# LIST OF AIRCRAFT ON DISPLAY

**Armstrong Siddeley Motors, Ltd.**

HUNTER F. MK. 2 (one Armstrong Siddeley *Sapphire* jet engine). First flew 30.11.52. Ordered for the R.A.F. Span 33 ft. 7 in.; length 45 ft. 9 in.

**Auster Aircraft, Ltd.**

*AIGLET TRAINER (one 130 h.p. de Havilland *Gipsy Major* piston engine). First flew 1951. Elementary trainer. Two seat (side-by-side) dual control, fully aerobatic clipped-wing version of standard *Aiglet*. Majority of components interchangeable with those of other Auster types. Span 32 ft.; length 23 ft. 2½ in.; maximum all-up weight 2,200 lb.; maximum speed 132 m.p.h.

*AMBULANCE/FREIGHTER (one 180 h.p. Blackburn and General *Cirrus Bombardier* piston engine). First flew 1951. Four-seater designed to operate from confined areas. Fuselage has 39 in. rear loading door and rapidly removable floorboard which is interchangeable with others incorporating modification sets according to use required. Eighty per cent. of parts interchangeable with Auster standard components. Span 37 ft.; length 24 ft. 8 in.; maximum total weight 2,600 lb.; maximum speed 112 m.p.h.

**Blackburn & General Aircraft, Ltd.**

*BEVERLEY (four 2,480 h.p. Bristol *Centaurus 171* piston engines). First flew 14.6.53. Developed from the Hercules-powered *Universal* Freighter. The first British aircraft designed for the dropping of heavy army equipment for which role the rear loading doors are removed. Carries nearly 20 tons of payload in a hold of nearly 6,000 cu. ft. capacity. In production for the R.A.F. A civil version which will carry six cars and five motor cycles in the freight hold and forty-two passengers in the tail is also to be produced. Span 162 ft.; length 99 ft. 2 in.; maximum speed 244 m.p.h.

**Boulton Paul Aircraft, Ltd.**

*SEA BALLIOL (one 1,245 h.p. Rolls-Royce *Merlin 25* piston engine). First flew 1951. Deck-landing version of the *Balliol T.2*, the R.A.F.'s two-seat advanced trainer. Span 39 ft. 4 in.; length 35 ft. 1½ in.

**The Bristol Aeroplane Co., Ltd.** (Aircraft Division)

*BRITANNIA 100 (four Bristol *Proteus 3* turboprop engines). First flew 16.8.52 at Filton, Bristol. Carries up to 104 " tourist " class passengers. Pressurized fuselage with track-mounted seats enabling passenger accommodation to be varied quickly. Three lengthened and more powerful versions of the *Britannia* with an all-up weight of 155,000 lbs. will be available for delivery in 1956/57. Thirty-five on order for B.O.A.C., ten of which will be lengthened passenger versions and another five, freight aircraft. Qantas Empire Airways has also signed a letter of intent to buy six of the bigger *Britannias*. Span 140 ft.; length 114 ft.; has an all-up weight of 140,000 lb. and can carry a 25,000 lb. payload over a distance of 3,650 statute miles, in still air, at a mean cruising speed of 360 m.p.h.

*TYPE 170 FREIGHTER (two 2,040 h.p. Bristol *Hercules 730* piston engines). First flew 2.12.45. Military and civil transport. Over 175 in use by military and civil operators in Britain and overseas. The *Mk. 32* long-nosed version, which can carry three cars instead of two, or more passengers, is also in service. The following particulars apply to the standard *Mk. 31 Freighter*. Span 108 ft.; length 68 ft. 3 in.; all-up weight 42,000 lb.; maximum speed 224 m.p.h.

*Supplied to countries overseas or export sales under discussion.

*TYPE 171, MK. 4 (one 551 h.p. Alvis *Leonides* piston engine). First flew 1950. Four/five-seat helicopter. In production for the British Services and Royal Australian Navy as the *Sycamore*. A civil model is used by B.E.A. Main rotor diameter 48 ft. 6¾ in.; length 61 ft.; all-up weight 5,200 lb.; level speed 141 m.p.h.; vertical climb 800 ft./minute.

TYPE 173 (two 550 h.p. Alvis *Leonides 73* radial, air-cooled, piston engines). First flew 3.1.52. Thirteen-seat, twin-rotor, passenger-carrying helicopter. Rotor diameter 48 ft. 6¾ in. Overall length (rotors folded) 78 ft. 2 in.; all-up weight 10,600 lb.; max. level speed at sea level 158 m.p.h. Three prototypes of the *Mk. 3* version fitted with stub wings have been ordered by the M.O.S. This version will be powered by two 850 h.p. Alvis *Leonides Major* engines and will cruise at 138 m.p.h. carrying sixteen passengers. The model shown at Farnborough this year is the *Mk. 2* fitted experimentally with stub wings.

**The Bristol Aeroplane Co., Ltd.** (Engine Division)-

OLYMPUS-CANBERRA (two 9,750 lb. static thrust Bristol *Olympus* jet engines). First flew 5.8.52. Experimental engine test-bed. On 4th May this machine set up a new world altitude record by climbing to 63,668 ft. Span 64 ft.; length 65 ft. 6 in.

**The de Havilland Aircraft Co., Ltd.**

*CHIPMUNK (one 145 h.p. de Havilland *Gipsy Major 10* piston engine). First flew in 1947. Two-seat civil and military elementary trainer. Designed by the de Havilland Aircraft of Canada. Standard elementary trainer of the R.A.F.V.R. Some hundreds on order and in service overseas. Also built in Portugal under licence. Span 34 ft. 4 in.; length 25 ft. 8 in.; all-up weight 2,000 lb.; maximum speed at sea level 140 m.p.h.

*COMET 2 (four 6,500 static thrust Rolls-Royce *Avon* jet engines). Prototype first flew 16.2.52. Long-range, forty-four seat version of the *Comet 1*. Twenty-seven *Comet 2's* are now on order, twelve of them for B.O.A.C. The first production B.O.A.C. *Comet 2* made its first flight on 27.8.53. Span 115 ft.; length 111 ft.; all-up weight 145,000 lb.; estimated range 4,500 miles at 520 m.p.h. at over 14,000 ft. with 17,500 lb. payload. A larger *Avon*-powered *Comet*, the *Series 3*, seating 58-78 passengers has been ordered by B.O.A.C., Pan American World Airways and Air India. Deliveries will commence in 1956. Altogether world operators have options for 100 *Comet 2's* and *3's* in addition to orders already placed.

*DOVE (two 345 h.p. de Havilland *Gipsy Queen, Series 70*, piston engines). First flew 25.9.45. Eight/eleven seat feederline transport. Some hundreds in world-wide use. Span 57 ft.; length 39 ft. 4 in.; all-up weight 8,500 lb.; maximum speed 210 m.p.h. One of the two examples displayed is fitted out as a radio calibration aircraft for use by the Ministry of Civil Aviation.

*HERON 2 (four 250 h.p. de Havilland *Gipsy Queen 30* piston engines). Retractable undercarriaged version of *Heron 1* which first flew May, 1950. Fourteen/seventeen seat feederliner. Fifty *Herons* have now been ordered by several overseas operators. Span 71 ft. 6 in.; length 48 ft. 6 in.; all-up weight 12,500 lb.; maximum cruising speed 177 m.p.h. at 3,000 ft.

*SEA VENOM (one 5,000 lb. static thrust de Havilland *Ghost* jet engine). First flew 1951. Two-seat all-weather naval fighter. Similar to the *NF Venom* but also has an arrester hook and folding wings. In quantity production for the Royal Navy and the Royal Australian Navy, and also being produced under licence in France. Span 41 ft. 9 in.; length 35 ft. 3 in.

* Supplied to countries overseas or export sales under discussion.

TYPE 110 (two Rolls-Royce *Avon* jet engines). First flew 26.9.51. Two-seat, radar-equipped, all-weather and night fighter. Made its first supersonic flight on 9.4.52. Under development for Royal Navy. Span 51 ft.; length 52 ft.

*VAMPIRE TRAINER (one 3,300 lb. static thrust de Havilland *Goblin 3* jet engine). First flew 15.11.50. In production for the R.A.F. and the Air Forces of twelve countries overseas. Also being built by de Havilland in Australia for the R.A.A.F. Span 38 ft.; length 34 ft. 5 in.; maximum speed 530 m.p.h.

*VENOM (one 5,000 lb. static thrust de Havilland *Ghost* turbojet engine). First flew 2.9.49. Two versions in production for the R.A.F. *FB.Mk.1*, single-seat day intercepter and fighter-bomber; *NF.Mk.3* two-seat night fighter with pilot and radar operator seated side-by-side in the fuselage nacelle, and search radar in the nose. The *NF Venom* has also been supplied to the Swedish Air Force. Built under licence in Italy and Switzerland. Span 41 ft. 9 in.; length (*FB.Mk.1*) 31 ft. 5 in. (*NF.Mk.3*) 35 ft. 4 in.

**The de Havilland Aircraft Co. of Canada, Ltd.**

*BEAVER 2 (one 520 h.p. Alvis *Leonides* piston engine). A British power plant has been installed in this Canadian-designed and built seven-passenger, light, all-metal transport. Over 500 *Beavers* have now been produced in Canada and have seen service with the U.S. Army in Korea as well as being widely used by civil operators in twenty-six countries. The *Beaver 2*, with its twenty per cent. power increase and all-round improvement in performance, is particularly intended for military use. Span 48 ft.; length 30 ft. 3 in.; cruising speed 147 m.p.h.

**The English Electric Co., Ltd.**

*CANBERRA (two Rolls-Royce *Avon* jet engines). First flew 13.5.49. Built by English Electric Co. and Shorts, Handley Page and A. V. Roe. High-speed, high-altitude, medium bomber. In production overseas for United States Air Force and Royal Australian Air Force. Also supplied to the Venezuelan Air Force. The *B.Mk.2* is the standard R.A.F. tactical bomber version. The *PR.Mk.3* is also in service as a high-speed, high-altitude, photographic reconnaissance aircraft. Among numerous speed records set up by *Canberras* since 1949 are the first double crossing of the Atlantic in 1952 and the London-Australia record in January this year. Span 64 ft.; length 65 ft. 6 in.; height 15 ft. 7 in.

**The Fairey Aviation Co., Ltd.**

*FIREFLY, MK. 7 (one Rolls-Royce *Griffon* piston engine). First flew 27.5.51. Three-seat, carrier-borne anti-submarine aircraft. Wings fold. In production for Royal Navy. Span 44 ft. 6 in.; length 37 ft. 11 in.

*GANNET (one 2,950 s.h.p. Armstrong Siddeley *Double-Mamba* turboprop engine). First flew 29.9.49. Anti-submarine search and strike aircraft. In " super-priority " production for Royal Navy. Also on order for Royal Australian Navy. Retractable radome beneath rear fuselage, sono-buoys and other war equipment can be carried beneath the wings. Wings fold. Span 54 ft. 4 in.; length 43 ft.

