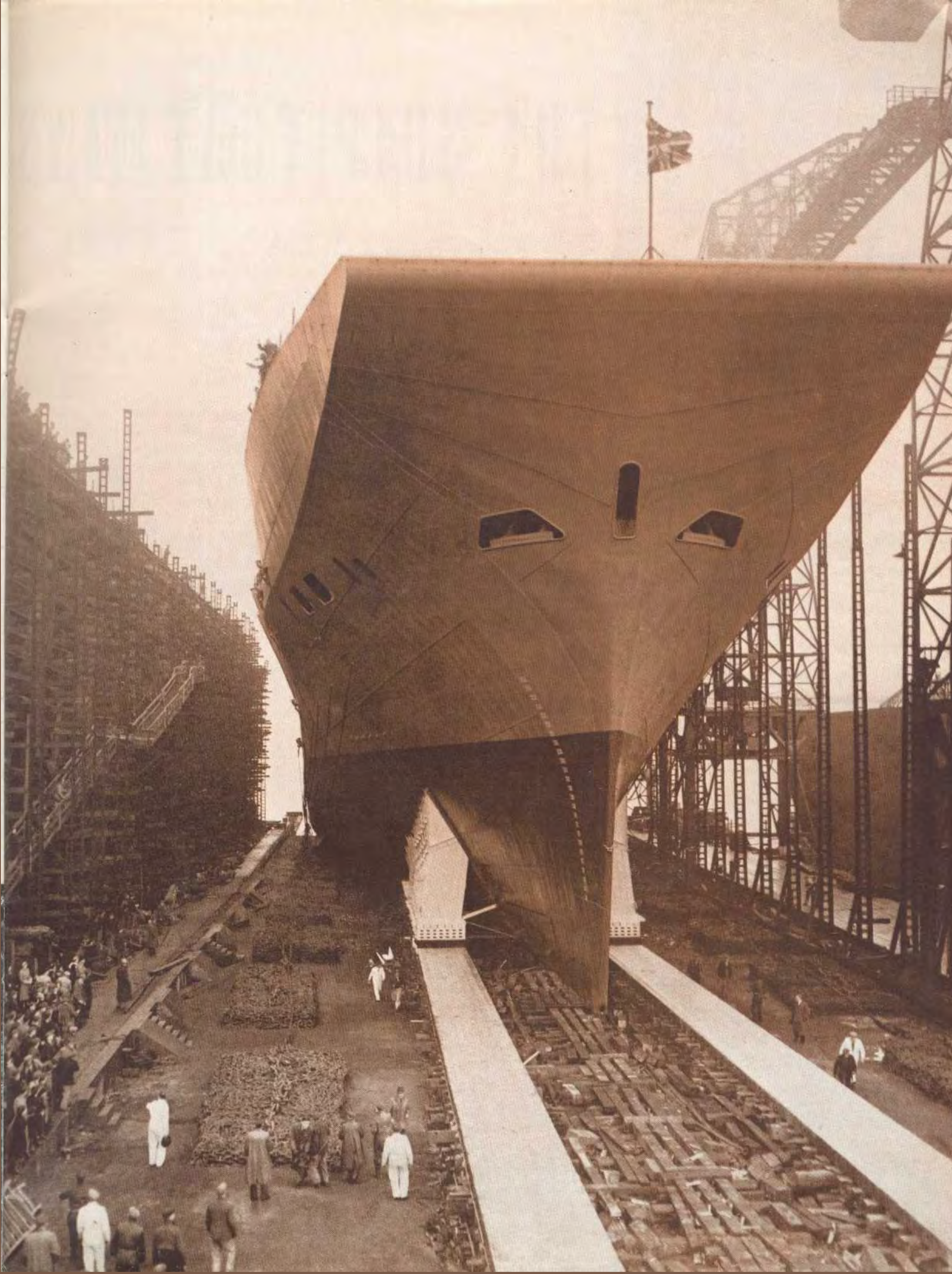
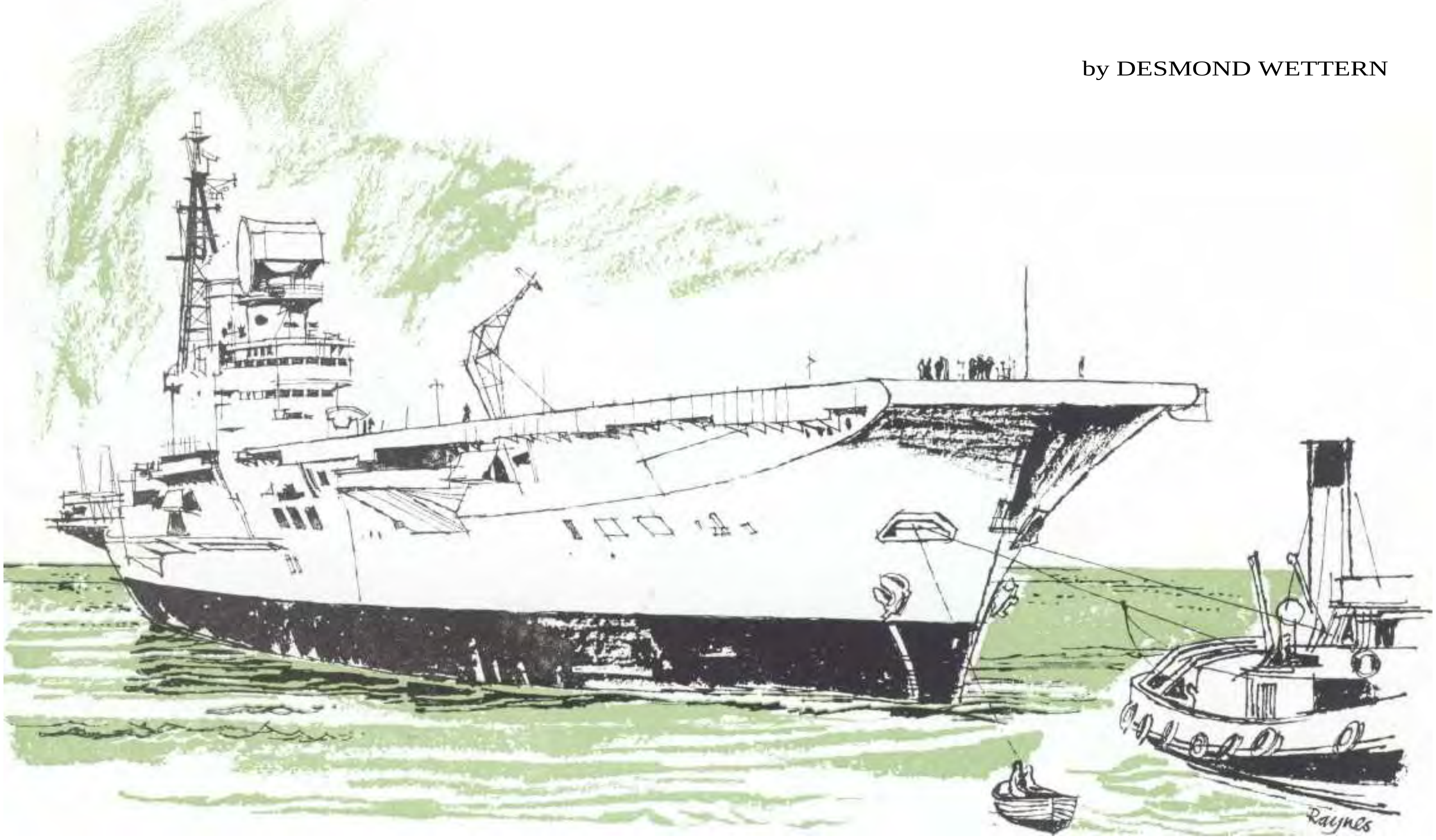
