NEW COMPLETE GUIDE

LONDON AIRPORT

OVER 100 ILLUSTRATIONS

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COMET 4 JETLINER
INSIDE

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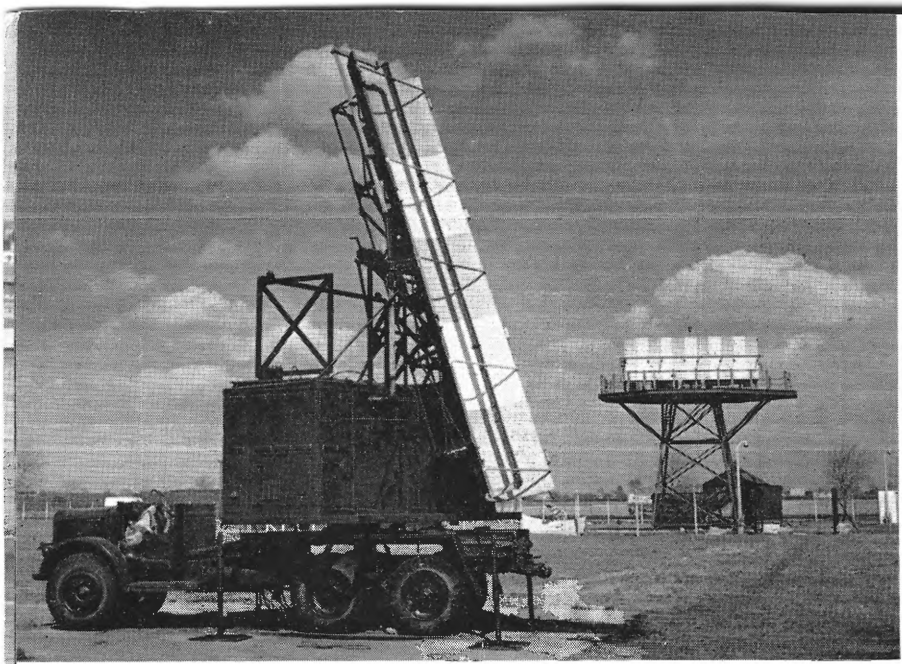
HOW THE AIRPORT OPERATES · RADAR AIR CONTROL SYSTEMS
AIRLINE HISTORY · FUTURE AIRLINERS · A/C SILHOUETTES

THE NEW COMPLETE GUIDE TO

LONDON AIRPORT

WITH **EIGHT-PAGE** SPOTTERS' **SUPPLEMENT,**
TECHNICAL AND HISTORICAL SECTIONS

ABOVE: An impressive line-up of aircraft on the Marshalling Apron at London Airport Central.
FACING PAGE: From the "Waving Base" visitors watch the arrival of a Paris-London service.



RADAR SCANS THE SKIES

The futuristic radar scanners serving the Microwave Early Warning system of the Southern Air Traffic Control Centre are visible from the Bath Road. In the background of the picture above can be seen the azimuth or direction scanner, which rotates once every fifteen seconds; mounted on the vehicle in the foreground is the altitude scanner which rocks through 22 degrees in the vertical plane. Impulses from the two scanners are fed into the desk mounted consoles and enable controllers to maintain their unceasing watch on the skies over Southern England. Details of every flight are noted on flight progress slips which are inserted in metal carriers. In the lower illustration several of these can be seen in front of the controllers, each of whom wears a special light-weight set of headphones and microphone. Contact with pilots of aircraft in the area is maintained by means of V.H.F. (very high frequency) radio-telephony; all messages are automatically recorded.

CENTRAL AREA

airliners weighing 100 or more tons and landing at speeds well over 100 m.p.h. impose considerable loads on the point of touch-down. The runways at London Airport are of concrete nearly two feet thick laid on gravel foundations. With a total runway length of some eight miles, and associated taxi-tracks and roadways, the amount of concrete used reaches astronomical proportions, and the vast area of hard surface necessitated elaborate drainage systems. The consumption of electricity on the Airport equals that of a fair-sized town, and ducts had to be laid for over 2,000 miles of cables.

For many reasons it was decided that the permanent buildings should be centred at the very heart of the system, with the life-blood of the Airport—the aircraft and coaches, freight vans and refuellers—flowing out along the encircling pattern of runways and roads. All the buildings in the central area were designed by Mr. Frederick Gibberd, C.B.E., F.R.I.B.A., M.T.P.I., and the designs were approved by the Royal Fine Art Commission. Strictly functional in conception, the buildings are handsome and severe in outline, clean-limbed and purposeful like the soaring airliners they serve. The bold sweep of the main concourse in the passenger building, long and lofty with one wall entirely of glass, is breathtaking in its spacious proportions. The control tower is an arsenal of electronic aids and telecommunications services. It is 127 feet high and outside walls were designed to show varying planes at angles to each other in order to minimise large flat surfaces which might cause interference to the probing waves of radio and radar.

Because the central area is surrounded by runways, a tunnel nearly half a mile long was constructed to give access to the passenger and control buildings. The reinforced concrete shell, which passes under the No. 1 runway, is 86 feet wide and the height is 18 feet, sufficient to enable London Transport to run a regular service of double-decker buses to the terminal area. The tunnel accommodates inbound and outbound pedestrian paths and cycle tracks in addition to the duplicated dual carriageways each of which permits a steady flow of 2,000 vehicles an hour. Subways have also been constructed under the concrete aprons fronting the passenger buildings, and passengers are taken to and from aircraft on the

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APPROACH CONTROL

Behind the sloping windows on the sixth floor of the London Airport tower is the nerve centre of the Airport. Here a team of Air Traffic Controllers maintain a constant watch by radar on all aircraft in the London Control Zone. As at the Southern A.T.C.C., special lighting is installed. The Approach Control Room is seen left. Flight plans are received by an A.T.C. Assistant, and relevant details, written on flight progress strips, are passed to the Assistant Approach Controller who is on the extreme right of the picture. He maintains liaison with the Regional Control Centre and with neighbouring airfields, and, when the inbound aircraft is about 20 miles away, passes control of it to the Approach Controller on his right. The latter is assisted in his task by the first and second radar controllers. In the foreground is the Talkdown Director seated at the Precision Approach Radar, and the centre picture clearly illustrates the type of display from which he works. Both the direction and altitude of the aircraft are displayed on each tube. The control tower stands in the centre of the vast network of runways, taxiways and marshalling aprons sprawling across the pilots-eye view of London Airport below. This *Flight* picture was taken from beyond the Airport's western boundary, with the main east–west runways, each nearly two miles in length, stretching away towards the east and London itself. In the foreground are seen the tanks of the new bulk fuel installation.

THE CONTROL TOWER

The control tower bears a resemblance to the superstructure of an aircraft carrier, and indeed its functions are very similar. The tower itself rises nine storeys high from the T-shaped Control Building, and is capped by an all glass penthouse. To minimise the effect of external noise all windows are double-glazed, and those of the Approach Control room (A) and Aerodrome Control (B) are sloped outwards to eliminate reflected light. The former has an external and internal balcony at mezzanine level to permit special visitors with a direct technical interest to study the work. On the right a member of the control staff is testing switches on the panel which controls the vast number of taxiway lights. Below, the Ground Controller is seen working in liaison with the Air Controller (back view).

NEXT PHASE

outer stands in motor coaches through these tunnels.

The layout of the central area is in the shape of a large diamond covering 158 acres. The original plan made provision for four buildings for passenger and cargo handling, each forming one side of the diamond, with two apex buildings at the eastern and western points. The northern apex is occupied by the end of the access tunnel, and the control tower and its associated buildings are sited in the centre of the area. The tower and the first passenger building came into use in April, 1955, when British European Airways and foreign short-haul operators moved from the temporary buildings on the north side of the Airport.

The Queen's Building, which houses the administrative offices of airline companies and a number of public amenities, including a post office and additional restaurant and grillroom, was opened in May, 1956. Its completion marked the end of the first phase of development of the Central Area. The next phase has now begun with the construction of a further building to provide passenger handling amenities for B.O.A.C. and other long distance operators.

The new air station, costing about £3,000,000, will be ready for full occupation by these airlines by early 1962. It will be situated on the south-west side of the central area, and will consist of a main building 430 feet by 280 feet, with two flanking office blocks each 211 feet by 55 feet. The latest advances in planning airport terminal buildings have been incorporated in order to speed the flow of the ever increasing tide of long-distance passengers.