**Gloster Aircraft Co., Ltd.**

JAVELIN (two Armstrong Siddeley *Sapphire* jet engines). First flew 26.11.51. Two-seat long-range, day and night, all-weather, radar-equipped fighter. The world's first twin-jet engined delta. In " super-priority " production for the R.A.F. Carries a tail braking parachute for slowing the landing run. Capable of flying faster than sound. Span 52 ft.; length 57 ft.; height 17 ft.

* Supplied to countries overseas or export sales under discussion.

*METEOR T.MK.7 (two 3,500 lb. static thrust Rolls-Royce *Derwent 5* or *8* turbo-jet engines). First flew 19.3.48. Two-seat (tandem) unarmed trainer version of the *Meteor F.Mk.4*. Full dual controls. In production for the R.A.F. and overseas Air Forces. Span 37 ft. 2 in.; length 43 ft. 6 in.; height 14 ft. 9 in.; all-up weight 14,000 lb.; maximum speed 586 m.p.h. at sea level.

**Handley Page, Ltd.**

VICTOR (four Armstrong Siddeley *Sapphire* jet engines). First flew 24.12.52. Four-jet, crescent-wing bomber. In " super-priority " production for R.A.F. Bomber Command.

**Hawker Aircraft, Ltd.**

*HUNTER F. MK. 1 (one Rolls-Royce *Avon* jet engine). First flew 20.7.51. Single-seat fighter. Swept-wing. In " super-priority " production for the R.A.F. and also being built under licence in Holland and Belgium under a U.S. off-shore contract. Span 33 ft. 7 in.; length 45 ft. 9 in.

SEA HAWK (one 5,000 lb. static thrust Rolls-Royce *Nene 4* turbojet engine). First flew 31.8.48. Carrier-borne jet fighter. In production for the Royal Navy. In addition a U.S. off-shore order for *Sea Hawks* has been placed in this country. Has folding wings and is armed with four 20 m.m. cannon in the lower forward fuselage. All development work and production is now being undertaken by Armstrong Whitworth. Span 39 ft.; length 39 ft. 7 in.; wing area 278 sq. ft.

**Percival Aircraft, Ltd.**

*PEMBROKE (two Alvis *Leonides* piston engines). First flew 20.11.52 Eight-seat service transport. A development of the *Prince 3* and *Sea Prince*. Has increased wing span and rearward-facing passenger seats. Can also be used as an ambulance and training aircraft. In production for the R.A.F. and the Air Forces of Belgium and Southern Rhodesia. A civil version known as the *Prince Series 5* is under development. Span 64 ft. 6 in.; length 46 ft. 0 in.; height 16 ft.

*PROVOST (one 550 h.p. Alvis *Leonides Mk. 2500* piston engine). First flew February, 1950. Two-seat side-by-side basic trainer for Service and Civil use. In quantity production for R.A.F. and the Southern Rhodesian Air Force. A jet-powered version is also being developed. Span 35 ft. 2 in.; length 29 ft.; all-up weight 4,250 lb.; maximum speed 200 m.p.h. at 2,500 ft.

**A. V. Roe & Co., Ltd.**

*SHACKLETON 2 (four 2,450 h.p. Rolls-Royce *Griffon* piston engines). First flew 17.6.52. Maritime reconnaissance bomber. More powerfully armed and more streamlined version of the *Shackleton G.R.I.* with which it is in service with the R.A.F. Coastal Command. Carries a crew of ten. Span 120 ft.; length 87 ft. 4 in.; height 16 ft. 9 in.

TYPES 707A AND B (one Rolls-Royce *Derwent* jet engine). Experimental delta-wing research aircraft built to provide data for the design of the *Vulcan* delta bomber. Prototypes only. *707B* first flew September, 1950. Type *707A*, which differs from other version by having air intakes in the leading edge of the wing instead of on top of the rear fuselage, first flew in summer, 1951. Both types are fitted with 8 ft. tail parachute for use as a landing brake. Dimensions: (*707A*) Span 34 ft. 2 in.; length 42 ft. 9 in.; (*707B*) Span 33 ft.; length 41 ft. 10½ in.

TYPE *707C* (one Rolls-Royce *Derwent* jet engine). First flew 1.7.53. Two-seat (side-by-side) dual-control delta-wing trainer.

* Supplied to countries overseas or export sales under discussion.

VULCAN (four Armstrong Siddeley *Sapphire* jet engines). First flew 31.8.52. World's first delta-wing, four-jet bomber and in " super-priority " production for the R.A.F. Prototype first flew with four Rolls-Royce *Avon* jet engines but has now been fitted with four Armstrong Siddeley *Sapphires*. Production *Vulcans* will have Bristol *Olympus* engines.

**Rolls-Royce, Ltd.**

CANBERRA (two Rolls-Royce *R.A.14* jet engines of 9,500 static thrust each). Converted from a standard *Canberra B.Mk.2* by Rolls-Royce, Ltd. Span 64 ft.; length 65 ft. 6 in.

**Saunders Roe, Ltd.**

PRINCESS (ten Bristol *Proteus 2* and *3* turboprop engines in four coupled pairs and two single units outboard). First flew 22.8.52. Long-range, transport flying-boat. Span 219 ft. 6 in.; length 148 ft.; height 55 ft. 9 in.; all-up weight 140 tons.

SKEETER 5 (one 180 h.p. Blackburn and General *Cirrus Bombardier 704* piston engine). First flew October, 1948. Two-seat light helicopter for military and civil use. The *Mk. 3* military *Skeeter* is powered by a *Cirrus Bombardier 702* engine of slightly less horsepower than that fitted to the civil *Mk. 5*. As an alternative to the tricycle undercarriage, a skid landing gear is being developed. Rotor diameter 32 ft.; length 31 ft. 2 in.; all-up weight 2,100 lb. Maximum speed at sea level 115 m.p.h.

**Scottish Aviation, Ltd.**

*PIONEER 2 (one 520 h.p. Alvis *Leonides* piston engine). First flew June, 1950. Four/five seat light transport for civil or service use. In production for the R.A.F. and shortly to enter service in Malaya. The version displayed is fitted out as an air ambulance. A two-engined *Twin-Pioneer* is planned. Span 52 ft. 6 in.; length 34 ft. 4 in.; maximum all-up weight 5,400 lb.; maximum speed 173 m.p.h.

**Short Brothers & Harland, Ltd.**

SB.5 (one Rolls-Royce *Derwent* jet engine). First flew 2.12.52. Adjustable wing research aircraft designed to investigate problems arising in the handling of swept-back wing high speed aircraft. Fixed undercarriage. Wing can be set at 50, 60 or 69 degrees of sweep-back, and the tailplane can be positioned high or low on the fin and set to any desired angle of incidence between 10 degrees above or 10 degrees below the horizontal.

SB.6 SEA MEW (one Armstrong Siddeley *Mamba* turboprop engine). First flew 23.8.53. Light, anti-submarine aircraft specifically designed for operation with escort carriers of N.A.T.O. forces. Fixed undercarriage.

**Vickers-Armstrongs, Ltd.**

VALIANT (four Rolls-Royce *Avon* turbojet engines). First flew 18.5.51. The first of the R.A.F.'s trio "V" class four-jet bombers which were ordered " straight off the drawing board ". In " super-priority " production for Bomber Command.

*VISCOUNT (four 1,400 h.p. plus 365 lb. static thrust Rolls-Royce *Dart* turboprop engines). First flew 18.7.48. Forty/fifty-three passenger airliner. Opened the world's first turboprop airliner service in April last with B.E.A. Over eighty on order for B.E.A., Hunting Air Transport, Air France, Aer Lingus, Iraqi Airways, Trans Australian Airlines and Trans Canada Airlines. Larger versions are being developed. Span 94 ft.; length 81 ft. 2 in.; all-up weight 52,000 lb.; maximum speed 340 m.p.h.

*Supplied to countries overseas or export sales under discussion.

**Vickers-Armstrongs, Ltd.** (Supermarine Division)

SWIFT (one Rolls-Royce *Avon* jet engine with reheat). First flew 1.8.51. Single-seat, swept-wing fighter. In " super-priority " production for the R.A.F. as the *Swift F.Mk.4*. Set up a London to Paris record of 19 min. 5.6 sec. on 5th July last.

**Westland Aircraft, Ltd.**

*S.51 (one 550 h.p. Alvis *Leonides* piston engine). First flew 1948. Four/five seat helicopter, Sikorsky design, built under licence. In service with R.A.F., Royal Navy and overseas (as *Dragonfly*). Rotor diameter 48 ft.; length 57 ft.; all-up weight 5,700 lb.; maximum speed 103 m.p.h.

*S.55 (one 800 h.p. Alvis *Leonides Major* piston engine). A new British power plant has been installed in this particular *S.55* which is a Sikorsky design built under licence. Other Westland-built *S.55's* are in service with the Royal Navy. Rotor diameter 53 ft.; length 41 ft. 8½ in.; all-up weight 6,800 lb.; maximum speed 110 m.p.h.

WYVERN (one 3,650 e.h.p. Armstrong Siddeley *Python* turboprop engine). First flew summer, 1949. In production for Royal Navy. Single-seat naval strike fighter. Span 44 ft.; length 42 ft.

*Supplied to countries overseas or export sales under discussion.

# LIST OF ENGINES ON DISPLAY

(*Many of these engines are being manufactured overseas under licence.*)

**Alvis, Ltd.**

LEONIDES LE.23HM. Nine-cylinder, air-cooled, vertical radial piston engine for use in helicopters; single-stage, single-speed supercharger. Weighs 642 lb. dry, and measures 41.5 in. long by 41.5 in. wide by 32.8 in. high. Has compression ratio of 6.8 and is of direct drive type. Take-off power at sea level is 550 b.h.p. at 3,200 r.p.m.; maximum emergency, 570 b.h.p. at 3,200 r.p.m. at 4,000 ft.; and maximum continuous cruise 410 b.h.p. at 2,800 r.p.m. at 9,750 ft. Fuel consumption is 31.5 g.p.h. and oil consumption 5 pints per hour, both at maximum cruising power.

*Installed in S.51 and Types 171 and 173.*

LEONIDES MAJOR. Fourteen-cylinder, air-cooled, two-row radial piston engine for use in improved versions of aircraft in which the *Leonides* is already fitted, new aircraft which need an engine of about 50 per cent. greater power, and in helicopters. The horizontal crankshaft version weighs 1,060 lb. dry, measures 70.9 in. long by 38.9 in. diameter. Has compression ratio of 6.8 : 1 and incorporates a low-pressure fuel injection system, enabling the engine to be controlled by a single lever. Take-off power at sea level is 870 b.h.p. at 3,000 r.p.m.; maximum continuous power 700 b.h.p. at 2,900 r.p.m. at 7,000 ft. and maximum weak mixture 515 b.h.p. at 2,600 r.p.m. at 11,000 ft. Fuel consumption is 525/555 pints/b.h.p./hour, and oil 6-10 pints per hour at maximum continuous power.

