8 will also rise; some of the scatter in that illustration may arise

from the fact that the quoted prices which have been used span the period 1959-1963, and some escalation is inevitably involved. Plenty has been heard of the rise in aircraft prices over the past few years, but it is interesting to take a further look at this factor in the context of this article. Fig 10 shows how the specific first cost of aircraft per ton-knot has risen since 1936. Against this rise there has been the previously discussed fall in the power requirements per ton-knot (Fig 9), which factor produces some of the scatter in Fig 10 and reduces the slope of the curve.

Fig 11 brings out the "size" effect, in terms of payload × cruising speed, which benefits the ACV; and, of course, increases in size naturally lead to general development in many direc-

† The recently announced SR.N4 proposal confirms this argument.  
‡ Reproduced in Pt 1.

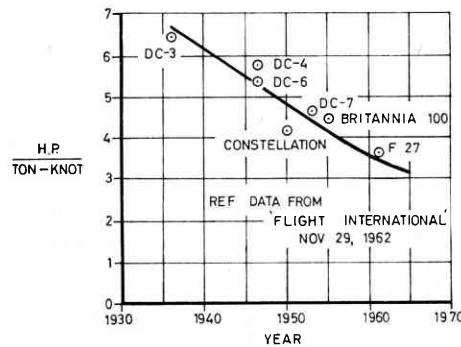


Fig 9: Decrease in horsepower per payload ton-knot of passenger-carrying aircraft over the past 25 years

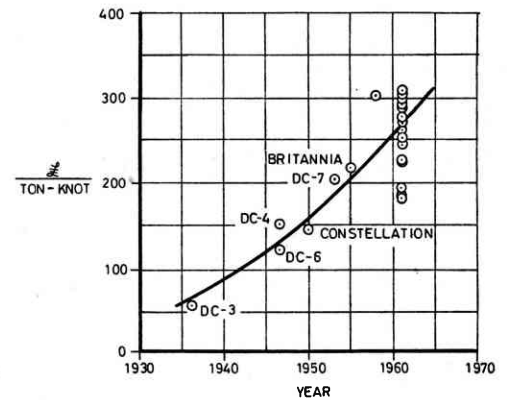
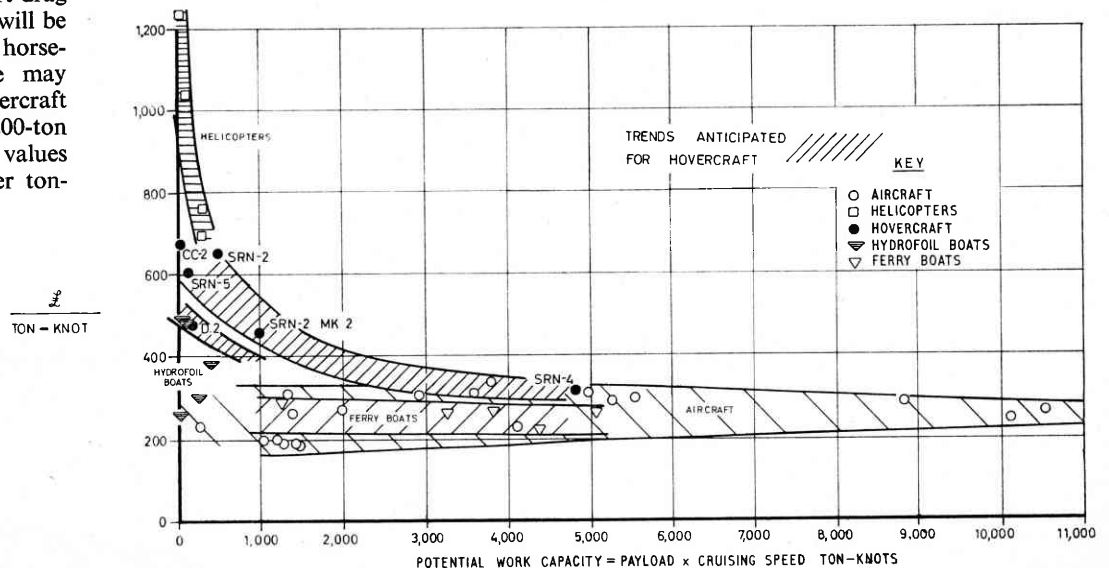
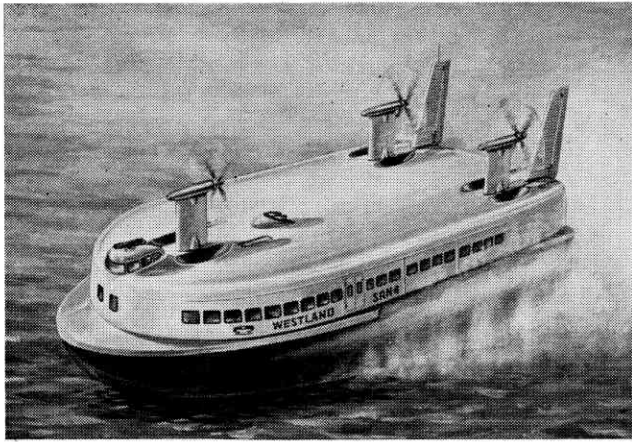