London Airport is a self-contained community with a working population of some 26,000 people, and the impressive buildings in the Central Area house only a part of its varied activities. All passenger and cargo-carrying airliners are subjected to the most rigorous and searching maintenance involving the examination and overhaul of engines and other equipment at regular intervals. London Airport is the home base for Britain's two airline corporations, B.O.A.C. which flies the long-distance routes to America, Africa, the Middle and Far East and Australia, and B.E.A. which operates services to Europe and within the British Isles. Leading independent companies also have bases there.

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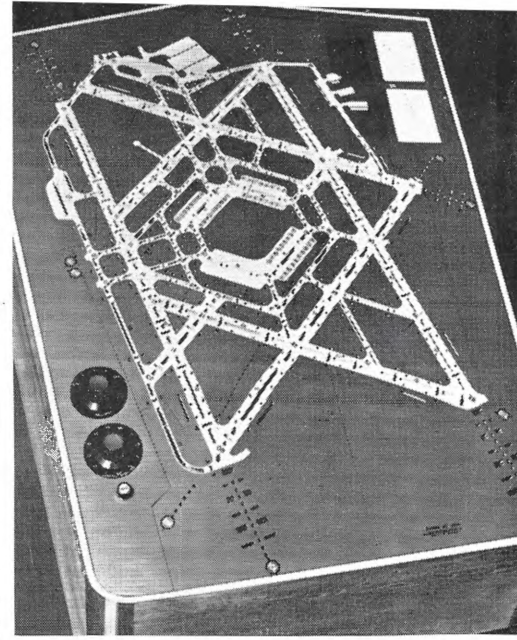


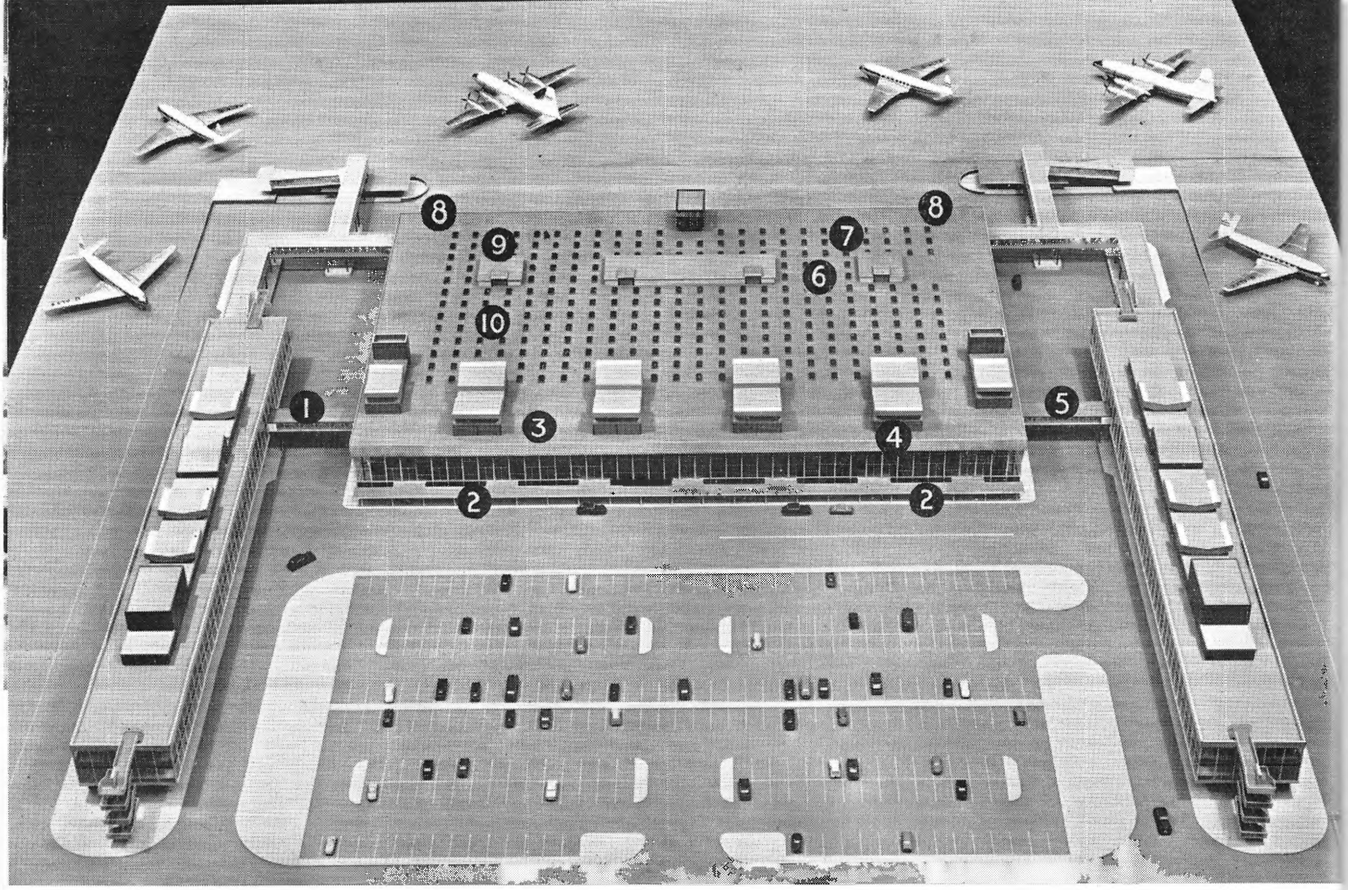
LANDING AN AIRLINER AT NIGHT

The enormous array of switchgear at the top of the tower controls one of the most modern and extensive airfield lighting systems. The Calvert Line-and-Bar system offers the approaching pilot what is virtually a funnel of light at night—as can be clearly seen above, left—which guides him to the runway in use for landing. The 3,000 feet long centre line of light is an extension of the centre-line of the runway, and the horizontal bars, with the shortest one nearest to the threshold, offers a pilot a series of artificial horizons with which to check the alignment of his machine. Once over the green lights at the threshold the pilot can land between rows of white lights set flush with the concrete. The many combinations of runway and taxi-way lighting can be checked at any given moment on the lighting mimic—a large illuminated plan of the Airport housed in Aerodrome Control and seen in the photograph above, right.

* * *

APRON CONTROL

The movement of the aircraft on the aprons is controlled by the Face Supervisor (Marshalling). In the photograph on the left he is shown (seated) passing instructions by radio; his tape machine by which he is informed of aircraft arrivals and departures is in front of him. Below, a tarmac marshaller having received the Face Supervisor's orders via a "walkie-talkie" set is seen positioning a B.E.A. Viscount 701 on the apron.



A model of the new building in the central area for "long haul" services which will come into full use in 1962. Costing some £3,000,000, the building has been designed to handle 1,000 long distance passengers an hour in busy periods. Departures will be dealt with in one half of the building, arrivals in the other half. KEY: (1) Bridge to Restaurant and Offices; (2) Entrance Hall; (3) Departure Hall; (4) Arrivals Customs Hall; (5) Bridge to Offices; (6) Immigration and Health Control; (7) Arrival Lounge; (8) Airside Gallery; (9) Final Departure Lounge; (10) Customs and Immigration.

"AIR-LANE" CONTROL BY RADAR AND V.H.F.

Some of the controllers use a short-range display which enables them to see aircraft almost as soon as they are airborne from London Airport and they subsequently "hand the aircraft over" to the long-range radar controllers. The maximum range of this equipment is 130 miles but the controllers can arrange their displays so that they observe only that section of the surrounding air space for which they are responsible. Communication between controllers and aircraft is by Very High Frequency radio-telephony, the messages travelling over land-lines from the Centre to a number of transmitting stations reaching from Suffolk to Cornwall, and thence to the aircraft.

All airliners arriving or departing at London Airport are directed along specific "air-lanes" depending on the destination or point of departure. For instance, southbound traffic for Paris or Rome is instructed to follow the appropriate lane in that direction, and the main artery—comparable with a trunk road—is known as Airway Amber One. The main airway for traffic coming in from these places is Airway Amber Two which crosses the English coast near Dungeness. Airliners flying to or from Amsterdam and Scandinavia and from Brussels and Germany are routed over Clacton. The airliners come under the control of the Centre from the time they cross the boundaries of its area until they are handed over to London Airport control authorities at the radio ranges near Epsom and Watford or, if they are over-flying on the Paris–Manchester route, for instance, until they reach Daventry, where they are handed over to the adjacent Northern Area Control Centre. The Centres receive advance notification of incoming flights, with details of height, destination and other relevant information, from whichever Air Traffic Control Area the aircraft is coming. In the case of outgoing flights the advance details are received from the aerodrome of departure. This information, together with aircraft R/T reports at fixed points on the airways, enables the controllers to identify the various "blips" representing aircraft on their radar screens. Departing airliners are given a "clearance" before take-off notifying them of the route they are to follow and the height at which they are to fly on the "air-lanes."