*Installed in Westland S.55.*

LEONIDES 502/4. Nine-cylinder, air-cooled, radial piston engine; single-stage, single-speed compressor. Weighs 790 lb. dry and measures 54.4 in. long by 41.5 in. wide by 41.5 in. high. Has compression ratio of 6.8 and reduction gear of 0.625. Take-off power at sea level is 570 b.h.p. at 3,000 r.p.m. at 2,000 ft.; and maximum cruise 460 b.h.p. at 2,900 r.p.m. at 8,000 ft. Fuel consumption is 38 g.p.h. and oil consumption 6 pints per hour, both at maximum cruising power.

*Installed in Provost, Pembroke, Pioneer and Beaver 2.*

**Armstrong Siddeley Motors, Ltd.**

MAMBA. Turboprop with ten-stage axial compressor, two-stage twin-disc turbine and six combustion chambers. Airscrew drive: epicyclic reduction gear driven by quill shaft from front of compressor. Is 87.33 in. long, and 29 in. in diameter, weighing 771 lb. dry and having a weight/power ratio of 0.52. Develops 1,320 b.h.p. and 405 lb. thrust at 15,000 r.p.m. at sea level, and cruises at 1.050 b.h.p. plus 305 lb. thrust at 14,500 r.p.m. at sea level. Fuel consumption is 0.67 lb./e.h.p./hr. and oil consumption is 2 pints per hour at 350 m.p.h. and 14,500 r.p.m. at sea level. First ran April, 1946. Powered the first single-engined prop-jet aircraft to fly and the world's first axial-flow turboprop airliner.

*Installed in SB.6 Sea Mew.*

DOUBLE-MAMBA. Coupled turboprop with ten-stage axial compressor, two-stage turbine and twelve combustion chambers. Airscrew drive; epicyclic reduction gears driving independent co-axial shafts. Is 98.7 in. long, and 52.8 in. in diameter, weighs 2,000 lb. dry and has a weight/power ratio of 0.68. Develops 2,640 b.h.p. and 810 lb. thrust at 15,000 r.p.m. at sea level, and cruises at 2,100 b.h.p. and 710 lb. thrust at 14,500 r.p.m. at sea level. Fuel consumption is 0.67 lb./e.h.p./hr., and oil consumption is 4 pints per hour at 300 m.p.h. at sea level. One of the coupled engines can be shut down completely allowing an aircraft to fly on only one bank of the motor. The engine can run on kerosene, high-octane or ships' diesel fuel, or any mixture of the three.

*Installed in Gannet.*

PYTHON. Turboprop with axial fourteen-stage compressor, two-stage turbine and eleven combustion chambers. Airscrew drive; epicyclic reduction gear to co-axial shafts from compressor shaft. Is 122.7 in. long and 54.5 in. in diameter, weighs 3,150 lb. dry and has a weight/power ratio of 0.77. Develops 3,670 b.h.p. and 1,150 lb. thrust at 8,000 r.p.m. at sea level and cruises at 2,750 b.h.p. and 960 lb. thrust at 7,600 r.p.m. at sea level. Oil consumption 2-4 pints per hour both at 300 m.p.h. at sea level.

*Installed in Wyvern.*

SAPPHIRE. Jet with axial-flow compressor and annular combustion chamber. Is 133.85 in. long and has a diameter of 35.25 in.; weighs 2,500 lb. dry and has a weight/power ratio of 0.35. Test run at sea level static thrust 8,300 lb. Being built under licence in America by Curtiss-Wright as the *J65*. *Sapphire Meteor* holds international records for climb up to 40,000 ft. in three minutes.

*Installed in Javelin, first prototype Vulcan, Victor, Hunter F.2, and experimentally installed in Canberra.*

SNARLER. A bi-fuel liquid rocket motor which can be switched on and off at the pilot's will. Weighs 215 lb. without fuel. Runs on a mixture of liquid oxygen and water/methanol and the designed endurance is three minutes at full thrust. Developed for the Ministry of Supply and air tests have been made with the unit installed in the Hawker *P.1072*. A maximum thrust of 2,000 lb. is delivered at sea level.

VIPER ASV3. An expendable jet engine with an annular combustion chamber. Powers the *Jindivik Mk. 2* pilotless target aircraft which is being built in Australia. Is being built under licence in France. Is 65½ in. long and weighs 365 lb. dry. Has been type-tested at 1,640 lb. thrust. A long-life version, the *ASV5*, is being developed for the Percival *P.84 Jet Provost*. The latest *Viper* released is the *ASV6* which develops 1,900 lb. thrust.

**Blackburn and General Aircraft, Ltd.**

CIRRUS BOMBARDIER. Four-cylinder air-cooled in-line direct injection piston engine, unsupercharged. Weighs 354 lb. dry and measures 45.27 in. long by 17.2 in. wide by 31.1 in. high. Has compression ratio of 7.0 direct drive to airscrew. Take-off power at sea level is 180 b.h.p. at 2,600 r.p.m.; maximum emergency 180 b.h.p. at 2,600 r.p.m. at sea level and maximum cruising 158 b.h.p. at 2,300 r.p.m. at 1,250 ft. Fuel consumption is 10.8 g.p.h. and oil consumption 1-3.5 pints per hour, both consumptions at maximum cruising power.

*Installed in Ambulance/Freighter and Skeeter.*

**The Bristol Aeroplane Co., Ltd.**

CENTAURUS 661. Eighteen-cylinder, air-cooled, two-row, sleeve-valve radial engine with single-stage two-speed supercharger. Weighs 3,300 lb. dry and measures 74.6 in. long by 57.75 in. in diameter. Has a compression ratio of 7.2 and reduction gear ratio of 0.40. Take-off power at sea level is 2,600 b.h.p. at 2,500 r.p.m. at 13,000 ft., and maximum cruising 1,755 b.h.p. at 2,500 r.p.m. at 13,000 ft. Fuel consumption is 108.5 g.p.h. and oil consumption eleven pints per hour, both at maximum cruising power (continuous). Produced during end of war and still in production.

*Installed in various military and civil aircraft, including the Sea Fury naval fighter and the Ambassador (Elizabethan) medium range airliner now in service with B.E.A. A slightly modified version powers the Blackburn Beverley.*

HERCULES 730 SERIES. Fourteen-cylinder, air-cooled, two-row, sleeve-valve radial engine with single-speed supercharger. Weighs 2,100 lb. dry and measures 62.25 in. long by 52 in. diameter. Has a compression ratio of 7.0 and a reduction gear ratio of 0.444. Take-off power at sea level is 2,040 h.p. at 2,800 r.p.m.; maximum emergency 2,090 h.p. 2,800 r.p.m. at 3,000 ft. and maximum cruising 1,215 h.p. at 2,400 r.p.m. at 10,750 ft. Fuel consumption is 75.0 g.p.h. and oil consumption is nine pints per hour, both at maximum continuous cruising power. Post-war development of the war-time *Hercules* of which 57,400 were built. The various series *Hercules* engines are widely used in civil and military aircraft. It is also being built under licence in France.

*Installed in the Type 170 Freighter* (*Hercules 734*).

OLYMPUS. Jet of the two-spool type—basically a low pressure unit and a high pressure unit, each having an entirely independent axial compressor and turbine. The low pressure unit acts as a supercharger to the high pressure compressor, and each is driven through concentric shafts by its own separate turbine. This arrangement gives all the advantages of handling and easy starting obtained with engines of medium compression ratios, but yields the much lower fuel consumption made possible by the use of high compression ratios. Is 124 in. long and has a diameter of 40 in., weighs 3,520 lb., consumption lb./lb. t./hr. 0.766, maximum thrust 9,750 lb. Built under licence in the U.S.A. by Wright, as the *J67*.

*Installed in second prototype Vulcan. Experimentally installed in the Canberra which holds the world's altitude record.*

PROTEUS 3. Turboprop with axial and centrifugal twelve plus one stage compressor, three-stage turbine and eight combustion chambers. Airscrew drive; free turbine and epicyclic gear. Is 100.5 in. long and 39.5 in. in diameter, weighs 2,810 lb. dry and has a weight/power ratio of 0.6. Has a maximum continuous power rating of 2,920 s.h.p. plus 1,100 lb. jet thrust at 17,000 compress or p.p.m. at sea level. More powerful and compact development of *Proteus 2* which powers the *Princess* in both single and coupled-unit form.

*Installed in the Britannia.*

**The de Havilland Engine Co., Ltd.**

GHOST 50. Jet with centrifugal single-stage compressor, single-stage turbine and ten combustion chambers. Is 121 in. long and 53 in. in diameter, weighs 2,218 lb. dry and has a weight/power ratio of 0.44. Develops 5,000 lb. thrust at 10,250 r.p.m. at sea level and cruises at 3,350 lb. thrust at 9,000 r.p.m. at sea level. Fuel consumption is 1.33 lb./lb. t./hr. and oil consumption two pints per hour, both at 500 m.p.h. First pure jet engine to power a civil aircraft, the de Havilland *Comet*. Established an international height record for aeroplanes when a *Ghost*-engined *Vampire* reached 59,446 ft. on 23.3.48. Also built in Italy, Sweden and Switzerland under licence.

*Installed in Venom series.*

GIPSY MAJOR 10/2. Four-cylinder, air-cooled, in-line piston engine; unsupercharged. Weighs 312 lb. dry and measures 45.4 in. long by 20.1 in. wide by 30.6 in. high. Has compression ratio of 6.0 and direct drive to airscrew. Take-off power at sea level is 145 b.h.p. at 2,400 r.p.m. at sea level. Fuel consumption is 11 g.p.h. and oil consumption 2-5 pints per hour at maximum continuous cruise.

*Installed in Chipmunk and Aiglet Trainer.*

GIPSY QUEEN 30/2. Six-cylinder, air-cooled, in-line piston engine, unsupercharged. Weighs 560 lb. dry and measures 61.5 in. long by 19.6 in. wide by 33 in. high. Has a compression ratio of 6.5 and direct drive to airscrew. Take-off power at sea level 250 b.h.p. at 2,500 r.p.m.; maximum cruising power 250 b.h.p. at 2,500 r.p.m. at sea level. Fuel consumption 13 g.p.h. and oil consumption 3-7 pints per hour at maximum continuous cruise.