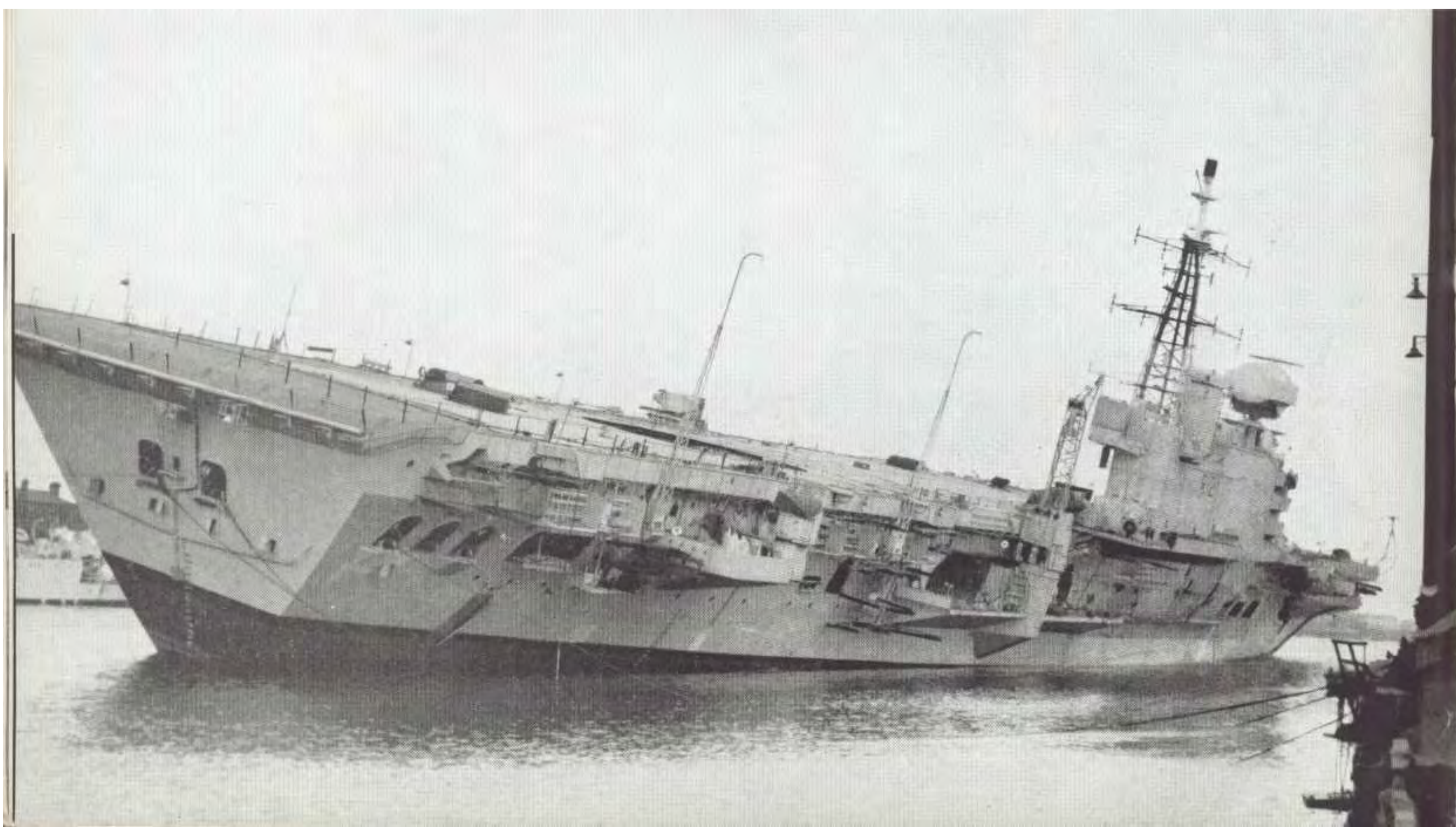