The following example illustrates how the work of the Air Traffic Control and the London Airport

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The airside face of the Queen's Building. Intended mainly for sightseers, it contains roof gardens and terraces, children's playgrounds, an observation platform, restaurants, book and souvenir stalls and an exhibition hall. In the non-public section of the building are airline offices, crew briefing and rest-rooms and a miniature television studio for interviews.

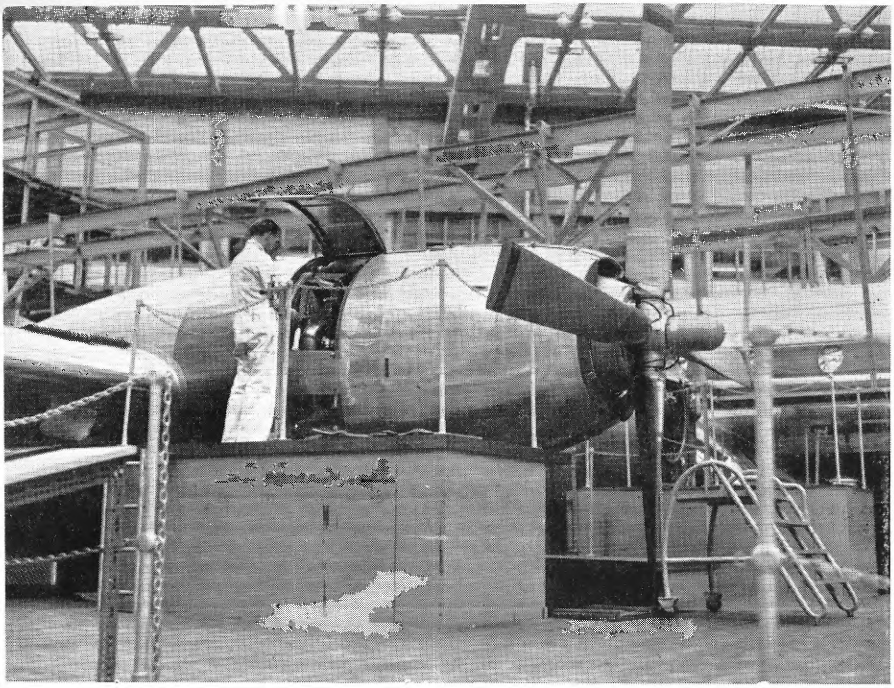
control authorities is integrated. A B.O.A.C. service from the Far East makes its last port of call at Rome, and flies northwards across France towards the English Channel. It comes in along Airway Amber Two, and as it leaves the area controlled by Paris the pilot is instructed to alter his radio to the frequency of the Southern Air Traffic Control Centre. As he flies over Abbeville in northern France the pilot calls the Centre and gives his height and estimated time of arrival over Lydd in Kent.

The Centre acknowledges and passes a time check and the barometric altimeter pressure setting in use. This ensures that all aircraft flying in the area will have their clocks synchronised and their altimeters working on the same basic data so that there can be no errors due to inaccurate timing or incorrect height-keeping. When he passes over the radio beacon at Lydd the pilot again reports by radio to the Centre, and sets course for the next radio facility marking the way to the radio range at Epsom in Surrey. Depending on traffic conditions he will be given permission to start descending at a particular point, and a height at which to arrive over the radio range at Epsom. All this time the controllers will have been watching his progress in relation to other aircraft in the vicinity and, if necessary, sending instructions for changes in course or height. As he approaches Epsom the pilot is told to switch to the radio frequency of London Approach, and this is the point at which control passes from the Control Centre to the Airport's Approach Control. Had the aircraft flown to London from a different direction it might have been directed to the radio range at Watford where the changeover from Control Centre to Approach Control would take place.

London Approach Control is situated near the top of the tower in the Central Area, and is equipped with radar consoles similar to those in the Control Centre. The task of the Approach and radar controllers is to maintain the flow of aircraft in orderly sequence from the radio ranges at Epsom and Watford towards the runways.

When low cloud or fog restrict the pilot's vision, he usually makes his approach with the assistance of an electronic landing aid, known as Instrument Landing System (ILS). This system presents the pilot with information on height and direction through the medium of pointers on an instrument in the cockpit.

Another landing aid is the Precision Approach Radar "talkdown" system. The Precision Talkdown Controller sits in the control tower near the radar approach controllers in order to simplify the procedure of handing over when the aircraft is at a position about seven miles from the runway at an altitude of 1,500 ft. This is where the talkdown begins and the controller, watching the movements of the aircraft on radar screens, calmly and quietly issues instructions over the R/T which



AN ARMY OF MAINTENANCE MEN

Away to the east of the airfield in No. 1 Maintenance Area, a small army of men work round the clock maintaining the fleets of airliners. In the 800 feet long by 90 feet wide Engineering Hall of the B.O.A.C. Headquarters Building various components are overhauled. In another part of the building a maintenance dock for complete overhauls of Britannia airliners has been built. Above is seen part of the dock. The engineer working on one of the turboprop engines stands on a power-operated platform which, at the press of a button, can be adjusted to any required level. The sister corporation, B.E.A., are equally proud of their maintenance facilities. In their hangars they too have developed maintenance docks for Viscount aircraft. Each dock consists of a continuous platform at varying levels which can be moved into position to surround the whole aircraft, and electricity, compressed air, lubricants, water and telephones are available at strategic points. Rolls-Royce Dart propjet engines for Viscounts are overhauled at the base; the photograph below shows the control room of the test house.

PILOTS' AIDS

enable the pilot to bring the aircraft down at the correct rate of descent and on an accurate heading to an altitude of some 250 ft. at a point 400 yards from the end of the runway. The landing is then completed visually. When an airliner is approaching with the aid of ILS, its progress is also followed on radar screens by the Precision Talkdown Controller but he does not issue any instructions to the pilot unless his help is needed.

In the glass "penthouse" atop the Tower is the Aerodrome Control. The functions of this department are divided between the Air Controller and the Ground Controller whose titles indicate their spheres of responsibility. From the tower they have an uninterrupted panorama of the runways and taxi-tracks and an unobstructed view of the sky in all directions. In good visibility the Air Controller takes over from Approach Control when the aircraft is making its run-in towards the Airport. When the weather deteriorates, and ILS and PAR approaches are being made, he takes over when the aircraft has landed. He is concerned with the movement on the runways of aircraft actually landing or taking-off.

In the case of an arriving service he hands over to the Ground Controller when the airliner has finished its landing run and is clear of the runway. The Ground Controller has been notified in advance of the parking bay to which the aircraft is to go, and he advises the pilot of the route to be followed to reach it. As an additional aid to the pilot at night-time and in dull weather, the Ground Controller can illuminate the selected route with a line of flush green lights which run through the centre of all taxi-ways. Precise control of aircraft and vehicles is maintained by the use of a "block" system under which the pattern of runways and taxi-tracks is divided into about a hundred sections with lines of red lights, called stop-bars, at the entrance to each block. No aircraft may move into the next section while the stop-bar is illuminated. In bright daylight, pilots are guided along the correct route by powerful white indicator lights on diagrammatic signboards.

In their penthouse the Air and Ground Controllers have a special type of radar called an Airfield Surface Movement Indicator which shows them a picture of the runways and roads with "blips" giving the

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THE ENGINEERING BASES

The buildings in which the two great British corporations have their headquarters are themselves of great interest. The B.E.A. Engineering Base, seen above, is claimed to be the largest pre-stressed concrete structure in Europe; it is about 1,000 feet long, and has five hangar pens in each of two arms, each with a door aperture 150 feet wide and 30 feet high. Another vast building has recently been added to the B.E.A. base. The B.O.A.C. Headquarters Building covers an area of over 8½ acres, and includes four hangar pens, one of which is seen below; there are four storeys of office accommodation, and between the backs of each pair of hangars is the huge Engineering Hall. In order to achieve an unobstructed entrance of over 300 feet, the hangar entrances are built on the cantilever principle, and each of the eight counterpoise blocks consists of some 1,100 tons of solid concrete. Several airlines have their own radio systems at London Airport which enable their headquarters staffs to control work on the tarmac. On the left a B.E.A. maintenance officer is seen reporting to headquarters via a R/T equipped motor-van.