*Installed in Heron.*

GIPSY QUEEN 70/2. Six-cylinder, air-cooled, in-line piston engine. Single-stage, single-speed supercharger. Weighs 670 lb. dry and measures 71.75 in. long by 19.56 in. wide by 33.23 in. high. Has a compression ratio of 6.5 and reduction gear ratio of 0.711. Take-off power at sea level is 380 b.h.p. at 3,000 r.p.m. and maximum cruising 356 b.h.p. at 2,700 r.p.m. at 4,400 ft. Fuel consumption is 17.5 g.p.h. and oil consumption 2-6 pints per hour at maximum continuous cruise.

*Installed in Dove.*

GOBLIN 35. Jet with centrifugal single-stage compressor, single-stage turbine and sixteen combustion chambers. Is 100.5 in. long and 49.9 in. in diameter, weighs 1,629 lb. and has a weight/power ratio of 0.46. Develops 3,500 lb. thrust at 10,750 r.p.m. at sea level and cruises at 2,320 lb. thrust at 9,500 r.p.m. at sea level. Fuel consumption is 1.47 g.p.h. and oil consumption 1.6 pints per hour, both at 500 m.p.h. Civil version of other *Goblin* engines. The *Goblin* first flew on 5.3.43. Passed British type test in new Gas Turbine Category in January, 1945, and holds Approval Certificate No. 1. Also being built under licence in Italy and Sweden.

*Installed in Vampire Trainer.*

SUPER SPRITE. Assisted take-off rocket motor. Development of the *Sprite* " cold " rocket motor and intended primarily for use with military aircraft. Employs hydrogen peroxide with kerosene or petrol injection and a solid catalyst which replaces the liquid potassium permanganate used in the *Sprite*. The catalyst breaks down the hydrogen peroxide into water, in the form of steam, and free oxygen, thus providing the bulk of the thrust. The injection of kerosene or petrol—drawn from the aircraft's main tanks—and its combustion in the free oxygen in the exhaust stream increases the rocket's energy, and this additional energy can be used either to increase the thrust or to extend the duration of run. The *Super Sprite* weighs 600 lb., gives a total impulse of 120,000 lb./seconds in its present form, and has a duration of about 40 seconds with a maximum thrust of 4,000 lb.

**D. Napier and Son, Ltd.**

ELAND. Turboprop of single-shaft type driving a single-rotation constant-speed propeller. Axial compressor, six combustion chambers and an axial flow turbine. A notable feature of the *Eland* is its extremely low specific weight, approximately ½ lb. per h.p., length 104.5 in. Maximum diameter 36 1/16 in., weight 1,575 lb. dry and has a specific weight of .525 lb. per h.p. Take-off power at sea level 3,000 e.h.p.

NOMAD. This is a combination of piston and turbine engines connected to drive a propeller. The advantage of the composite power plant lies in its low fuel consumption which means extra range for long-distance civil and military aircraft. Its basic principle is that the gases for driving the turbine are produced by a highly supercharged piston engine and not by static combustion chambers. The exact combination of this arrangement used on the *Nomad* is secret, but the latest version of the *Nomad*, the *NNm6*—a development of the earlier *NNm3* which first flew in 1951 as an experimental installation in a *Lincoln*—delivers 3,135 e.h.p. and weighs 3,580 lb. dry. Is 9 ft. 11 in. long and has a frontal area of only 19.25 sq. ft.

**Rolls-Royce, Ltd.**

AVON. Axial-flow jet engine. The first *Avon* to be revealed in 1948 developed 6,000 16 static thrust. Since the *RA3* went into production in June, 1950, the *Avon* has undergone continual development, the thrust having increased to 7,500 lb. (with reheat) in the *RA.7* and to 9,500 lb. (without reheat) in the *RA.14*—the latest type-tested version to be announced and the highest world figure. Production and delivery of this engine has already begun and newer versions are being developed in flight to give jet higher powers, well into five figures. A civil version of the *RA.14*, the *RA.16*, will power the long-range *Comet 3*. Six different production lines are making *Avons* in Britain, and it is also being built under licence in Australia, Belgium and France.

*Installed in Canberra, Valiant, Hunter F.1, Swift, Type 110 and Comet 2.*

DERWENT 8. Jet with double-sided centrifugal-type single-stage compressor, single-stage turbine and nine combustion chambers. Length 83 in., 43 in. in diameter, weighs 1,280 lb. dry and has weight/power ratio of 0.356. Develops 3,600 lb. thrust at 14,700 r.p.m. at sea level and cruises at 3,090 lb. thrust at 14,100 r.p.m. at sea level. Fuel consumption is 1.45 lb./lb. t./hr., and oil consumption one pint per hour, both at 500 m.p.h. Also built under licence in Belgium.

*Installed in Meteor T.7, SB.5 and Types 707A, B and C.*

NENE. Jet with double-sided centrifugal-type single-stage, compressor, single-stage turbine and nine combustion chambers, 97 in. long and 49.5 in. in diameter, weighs 1,755 lb. dry and has weight/power ratio of 0.355. Develops 5,000 lb. thrust at 12,500 r.p.m. at sea level and cruises at 4,000 lb. thrust at 11,800 r.p.m. at sea level. Fuel consumption 1.43 lb./lb. t./hr., oil consumption one pint per hour, both at 500 m.p.h. Also built under licence in Australia and France.

*Installed in Sea Hawk and P.111A.*

DART R.DA.3. Turboprop with centrifugal two-stage compressor, two-stage turbine and seven combustion chambers. Airscrew drive, epicyclic reduction gear from compressor shaft. Is 95 in. long and 38.5 in. in diameter, weighs 929 lb. dry and has a weight/power ratio of 0.63. Develops 1,400 b.h.p. and 365 lb. thrust at 14,500 r.p.m. at sea level and cruises at 1,120 b.h.p. and 295 lb. thrust at 13,800 r.p.m. at sea level. Fuel consumption is 0.94 lb./e.h.p./hr. and oil consumption one pint per hour, both at sea level. The *Dart* was the first engine designed as an airscrew turbine to fly and made its first flight in October, 1947. The *Viscount* fitted with four *Dart* engines was the world's first prop-jet powered airliner to fly and to go into scheduled service.

*Installed in Viscount*

GRIFFON 57. Twelve-cylinder vee liquid-cooled piston engine, two-speed, single-stage supercharger and gearing for contra-rotating propellers. Weighs 2,100 lb. dry and measures 83.5 in. long by 31.8 in. wide. Has a compression ratio of 6.0 and a reduction gear ratio of 0.442. Take-off power at sea level 2,450 h.p. at 2,750 r.p.m.; maximum emergency 1,985 h.p. at 2,750 r.p.m. at 1,500 ft. and maximum cruising 1,360 h.p. at 2,400 r.p.m. at 6,000 ft. Fuel consumption (specific cruising) 118 g.p.h.; and oil consumption 4-20 pints per hour. The *Griffon* is a similar type of engine to the *Merlin* of war-time fame, but of larger capacity.

*Installed in Shackleton (Griffon 57) and the Firefly 7 (mark of engine unspecified).*

MERLIN 35. Twelve-cylinder vee liquid-cooled piston engine; single-speed, single-stage supercharger. Weighs 1,515 lb. dry and measures 75 in. long by 33.6 in. wide by 49.1 in. high. Has compression ratio of 0.471. Take-off power is 1,280 b.h.p. at 3,000 r.p.m. and +12 lb./sq. in. boost and maximum cruising 1,050 b.h.p. at 2,850 r.p.m. at 8,000 ft. Fuel consumption (specific cruising) 112 g.p.h.; and oil consumption 3-10 pints per hour. Development of the famous war-time *Merlin* which powered the *Hurricane, Spitfire, Lancaster* and many other outstanding aircraft of all categories. The *Merlin* engine has been produced in large numbers and over 150,000 have been built.

*Installed in Sea Balliol.*

## HOURS FLOWN BY BRITISH JETS

The flying experience with British turbine engines is mounting rapidly every day. It now totals millions of hours. Some of the more important figures are given below:

Rolls-Royce *Derwent* (mainly *Meteors*)—1½ million engine flying hours.

de Havilland *Goblin* (mainly *Vampires*)—½ million engine flying hours.

*Comets*—Over 100,000 engine flying hours in passenger-carrying service.

*Viscounts*—Over 12,000 engine flying hours in passenger-carrying service.

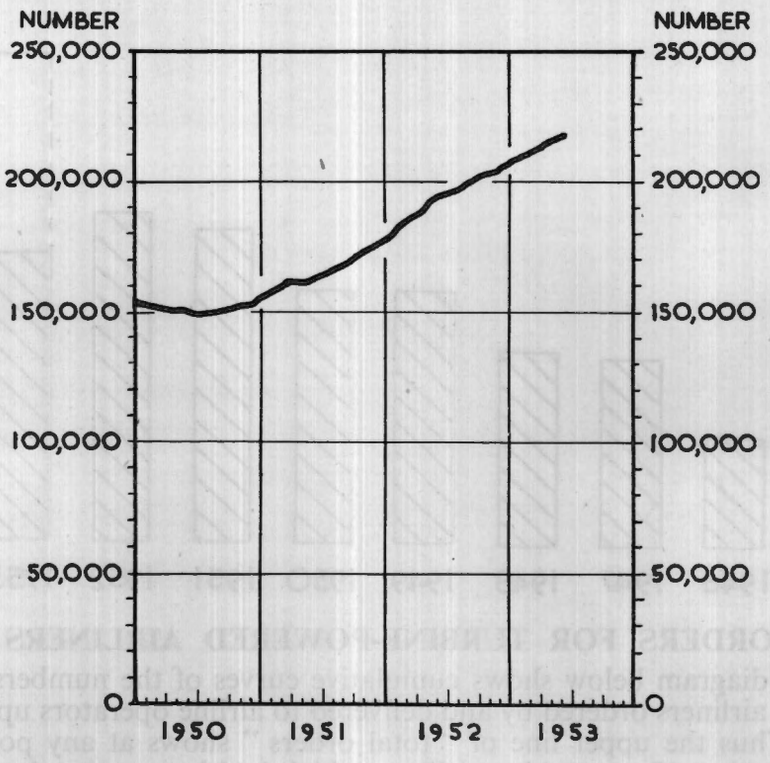
# THE EXPANSION OF AVIATION IN GREAT BRITAIN

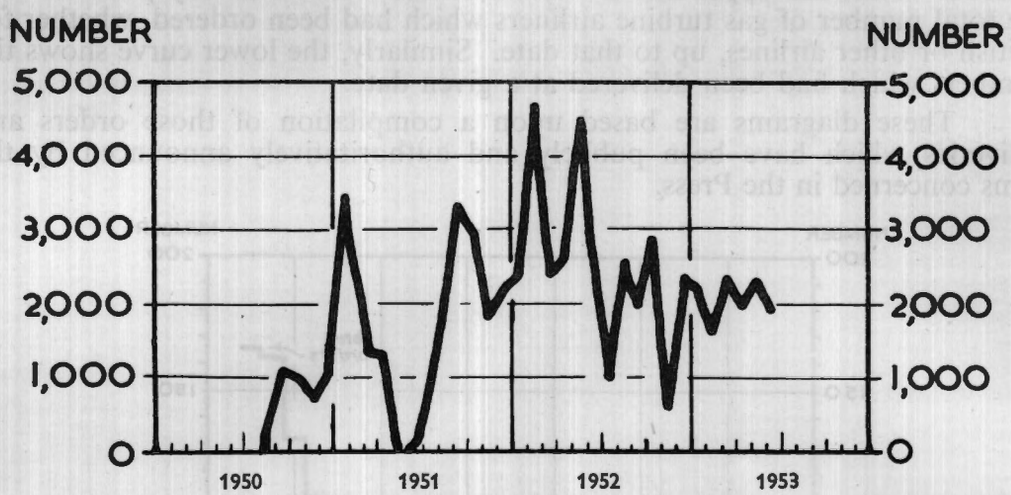
*The six graphs which follow have been drawn to show the steady expansion of aviation in Great Britain over recent years.*

## AIRCRAFT INDUSTRY MANPOWER

Manpower in the Aircraft Industry rose from 149,900 in June, 1950, to 218,000 at the end of June this year, the latest month for which figures are available. The two graphs below show how this growth has taken place.