THE SHIP THAT WAS

by DESMOND WETTERN



Above, `Hermes' leaves her birthplace at Barrow, and, below, goes through the rigours of heeling trials



BUILT TWICE

The new aircraft carrier is launched by Mrs Churchill

IT all began on 12th July 1943. Mr Bernard Pool, Deputy Director of Naval Contracts, wrote to Vickers-Armstrongs at Barrow:

I have to request that you will proceed with the construction and completion in all respects of one in number Light Fleet Carrier for His Majesty's Navy.

That was the `birth certificate' of a ship destined to become the most advanced and up-to-date aircraft carrier in the world - H M S *Hermes.*

But before *Hermes* finally hoisted the White Ensign on the morning of 18th November 1959 there had first to be unfolded a story of delays and disappointments and of skill and achievement.

In July 1943 there were the first dim gleams of victory. But at sea the battle was far from won. In the North Atlantic the U-boats were still sinking thousands of tons of Allied shipping every month. The impact of the new Support Groups pioneered by men like Captain 'Freddie' Walker was only beginning to be felt by the U-boats and their crews. And in shipyards like Barrow, with their long tradition in the building of warships, anti-submarine vessels were being built in vast numbers to make good war losses and the deficiencies resulting from the parsimonious policies of pre-war politicians. But now, with funds readily available, the Admiralty was able to look well ahead. The U-boats would be beaten in time and once again it would be possible to unfold the map of Europe. There remained Japan, now sprawled across the Pacific and South East Asia. Already the United States Navy had shown the need for seaborne airpower and amphibious forces in the Pacific.

So, as four `U' and `W' class destroyers neared completion at Barrow, new types of ships were appearing on the drawing boards. There were landing craft first and then aircraft carriers.

By the time Mr Pool signed the `birth certificate' for the new light fleet carrier, two other carriers were already building: the *Perseus* and *Majestic.* But with the atom bomb still a long way from being a practical reality, the Admiralty was preparing for the long drawn out struggle with the Japanese. A new fleet of carriers was planned ranging from the 14,000 ton ships of the `Colossus' class to the giants like the *Gibraltar* and *Malta.*

On Ist October 1944 the drawings for the *Elephant,* the new light fleet carrier to be built at Barrow, had been received in the Yard drawing office. And by the end of the month the drawing office had started work. On 23rd November the first offsets were laid in the mould loft. The *Elephant* had left the drawing board.

Eight ships of the class were ordered; the others being *Centaur, Albion, Bulwark, Monmouth, Polyphemus, Arrogant and Hermes.* The first three were soon under construction and by 1944 they had been laid down. The *Elephant* was laid down on 21st June of that year. In the previous eight months hundreds of drawings had been prepared by the drawing office, orders had been placed with sub-contractors and schedules had been worked out for every department in the yard concerned with building the new ship.

The specification prepared by the Admiralty read like the stock list of some gigantic store with departments ranging from engineering to soft furnishings. The Yard had to provide for arresting gear and armchairs, bacon-slicing machines and balance weights for hatches, cleats, clips and cloakrooms. Many such items were made by sub-contractors but it was ultimately the Yard's responsibility to see they worked and were fitted correctly.

The plan of the ships of the `1943 Class Light Fleet Carriers' - as the eight ships were known at this time - bore little resemblance to any of the four eventually completed.

By 1945 work on the *Elephant* was going ahead fast. The demands of the British Pacific and East Indies Fleets were throwing a severe strain on the Fleet Air Arm and every available fleet carrier in commission was already in the Far East. Carriers and still more carriers were urgently needed if the British Pacific Fleet was to continue to play a major role alongside the task forces of the U S Navy. The need to cover the landings on the Japanese mainland, and subsequent operations ashore, would throw an even greater strain on the carriers of both navies.

Then the mushroom clouds rose over

April 1959. At Barrow work continues in preparation for the voyage to Southampton for drydocking.

Fitting out not fully completed, `Hermes' nears Southampton

Hiroshima and Nagasaki and in a few days the war was over. And with the ending of the war many of the long-established notions for the conduct of war had vanished. Air power, as the means of delivering the atom bomb, was for the moment supreme. It might well be thought that this greatly increased the value of ships like *the Elephant* which could carry aircraft over two-thirds of the world close to their targets. But the demands of peace intervened. All work on the *Elephant* was stopped; though this was a better fate than that of four of her sister ships, the *Polyphemus, Monmouth, Arrogant* and *Hermes,* which were cancelled. With the original *Hermes* now cancelled, the Admiralty decided to perpetuate a name that had close connections with the birth of the Fleet Air Arm. Accordingly the *Elephant* was renamed *Hermes* and became the tenth ship since 1796 to bear the name in the Royal Navy.

The outlook for the new *Hermes* was not good in 1945. The only warships being completed were those whose construction was well advanced and which had in most cases been launched. Even some ships which had been launched were being cancelled. On the date when work stopped on *Hermes* the shell was up to middle deck level, and the main internal bulkheads, had been completed. For the next three years little more than maintenance work was done on her. To preserve her, the steelwork was continuously coated with oil. Some work did however continue in the drawing office.

With the tremendous demands for merchant ship tonnage to replace war losses, every available building berth was needed. So in 1949 it was decided to go ahead and complete the ship up to the launching stage, in order to clear the slip. On 16th February 1953 she was launched by Lady (then Mrs) Winston Churchill. By the middle of 1953 all work on *Hermes* had virtually stopped again. In the Press and elsewhere questions were raised: would she ever be completed? Then came another significant letter from the Admiralty. '. . . Since these ships were designed, numerous additions have been made as the result of new staff requirements, the lessons of the war and the partial return to peacetime amenities.'

And by now the angled deck, the steam catapult and the mirror deck landing aid were appearing. At last there seemed to be a future for *Hermes.* When at length new plans arrived from the Admiralty it was obvious that it was not just a case of making modifications to the existing plans but of virtually building a new ship within the confines of the original hull as laid down.

The big difference was in the armament. With guided missiles and `stand-off' bombs now coming into service, the need for a multitude of medium and close range weapons had gone. The 4.5 in. guns and all but ten of the 40mm. bofors, together with all the 20mm. oerlikons, were removed. But it was not as easy as that as the magazine stowage and ammunition supply hoists had all to be removed or modified. The steam catapults up at the forward end of the flight deck caused some headaches. To allow for the tremendous increase in thrust and the far heavier aircraft which would be handled the ship's structure had to be drastically strengthened. New and heavier longitudinal bulkheads supporting the catapult troughs and machinery were fitted, and additional stiffening was necessary not only for the gallery deck, which supported the machinery, but on several decks below.

The deck edge lift on the port side posed further problems. This type of lift is common to American carriers but its first application in a British carrier, H M S *Ark Royal,* was not too successful. The reason was that part of the lift in the `down' position encroached on the internal space within the hull. In *Hermes* it was decided that the whole lift should be outboard of the ship's side. This, however, required greater strengthening of the surrounding areas of shell, hangar deck plating and hangar bulkheads to support the overhanging load, and consequently it was found necessary to build the lift supports and other adjacent structure of special steel. The `island' superstructure was completely redesigned and, in place of the foremast, provision had to be made for the new 984 comprehensive display system radar antenna-weighing 28 tons.