RUNWAY LIGHTS

position of moving aircraft and vehicles. This equipment is of particular value when visibility is limited, and the application of radar to movements on the ground is additional to the normal R/T facilities which enable the Ground Controller to speak direct to the pilots of taxiing aircraft, and also to the drivers of vehicles. Cars, vans and coaches habitually moving on the Airport are fitted with radio. Another fascinating piece of equipment in Aerodrome Control is the huge bank of switchgear controlling all the aerodrome lighting, and the "mimic", which is a special diagram of the Airport and its approaches showing by means of miniature lamps which of the many lighting systems is in operation at any moment.

A "location" beacon, flashing alternately white and green, is situated two miles east-north-east of the Airport and it is sufficiently powerful to be seen from an aircraft 30 miles away on a clear night. There is also an "identification" beacon, of lesser intensity, inside the Airport boundary. It flashes in green the Morse code for "VA". At night-time the approaches at either end of the two east-west runways are strikingly signposted by "line-and-bar" lighting which helps to guide the pilot in his approach to the end of the runway. This system was devised by Mr. E. S. Calvert of the Royal Aeronautical Establishment at Farnborough.

The Calvert system employs a straight line of lights 3,000 feet long leading directly to the end of the runway, and at intervals of 500 feet there are cross-bars of lights at right angles. The cross-bars become progressively shorter as they approach the runway so that the pattern as seen from the air can be said to resemble a funnel with the wide mouth towards the approaching aircraft and the neck at the beginning of the runway. An additional guide to the distance from touch-down is provided by the arrangement of lights along the centre line. The first 1,000 feet has triple lights, the next 1,000 feet is of double lights, and the remaining 1,000 feet, nearest the runway, of single lights. In bad weather at night or in poor visibility during the day the lights can be switched to a peak brilliancy of 80,000 candle-power, directed in line with the beam of the radio aid. In better visibility red omni-directional lights of lower power are used.

Each runway is defined by rows of white lights inset some way from

FREIGHT — FROM ELEPHANTS TO ISOTOPES

The carriage of freight by air grows year by year. Currently over 70,000 tons freight and mail passes through London Airport. The variety is never-ending and ranges from insects and snakes to minute electric motor parts and mammoth printing presses. Much is carried in the freight holds of passenger liners, like the B.O.A.C. Britannia seen above which is about to receive a load of diesel engine spares from a mechanical lift truck, but several airlines run special aircraft for freighting purposes. An example of this is the Africargo service operated by Hunting-Clan with DC-6C aircraft. British exporters are offered a regular twice-weekly service and the flight to Nairobi takes less than 24 hours, an important factor when valuable live stock are shipped. The picture right shows pedigree lambs, being penned for the journey to Kenya. Inward Africargo traffic includes thousands of monkeys for research purposes. Live freight is cared for at London Airport by a R.S.P.C.A. staff and there is a specially equipped hostel for animal passengers. The bottom picture shows the loading of a consignment of radioactive isotopes for medical use in the wing-tip compartment of a B.O.A.C. Britannia.

the edge of the concrete and a line of green lights at each end. The main runway lights are let into the concrete and the domed covers project only a short distance above the surface so that they present no obstacle to aircraft wheels. The lights along the last 2,000 feet of runway are fitted with "cautionary" yellow filters as an indication to pilots of the distance they have travelled on the ground. The runway lighting normally operates at 30 per cent of maximum power but the intensity of both the approach lights and the runway lights may be varied in changing weather conditions or on request to suit individual pilots. A sodium flare-path is also available should the normal lighting become obscured by snow.

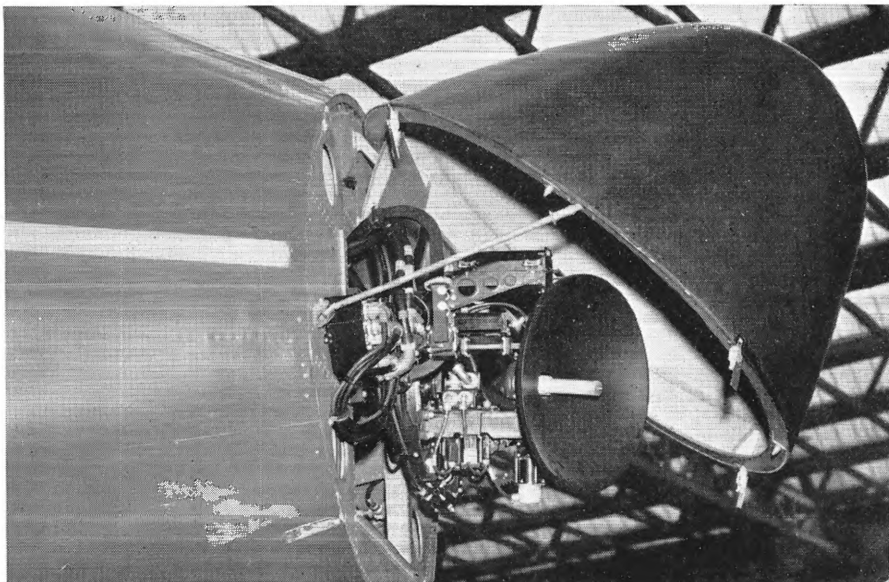
London Airport is a major junction on the intricate web of global air routes. The services of over forty different airline operators of many nationalities provide fast and frequent services, bringing London within a few hours' travelling time of most capitals. Airliners of varying types and sizes, proudly bearing the colourful emblems of their parent companies, stand wing-tip to wing-tip on the busy parking aprons.

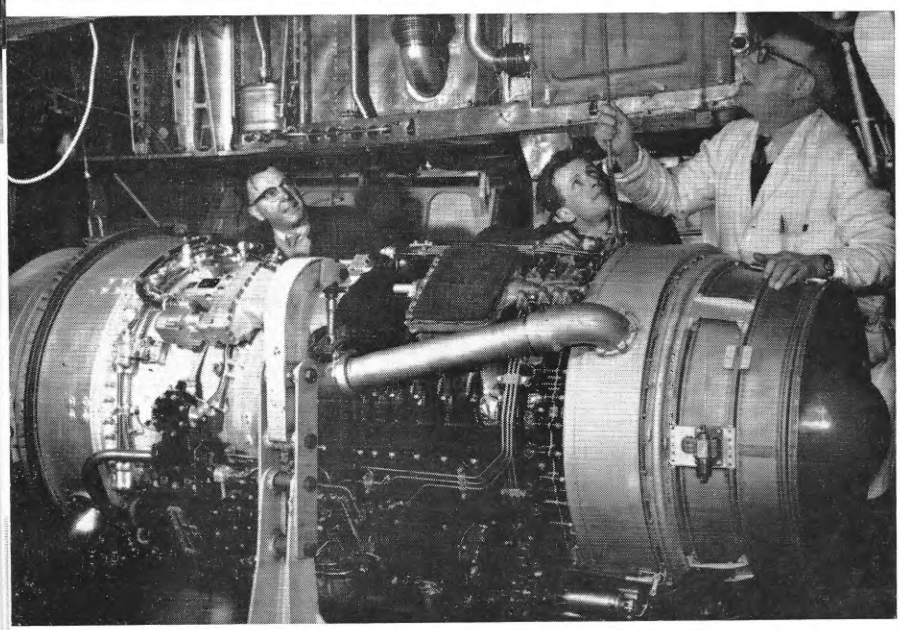
Day and night the airliners come and go with their precious "payloads" of passengers, mail and cargo. Sometimes there are diplomats, politicians, film stars, famous sporting personalities or other prominent people whose travels attract the press photographers and newsreel cameramen to the aircraft steps. But the vast majority of air passengers today are people whose lives do not bring them into the public eye, people who fly on business or pleasure because air travel is quick, comfortable and convenient.