Fig 10: Rise in specific first cost of passenger-carrying aircraft over the past 25 years

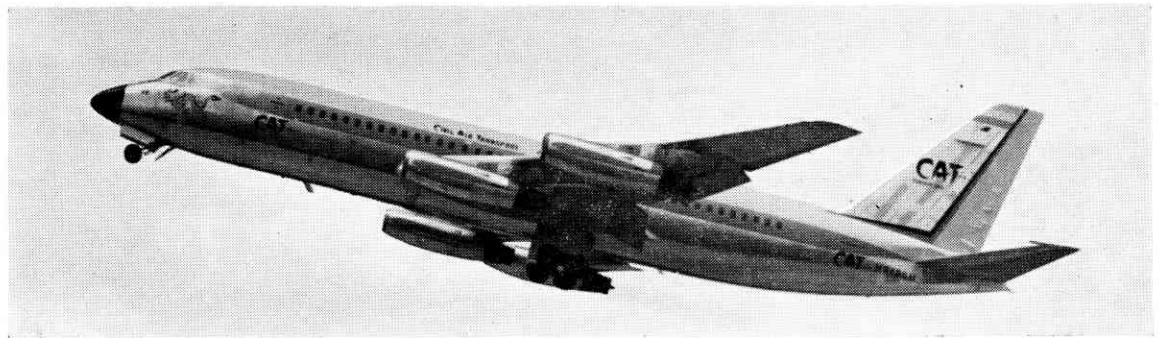
Fig 11 (right): Trends of ACV specific costs (peripheral-jet and sidewall) in relation to similar trends for other forms of overwater passenger transport





These three overwater passenger-carrying vehicles all have similar work-capacities and similar first costs: Westland SR.N4 air-cushion vehicle (about 4,820 ton-kt, about £1,500,000); "Koningin Fabiola" Belgian Marine car ferry (5,050 ton-kt, £1,320,000); and General Dynamics/Convair 880M jetliner (4,990 ton-kt, £1,536,000)