New air weapons such as the *Firestreak* air-to-air missile meant a major increase in the space required for air weapons. New and heavier aircraft meant strengthening the flight and hangar decks and increasing the size of the after lift well.

Perhaps one of the biggest changes which had to be allowed for was the increase in complement. As laid down, *Hermes* was intended to carry a crew of about 1,500. Now new aircraft, and electronic equipment especially, resulted in an increase of over 1,200 in the crew. Not only had more messing space to be provided but additional galley, storage and recreational areas were required.

To meet the demands of nuclear warfare a remote control system for the engine and boiler rooms was worked out, so that, if required, the ship could continue to steam without a single man in either engine or boiler rooms. All pumps and fans in these compartments had to be capable of remote control from the control room. A separate system of air supply for the boilers had to be arranged so that air intakes for the furnaces would not contaminate the air in the boiler rooms. 'Pre-washing' equipment had to be provided on all exposed decks.

As jet aircraft use a different fuel from other types, two separate fuel systems for Avcats (for jets) and Avgas (for piston-engined aircraft) as well as an Avlub lubrication system meant a big increase in fuel

Aided by attendant tugs,

stowage space, pumps and fuel lines. A system whereby fuel pumped to the boiler rooms but not consumed could be pumped back to the tanks was introduced. This entailed putting in a 'spill-back' arrangement.

One of the most complicated changes which had to be made was the changeover from a D C to an A C electricity supply. The original electrical equipment was designed on a ringmain system requiring the use of low voltage relay open breakers controlled from one main and four unit switchboard rooms. This comprised a 220 volt D C system of distribution involving the use of turbo and diesel D C generators. All the drawings in connection with the D C system were completed before the ship was rebuilt to the new design. The switchboards had been delivered and were nearly ready for installing. Some generators and much wiring had already been fitted aboard. It was then decided that the ship should become A C, with a distribution system of 440 volt, 60 cycle, 3 phase. This meant that all the motor auxiliaries would be supplied at this voltage and that lighting would have a supply of 115 volts, transformers being used for this purpose. The changeover from D C to A C in a ship of this size made it necessary to have close collaboration and exchange of ideas between the Department of the Director of Electrical Engineering at Admiralty and the electrical drawing office at Barrow.

A reason for the changeover from DC to A C was to conform with current American practice; another was the need to keep to a minimum the number of DC/AC machines (motor alternators) which would be required in connection with the 984 C D S radar, together with the necessary subsidiary units requiring alternating current. It was also decided that the use of AC fluorescent lighting should be a predominant feature and for this quite a large amount of A C was required. The electrical system is controlled from four switchboards, two forward and two aft. One forward and one after switchboard are each connected to two turbo-generators of 1,000 k/W each. The other two switchboards are each connected to two 360 k/W diesel generators. Each major and some minor pieces of electrical apparatus on board have two sources of supply. Originally the ship as first designed was capable of producing 3,200 k/W; today her output is 5,440 k/W. The electrical installations cost £1+ million.

Some of the other alterations in the plans resulting from the change in the design included the fitting of a sponson on the port side for the mirror landing aid; the provision of air conditioning in offices and living spaces; the fitting of liquid oxygen-making apparatus; the removal of separate accommodation for warrant officers and a corresponding increase in wardroom accommodation; new all-electric equipment in the galleys; removal of hammock hooks and provision of improved kit stowage and bunks; improved laundry and bathroom facilities; new and more cheerful deck coverings on

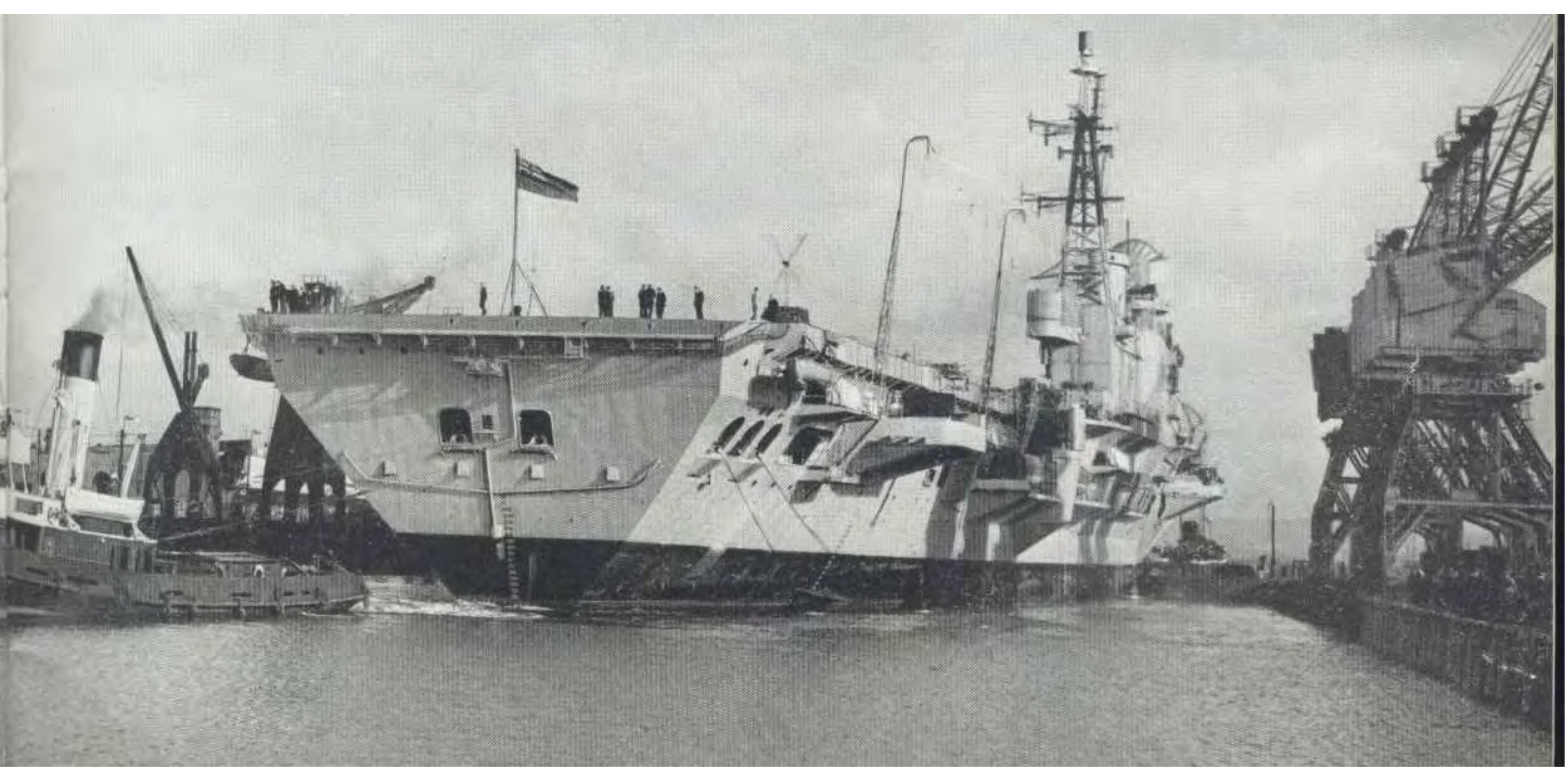
Entering Southampton's King George V graving dock in May 1959

