

pattern after take-off which would result from re-engining a four-jet airliner with BE.72 ducted-fan engines.

BS.75 An engine of this designation was recently described by the manufacturer as having a specific fuel consumption (sea-level static at maximum thrust) of 0.5. This is the lowest s.f.c. announced for any jet engine. The latest member of the company's ducted-fan family, and the first of the new "BS" designations, it is expected to run in mid-1961. Rating would be about 7,000lb.

Double Mamba In production for ten years, the final version of this unique powerplant is the ASMD.8, doubtless installed in the Gannet AEW.3. It weighs 2,500lb and has a maximum rating of 3,875 c.h.p. with a specific consumption of 0.65.

Olympus Since it first ran in 1950 at a design rating of 9,140lb, this outstanding two-spool turbojet has been doubled in thrust, and is the holder of many records for performance and reliability. It exists in two main versions: the 100-series engines employ compressors with six or seven l-p. and eight h-p. stages, and have been produced in quantity at ratings from 11,000 to 13,500lb for the Vulcan B.1 bomber; and the 200-series, which is described in greater detail later in this account.

In service with RAF Bomber Command since 1957, the engine of the Vulcan B.1s has performed superbly, and is the RAF's most powerful, most efficient and most reliable combat engine, with the highest overhaul life and lowest premature removal rate. It has been officially acknowledged that the handling characteristics of these powerplants surpass those of any other turbojet in the world, particularly at heights above 50,000ft. The first Mark to enter service

it has a thrust/weight ratio better than that of any other large type-tested turbojet. The existence of the BOL.21 may also be mentioned, but no details may be given.

In its ultimate form the Olympus is being developed with an afterburner as the powerplant of the supersonic Vickers/English Electric TSR.2. Several forms of reheat Olympus have been developed. A straightforward conversion of the Olympus 201 has a rating of 24,000lb, but a development fitted with Bristol Siddeley/Solar fully-variable reheat has a maximum thrust of 33,000lb. Doubtless the TSR.2 will have two engines of approximately this power, conferring upon it an outstanding thrust/weight ratio.

Orpheus Planned as a simple and reliable successor to such engines as the Nene, the Orpheus first ran in December 1954 and flew in the prototype Gnat the following year at an initial rating of 3,285lb. Owing to its intrinsic merit, and to the paucity of competition, it has now become virtually a world standard in fighters, trainers, transports and tactical attack machines. Several hundred first-generation Orpheus have so far been produced, all conforming approximately to the specification given for the Mk 803.

The principal members of this family are the Mk 100 for the Gnat Trainers, the Mk 701 for the Gnat fighters, the 801 and 803 in the Fiat G.91 (these engines are licence-built by Fiat in Italy, Klöckner-Humboldt-Deutz in West Germany and Hindustan in India), and the 805 in the Fuji T.1A. Similar engines have been supplied for aircraft designed in Yugoslavia, France and the USA. Special mention should be made of the Mk 100, which for the Gnat T.1 has been derated to 4,230lb, redesigned in detail and provided with anti-icing, to fit it for its arduous duties. Another variant is a transport version (the BOR.3/5 Mk 810, rated at 5,100lb and incorporating bleed-air anti-icing and additional accessories).

In order to provide a powerplant of increased capacity better matched advanced strike aircraft, Bristol Siddeley have developed the BOR.12, under the auspices of the Mutual Weapons Development Programme. From its inception the Orpheus 12 has performed admirably. It completed its type-test last October at the full rating given in the data panel, with a fuel consumption 2 per cent below the design figure. It also stripped excellently after a 24hr special-category test with reheat at 8,000lb thrust, and flight testing in a Sabre up to heights over 50,000ft has shown startling improvements over the design targets (at the tropopause, thrust was more than 7 per cent up, and s.f.c. 11 per cent down).

The BOR.12SR has a reheat system of a special simplified pattern, intended principally to provide increased thrust for operations from poor airfields. Aircraft designed to use it are in various stages of development in France, India and Spain. There is also a non-reheat commercial variant, fitted with a two-position nozzle which in the closed position permits the take-off rating to be raised to 7,200lb and at full area lowers the cruising consumption. Weight would be some 1,220lb with full airline equipment.

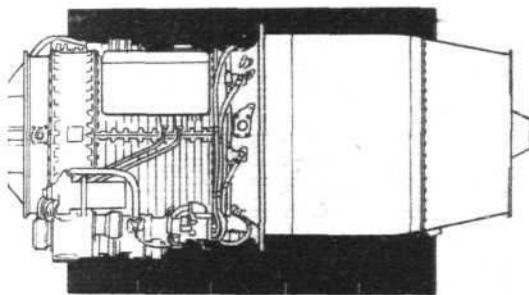
Proteus This highly developed turboprop remains the most powerful propeller engine in airline service. Hours flown on scheduled routes are well over one million. First to enter service was the 3,900 c.h.p. Proteus 705, which built up its overhaul life more rapidly than any other aero engine has ever done, reaching 2,000hr in under two years. It was followed in December 1957 by the 755 of 4,160 c.h.p., which has been succeeded by the 761 (4,175 c.h.p. and reduced specific consumption), the 762 (4,350 c.h.p. for hot and high airfields) and the 765. The latter is used by Cubana and (in 255 military form with water injection) by the RAF, and for a weight of 2,900lb has a rating of 4,445 c.h.p. (s.f.c., 0.6). In December 1958 it was announced that the Proteus 770

would succeed the 765, with 3 per cent lower specific consumption and a take-off power of 4,615 c.h.p. Other Proteus are employed in the propulsion of naval craft and in ground power generation.