The first graph shows the labour force month by month over the period. The second shows the intake into the Industry each month. Over the first half of 1953 there was an average monthly intake of 2,100 workers.



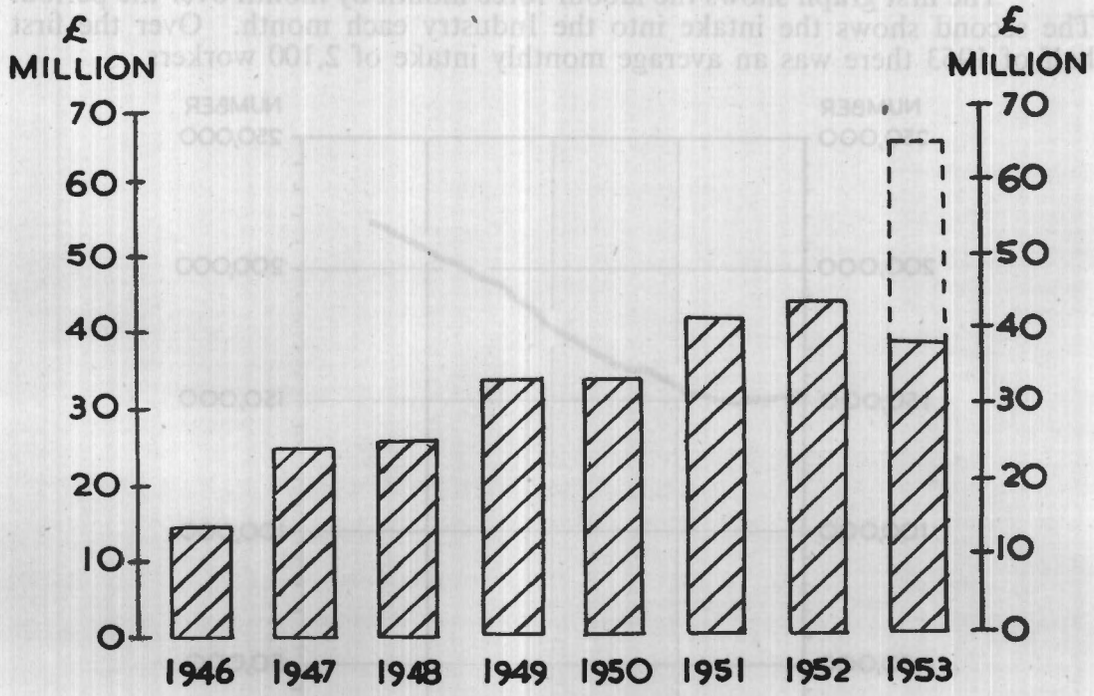

*Important Note.*—These statistics are the official census estimates which only cover employment in firms manufacturing airframes, engines, undercarriages and propellers; they exclude employment in many other firms making parts and accessories for aircraft and work sub-contracted outside the main firms. Therefore, although the statistics cover the greater part of the Industry and are a fair index of trends, they are not a full measure of the total manpower engaged in making aircraft, engines and parts.

## AVIATION EXPORTS

The total value of aero exports since the beginning of 1946 is now about £260m.

Up to the end of July, exports in 1953 had already reached £38m., not far short of the total for the whole of 1952, and with five months still to go. If the rate of exports for the first seven months is no more than maintained for the rest of the year, total exports for 1953 will be well over £60m., as shown by the dotted column in the diagram.

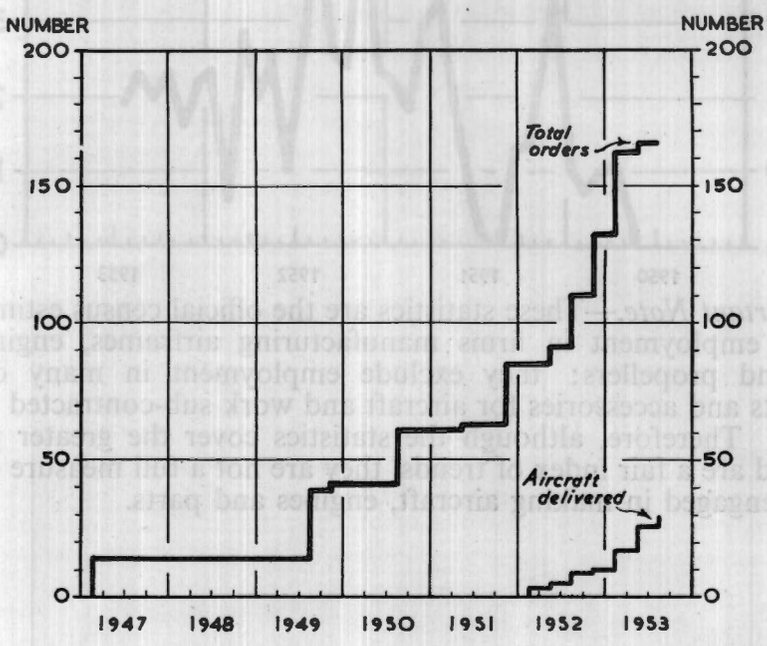
An important point to note is that the export totals up to and including 1952, although showing a progressive rise, had not yet been influenced by the export of the new gas turbine aircraft, of which deliveries abroad only began in 1953. On the other hand, the rising curve of exports up to the end of 1952 includes certain sales of Service aircraft abroad, and was therefore influenced by the expanding armament programmes of our allies.




## ORDERS FOR TURBINE-POWERED AIRLINERS

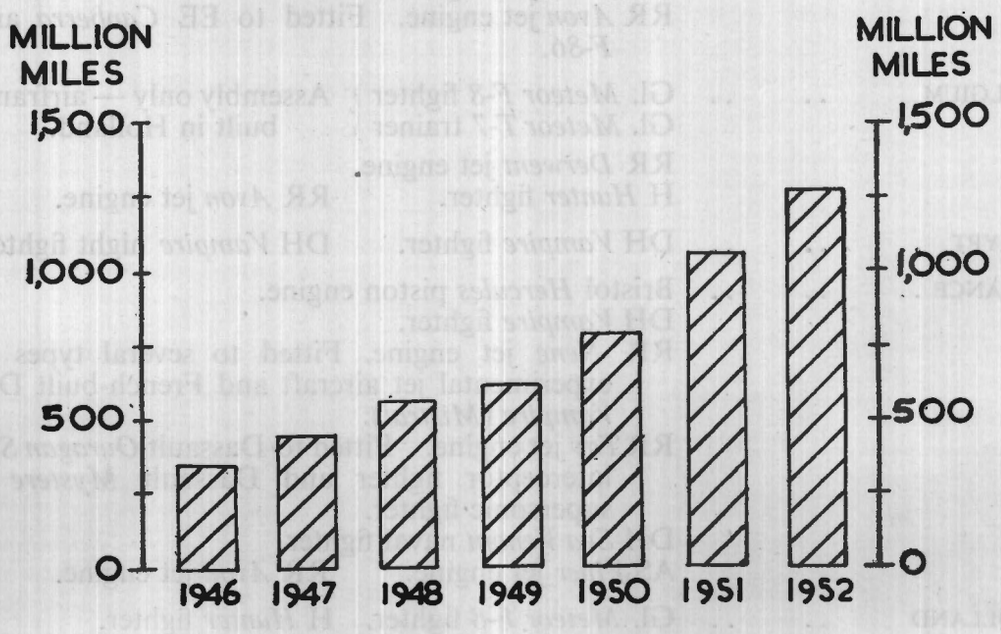
The diagram below shows cumulative curves of the numbers of British gas turbine airliners ordered by and delivered to airline operators up to the end of 1953. Thus the upper line of " total orders " shows at any point in time the total number of gas turbine airliners which had been ordered, whether for British or other airlines, up to that date. Similarly, the lower curve shows the numbers which had been delivered at a given date.

These diagrams are based upon a compilation of those orders and deliveries which have been publicly and authoritatively announced by the firms concerned in the Press.



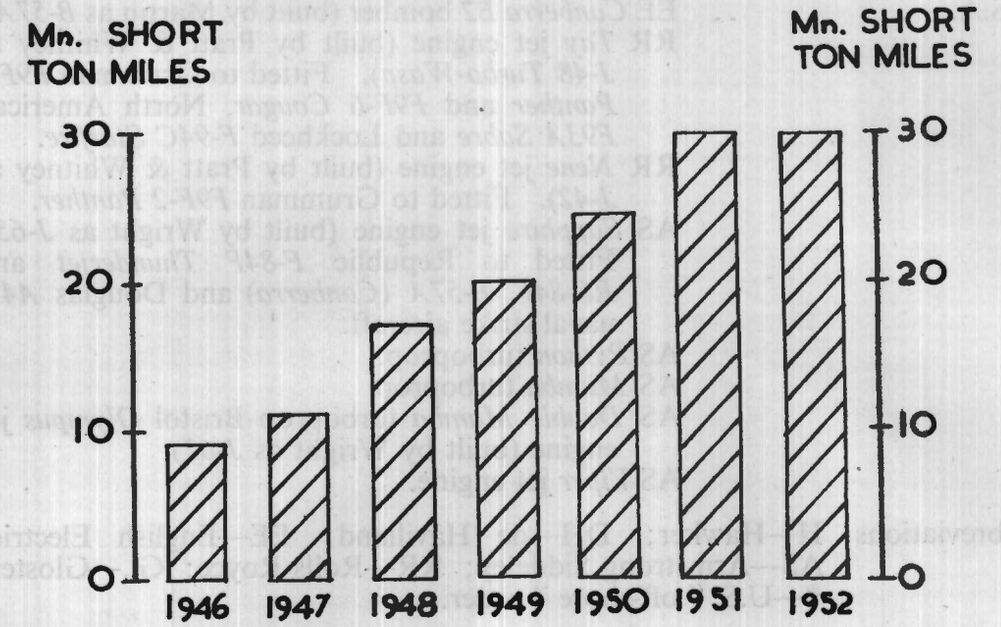
## GROWTH OF PASSENGER TRAVEL ON BRITISH AIRLINE SERVICES

This graph is drawn from Ministry of Civil Aviation statistics, which include travel on all scheduled services flown by British operators—B.O.A.C., B.E.A. and the independent companies. They show that the miles flown have increased by more than three times since 1946.