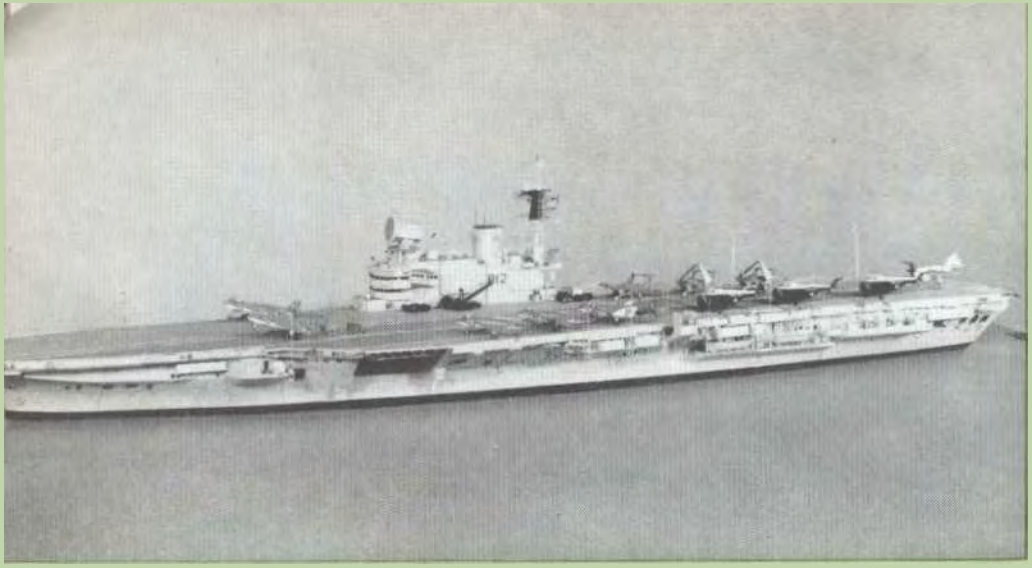
the messdecks and even the removal and redesign of such anachronisms as the air gunners' ready room. Gone, too, were such things as wooden topped messtables. Vending machines for hot or cold drinks, a much improved canteen, and recreation rooms were among some of the many new items fitted.

Yet in spite of these varied and large scale alterations in the design, the Yard was able to give the Admiralty a firm delivery date for the ship as far back as January 1958.

In May 1959 *Hermes,* still only partially complete, sailed for Southampton for drydocking before proceeding on contractors' sea trials. After a spell at Southampton and at sea in the Clyde she returned to Barrow and on 1st November she left her builders for the last time. Once more she returned to Southampton and on 17th November she sailed down Southampton Water wearing the Red Ensign. The following day Captain D. S. Tibbits R N signed for her on behalf of the Admiralty. The Red Ensign was lowered and the White Ensign was hoisted in its place. *Hermes* was now H M S.

'Hermes' arrives at Southampton for her final docking before acceptance trials





This 16 ft to the inch scale model of HMS `Hermes', made for the Admiralty by Julian Glossop, is to be displayed at exhibitions and recruiting centres throughout the United Kingdom by the Director of Naval Recruiting

THE object of the organisation of an aircraft carrier is about the only simple thing about it. It is to enable the vessel to operate, and to continue to operate, her aircraft to the best effect.

This aim seemed a little remote when I took my seat at a desk in an office on the top floor of Vickers-Armstrongs' at Barrow-in-Furness last January. I had just been appointed Senior Officer and Executive Officer (designate) of H M S *Hermes.* It had become a good deal less remote, though still a long way from fulfilment, as I wrote this in the middle of the Bay of Biscay surrounded by gale warnings of force 10 to 15 (hurricane force) winds. We were on the last stage of our shakedown cruise after commissioning some ten days earlier. We had come a long way in the previous ten months but the testing time will be when our squadrons of aircraft fly aboard at the end of our period of trials.