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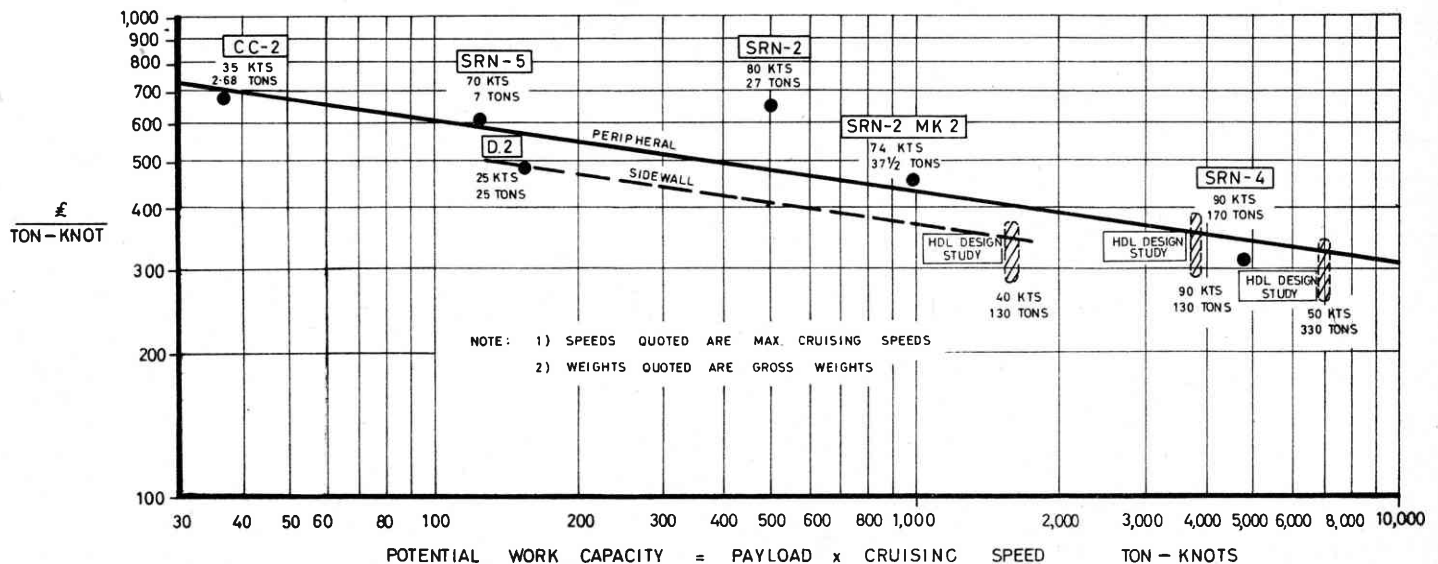
tions. For the specific first cost of the projected SR.N4 to be already of the order of that of ferry boats and aircraft is some achievement when it is considered that only some six years development will lie behind such a craft, compared with 50 years or more for the boats and aircraft. Many highly developed components as well as advanced

materials and manufacturing techniques, are, of course, already available for any new vehicle such as a Hovercraft; and these factors certainly contribute towards the ability to produce an efficient and low-cost craft in a relatively short time.

When plotted on a logarithmic grid, the ACV prices of Fig 11 show a trend

which would predict a continued decrease in first cost per ton-knot with increasing size (Fig 12). This trend, combined with further ACV development, indicates that we may expect to see Hovercraft first costs per ton-knot to fall as low as those of other forms of comparable overwater transport, and eventually to drop to a new low level.

Fig 12: A plot on logarithmic axes of the same parameters as those of Fig 11. This presentation brings out the trend of costs resulting from the fundamental "size" effect: cushion power/perimeter divided by cushion lift/area



**Conclusion**

This article has attempted to show the likely trends of Hovercraft first costs in relation to those of existing forms of overwater transport. Looking at first cost in relation to the payload-ton-knot output of a craft shows the dominant influence of this parameter; and, further, that installed horsepower per ton-knot has a significant influence on first cost over the broader spectrum.

Considering cost per unit weight, it is well known that there is a wide gulf between ships and aircraft. For a new type of craft there is no satisfactory approach by which an interpolation or extrapolation of aircraft or ship costs on a basis of cost per unit weight may be made. On a basis of ton-knot capacity and horsepower per ton-knot, the first cost has been shown in this article to follow well-defined trends for five types of overwater passenger-carrying transport craft. These trends demonstrate the point that, as the installed horsepower per ton-knot for Hovercraft will decrease with increasing size (a fundamental characteristic of these craft), and the development of flexible sealing elements and aerodynamic refinement will lead to increased lift/drag ratios and payload-

to-gross-weight ratios, first cost per ton-knot will decrease; and we may expect it to reach the values already achieved by ferry boats and passenger-carrying transport aircraft. The latter vehicles are, of course, capable of very profitable operation; but it is interesting to note that hydrofoil boats, which have slightly higher horsepower per ton-knot values, and helicopters—which are much higher—are also in commercial passenger-carrying operation on a profitable basis, although in the case of the latter on only a very small scale.

The point here is that helicopters, hydrofoil boats and ACVs all permit transport operations which ferry boats and aircraft cannot perform. This is especially true of the Hovercraft. Though it has been shown in this article that first cost can be related to the work-capacity of the craft—and, more broadly, to the power required per unit of work-capacity—it is also obviously true that the cost must be judged as well in relation to the other capabilities of the vehicle which are less easily defined. For instance, in the case of the ACV, if a demand is present for particular requirements such as an amphibious capability, or over-ice or

over-swamp operations, then, in assessing the cost of the craft, consideration must be given not only to its efficiency as a transport vehicle, but also to what it can do that other craft cannot.