Sapphire Only very few Sapphires remain to be constructed, but well over 2,000 have been delivered from Brockworth in both 100 and 200 series. The former version, rated at from 8,000 to 8,500lb, is fitted to the Hunter 2 and 5, and Javelins 1 to 6. The 200-series engines, rated at 11,000lb dry, power the Javelin 7 and Victor B.1. The ASSa.7R, incorporating a simple reheat system giving a maximum rating of 12,230lb, remains in production for the Javelin FAW.8 and 9.

Viper Conceived as a 1,640lb-thrust short-life turbojet, the Viper has now been developed to give more than double this thrust. Still the most numerous, the first-generation Vipers are typified by the Mk 101, weighing 525lb, giving a dry thrust of 1,750lb, and fitted to the Hunting Jet Provost T.3. In one of these machines a Viper 101 completed 500hr of intensive flying, including over 100hr at take-off thrust, and was finally stripped excellently after a further 250hr on the bench (with no replacement of parts at any time). Similar engines have been employed in many British and foreign aircraft, target drones and missiles.

Virtually a scaled-down Sapphire, the 2,460lb Viper ASV.11 handles a greater mass flow within the same diameter. Engines of this type are in production for the Jindivik 3 and Macchi MB.326. From it are being evolved the ASV.12 (2,700lb thrust, achieved by very minor improvements), the ASV.20 (575lb weight,

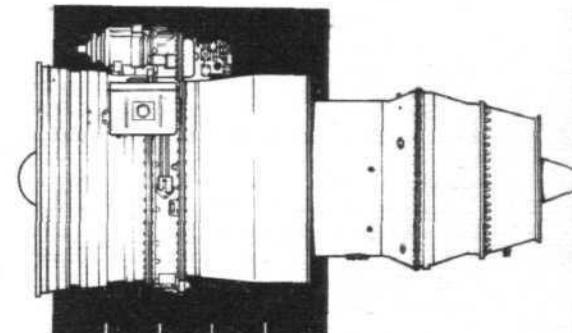


Bristol Siddeley Orpheus BOR.12 Single-shaft turbojet. Multi-stage compressor, can-annular combustion chamber and single-stage turbine. Overall diameter, 32.4in; length, 98.325in; dry weight, 1,100lb; max rating, 6,810lb dry. The BOR.12SR gives 8,170lb thrust with simple reheat.

Orpheus BOR.3 Mk 803 (not illustrated). Overall diameter, 32.4in; length, 75.45in; weight, 825lb; max rating, 5,000lb at 10,000 r.p.m. (s.f.c., 1.06); max mass flow and pressure ratio, 84lb/sec and 4.4:1.

was the 101, rated at 11,000lb dry. This engine was succeeded by the Olympus 102, incorporating a zero-stage and rated at 12,000lb. Practically all the Mk 102 engines have now been converted to Mk 104 standard. The take-off rating given in the data panel has only recently been authorized; at the same time the maximum cruise rating was increased to 13,000lb. The engine has a Lucas fuel system and Rotax electric starter, and is equipped for all-weather operation.

In the evolution of the 200-series engines a much higher value of work-per-stage was chosen, in order to achieve a similar pressure-ratio with three fewer compressor stages. At the same time the mass flow has been increased by something like 50 per cent, and the resulting unit is substantially more powerful than its predecessors, for roughly the same cost and weight. The Olympus 200 went into production in 1956 as the powerplant of the Vulcan B.2. Rated at 16,000lb dry, these engines were quickly superseded by the Mk 201, which has since been manufactured in quantity at 17,000lb and is performing excellently in production aircraft. Bristol Siddeley believe that



Bristol Siddeley BE.58 Commercial turboprop. Two-stage fan, seven-stage compressor, annular combustion chamber, single-stage high-pressure turbine and two-stage low-pressure turbine. Front-frame diameter, 46.5in; basic length, 123in; dry weight, 2,600lb; max rating, 14,500lb with s.f.c. of 0.572; cruise rating, at 36,000ft at 500kt, 3,750lb with s.f.c. of 0.8.

3,240lb thrust), and the P.209, which weighs 593lb and will be rated at from 3,000 to 3,830lb dry with s.f.c. correspondingly varying from 0.845 up to 0.975.

Ramjets Originally Bristol Aero-Engines acquired experience in the field of supersonic ramjets with the development of the Thor engine to provide cruise propulsion for the Bloodhound missile. Such units are now exceedingly reliable, and in service in great quantity. With a diameter of 15.75in they generate a maximum theoretical thrust horsepower of over 100,000 at M3. The BRJ.801, with a diameter of 18in, may be almost twice as powerful.

These missile engines have been mentioned as an introduction to Bristol Siddeley's exploration of the field of propulsive systems for supersonic airliners. They have demonstrated the calculated advantages of a transport powered by a combination of turbojets and ramjets. Assuming a still-air range of 4,000 n.m. and a cruising L/D of 7.5 at M3, the turbo-ramjet machine has a payload of 8.6 per cent of the gross weight, more than twice