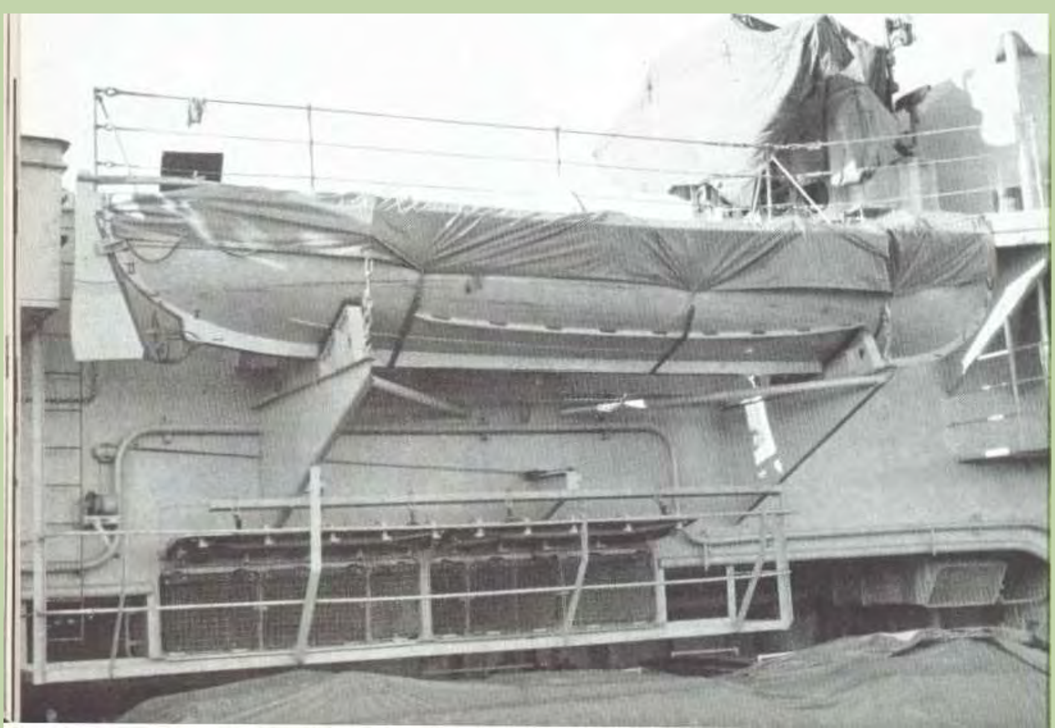
My problem was to arrange, with my Naval colleagues, for the accommodation, feeding, health, welfare, recreation, morale, training and amenities of some 200 officers and 2,000 men of all ranks, ratings and specialisations in such a way that they could each in their own way make their contribution to the effective running of the ship's services. These include such varied things as aircraft control, radar, lighting, propulsion, cooking, navigation, gun control, steam catapults and radio communications systems. The arrangements must be so devised that everyone knows what is expected of him and when, and in such a way that conflicts do not occur; for instance the flight deck should not be painted on the same day as flour is embarked by way of the aircraft lift. It is also important that the ship should be run

SHIP

with the minimum recourse to the internal broadcast system, because the bedlam otherwise would rapidly bring chaos through sheer mental strain.

The approach to the solution is as old as the Navy, although my ideas may well differ in detail from those of the executive officer of another ship. Basically the officers and ship's company had to be divided into departments as a first step. This was simple as it follows naturally from the training which each has received. The departments in this case are five, although there are, in fact, a good few smaller ones and many sub-departments. These five are the air, the seaman, the engineering, the electrical and the supply departments. These departments had then to be split into divisions which, in the case of the air department are the flight deck, the hangar, the photographic, safety equipment, air electrical, air engineering and air ordnance divisions. In many cases, to ensure that the numbers should be of manageable size, these divisions had to be further split into sub-divisions. Responsible for each department is a Comman-

Above: *Designed for greater efficiency-'R' switchboard room*
Below: *One of the 27 ft motor whalers*



der, known as the Head of Department, who is assisted by a deputy of Lieutenant-Commander's rank who, of course, does the work! The divisional officers may be of Lieutenant-Commander's, Lieutenant's or Sub-Lieutenant's rank and in most cases there is more than one officer as well as several Chief Petty Officers or Petty Officers attached to each division. This is the basic means of controlling and arranging the work of the ship's company, as well as their play.

Starting from this basis it then became necessary for me to produce a guide book called `Hermes Standing Orders' containing the rules and procedures for matters common to all departments. This guide also contains the basic `routine' for the ship as a whole for weekdays, Saturdays and Sundays, in harbour and at sea. Using this framework the heads of departments then set about writing their own departmental orders which give detailed

1*Principal task of the versatile ship's crane is loading supplies which may vary from sacks of flour to heavy spares - and stowed beside it - a 35 ft medium speed power launch*

SHAPE

`The most important quality of all'

From the foreword to a pamphlet issued to each man who joins the ship. `To all the material features which make this fine ship must be added the most important quality of all, the will and spirit of every individual officer and man of her company. This alone can bring the ship to life and make her respected, efficient and happy ....'

instructions for the running of their own department.

Three things became very evident to me at an early stage of my time in Lancashire. First, the heads of departments must be on speaking terms. Second, in an affair as complicated as the running of a carrier there must always be mutual consultation between departments, not to say agreement, before any matter, other than in emergency, is put into effect; it is just not possible for any one man to take into account the full repercussions of some particular measure. Third, some means of keeping the 2,000 or so individuals informed and pulling in the same direction must be found.

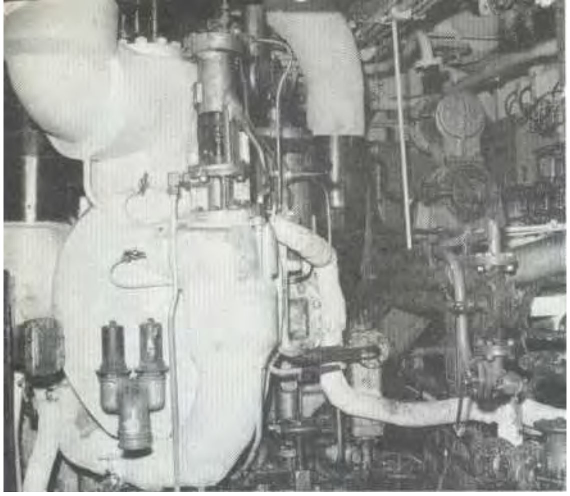
We have, I think, made progress in all these things. The heads of departments are on far better than speaking terms; they are friends. We have set up a `Ship's Activities Co-ordination Team' happily known by the short title of `Accord', which consists of the deputies who, you will remember, do the work, and the heads of all the sub-departments. This team meets regularly. In the early stages of our taking over the ship they met daily. Now they meet about twice a week and will always meet at least once a week. Their terms of reference are to produce the ship's programme from the outline decided upon by our operational authority, to work out the detailed dovetailing to avoid clashes such as I referred to earlier, and to iron out difficulties which may arise from day to day, referring as may be necessary (not often) to the heads of department.

