

Atar turbojet, largely on the success of which the company has grown to its present size and status. Replacing the Atar gradually is the BSE/SNECMA Olympus 593 for which SNECMA is developing the entire exhaust system, the M45F turbofan, and the TF306. Overhaul of P&W civil turbofans continues at a high rate, the 1,000th overhaul being completed last year at the company's Billancourt factory. The JT8D turbofan from European-operated Boeing 727s has also joined the JT3C and JT4A lines.

To house the majority of its production work and laboratory facilities, SNECMA has started commissioning an extensive new plant at Evry-Corbeil near Paris. Already occupied are the pre-production shops engaging some 800 personnel. A further 2,000 will move into new production shops and laboratories this year, and by 1969 the plant will employ 6,000. It will take over the previous activities at SNECMA's Gennevilliers factory and most of its Kellerman, Paris, plant. Major production activity at present is manufacture of the Atar 9K turbojet for the GAM Dassault Mirage III E and IV. Basic rating of this engine is 10,350lb, rising to 14,770lb with afterburning. Olympus 593 exhaust system and component manufacture is also undertaken.

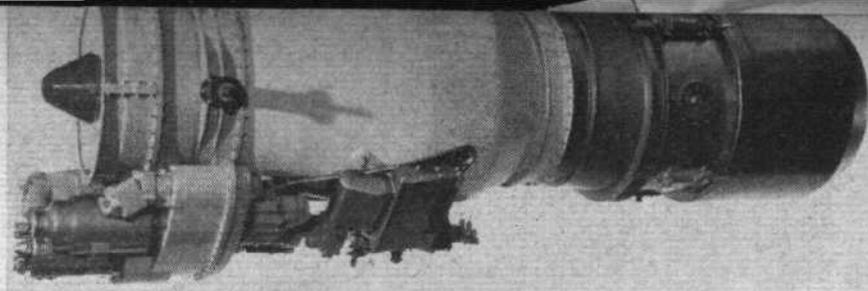
SNECMA is responsible for 40 per cent of the work on the 593 power unit, and has full design and development authority over the exhaust system. This comprises the afterburner, thrust reverser, noise suppressor and variable-geometry convergent-divergent exhaust nozzle. Testing of these components is now well advanced, and full-scale exhaust system tests have been run, including thrust reverser operation. Olympus 593 engines are being run both at SNECMA and CEP, Saclay, total running time at these two establishments amounting to more than 270hr by last month.

A second joint venture with BSE is the M45 series of turbofans. The first of these engines, the M45F demonstrator, ran on June 7 last year, only 16 months after the issue of the first drawings. The M45F has a 1.2:1 BPR and a thrust of around 6,500lb. The second demonstrator ran on November 18. The fact that the engines were designed and manufactured jointly by SNECMA and BSE and have since been demonstrated to advantage is a major achievement for Franco-British aerospace collaboration.

SNECMA also reports that a turbojet version of the M45F, having a common h-p spool with the turbofan, will be tested at Melun Villaroche in the near future. This presumably is the M45A, rated at 5,500lb. The M45G and H turbofans have been selected to power the Anglo-French VG project and the VFW 614 respectively (see Bristol Siddeley Engines).

Third of SNECMA's development activities concerns the TF306 turbofan for the Mirage IIIF2 and IIIG. This engine comprises the P&W TF30 with SNECMA afterburner, and has a thrust with augmentation of 20,600lb. A 100hr endurance test is scheduled to have been run by the end of 1966, by which time the TF306 should also have flown in the second prototype Mirage IIIF2. Meanwhile the first IIIF2, which first flew on June 12 last year, is powered by a SNECMA TF30. This has the lower augmented thrust of 18,700lb. First flight of the Mirage IIIG with the TF306 is planned for May 1967.

As a tripartite activity, SNECMA and BSE signed an agreement in July last year with Pratt & Whitney which allowed the two European companies certain licence rights in the P&W JT9D turbofan. As an adjunct to the agreement SNECMA and



Rolls-Royce/Turbomeca RB172-T.260 twin-spool turbofan with afterburner. Two-stage axial fan. Five-stage axial h-p compressor. Annular straight-through-flow combustion system. Single-stage axial h-p turbine. Single-stage axial l-p turbine. Pressure ratio, 9.6:1 and b.p.r. 1.0:1. Rating, 6,300lb with afterburning, 4,200lb without. Weight, 810lb. Diameter, 31.8in

BSE are each developing alternative designs of h-p compressor for the engine (see Bristol Siddeley). In view of BSE's subsequent acquisition by Rolls-Royce, some review of this activity may be underway. However, the fact that SNECMA for the past six years has had close associations with P&W—the American company has a holding in SNECMA—will almost certainly mean that there will be resistance to modification of the agreement.

TURBOMECA (Société Turboméca) Bordes (Basses-Pyrénées).