Summing up then, in the light of present knowledge, it may be said that small peripheral-jet Hovercraft (up to say 50 tons gross weight) have specific first costs on a level between helicopters and aircraft or ferry boats, and may be quite acceptable for specialized applications. Larger peripheral-jet ACVs—say 50 to 200 tons—will have specific first costs approaching and equalling those of existing ferry boats and passenger-carrying aircraft, and should be acceptable for a wide field of general operations.

Sidewall Hovercraft, relatively economical in power, though at present restricted to speeds below 50kt, will have specific costs approaching those of ferry boats and aircraft from the smaller sizes (25 tons) upwards. In fact, project studies indicate that specific costs lower than those of present ferry boats and aircraft may be obtained when craft of 100 tons and upwards are envisaged.

It is highly probable that ultimately, through the development of flexible

*Right, a Boeing 707-320B jetliner; below, the French Line flagship "France." Respective work-capacities are 10,560 ton-kt and 11,200 ton-kt; yet the liner costs ten times as much and weighs some 400 times as much*



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engineering techniques, the big differences at present marked between sidewall and peripheral-jet ACVs will disappear. The differences are fundamentally those associated with sealing

the air cushion and, as more refined methods are developed for achieving this seal, we may expect to see varying proportions of air-curtain and flexible-curtain sealing, depending upon the speed, wave and amphibious capabilities required. In all probability, the rather sharp differences in specific first cost for peripheral and sidewall craft

referred to above will also be lost; though it is to be expected that there will always remain some specific first cost difference between an amphibious and non-amphibious vehicle, and this is where it is essential to take account of the "what-it-can-do" factor. This factor should always be remembered in assessing the costs of any vehicle.

TABLE 1: AIRCRAFT DATA

Type	Basic price (£)	Equipped weight (lb)	Payload (long tons)	Cruise speed (kt)	Work capacity (ton-kt)	Cost per ton-kt (£)	Cost per lb wt (£)	Max h.p.	Power per ton-kt (h.p.)	Remarks
Heron 2	60,000	8,996	1.673	159	266	226	6.67	1,000	3.76	1961 price
748 Series 1	200,000	23,026	4.72	220	1,038	193	8.68	3,480	3.36	1961 price
748 Series 2	231,000	23,935	4.90	245	1,200	193	9.65	4,210	3.51	1961 price
748 E	260,000	24,818	5.81	245	1,423	183	10.47	4,210	2.96	1962 estimated price
F.27 100	238,000	22,740	5.48	236	1,292	184	10.47	3,480	2.70	1962 price
F.27 200	262,500	23,325	5.49	264	1,450	181	11.25	4,210	2.91	1962 price
Namco YS-11	357,000	31,988	5.42	257	1,394	256	11.15	6,060	4.39	1962 price, wt includes crew
Viscount 700D	400,000	38,358	4.91	270	1,325	302	10.42	6,960	5.25	1958 price, wt includes crew
Viscount 810	535,000	43,000	6.47	309	2,000	268	12.43	7,960	3.98	1962 price, wt includes crew
One-Eleven	875,000	43,546	6.25	469	2,930	299	20.10	22,200	—	1962 price
Electra	928,000	59,700	11.73	352	4,130	225	15.55	15,000	3.63	1962 price, wt includes crew
Caravelle	1,092,000	62,082	8.17	440	3,600	304	17.60	24,000	—	1962 price
727	1,525,000	81,500	10.71	494	5,300	288	18.70	42,500	—	1962 price, wt includes crew
CV-880M	1,536,000	93,000	10.32	483	4,990	308	—	44,800	—	1962 price
CV-990	1,627,000	115,833	11.21	496	5,570	292	14.04	56,500	—	1962 price, wt includes crew
VC10	2,250,000	141,300	18.0	490	8,820	284	15.92	72,000	—	1962 price
Super VC10	2,500,000	150,450	20.7	490	10,130	247	16.60	82,000	—	1962 price
707-320B	2,785,000	140,000	22.33	473	10,560	264	19.90	92,000	—	1962 price, wt includes crew