On the matter of information, the ship's programme is promulgated for six months ahead, although this, of course, is subject

by Commander G. C. MITCHELL
ROYAL NAVY

to alteration. It is announced a month ahead in more detail, giving the timing of the more important events, is posted a week ahead in greater detail still and finally is shown on all the notice boards a day ahead in the form of `Daily Orders' which give all the detail necessary for the entire show to run. In addition to this the Captain gives periodical broadcasts which may be amplified or augmented by myself as often as desirable. We also have a regular programme each night at 18.45 on the ship's internal broadcasting system, lasting a matter of ten minutes, which runs over the events of the day and the aims for the morrow, and which tries to keep those in the engine room informed of what has happened on the flight deck and those who keep watch on the signal deck in touch with what has happened eight or nine decks below them during the last twenty-four hours.

To help us with our morale we have a varied selection of amenities within the ship. We have a fully equipped laundry, television, cinema, a barber's shop, canteen, bookstall, libraries, soda fountain and soft drink vending machines. We run theatricals, expeditions, tombola, deck hockey on the flight deck, gramophone record programmes and, of course, a full programme of sports of all kinds. We have a busy dental surgery, a very fine sick bay, and we have - perhaps as important as any other thing in the ship - a chapel complete with chaplain.



A pump unit of the high power twin steam catapults installed in `Hermes'

Three British inventions, all of which are installed in H M S *Hermes* - the steam catapult, the angled deck and the deck landing mirror sight - have made it possible for aircraft carriers to operate our new generation of naval aircraft. Commander H. C. N. GOODHART RN here explains the problem of

Fitting the aircraft carrier to the modern aircraft

AT Farnborough last year three types of naval aircraft were splendidly demonstrated. They were the *NA.39* strike aircraft, the *Sea Vixen* all-weather fighter, and the Vickers Supermarine *Scimitar* day fighter and ground attack aircraft; and they set new standards of performance, speed, rate of climb and weapon carrying ability, ushering in a new era in British naval aviation. Watching them perform at Farnborough, it was easy to forget there is the other side to the picture, without which a naval aircraft is useless - the aircraft carrier. Time was when the aircraft in an aircraft carrier were so slow, small and light that there were few problems in laying out the carrier's flight deck and hangar to operate them. With the advent of the jet aeroplane all this began to change. But for three British inventions, the introduction of this latest generation of aircraft could never have taken place.

Originally, aircraft carriers did not need to be fitted with catapults, since the length of the deck was sufficient (after making allowance for the wind due to ship's speed) for unaided take-off. However as the take-off speed and weight increased, it became progressively more necessary to fit catapults. In laying out the deck of an aircraft carrier, the length of the catapult is the most important feature. This length increases as the square of the launching speed required, assuming (correctly) that the `g' applied to the aircraft and pilot is not increased. Any increase in `g' over that currently in use would cause an appreciable increase in aircraft structure

`Scimitars' ranged on the catapult. These photographs were taken in another Vickers-built aircraft carrier, HMS `Victorious', before the air group of 'Hermes' was embarked.

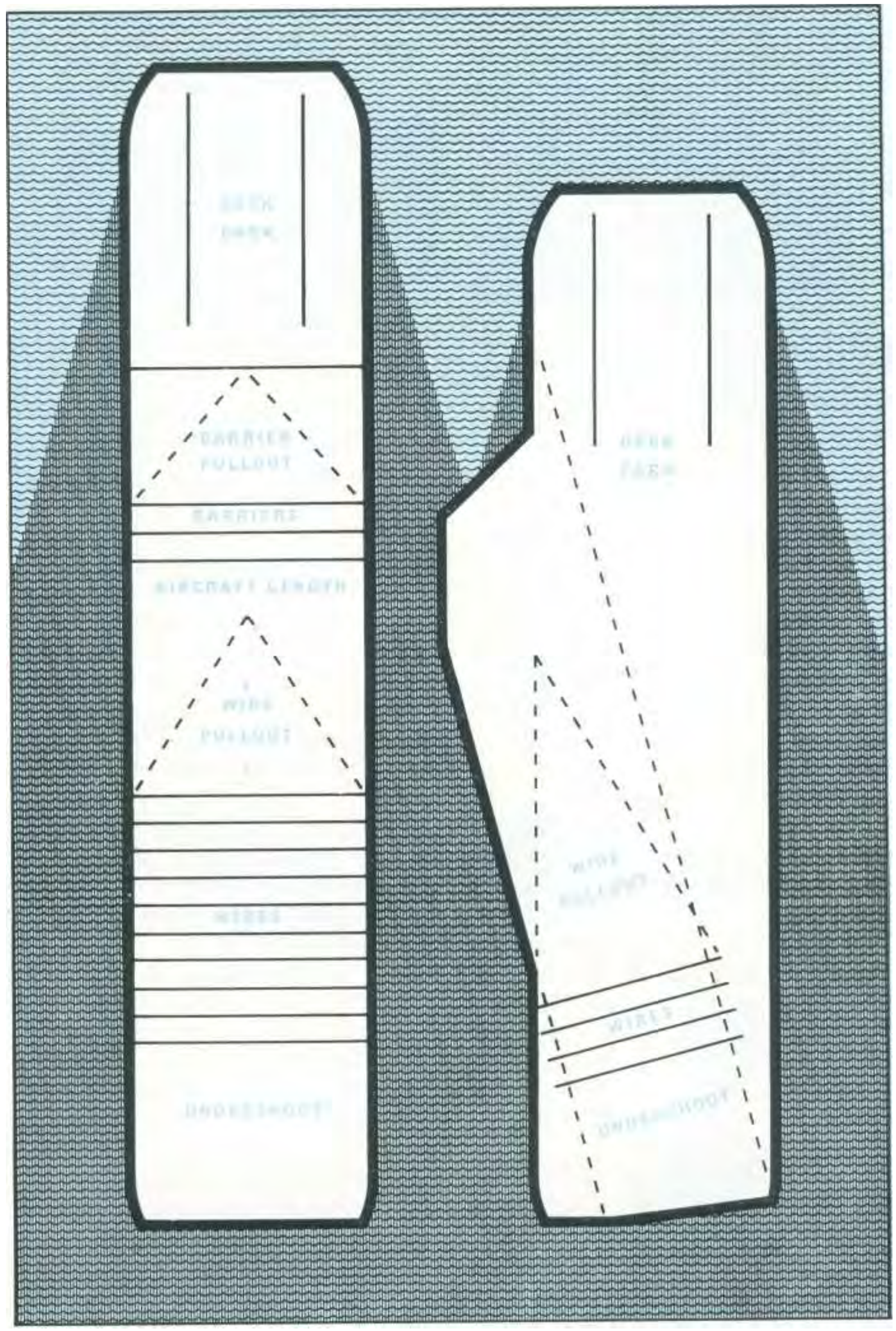
In seconds this 'Scimitar' will be airborne

weight as well as being nearer the absolute limit the pilot could tolerate. The resulting length required is about 150 ft, regardless of the source of power.