The past year has seen a further strengthening of the ties between Turbomeca and Britain, via the formation of joint companies with R-R and BSE, namely Rolls-Royce Turbomeca Ltd and Bristol Siddeley Turbomeca International SA. It has also seen Turbomeca break away from its traditional line of small centrifugal engine development, and enter the axial field via its work on the R-R/Turbomeca RB.172-T.260 turbofan for the Breguet/BAC Jaguar project. Rather surprisingly, Turbomeca is responsible for the design and development of the fan and h-p compressor, although the company has no previous experience of multi-stage axial compressors. The engine is scheduled to run in April.

The company is now at its largest size ever, with a total of 2,740 employees. Its new plant at Boucau-Tarnos, near Bayonne, is fully commissioned following its official inauguration 18 months ago, and is engaged on component manufacture and engine overhaul. To date more than 7,500 engines have been built by Turbomeca, and a further 7,000 by its licensees in Britain, USA, India, Spain and Yugoslavia. These engines power 102 types of aircraft, helicopter and missile produced in 37 countries and in service in 54 countries.

Present production and development work concerns the Marboré turbojet, Aubisque turbofan, Artouste II and III, and Turmo III turboshafts, and the Astazou and Bastan turboprops. Present applications for the Marboré include the SEEMS MS-760 Paris II and III business jets and the Potez 94 trainer for which the 1,058lb Marboré VIC received FAA certification last year. The 880lb Marboré IID powers the Saab 08/Nord M.20 tactical missile. For the Saab 105, the Aubisque IA turbofan is in extensive production, this version of the engine being certificated last year at 1,636lb. It succeeds the Aubisque I of 1,543lb initially delivered for the 105.

Helicopter applications for the turboshaft engines include the Sud-Aviation Alouette II with a 523 s.h.p. Artouste IIC6, the Alouette Astazou II with a 360 s.h.p. Astazou IIA, the Alouette III with a 550 s.h.p. Artouste IIIB, the SA.330 with two 1,300 s.h.p. Turmo IIIC4, and the SA.321 Super Frelon with three 1,500 s.h.p. Turmo IIIC3. The Bastan VIC turboprop of 1,065 e.h.p. powers the Nord 262, and development of the 1,100 e.h.p. Bastan VIIA and 1,250 e.h.p. Bastan VIIB is under way for the same application. Development also started last year of the 855 e.h.p. Astazou

XIV chosen to power the Handley Page Jetstream and as an alternative engine for the Mitsubishi-Pilatus MU-2B. This model will be certificated during 1967, and will be followed in 1969 by the 1,000 e.h.p. Astazou XX. The 741 e.h.p. Astazou XII powers the Short Skyvan and the Potez 842, and the lower-rated 555 e.h.p. Astazou II powers the Nord 510 flying platform which started testing at Melun Villaroche in April last year.

The joint Turbomeca/BSE Oredon III turboprop of 350 s.h.p. made its first run last summer, but BSE's participation in the project has now apparently been withdrawn. A recent event of possibly far-reaching consequences has been the initiation of negotiations between Turbomeca and the USSR on a licence agreement for the Astazou in its turboprop and turboshaft configurations. It is also presumably an indication of Russia's lack of engines in this size category.

GERMANY

DAIMLER BENZ

Stuttgart-Untertürkheim.

This company has been engaged in development of a series of indigenous designs of turboshaft, turboprop and turbofan. The smallest of these is the DB720/PTL6 turboshaft with ratings ranging from 1,000 to higher than 1,500 e.h.p., and intended as an engine for the German utility helicopter programme. The larger DB721/PTL10 turboshaft is rated from 2,000 to 2,500 e.h.p., and the gas generator from this engine has been adapted to energise an aft fan. This variant is designated DB730/ZTL6 and has a rating of 1,345lb.

KHD (Klößner-Humboldt-Deutz)

Oberursel-Taunus.

KHD's main aero activity has been licensed production of the Bristol Siddeley Orpheus 803 turbojet to power Dornier-built Fiat G.91 fighters. Last year it was announced that KHD and BSE were collaborating in the design and development of an APU for the VAK 191B V/STOL strike fighter. Designated KHD/BS T-112, the unit is a small single-shaft engine rated at 138 s.h.p. up to ISA+60°F. Its prime function is to provide main engine starting by means of hydraulic transmission. It will also provide accessory power and air supply during ground service. The T-112 is also suitable for use in helicopters and light transports. Development of the APU is now solely the company's to licence manufacture the Lycoming T53 turboshaft for German Army Bell UH-1D helicopters.

MAN TURBO Munich.

Major activity of this company is licensed manufacture of Rolls-Royce 5,955 e.h.p. Tyne RTy.20 Mk 22 turboprops as part of the European consortium for this engine. MAN is the prime contractor for the Mk 22 for the Transall C-160, of which 470 aircraft have been ordered. Overall manufacture of the Tyne by the consortium is split