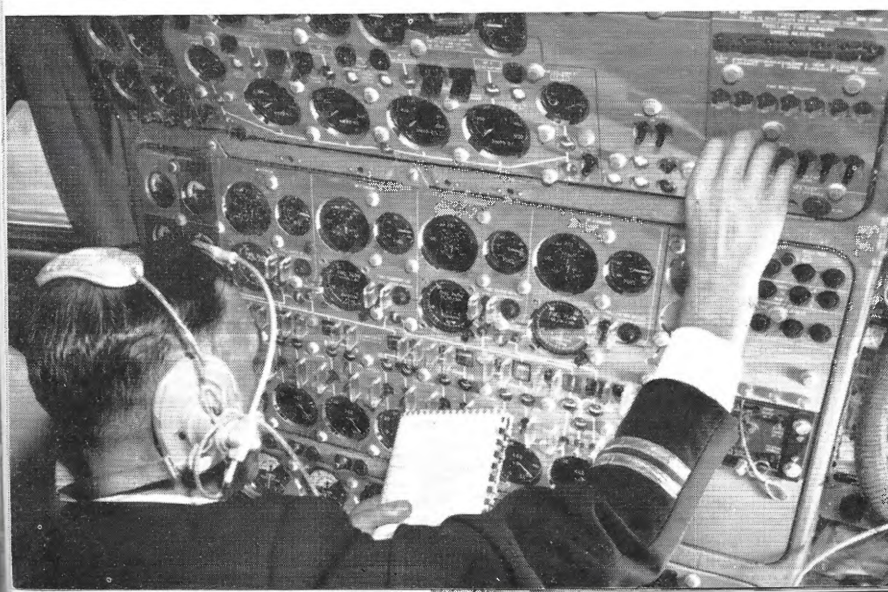
Over four million passengers a year now pass through London Airport, and the cheaper tourist and economy fares are bringing air transport within the reach of increasing numbers of people. The Airport will soon be capable of handling annually more than five million passengers and many thousands of tons of mail and cargo. Air transport has made fantastic progress since that day in 1919 when the single-engined D.H.4 took-off from Hounslow. The future holds the prospect of even greater achievement for this virile and expanding industry, and London Airport, Britain's No. 1 international air terminal, will play an increasingly important role in the exciting years ahead.

THE COCKPIT OF A TURBO-PROP AIRLINER

The photograph above shows the cockpit of a B.E.A. Viscount 800. The captain is on the left, the second pilot on the right. Each has before him a duplicate set of instruments for controlling the aircraft in flight. In the centre is the engine panel. Here are revolution counters, oil pressure and temperature indicators, torque meters, jet pipe temperature and flow gauges for each engine. The second pilot has his left hand on one set of engine throttles. Below these are undercarriage, flap, and auto pilot controls. The roof panel carries the engine master switches and a number of other switches for controlling cabin pressure, generator power, cabin and cockpit heating etc. The bottom photograph is of the weather detection radar in the nose of a B.O.A.C. Britannia. This equipment enables the pilot to avoid turbulent conditions ahead and is an additional safety aid in congested air lanes.







Technical Section

THE COMET 4— THE WORLD'S MOST TESTED AIRLINER

Britain's De Havilland Comet 4 is the most tried and tested airliner ever to be put into service. Behind it lies more than 30,000,000 miles of flying by B.O.A.C. and the R.A.F. and a 10-year research and development programme unprecedented in aircraft history.

The tests included the immersion of a complete Comet 4 fuselage in a water-tank. Whilst under pressure, the structure was subjected to the loads of take-off, landing and flight. The water-tank tests were equivalent to more than 100,000 hours of flight or 33 years of normal commercial operation. After every 2,000 "flying" hours, a searching inspection of the whole structure was made.

With such exhaustive testing it may be claimed that structurally the Comet 4 is the safest jetliner at present in service. The Comet 4's safety factor is increased by the tremendous power and wonderful reliability of the Rolls-Royce Avon engines. It can climb on three engines more quickly than some of its rivals can on all four. Because it needs a far shorter take-off run than the bigger American jetliners and lands at a lower speed, it can operate with full load from the medium sized airports which are barred to them. And because of the Comet 4's phenomenal rate of climb and the noise suppressors fitted to its engines, it is judged the quietest jetliner now operating. In the pressurised, air-conditioned cabins passengers get little impression of noise, and no vibration whatsoever is felt when the Comet 4 is cruising at 500 m.p.h.

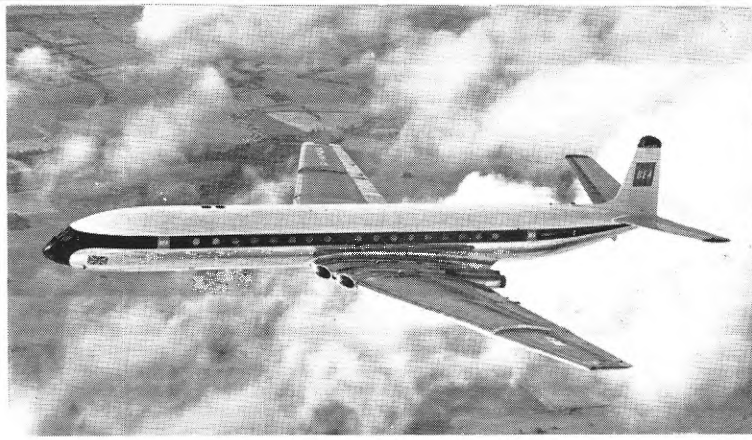
B.O.A.C. operate 19 of these magnificent airliners. To maintain them at the peak of efficiency a round-the-clock effort by a team whose jobs range from piloting to tractor driving is necessary. Some aspects of the testing, maintenance and operation of the Comet 4, which in various marks is operated by eight airlines, are seen in these pictures.

* * *

ABOVE: *A Comet 4 undergoing water pressure tests in a 250,000 gallon tank at De Havilland's Hatfield factory.*

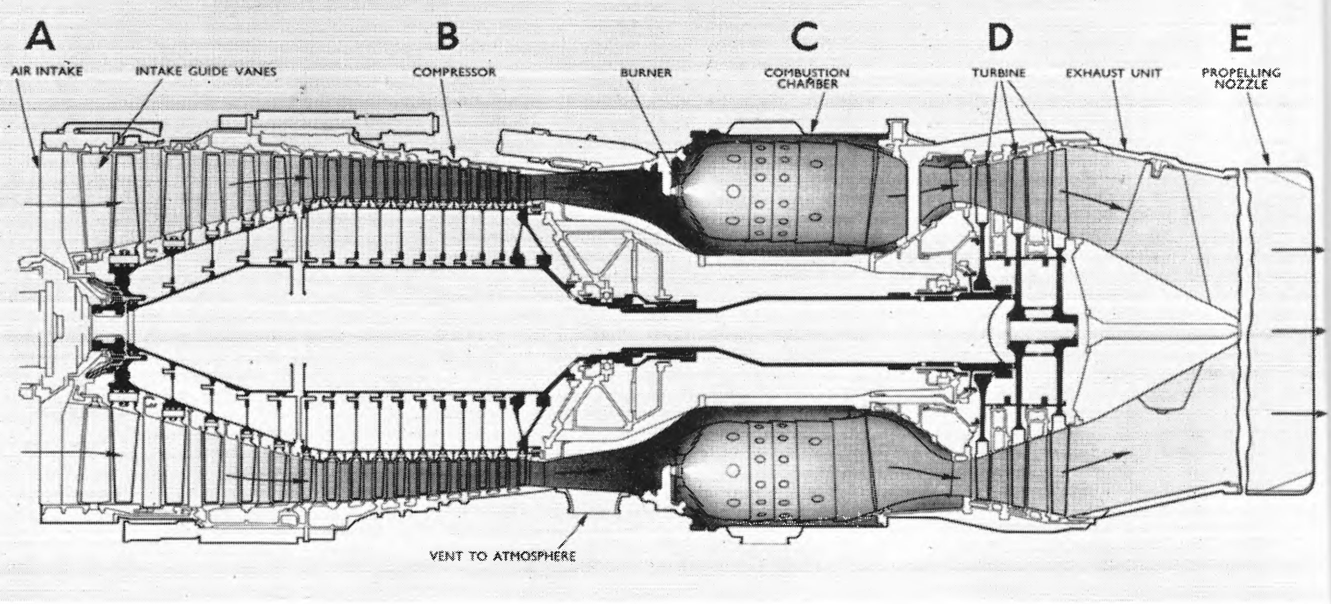
CENTRE: *Installing one of the Rolls-Royce Avon R.A.29 turbo-jet engines.*

