

Symbolic of an earlier era, the bright yellow Vickers VA-1 hovercraft is accompanied on trials in the Solent by a launch bearing a red flag, and is restricted to operation in visibilities of more than half a mile. Lift power is provided by a Gipsy Major driving, through a clutch and belt, cardan shafts to fore and aft lift fans. The propulsion engine is a Continental flat-four driving a fixed-pitch propeller. Individual cockpits are provided for pilot and observer, but the engines are left uncowed

## HOVERCRAFT NEW GENERATIONS AHEAD

EVER since Saunders Roe first demonstrated their SR-N1 on the Solent in 1959, British interest in hovercraft has been steadily quickening. Under the auspices of Hovercraft Development Ltd as a benevolent co-ordinating authority, the design of surface-effect vehicles has been carefully nurtured, so that only three years after the birth of the SR-N1 a whole family of complementary craft is coming into being.

Last week it was the turn of Vickers-Armstrongs to demonstrate the results of some of the effort which they have been putting into amphibious vehicles, and to outline the project work which may lead them, more rapidly than any other hovercraft manufacturer, to the first goal of current development—commercial scheduled services by an established operator.

For the better part of a year the South Marston firm has been experimenting with a simple research vehicle designed to explore the technical aspects of hovercraft development. By no means as refined in concept as the SR-N1, the VA-1 is a simple laboratory tool designed to be rapidly modified for empirical experiment. As such, it must offer more scope for the development of lift curtain systems, stabilizing devices and cushion controls than was easily possible with the SR-N1; and by the interchange of information through Hovercraft Development many of the lessons learned from the first Saunders-Roe vehicle should be available to Vickers-Armstrongs (South Marston) for re-assessment on VA-1. Above all, this 3,500lb platform is paving the way for VA-3, a passenger-carrying hovercraft which is now under construction.

With applications already before the Air Transport Licensing Board for hovercraft services, commercial pressure for a practical load-carrying vehicle is the spur to development for all members of the hovercraft club—Vickers, Saunders-Roe, William Denny, Britten-Norman and Folland. Saunders-Roe at least seems attracted, with the SR-N2, to naval and military hovercraft applications, and Folland to vehicles which operate overland, so that it may be Denny's sidewall craft or Vickers' VA-3 or VA-4 for which commercial orders for a hovercraft ferry are first placed in any quantity. This will be the second great milestone in the story of hovercraft.

Meanwhile, technical problems still have to be solved, particularly recovery and recirculation of static air, and the still difficult problem of effective control at low speeds. Much thought has been given by Vickers to recirculation and spray control, as wind-tunnel models, water spray rigs and VA-1 itself give evidence; outriggers and spray guides as now fitted to VA-1 appear to have virtually solved the spray problem. But dust and spray ingestion are difficulties still associated with recirculation ducts, so that this effective method of energy recovery is still largely a laboratory solution to increased efficiency.

After seeing Vickers' careful background work to cushion and curtain development, VA-1's control system seems surprisingly crude. No sensitive fore-and-aft control is provided, as in SR-N1, and all turning movement is provided by aerodynamic rudders operating in the slipstream of a 90 h.p. Continental engine. As propulsive thrust must be zero when VA-1 is hovering, the vehicle is particularly susceptible to side gusts and wind drift, and only when its momentum is high does control seem reasonably effective. Another disadvantage of the simple system used is that momentum is only destroyed by the drag of the structure, or by reversing direction of the whole craft to bring it to rest.

None of these difficulties is insurmountable, and VA-3 is to have a much more sensitive control arrangement using twin reversible-pitch propellers—a system shown to be successful in principle on the

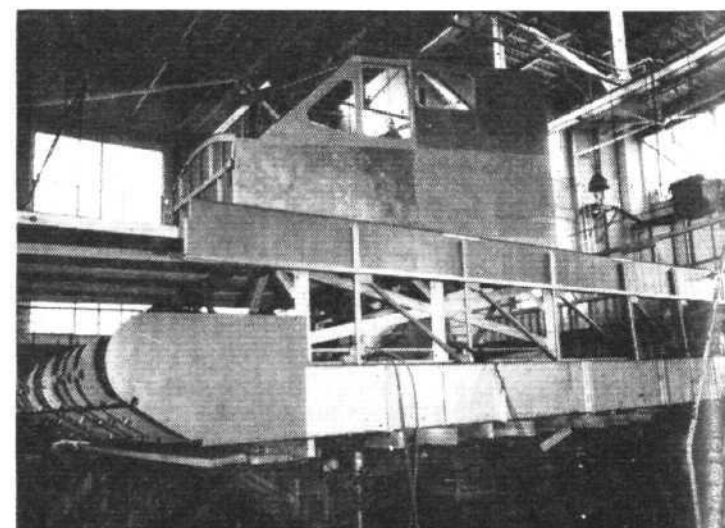
CC-1 Cushioncraft constructed by Britten-Norman. Two other development studies for which VA-1 is being used are investigations into length/beam ratio, and the use of spoilers in the efflux duct for lateral and pitch control. It was found on the SR-N1 that a considerable length of air curtain had to be sterilized to overcome the natural stability, but the spoilers on the Vickers craft are said to be fully effective.

All this development work should pay real dividends in the design of the "operational research" craft VA-3, the structure of which is now about one-third complete. Still, although too small to operate over wave heights greater than about two feet, and thus likely to be confined to service in estuaries and rivers, VA-3 could operate a passenger ferry where, because of sandbanks or tidal waters, none has been possible before. Given a route where substantial savings in overland distance are possible, the unknown variable of cost per seat-mile might conceivably look attractive. But it is the larger, third and fourth generation of hovercraft to which designers and operators are looking for the full potential of Mr Cockerell's invention to be realized; and Vickers are now working on VA-4, a car-ferry hovercraft of about 100 tons all-up weight and a hover height of 3ft, and VA-5, a 500,000lb vehicle capable of overwater operation. No time-scale is attached to these projects, but the thinking behind them is outlined in the following Vickers statement:

"For the type of seas likely to be encountered on unprotected waters hovercraft sizes of from 100 to 1,000 tons should be considered. Such

(Concluded on page 564)

	VA-1	VA-2	VA-3	VA-4
Length	25ft	28ft 4in	52ft 6in	173ft 0in
Beam	13ft	14ft 10in	25ft 0in	58ft 0in
Powerplant	Gipsy Major	2 light aircraft pistons	2 Turmo 603	
lift				
propulsion	Continental	1	2 Turmo 603	
Max weight	3,500lb		22,000lb	100 tons
Payload	2 crew	4 passengers	24 passengers or 4,000lb cargo	30 tons
Cruise speed	35-40kt	40kt	60kt	70-80kt
Hover height	4.1in	8.5in	8in	3ft
Range/endurance		1½ hr	87 n.m.	260 n.m.
Remarks	research vehicle	transportable demonstrator	commercial	commercial



First glimpse of the VA-3, due for hover-out next spring. This hovercraft, a ten-tonner, will carry a payload of 24-26 passengers at a cruising speed of 60 kts and a hover height of up to eight inches. Pairs of Turmo 603 shaft turbines provide power for lift and propulsion