## GROWTH OF FREIGHT CARRIED BY BRITISH AIRLINE OPERATORS

This graph is drawn from Ministry of Civil Aviation statistics, and shows freight carried by B.O.A.C., B.E.A. and their associated companies. It does not include the independent operators. They show that ton-miles flown have increased by more than three times from 1946 to 1952. The levelling-off of traffic in 1952 was due to import restrictions by some overseas countries. According to figures for world-wide freight, published by I.C.A.O., this British traffic forms about one-twentieth of international freight carried.



## BRITISH AIRCRAFT ENGINES BUILT OVERSEAS UNDER LICENCE.

| *Country* | *Aircraft or Engine Built under Licence* |
|---|---|
| ARGENTINA .. .. | RR *Derwent* jet engine. For Argentine-built fighter. |
| AUSTRALIA .. .. | DH *Vampire* fighter. DH *Vampire* trainer.<br>RR *Nene* jet engine. EE *Canberra* bomber.<br>RR *Avon* jet engine. Fitted to EE *Canberra* and *F-86*. |
| BELGIUM .. .. | Gl. *Meteor F-8* fighter } Assembly only — airframe<br>Gl. *Meteor T-7* trainer } built in Holland.<br>RR *Derwent* jet engine.<br>H *Hunter* fighter. RR *Avon* jet engine. |
| EGYPT .. .. .. | DH *Vampire* fighter. DH *Vampire* night fighter. |
| FRANCE .. .. .. | Bristol *Hercules* piston engine.<br>DH *Vampire* fighter.<br>RR *Nene* jet engine. Fitted to several types of experimental jet aircraft and French-built DH *Vampire* (*Mistral*).<br>RR *Tay* jet engine. Fitted to Dassault *Ouragan S/S* interceptor fighter and Dassault *Mystere 2* supersonic fighter.<br>DH *Sea Venom* naval fighter.<br>AS *Viper* jet engine. RR *Avon* jet engine. |
| HOLLAND .. .. | Gl. *Meteor F-8* fighter. H *Hunter* fighter. |
| INDIA .. .. .. | DH *Vampire* fighter. Percival *Prentice*. |
| ITALY .. .. .. | DH *Vampire* fighter. DH *Vampire* night fighter.<br>DH *Goblin* jet engine. DH *Venom* fighter.<br>DH *Venom* night fighter. DH *Ghost* jet engine. |
| PORTUGAL .. .. | DH *Chipmunk* trainer. |
| SWEDEN .. .. | DH *Ghost* jet engine. Fitted to *SAAB 29* fighter.<br>DH *Goblin* jet engine. |
| SWITZERLAND .. .. | DH *Vampire* fighter. DH *Venom* fighter.<br>DH *Ghost* jet engine. |
| TURKEY .. .. .. | DH *Gipsy Major* piston engine. |
| U.S.A. .. .. .. | EE *Canberra B2* bomber (built by Martin as *B-57A*).<br>RR *Tay* jet engine (built by Pratt & Whitney as *J-48 Turbo-Wasp*). Fitted to Grumman *F9F-5 Panther* and *F9F-6 Cougar*, North American *F93A Sabre* and Lockheed *F-94C Starfire*.<br>RR *Nene* jet engine (built by Pratt & Whitney as *J-42*). Fitted to Grumman *F9F-2 Panther*.<br>AS *Sapphire* jet engine (built by Wright as *J-65*). Fitted to Republic *F-84F Thunderjet* and *RF-84F*, *B-57A* (*Canberra*) and Douglas *A4D* naval strike aircraft.<br>AS *Python* turboprop.<br>AS *Mamba* turboprop.<br>AS *Double Mamba* turboprop Bristol *Olympus* jet engine (built by Wright as *J-67*).<br>AS *Viper* jet engine. |

Abbreviations: H—Hawker; DH—de Havilland; EE—English Electric; AS—Armstrong Siddeley; RR—Rolls-Royce; Gl.—Gloster; *—U.S. " off-shore " order.

## LIST OF AIRCRAFT FLYING IN THE SBAC DISPLAY

\+ means in production for export or export sales under discussion.

| | |
|---|---|
| Wyvern | Turboprop naval strike fighter. |
| +Shackleton | Large maritime reconnaissance aircraft. |
| +Viscount 700 | Turboprop airliner. |
| +Pembroke | Twin-engined Service transport and trainer. |
| +Heron 2 | 14-17-seat transport. |
| +S.51 | 4-seat civil and military helicopter. |
| +Bristol 171 | 4-5-seat civil and military helicopter. |
| Bristol 173 | 13-seat twin-engined helicopter with stub wings. |
| Sea Hawk | Carrier-borne jet fighter. |
| +Meteor 7 | Two-seat jet trainer. |
| Olympus-Canberra | Flying test-bed (Holds world height record). |
| Avon-Canberra | Fitted with 9,500 lb. thrust Avon engines. |
| +Provost | Two-seat basic trainer. |
| +Auster Aiglet | 4-seat light transport. |
| +Pioneer | 4-seat light transport. |
| +Comet 2 | Production version. |
| Javelin | Twin-jet, two-seat all-weather fighter. |
| S.B.5. | Adjustable-sweepback-wing research aircraft. |
| Victor | 4-jet crescent winged bomber. |
| P. 111A | Delta-wing research aircraft. |
| +Hunter | Fitted with reheat. |
| +Beverley | Royal Air Force Transport. |
| +Beaver | 6-seat light transport. |
| Hunter 2 | Fitted with Sapphire engines. |
| +Britannia | Turboprop airliner. Ist Prototype with new Proteus 3 engines. |
| +Canberra B.2. | Standard jet bomber. |
| DH 110 | Under development for Royal Navy. |
| Valiant | 4-jet bomber. |
| +Gannet | Anti-submarine search and strike aircraft. |
| Avro 707A & B | Delta-wing research aircraft. |
| Avro 707C | Two-seat delta trainer. |
| Vulcan | 4-jet, delta-wing bomber. |
| Swift F.4. | Production version. |
| Princess | Flying boat. |
| Vulcan 2 | Production version with Olympus engines. |
| Sea Mew | 'Utility' anti-submarine aircraft. |

## AIRCRAFT IN STATIC PARK

| | |
|---|---|
| +Ambulance Freighter | Light transport. |
| +Sea Balliol | Two-seat trainer. |
| +Freighter Mk.31 | Car-ferry version. |
| Dove (M.C.A.) | Radio calibration version. |
| +Dove | Standard model. |
| +Chipmunk | Primary trainer. |
| +Venom | Jet day fighter. |
| +Venom | Jet night fighter. |
| +Sea Venom | Carrier-based jet fighter. |
| +Vampire | Jet trainer. |
| +Heron 1 | 14-17-seat transport. |
| +Hunter 1 | Production version. |
| Canberra P.R.3. | Jet photo-reconnaissance version. |
| Firefly 7 | Naval anti-submarine aircraft. |
| +Provost (civil) | Two-seat basic trainer. |
| +S.55 | 10-12-seat helicopter, fitted with new Alvis Leonides Major engines. |
| A.S.T. | Towed target. |

THE SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS

# WEEKLY NEWS LETTER

This News Letter has been compiled by the Information Department, Society of British Aircraft Constructors, 32, Savile Row, London, W.1. (Telephone No. REGENT 5215), to provide journalists, particularly those writing for newspapers and other publications overseas, with useful material. The News Letter may be printed without acknowledgment, whole or in part, and used in the way best suited to individual publications.

A.1731 7th September 1953.

## THE BIG TENT AT FARNBOROUGH

This year the indoor static exhibition at the SBAC Display (the 'Big Tent') is larger than ever. It covers over two acres of ground (11,000 sq. ft. more than last year) and houses some 240 exhibitors.

In addition this year, there is an outside park to take larger pieces of equipment which could not be fitted inside the tent.

The following notes detail some of the more outstanding exhibits to be seen at Farnborough:

GUIDED MISSILES An early rocket built by Armstrong Whitworth, is shown with its booster rockets attached (Stand O). Also on the Ministry of Supply stand (P) is some of the equipment used in the testing of missiles.

PULSE-JET MOTOR, like that used in the German V.1. flying bomb, has been built by Saunders-Roe (Stand J) for installation in the tips of rotor blades of helicopters.

MODELS OF NEW TURBINE DRIVEN HELICOPTERS, can be seen at Percival's (Stand G), and at Fairey's (Stand E). A model of the new Rotorcoach is on Bristol's Stand (N).

A POWERFUL NEW ASSISTED TAKE-OFF ROCKET MOTOR, de Havilland's Super Sprite, will give extra boost for take off for Britain's 'V' bombers (Stand H). More rocket motors are on the Ministry of Supply Stand (P).

JET ENGINE PARTS AFTER 1,000 HOURS of running in commercial operation are shown on the de Havilland Stand (H).

A HYDROSKI JET FIGHTER with retractable skis which allow it to take off from water, ice or levelled snow, is shown by Saunders-Roe Ltd. in model form. (Stand J).

/continued

BRITISH PLANS FOR A 'DAKOTA' REPLACEMENT, are shown in two designs presented by Aviation Traders (Stand 180) and Handley Page (Stand D).

A RADIO-CONTROLLED TARGET AIRCRAFT, designed by M.L. Aviation, powered by a piston engine, and using rocket assisted take-off, is shown on Stand 218.

A NEW SKID-PREVENTING AUTOMATIC BRAKE, entirely contained in the wheel, is shown by Goodyear on Stand 56.

THE MULLARD RADAR SONDE, which is carried into the upper stratosphere by balloons and sends back automatic meteorological data is on Stand 111.

GRAVINER'S FIREWIRE - a wire which 'smells-out' a fire in an aircraft and automatically warns the pilot, is shown on Stand 104.

RADAR MAP SHOWING FIGHTER PILOTS THEIR POSITION ( a light-weight model of the Decca Navigator) is shown on Stand 198.

AIR TRAINERS' NEW DUAL GROUND TRAINER, which has the realistic performance of a twin-engined airliner necessary for training aircrews, is shown on Stand 25.