BELOW: *An engineer officer at the instrument panel of a B.O.A.C. Comet 4.*



OPERATING THE COMET 4

LEFT: A B.O.A.C. Comet 4 starting its steep climb away from the run-way at London Airport. Because of its oustanding take-off and rapid rate of climb, the Comet 4 can operate profitably from medium-sized airports on all the world's main air routes. B.O.A.C. has found this jetliner very economical in operation on its North Atlantic, Far East and other routes. ABOVE: The Comet 4B used by B.E.A. over stages up to 2,500 miles. It has a longer fuselage and shorter wing-span than the inter-continental model, has no nacelle fuel tanks, and can carry up to 102 passengers. BELOW: The team and vehicle fleet needed to put a B.O.A.C. Comet 4 in the air and keep it there in the forefront of world civil aviation. GROUP 1: Flight Manager, Works Manager (Aircraft Maintenance). GROUP 2: Flight Captain (West); Flight Captain (East); Officer i/c Training; Deputy Flight Manager; Works Superintendent; Comet Project Engineer; Fleet Supplies Officer; Fleet Planning Officer; Fleet Inspector. GROUP 3: Flight Planning Officer; Manager's Secretary; Cabin Services Officer; Flying Staff Administration; Communication Officer; Flight Operations Officer. GROUP 4: Captain; Co-Pilot; Flight Navigation Officer; Flight Engineering Officer; Flight Steward; Second Steward; Flight Stewardess; Stewardess. GROUP 5: Instrument Mechanic; Foreman; Assistant Foreman; Chargehand; Section Inspector; Inspector; Secretary; Upholsterer; Aircraft Scheduler. GROUP 6: Loader Driver (Freight); Loader Driver (Aircraft Catering); Driver (Passenger Coach); Sgt. (Security); Air Ministry Met. Forecaster; M. of A. Marshaller. GROUP 7: Station Duty Officer; Service Control; Receptionist; Station Operations. GROUP 8: Rigger; Electrician. GROUP 9: Driver; Cleaner; Leading Hand Fitter; Leading Hand Metal Worker. GROUP 10: Shell–B.P. Airfield Fuel Operators.



Technical Section

HOW THE TURBO-JET ENGINE WORKS

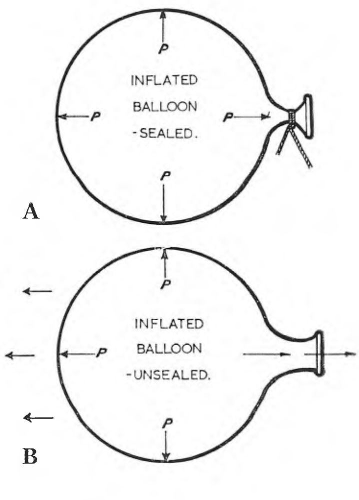
The basic principle on which the jet engine works is a very simple one. Air is drawn in at the front of the engine (A), illustration above, and compressed by a swiftly spinning "fan" (B). The compressed air passes into combustion chambers (C) where kerosene is sprayed into it to form an inflammable mixture. When this mixture is burnt the rise in temperature causes the air to expand with great force through the jet pipe at the rear of the engine (E).

Before it leaves the jet pipe, however, the stream of hot air passes through the blades of a turbine (D) —another "fan"—which is mounted on the same shaft as the compressor at the front of the engine. In this way some of the power produced by the jet is used to drive the compressor.

It is a mistake to imagine that the engine pushes the aircraft forward because of the force of the jet thrusting against the air behind the aircraft. A rocket engine—which is a form of jet propulsion—works efficiently in outer space where there is no air for it to push against.

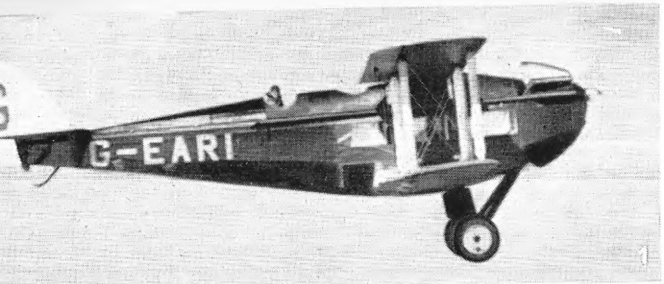
The basic principle of jet propulsion is actually to be found in one of the fundamental laws which every school boy has to learn in his physics lessons. This is the law which states that every force has an equal and opposite reaction. The way in which this law operates in a jet engine can be simply illustrated by imagining an ordinary toy balloon blown up and tied at the neck so that the air cannot escape, (A), sketch below. In this condition the air presses with equal force in all directions against the inside of the balloon, and the balloon itself remains static.

However, as everybody knows, if the balloon is inflated and the air is then allowed to rush out through the neck, the balloon itself moves smartly in the opposite direction from the escaping air, (B), sketch below. This happens because there is a release of the pressure at one point on the inside of the balloon while there is still pressure at the opposite point. Therefore, the air pressure *inside* the balloon pushes it along in the opposite direction from which the air is allowed to escape. This continues until all the air in the balloon has dropped to the external atmospheric pressure when the balloon collapses and falls to the ground.



If the pressure difference inside the balloon could be maintained the balloon would continue to move along. This is precisely what is done in the jet engine which sucks in and compresses a fresh supply of air all the time the engine is running. The engine, therefore, develops its thrust *internally* and not by pushing against the outer atmosphere.

Each of the Rolls-Royce Avon engines of the Comet 4 jetliner sucks in some 4½ tons of air and drinks about 17 gallons of kerosene a minute at take-off power. The stream of gas leaves the jet pipe at about 1,500 m.p.h. At normal cruising power the four Avon engines of the Comet between them consume some 1,000 gallons of fuel per hour. The compressor and turbine spin at the rate of 8,000 revolutions per minute at take-off power and at about 7,000 r.p.m. at cruising power. The temperature at the centre of the flame in the combustion chamber is 2,000° centigrade and the gas stream itself has a temperature of between 800° and 900° centigrade. Each Avon engine develops 10,500 lbs. of thrust.



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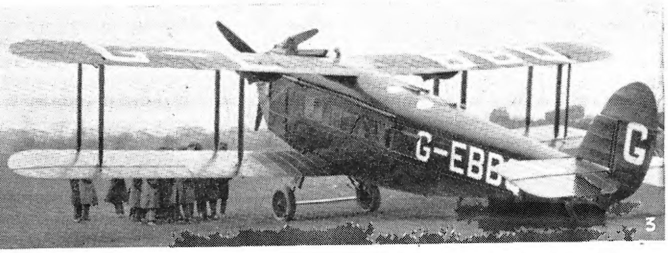

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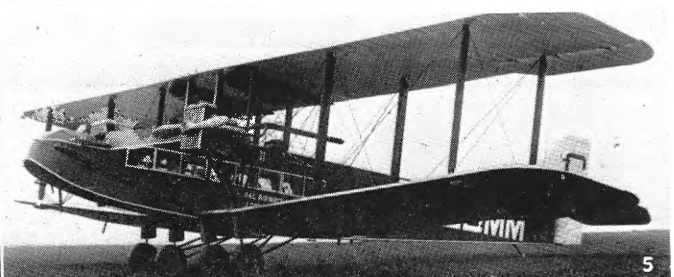
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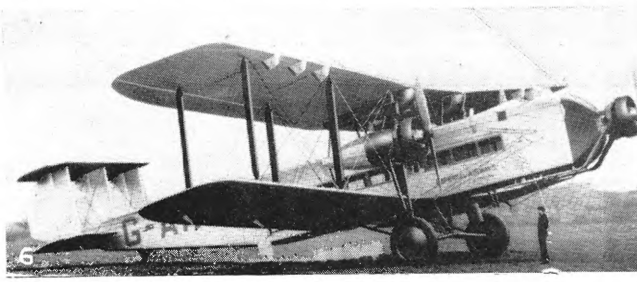
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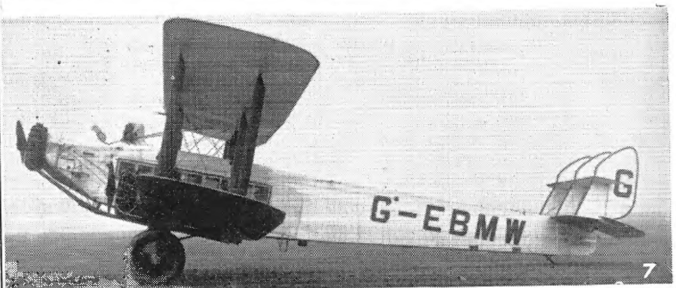