TABLE 2: ACV DATA

Type	Basic price (£)	Gross weight (lb)	Payload (long tons)	Cruise speed (kt)	Work capacity (ton-kt)	Cost per ton-kt (£)	Max h.p.	Power per ton-kt (h.p.)	Reference
CC-2 Mk 2	25,000	6,000	1.07	34.7	37	672	250	6.72	ACV Supplement March 28, 1963
D.2	75,000	56,000	6.25	25	156	481	800	5.13	Manufacturer
SR.N5	75,600	15,700	1.79	70	125	605	1,050	8.40	ACV Supplement June 28, 1963
SR.N2	325,700	60,700	6.25	80	500	651	3,260	6.52	ACV Supplement June 28, 1963
SR.N2 Mk 2	450,600	84,000	13.4	74	991	455	3,540	3.54	ACV Supplement June 28, 1963
SR.N4	1,500,000	381,000	53.6	90	4,820	311	—	—	ACV Supplement June 28, 1963

TABLE 3: FERRY-BOAT DATA

Name	Cost (£)	Gross weight (lb)	Payload (long tons)	Cruise speed (kt)	Work capacity (ton-kt)	Cost per ton-kt (£)	Max h.p.	Power per ton-kt (h.p.)	Reference
Free Enterprise	1,000,000	—	192	20	3,840	261	6,800	1.77	Modern Transport, February 10, 1962
Osborne Castle	360,000*	1,456,000	90	14	1,260	286	1,800†	1.43	The Engineer, April 20, 1962
Lord Warden	950,000	7,080,000	220	20	4,400	216	8,000	1.82	Travel Trade Gazette, July 13, 1962
Falaise	850,000	6,350,000	160	20.5	3,280	259	8,500	2.59	Various
Koningin Fabiola	1,320,000	7,210,000	240	22	5,050	262	10,560	2.10	Travel Trade Gazette, three issues

\* Price quoted in Press generally but not in named source; † continuous rating.

TABLE 4: HYDROFOIL DATA

Type	Price (£)	Gross weight (lb)	Payload (long tons)	Cruise speed (kt)	Work capacity (ton-kt)	Cost per ton-kt (£)	Max h.p.	Power per ton-kt (h.p.)	Reference
Aquavit	6,250	—	0.803	30	24.09	259	100	4.15	The Statist, July 20, 1961
Aquastroll	55,000	37,400	3.57	32	114.2	481	540	4.73	The Statist, July 20, 1961 (wt. from RINA paper by P. R. Crewe)
Supramar PT-50	160,000	134,300	10.44	40*	418	383	2,700	6.46	Southern Evening Echo, June 26, 1962
Supramar PT-20	75,000	62,700	6.7	38	254	295	1,350	5.31	Price, payload: ASNE Journal, November 1959
Wilson Albatross	26,800	13,440	1.97	28	54.5	491	181	3.32	Hovering Craft and Hydrofoil, March 1963

\* Speed quoted by travel brochure by Nyman and Schultz, Stockholm.

TABLE 5: HELICOPTER DATA

Type	Price (£)	Gross weight (lb)	Payload (long tons)	Cruise speed (kt)	Work capacity (ton-kt)	Cost per ton-kt (£)	Max h.p.	Power per ton-kt (h.p.)	Reference
Bell 204 B	101,800	8,500	0.893	109.2	97.5	1,044	1,100	11.30	Flight, May 11, 1961
Cessna Skylark*	28,600	3,100	0.268	86.8	23.25	1,230	270	11.60	Flight, May 11, 1961
Boeing Vertol 107-II	209,000	19,000	2.23	135	301	695	2,500	8.3	Flight, June 7, 1962
Sikorsky S-61N	232,000	19,000	2.50	121.5	304	763	2,500	8.22	Flight, June 7, 1962

\* No longer an active project.

TABLE 6: LINER DATA

Name	Cost (£)	Gross weight (lb)	Payload (long tons)	Cruise speed (kt)	Work capacity (ton-kt)	Cost per ton-kt (£)	Max h.p.	Power per ton-kt (h.p.)	Reference
Empress of England	5.5m	58,500,000	142	20	2,836	1,940	27,000	9.52	Journal of Commerce, January 1958
France	27m	128,000,000	362	31	11,200	2,410	160,000	14.3	The Engineer, March 2, 1962
Statendam	5.5m	—	178	20	3,560	1,540	22,000	6.2	Journal of Commerce, January 1958