NEW FORMS OF AIRCRAFT CONSTRUCTION, are on Aviation Trader's Stand 189, Armstrong Whitworth's Stand O, and Short's Stand L.

SARAH, THE MAE WEST LIFE SAVER, with its own radio transmitter, is seen on the stand of Ultra (Stand 6).

THE NEW PISTON-ENGINE, built in the jet age, the Leonides Major (850 h.p.) will be on the Alvis Stand (F).

THE AUTO-PILOT, which steers the Jindivik pilotless target on the Woomera rocket range can be seen on Elliott Brothers' Stand (128)

OUTSIDE PARK HOUSES BIG EQUIPMENT, including:-

A mobile jet engine test bed (John Curran Ltd.)

A mobile training tower for giving crews realistic training on ejection seat procedure. (Martin-Baker).

A very large pressure fueller (Thompson Brothers).

A Victor undercarriage (full scale) retracting into the wing (Electro-Hydraulics).

Amongst the aircraft in the Static aircraft park is a high speed flying wing target to give firing practice to fighter pilots and ground defences (Air Service Training). The all metal outer structure is filled with a foam resin. Holes caused by shell hits can be filled with the resin and painted over with a rubber-based paint.

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PK/ZJLN

Issued by:-

The Press Office,
The Bristol Aeroplane Co., Ltd.,
Filton House,
BRISTOL.

# BRISTOL EXHIBITS

# AT THE

# S.B.A.C. SHOW, FARNBOROUGH 1953.

Three projects awarded production super-priority - the Britannia airliner; its power unit, the Proteus turboprop; and the Olympus turbojet for the Avro Vulcan bomber - will be the principal Bristol exhibits at this year's S.B.A.C. Farnborough show.

The Britannia to be seen in the flying display is the first prototype - which made its debut at Farnborough last year - now re-engined with the Proteus 705 turboprops of the type which will power production Mark 100 aircraft.

The Olympus will be on view both in the static exhibition and, in the flying display, installed in the Olympus/Canberra bomber which last May set up a new world altitude record of 63,668 ft.

A model of the Proteus 705 will also be shown on the Company's stand, together with a sectioned and motorised model of the Centaurus 661 piston engine which powers B.E.A. Elizabethan aircraft, and 1/24th scale models of the Freighter (Type 170) Mark 31, Britannia Mark 300, Bristol Rotorcoach (Type 173 Mk. 3) and the Sycamore (Type 171) Mark 4.

Of particular interest this year will be the exhibition of two components - a plastic wing and a drop fuel tank - from the Company's Plastics Department, which for several years has conducted research into use of plastics for primary aircraft structure.

The Rotorcoach, fitted with stub wings, and the Sycamore Mark 4 will also be seen in the Flying Display, while a Mark 32 Freighter in service with Silver City Airways is to be released for a few hours from its cross-Channel car ferry duties to make an appearance in the civil flying display to be held on Thursday (10th) only. In the static park the familiar Mark 31 Freighter will also be on show, with a Vickers-Supermarine Attacker jet fighter loaded into its hold.

## DETAILS OF EXHIBITS.

### BRISTOL BRITANNIA

(Stand, 1/24th scale model of Mark 300;
Flying display, First prototype powered by
four Proteus 705 turboprops).

An airliner of unique performance offering accommodation for up to more than 100 passengers, the Britannia is in super-priority production and promises to be a revenue-earner of unprecedented efficiency. The initial production version is the Mark 100, with four Proteus 705 turboprop engines, but three larger and more powerful versions are also offered for world sale. These are the Mark 200 all-freight aircraft, the Mark 250 mixed freight and passenger machine, and the Mark 300 airliner seating 104 passengers in the standard version and up to 120 in high-density versions. All three will have Proteus 750 turboprop engines of 4,150 e.h.p. and a fuselage 10 ft. 3 in. longer than the Mark 100.

Twenty-five Mark 100 Britannias were originally ordered by British Overseas Airways Corporation, but it has since been announced that the Corporation will now have the first 15 Mark 100 aircraft and ten Mark 300. B.O.A.C. are also to take two Mark 200 cargo Britannias and have an option on a further five Mark 300 airliners. Considerable interest has been shown in all versions of the Britannia by overseas operators, and Qantas Empire Airways intend to operate six Mark 300 machines.

The Britannia's strength lies in its combination of low operating cost, great payload and range, and a cruising speed considerably higher than present standards. The scope of the payload/range performance of the Mark 100 is demonstrated by the fact that, although the maximum still-air range is 5,500 miles and the full volumetric payload can be carried over a range of 4,000 miles, direct operating costs for ranges as short as

500 miles are low enough to be competitive with those of much smaller airliners. In the Mark 200, 250 and 300 aircraft, greater payload and higher speed have been achieved for equivalent ranges while operating costs have been reduced still further.

The first prototype aircraft made its maiden flight on August 16, 1952, and has since been engaged upon a rigorous test schedule. Originally having a power installation of four Bristol Proteus 600 series engines the aircraft has now been fitted with Proteus 705 engines. The all-up weight is 130,000 lb, compared with 140,000 lb. for the production Mark 100 and 155,000 lb. for Marks 200, 250 and 300.

Leading Particulars.

Mark 100. All-up weight, 140,000 lb; landing weight, 110,000 lb; still-air range with max. payload, (25,000 lb) 4,000 statute miles; max. still-air range, 5,500 statute miles with 12,000 lb payload; take-off distance (140,000 lb.), 3,700 ft; landing distance (110,000 lb.), 2,800 ft; mean cruising speed, 360 m.p.h.; span, 140 ft; length, 114 ft; height, 36 ft. 8 in; track, 31 ft; fuel capacity, 6,800 Imp. galls.; engines, four Proteus 705 rated at 3,780 e.h.p. each.

Marks 200, 250, 300. All-up weight, 155,000 lb; landing weight 125,000 lb; range with full tanks plus 20,000 lb. payload, 5100 statute miles; range with capacity payload (30,000 lb.), 3,940 statute miles; take-off field length, 5,700 ft; max. cruising speed, 389 m.p.h.; span, 140 ft; length, 124 ft. 3 in; height, 36 ft. 8 in; fuel capacity, 6,800 Imp. galls; engines, four Proteus 750 of 4,150 e.h.p. each.

## BRISTOL SYCAMORE (TYPE 171)

(Flying display; Mark 4 aircraft.
Stand; 1/24th scale model).

The Sycamore is a four/five seat helicopter for civil or military duties. It is in service with British European Airways, Coastal and Fighter Commands of the Royal Air Force, the British Army, and the Royal Australian Navy.

The latest basic production version of the Sycamore is the Mark 4, probably the most versatile aircraft in the world. It is equipped to undertake search and rescue, air ambulance, communications and reconnaissance duties and can be quickly converted from one role to another. The front fuselage has been redesigned to facilitate the work of search and rescue, a wide aperture being provided on the starboard side with a sill flush with the floor. In the ambulance version, Perspex blisters on each side of the fuselage increase the cabin width to accommodate two stretchers athwart the aircraft behind the pilot. A swivel seat beside the pilot enables a medical orderly to attend casualties in flight.

For communications, reconnaissance or civil duties, the Sycamore can accommodate a pilot and four passengers - one beside the pilot and three on a bench-type seat at the rear of the cabin.

Leading Particulars (Mark 4).

Rotor diameter, 48 ft. 6.7 in; overall length (blades folded), 43 ft. 8.5 in; gross weight, 5,400 lb; max. cruising speed, 107 m.p.h.; max. range, 268 statute miles at sea level with 566 lb. payload and 65 Imp. galls. of fuel; engine, Alvis Leonides LE 23 HMV of 525/545 b.h.p.

## BRISTOL ROTORCOACH (TYPE 173)

(Flying display, Mark 2 aircraft fitted with stub wings; Stand, 1/24th scale model of passenger version).

The Bristol Rotorcoach, or Type 173, is the first British twin-engined helicopter and the first twin-engined helicopter in the world to offer safe flight on one engine in that both rotors can be driven by either engine.

The Rotorcoach is being developed as a short range transport for 14/16 passengers but is also capable of filling a number of military roles. It can be readily converted to carry 3,000 lb. of freight, the four-wheel undercarriage providing a level loading attitude, or can be used as a "crane", lifting still greater weights over very short distances by slinging the loads from an external beam below the fuselage.

The Rotorcoach made its maiden flight on January 3, 1952, and has since completed a considerable amount of test and development flying. The machine appearing in the display is the second prototype, which flew for the first time in May this year. It is fitted with stub wings of the type to be embodied in three Mark 3 machines which, powered by 850 b.h.p. Alvis Leonides Major engines, have been ordered for the development of commercial services.

Leading Particulars (Mark 3).

Main rotor diameter, 48 ft. 6.7 in; overall length (blades folded), 55 ft. 2 in; disc loading (13,500 lb. A.U.W.), 3.63 lb/sq. ft; max. level speed, 153 m.p.h.; max. w-m cruising speed, 138 m.p.h.; max. single engine rate of climb 120 ft./min.; Service ceiling 15,000 ft.; engines, two Alvis Leonides Major of 850 b.h.p.

## THE OLYMPUS/CANBERRA

(Flying Display)

Of particular interest this year will be the appearance in the flying display of the Olympus/Canberra which on May 4 established a new world altitude record (Class C - Aeroplanes) of 63,668 ft. This feat was the climax of a programme in which the Canberra had proved admirably suited to the task of testing so powerful an engine for high altitude operation; the aircraft has excellent handling qualities, and has plenty of room for the flight research crew and the necessary test instrumentation.

Installation of the Olympus made it necessary to strengthen the airframe structure in the region of the engine bays by providing additional and heavier ribs and rib-booms. The nacelles are somewhat larger than those for the normal units and extend farther forward of the wing leading edge, although the length of the installation within the wing is the same as that which applies for the Avon. Test instrumentation and two large automatic-observer cameras are housed in the bomb bay; in addition, other equipment had been accommodated in the space yielded by removal of one of the ejector seats.

## BRISTOL FREIGHTER (TYPE 170)

(Static Park, Mark 31; Flying Display, Thursday only), Mark 32 (in service with Silver City Airways).

First flown in December 1945, the Type 170 Freighter is to-day in service with over 20 civil and military operators in all parts of the world. During the past two years, orders have risen to a point where manufacturing capacity has had to be increased in order to meet demands.

Robust and straightforward in construction, the Freighter was designed for economical operation as a cargo or passenger transport over short/medium ranges.

Among notable services operated by the Type 170 are the Silver City Airways vehicle ferries across the Channel; the Air Beef scheme in Australia; and the Cook Strait freight ferry in New Zealand.

Military operators of the Freighter include the R.A.F., the Royal Australian Air Force, the Royal Canadian Air Force, the Royal New Zealand Air Force, and the Royal Pakistan Air Force.