The hydraulic-pneumatic catapult had reached a state of development enabling it to launch the *Seahawk/Sea Venom* generation of aircraft satisfactorily, but further development for the new generation was considered beyond the bounds of practical engineering. Fortunately, the new slotted tube steam catapult design has arrived in time to enable it to be fitted to all aircraft carriers before they are equipped with the latest aircraft.

Little shows on deck. But it must be remembered that the installation of these very powerful catapults, with about three times the power of the hydraulic-pneumatic catapults they succeed, has inevitably involved a considerable penalty on the ship in terms of valuable space occupied and the top weight of the catapults, their associated accumulators and the necessary structural stiffening. At high launching rates they have an additional penalty in that their steam consumption involves an appreciable reduction in the amount of steam available for the ship's main engines. In association with each catapult, it has also been found necessary to provide catapult automatic loading equipment and a jet blast deflector.

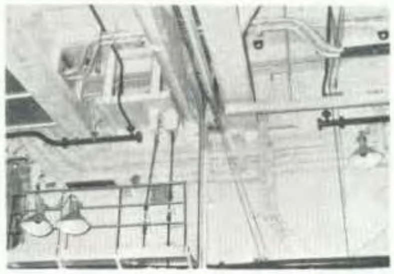
In the preceding type of carrier layout (now known as the axial deck) it was necessary to divide up the overall length as shown in the diagram on this page. Even in the days of the slower piston-engined aircraft, this ideal layout could not be fully achieved and, in fact, it was necessary to allow some of the areas to overlap, thus producing a number of minor accidents. With the new generation aircraft, a deck laid out in this style would have to be a minimum of 1,100-1,200 ft long. But because of the necessity to limit ship sizes, for a variety of reasons including deck sizes and cost, the flight deck length cannot be more than about 750-800 ft; so it would be impossible to lay out an axial deck on a British aircraft carrier for the latest aircraft.



AXIAL DECK ANGLED DECK

An angled flight deck is a necessity for new jet aircraft. The number of arrester wires is reduced, barrier space is dispensed with, handling is speeded, parking space is increased and the pilot is enabled to go round again if he misses an arrester wire. In both types of deck, catapults are placed at the forward end of the deck park.

The invention of the angled deck solved this problem and the layout has been developed as shown in the diagram. The length occupied by barriers and barrier pullout disappears completely. The number of wires required is reduced from ten to thirteen to four to six and, from the pilot's point of view, the most important feature is the ability to go round again in the event of missing an arrester wire.



Fire precautions are of paramount importance. In the spacious hangar fire curtains are fitted - shown (right) in the stowed position outside the hangar control room.

But from the ship constructor's point of view this is not such a happy solution. He is now faced with building out a vast overhanging structure on the port side, stressed for the landing of heavy aircraft. Topweight again rears its ugly head and the overall beam of the ship becomes extremely clumsy. Canals and docks must be considered, as well as berthing problems and the design of tenders, many of which can only come alongside on the starboard side.

In the piston-engined era the method of deck landing was based on aiding the pilot to achieve the required accuracy of positioning and flying by means of signals from a batsman standing on the after end of the flight deck. Each deck landing was, therefore, a team affair with responsibility shared between pilot and batsman. As closing speeds increased - and they have nearly doubled in a decade the pilot-batsman combination was found to have limitations and a consequent high accident rate. It was the limitations of this system which necessitated the provision of a large number of arrester wires to ensure a reasonable chance of catching late touch-downs and avoiding a barrier crash.

To overcome the limitations of the pilot-batsman combination, a device called the deck landing mirror sight was produced, consisting of a gyro-stabilised mirror in which the approaching pilot sees the reflection of a battery of lights. His movement up or down relative to the required straight line approach path is indicated by movement up or down of the reflection he sees in the mirror. He is thus given instantaneous and proportional information of any divergence he may have from the required approach path.

This device enables pilots to make an accurate approach and touch-down very close to the selected point, thus reducing the number of wires required to achieve any given percentage of catch. At the same time, an angled deck reduces the percentage of catch which is acceptable, e.g.. Perhaps five 'bolters' (aircraft which do not catch a wire and take an overshoot) in 100 landings would be acceptable in an angled deck carrier, whereas perhaps one in 500 would be the maximum tolerable in an axial deck carrier.

A helicopter descends gently to the flight deck of 'Hermes' during trials

From the shipbuilding point of view the deck landing mirror sight is an awkward piece of equipment. It has to be on the port side and, because it is part of the flight deck, it has to be mounted on a large and very rigid sponson sticking out at least 12 ft from the deck edge. Unfortunately, the required position may necessitate the sponson protruding even further from the centre line of the ship than the angled deck. There are, however, some compensations to the shipbuilder. The removal of the barriers and more than half of the arrester wires has saved a good deal of weight and space, though of course the arresting engines now fitted to deal with the landing weights of the modern aircraft are very much larger. Previously, two wires were rove to one arresting engine, whereas now each engine can only compete with one wire.

The high performance of the modern fighter must be complemented by the provision of high performance radar. The big aerial which dominates the island of *Hermes* and *Victorious* like a gigantic searchlight, shows clearly what is necessary in this field and it is obvious that this massive piece of machinery at such a height must represent a major item of top-weights. Lifts to raise and lower an aircraft weighing perhaps 20 tons must be capable of making the trip from hangar to flight deck in ten seconds and consequently are considerable pieces of engineering with the inevitable weight and power penalties.

Another feature of the modern aeroplane which is not so obvious is the amount of ground and test equipment necessary for its servicing, so that, in addition to the actual weight of aeroplanes embarked, weight and space provision is also required for all the equipment. And, as if all this is not enough, maintenance of the modern aeroplane calls for greatly increased man-power, all of whom must be provided for and accommodated in the ship, and at a higher living standard too.

That the shipbuilders have contrived to fit all this into a ship no larger than her predecessor is indeed a tribute to their craftsmanship and design.