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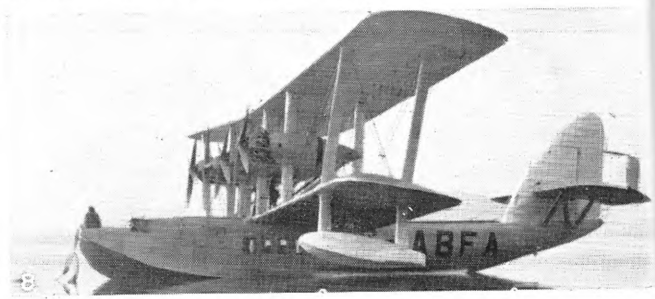

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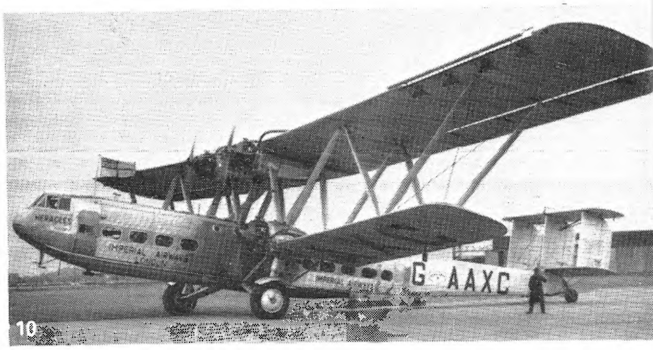

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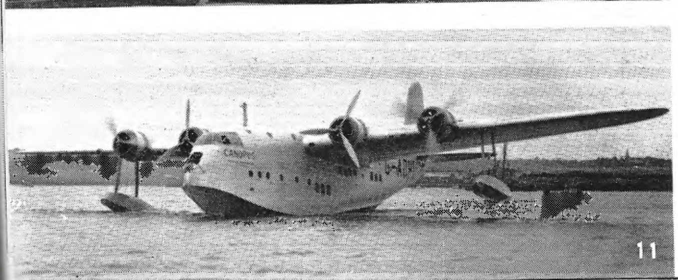
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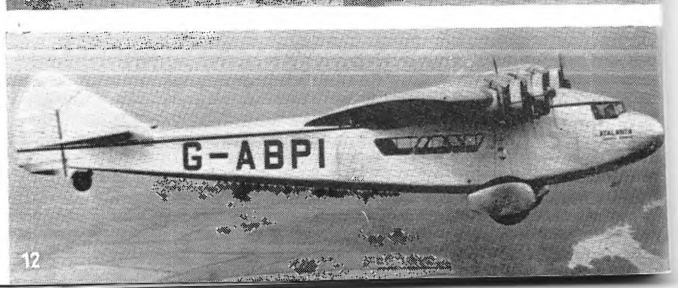

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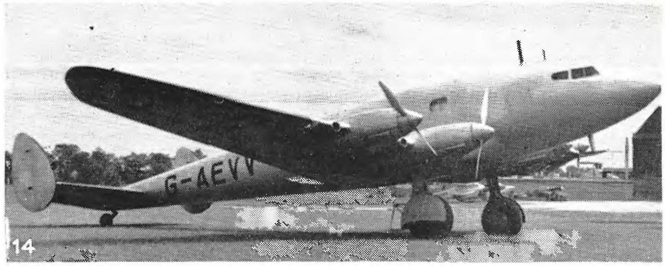
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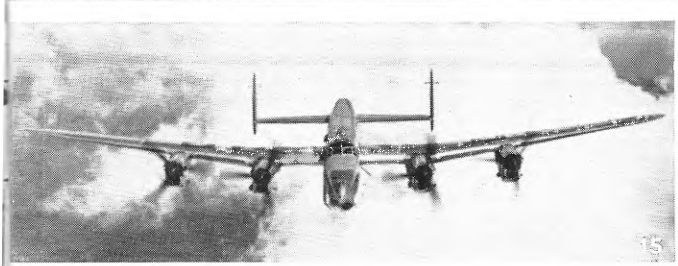
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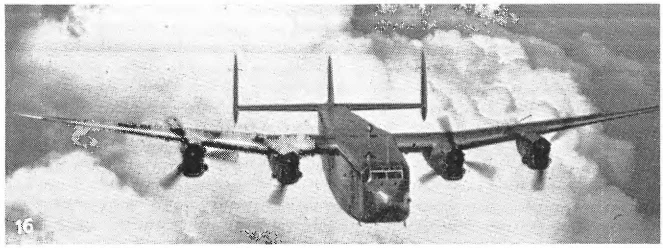
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Historical Section

HOW THE BRITISH AIRLINER DEVELOPED

The first commercial air services were flown with converted World War I bombers. One of the first specifically civil planes was the D.H. 18 (1). Designed and built by the Aircraft Manufacturing Co., it carred eight passengers and a pilot who sat in an open cockpit. A single 450 h.p. Lion engine gave a maximum speed of 128 m.p.h. and a range of 400 miles. The D.H. 18 was first used in the London–Paris service in 1920. Two years later the Vickers Vulcan (2) emerged in the colours of the Instone Air Line. Also an eight-seater, it was powered at first with a 360 h.p. Eagle engine, though later the 450 h.p. Lion was used. The D.H. 34 (3) (one 450 h.p. Lion) appeared at the same time. Daimler Airway operated the first of the series, providing a "cabin boy" to attend the eight passengers.

Meanwhile, Handley Page Ltd. were pressing ahead with civil designs. Their W.8 (4), seating twelve passengers, won the Air Ministry's Civil Aviation competition in 1920 and first prize at the International Meeting in Brussels for commercial aircraft. The W.10 (5) was a successful machine introduced in 1926.

Up to this point the development of British commercial aircraft was dependent upon two engines of World War I design—the 450 h.p. Napier Lion and the 360 h.p. Rolls-Royce Eagle VIII. Both were water-cooled and thus needed heavy radiators. By 1926 the Armstrong Siddeley and Bristol companies had introduced lighter air-cooled engines and the trend was towards three- and four-engined aircraft offering greater safety. The Armstrong Whitworth Argosy (6) (three 385 h.p. Armstrong Siddeley Jaguars) and the de Havilland D.H. 66 (7) (three 465 h.p. Bristol Jupiter VI's) are examples of design in the mid-twenties. The first was a 20-seater, the latter a twelve-seater, and both were used on Imperial Airways routes.

Flying boats, built by Short Bros., were used on certain Empire routes ; in 1931 the Kent class (8) came into service. Four 555 h.p. Bristol Jupiter engines propelled this comfortable sixteen-seater at 137 m.p.h over 450-mile stages. Passengers reclined in Pullman chairs and ate hot meals prepared on board. Wing, engine and tail units from this type were fitted to landplane hulls to provide the Scylla landplane (9).

In 1930 a new Handley Page multi-engined airliner, the H.P. 42 had made its first flight. Known as the Hannibal/Heracles class (10), these were the most famous and popular aircraft of their time. Eight were built, some being " tropicalised " for the African services. The continental version carried 38 passengers who could enjoy a four-course lunch or a seven-course dinner on the London–Paris run. H.P. 42's served Imperial Airways to the outbreak of World War 2.

The H.P. 42's were the last great biplanes to be built. New building techniques and metals now made the large monoplane with its greater speed potentialities possible. In 1937 the " C " or Empire Class flying boats (11) began to fly regular through services on the African routes. Four 740 h.p. Bristol Pegasus XC engines gave this Short aircraft a top speed of 200 m.p.h. and a range of 810 miles. The Armstrong Whitworth Atalanta (12) was a monoplane which began operating in 1932. The four A.W. Serval engines (totalling 1,360 h.p.) were mounted directly on the cantilever wings. The Atalanta carried 9–11 passengers on the Africa and Far East routes of Imperial Airways. Experience gained from this new type enabled Armstrong Whitworth to build the Ensign (13). It was the largest aircraft in the world when it first flew in 1938 and carried 40 passengers on European services. Its four A.S. Tiger engines produced a total of 3,400 h.p.

Also in 1938 a new de Havilland commercial aircraft joined Imperial Airways' fleet. It was the D.H. 91, a fast mail and passenger plane, named the Albatross (14). Four 525 h.p. D.H. Gipsy 12 engines gave this beautiful airliner a cruising speed of 210 m.p.h. for 1,000 miles.