Current basic production versions of the Type 170 are the Mark 31 "pure" freighter and the Mark 31E mixed cargo and passenger aircraft.

The most recent development of the Type 170 is the Mark 32 long-body version operated by Silver City Airways, which appears in the civil flying display on Thursday, September 10. With the fuselage extended by a new front section incorporating new nose doors, the Mark 32 can simultaneously accommodate three cars, 20 passengers and a number of motor-cycles or pedal cycles

The aircraft on display in the Static Park will have in its hold a complete Vickers-Supermarine Attacker jet fighter. Freighters have been used on a number of occasions to carry back to repair bases damaged or wrecked aircraft, and R.C.A.F. Freighters have frequently flown Canadian Sabre jet fighters to Filton, where they are repaired and serviced by The Bristol Aeroplane Company. The Attacker fuselage will be loaded tail first, with the wings stowed alongside.

Leading Particulars (Mark 31).

Wing span, 108 ft; length, 68 ft. 4 in; height over fin 26 ft. 3½ in; all-up weight, 44,000 lb; max. speed, 230 m.p.h.; cruising speed, 166 m.p.h.; max. range, 1,660 miles; payload, approx. 6 tons; engines, two Bristol Hercules 734 sleeve-valve, each developing 2,020 b.h.p.

## BRISTOL OLYMPUS

(Flying display, Olympus/Canberra; Stand, full scale model of Olympus engine).

The Olympus is a super-priority engine and has been specified for the Avro Vulcan delta-wing bomber. Important as is the recently established Olympus/Canberra altitude record in its own right, even greater significance attaches to the demonstration of the ability of the Olympus to operate at immense heights.

The first "two-spool" engine to be built in Britain, the Olympus is an advance in design and is the most powerful jet engine now flying. The use of two independent compressors in series, each driven by a separate turbine, has been largely responsible for the mastering of the problem of maintaining a sufficient air supply to the engine at extreme

altitude. The two-spool design has also enabled an unusually low fuel consumption to be achieved. The Olympus is thus an engine of immense potentialities, capable of long range operations and of taking a bomber to heights achieved by no present fighter.

The Olympus is the subject of a licence agreement in the U.S.A. with the Wright Aeronautical Corporation. The only performance figures so far released (June 1952) give the maximum thrust rating as 9,750 lb.

Leading Particulars.

Diameter, 40 in; length, intake flange to exhaust flange, 124 in; weight, 3520 lb; maximum thrust rating, 9,750 lb; specific fuel consumption, 0.766 lb/hr/lb. thrust.

## BRISTOL PROTEUS TURBOPROP

(Stand, full scale non-sectioned model of Proteus 705).

The Proteus is in super-priority production for the Britannia airliner. The most economical turboprop engine in the world, it combines high power output with its exceptionally low fuel consumption.

Both prototype Britannias have, and subsequent Mark 100 aircraft will have, a power installation of four Proteus 705 engines of increased power and greater efficiency - vis-a-vis the earlier marks of engine - while the Britannia Mark 200, 250 and 300 aircraft will have four Proteus 750 engines of still further enhanced performance.

To date, some 15,000 hours' running has been completed by Proteus development engines, including considerably more than 1,000 engine flying hours in the first Britannia prototype and a Lincoln test-bed. During flight tests of the Britannia, the 600 series engines have behaved admirably, the excellent power response being particularly evident in the shortness of take-off run and the rapid initial climb.

The Proteus 705, which has been developed from the 600 series, is a re-designed engine, in which a considerable advance in efficiency and performance has been achieved together with a reduction in weight and overall length. Still greater power and improved economy are features of the Proteus 750, which has a design rating of 4,150 e.h.p. compared with the Proteus 705's rating of 3,780 e.h.p.

Leading Particulars.

Proteus 705. Diameter, 39.5 in; length, cone fitting line to jet pipe, 100.5 in; weight 2,650 lb.; max. power rating, 3,320 shaft h.p. plus 1,200 lb. jet thrust (3,780 equiv. h.p.); specific fuel consumption, 0.48 lb/E.H.P./Hr. at 300 knots at 35,000 ft.

## BRISTOL CENTAURUS 661.

(Stand, full scale sectioned model).

The Centaurus 661, an eighteen-cylinder air-cooled radial sleeve-valve engine developed to give economical operation at altitudes up to 20,000 ft., is used in the Airspeed Ambassador, the Elizabethan-class airliner of British European Airways. Its installation in this aircraft marks the first application of the Centaurus to civil requirements and in its first eighteen months of B.E.A. service it has achieved a truly outstanding record of reliability.

The Centaurus is the latest and most powerful of a long and distinguished line of Bristol piston engines. Among the most recent versions of the engine is the 165, developed to power the huge Blackburn and General Aircraft Beverley freight transport ordered for the Royal Air Force.

The Centaurus 661 has a two-speed supercharger and is rated on the universally available 100/130 grade fuel. Special attention has been paid to enhancing passenger comfort in that vibration has been reduced to a very low order by a new type of dynamic flexible mounting, and engine noise greatly suppressed by special twin rear exhaust manifolds.

Leading Particulars.

Diameter, 57.75 in; weight (dry), 3,400 lb; take-off power rating, 2,625 h.p. at 2,800 r.p.m.; max. economical cruising power, 1,575 b.h.p. at 2,500 r.p.m. at 17,500 ft.

## PLASTICS EXHIBITS.

(Static Exhibition)

Two exhibits from the Company's Plastics Department give some indication of results achieved during several years' research into the manufacture in plastic materials of efficient primary aircraft structure suitable for wings, control surfaces and fuselage sections. This research has shown that for certain structural applications plastic materials may be superior to metals on a strength/weight basis.

## Plastic Wing

This wing, designed for flight at high subsonic speeds, is approximately 10 per cent more efficient on a strength/weight basis than an equivalent wing in aluminium alloy.

It comprises four mouldings in asbestos phenolic material. The port and starboard wing sections, which are composed of two mouldings glued together on the median plane, are themselves assembled by means of glued butt straps at the wing centre line.

The production advantages are obvious when it is considered that the mouldings for a complete wing can be turned out at a rate of approximately one an hour.

Leading particulars are :-

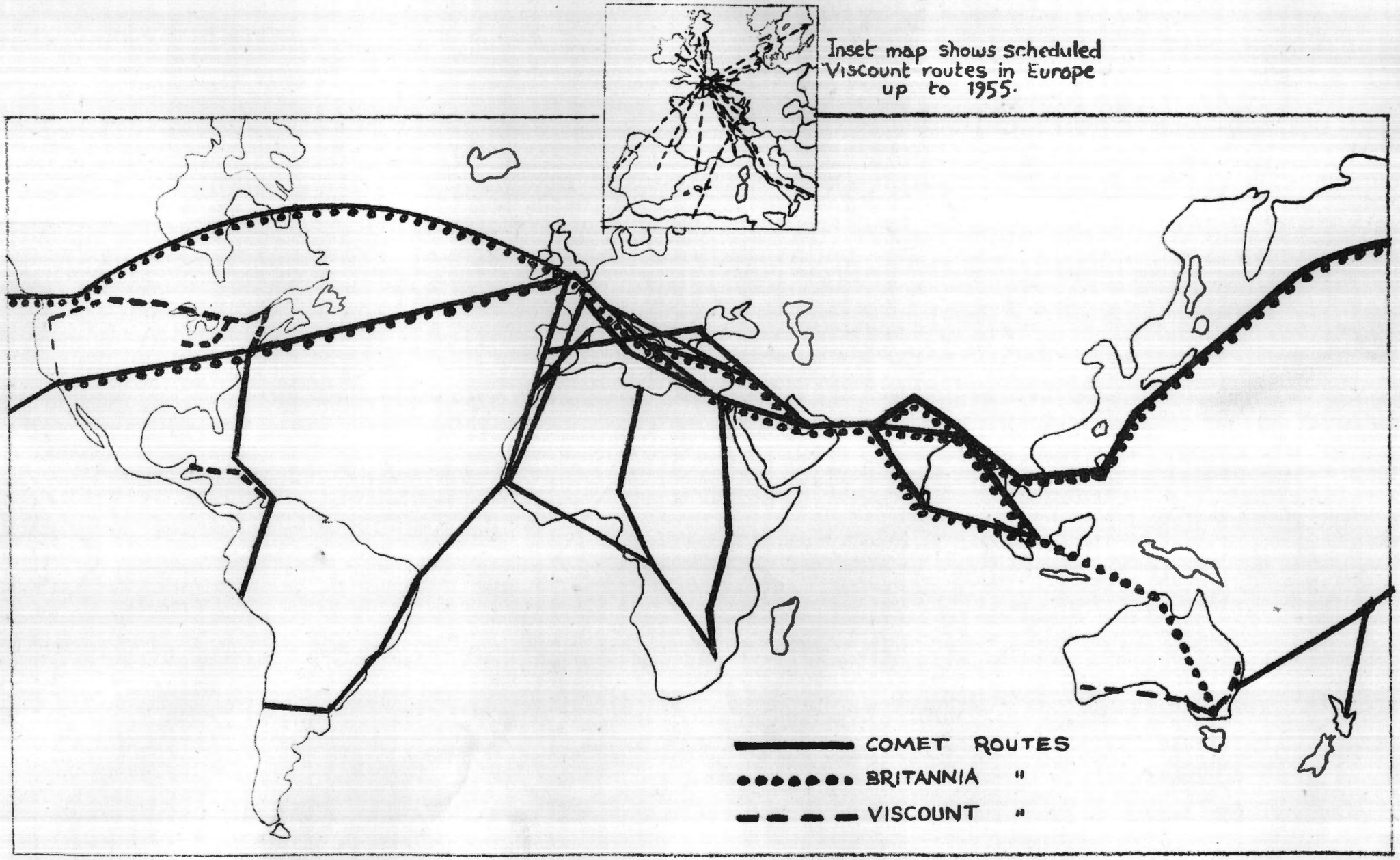
| | |
|---|---|
| Span | 10.5 ft. |
| Area | 36.25 sq. ft. |
| Thickness chord ratio, 7 per cent. | |
| Sweep-back | 30 deg. at 50 per cent chord. |

## Drop Fuel Tank

Another aspect of work in this field is development of drop tanks in plastics. Use of these materials relieves the demand for aluminium alloy and gives tanks which are lighter and considerably cheaper than aluminium alloy units of similar size and capacity. Particular attention is being paid to a standard type of expendable plastic tank, designed for use on all types of aircraft.

The drop tank exhibited is in asbestos phenolic material, weighs 70 lb., and is of approximately 90 gallons capacity. The structure comprises two main shell sections, a tail cone and four high pressure moulded frames; assembly is by cold gluing.

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# PROPOSED TURBINE AIRLINER ROUTES Up to 1957.