When commercial flying was resumed in 1945, airline operators again had to make use of converted wartime aircraft. One conversion was the Avro Lancastrian (15) derived from the Lancaster bomber. Its power plant was four liquid-cooled 1,280 h.p. Rolls-Royce Merlin engines. A fleet of Lancastrians supplied to B.O.A.C. maintained the England–Australia route, beginning operations in May, 1945. At about this time the Avro York (16) became available. Conceived originally for trooping and ambulance duties, it was especially suitable for passenger carrying and several versions were supplied to B.O.A.C. Built largely of Lancaster components, the York is still used by some independent charter companies as a freighter.

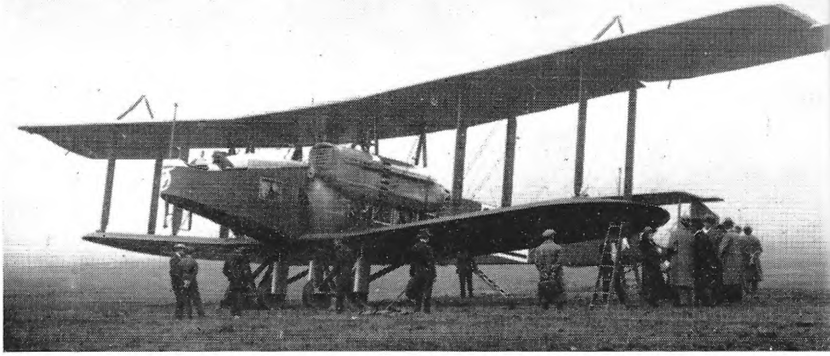
THE WORLD'S FIRST DAILY AIR SERVICES

To Britain falls the honour of having inaugurated the first international passenger air services. The momentous day was 25th August, 1919. Two companies in healthy competition began operations that gusty summer morning.

One, the Aircraft Transport and Travel Company, was founded by Mr. George Holt Thomas whose Aircraft Manufacturing Company had built thousands of World War I aircraft. At 9 a.m. the first converted D.H.4 of the A.T. & T. Co., piloted by the late Capt. Bill Lawford, left Hounslow for Paris. This de Havilland aircraft was powered by a single 360 h.p. Rolls-Royce Eagle engine and had a top speed of 120 m.p.h. One passenger, a newspaper reporter, was carried in addition to the freight. Soon after noon a D.H. 16, a four-seat conversion of the D.H. 9A day bomber, of the same company, took off for Paris with two passengers.

Meanwhile, at near-by Cricklewood, the London to Paris service of the Handley Page Transport Company was starting. A "special" was flown that day—regular daily services started a week later. Its fleet consisted of civil versions of the 0/400 Handley Page heavy bomber, the "bloody paralyser" of the then recently ended war. Driven by two Rolls-Royce 360 h.p. Eagle engines, these, the earliest multi-engined airliners, had a top speed of 87 m.p.h. Eleven passengers, mostly newspaper men, were carried on the first Handley Page London to Paris flight.

In 1924 the four British private airlines which had weathered the economic hazards of early commercial aviation were merged into the State supported Imperial Airways. Some years later another independent concern, British Airways, was given a subsidy to fly certain European routes. In 1940 these two organisations were combined by Act of Parliament and the British Overseas Airways Corporation was born. In 1945, another State airline, British South American Airways, evolved from the independent British Latin American Airways, but four years later this too, was merged with B.O.A.C. The other State airline, British European Airways, dates from 1946 in which year it was formed from the European division of B.O.A.C.



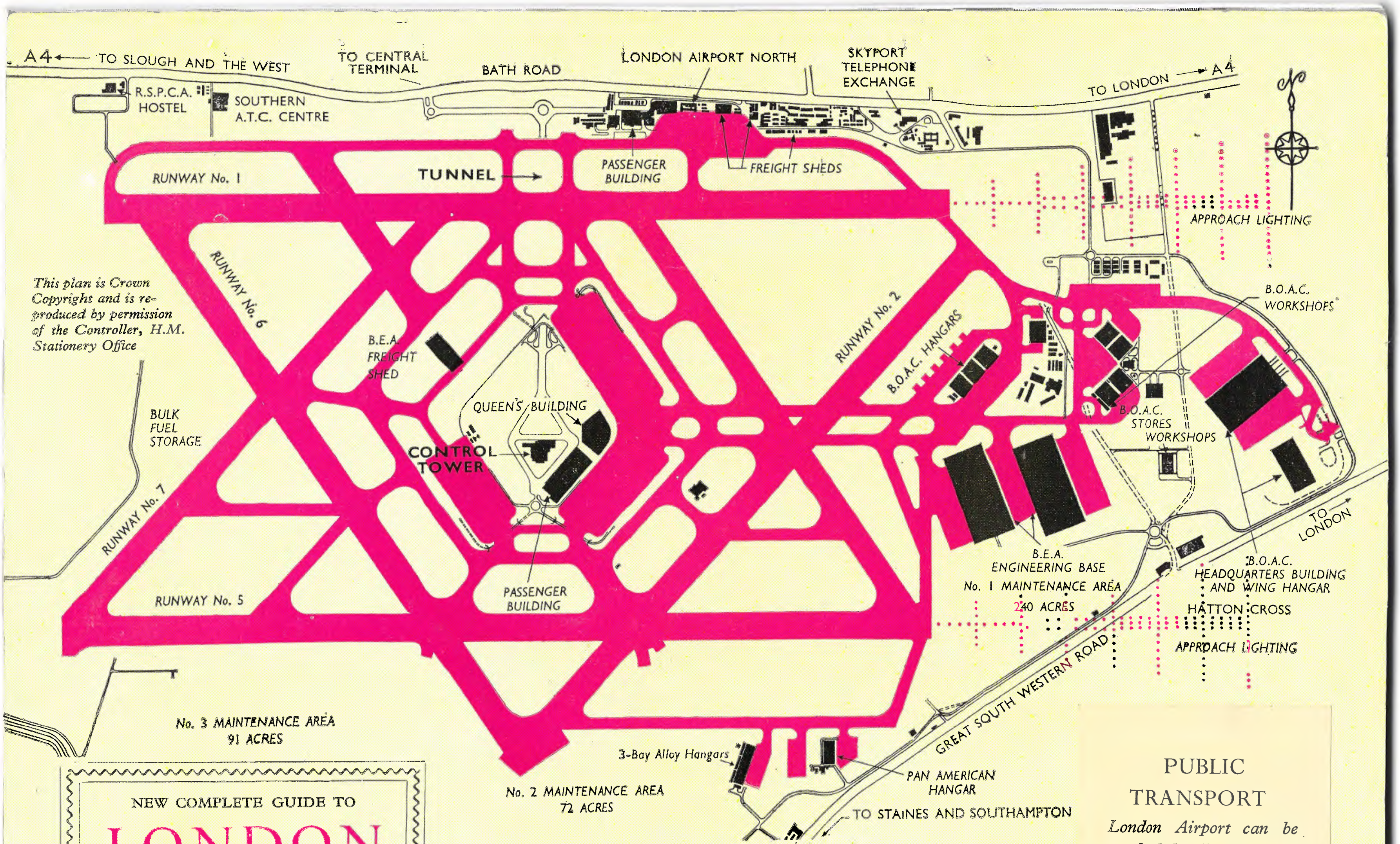
SCENES FROM THE PIONEER DAYS

TOP: Loading a D.H. 4A of the Air Transport and Travel Company for a pioneer cross-channel flight. ABOVE: The Handley Page 0/400 of the Handley Page Transport Company about to start on its historic journey on 25th August, 1919. LEFT: Captain Gerry Shaw with the D.H. 4A with which he flew the A.T. & T. service to Paris on the second day of the Company's operation, 26th August, 1919. BELOW *left:* Mr. Frank Hedges-Butler, who was appropriately dressed, was one of the first fare-paying air passengers.

* * *

ACKNOWLEDGMENTS

The publishers are grateful to the Ministry of Aviation for their help in producing and revising this guide, and to the many airlines, and aircraft manufacturers, who kindly supplied photographs and technical information.



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PUBLIC TRANSPORT

London Airport can be reached by Underground (Piccadilly or District Lines) with frequent trains to Hounslow West Station. Then by 81B or 91 (Monday to Friday) bus to London Airport Central.