

fans. Wind-tunnel testing of the model started early last year. The J85's main V/STOL application, the Ryan XV-5A fan-in-wing experimental aircraft, suffered a further setback in October, when the second prototype crashed. The first XV-5A was destroyed in an accident in 1965.

In Italy the 4,080lb J85-GE-11s chosen to power the new twin-engined Fiat G.917 started intake and installational checks at Fiat. The company's success in ousting the normal BSE Orpheus turbojet from this aircraft was followed later last year by the 3,060 e.h.p. T64-GE-14 turboprop being chosen for the Fiat G.222 transport to replace the R-R Dart previously specified. Initial T64 deliveries to Fiat start in June and flight testing in 1968. A second major success for the T64 was its recent selection as the engine for the US Army's AAFSS now being developed by Lockheed. Twenty 3,435 s.h.p. T64-GE-16 turboshafts are involved in the test programme for the AAFSS. The preliminary flight rating test of the -16 is scheduled for early this year, with the model qualification test and FAA certification following in 1968. The -16 is a growth version of the T64-GE-12.

The 3,080 s.h.p. T64-GE-3 has been ordered for USAF Sikorsky HH-53B helicopters to be used in rescue work in Vietnam. The German VC400 V/STOL application for the 3,745 s.h.p. T64-GE-12 is reported to be threatened with cancellation.

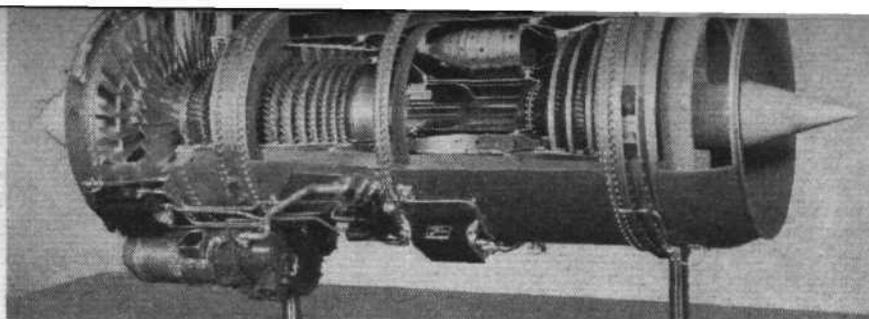
GE's smaller T58 turboshaft is involved in a programme to convert USN Seasprite utility helicopters to twin-engine installations. The same 1,250 s.h.p. T58-GE-8B is retained for this purpose, but with the second engine flat rated. This arrangement provides an 800 s.h.p. reserve for emergencies, with improved hot-weather and high-altitude performance. Two modified UH-2A/B Seasprites are at present being used in development tests for the programme.

LYCOMING (Lycoming Division, Avco Corporation) Stanford, Connecticut.

In a remarkable series of US Army contracts issued at almost monthly intervals throughout 1966, Lycoming received orders for T53 and T55 turboshaft engines and components valued at well in excess of \$150 million. These are for the Bell UH-1B and D, and the Boeing-Vertol CH-47A Chinook helicopters for use in the Vietnam war. A small proportion of the contracts were for T53 turboprops powering the Grumman OV-1 Mohawk. The engines primarily concerned were the 1,100 s.h.p. T53-L-11 and 1,400 s.h.p. T53-L-11 turboshafts, and the 2,650 s.h.p. T55-L-7 turboshaft. This boom in Lycoming's business has necessitated an expansion of the company's production facilities and an increase in payroll to around 8,000, the highest ever in its post-war history.

A further outcome of Lycoming's Vietnam production must be to elevate the company to being the most experienced helicopter turbine concern in the West.

In October the first model of an advanced version of the Chinook flew, powered by two 2,850 s.h.p. T55-L-7C turboshafts. This was the CH-47B, forerunner of the CH-47C to be powered by two T55-L-11s. Delivery of the first CH-47C to the US Army is planned for the spring of next year. A derivative of the T55 in the form of the variable-geometry PLF1C-1VGC compound turboshaft of 5,220lb thrust is specified for Boeing-Vertol's Rotafix V/STOL projects. The engine provides thrust in its fan mode and, when coupled to the aircraft rotor, is alternatively capable of transmitting powers ranging from 4,000 to 4,500 h.p.



Pratt & Whitney JT8D-5 twin-spool turbofan. Two-stage axial fan plus four-stage axial i-p compressor. Seven-stage axial h-p compressor. Cannular straight-through-flow combustion system. Single-stage axial h-p turbine. Three-stage axial i-p turbine. Air mass flow, 316lb/sec. Pressure ratio, 16:1. By-pass ratio, 1.1:1. Rating, 12,250lb. Weight, 3,096lb. Diameter, 44.0in

PRATT & WHITNEY (Pratt & Whitney Aircraft Division, United Aircraft Corporation) East Hartford, Connecticut.

Pratt & Whitney has entered a period of major expansion both of its development and manufacturing facilities and of its payroll. It is in production with the TF30, JT3D and JT8D turbofans, and the JT12, J60 and J52 turbojets. Under development are the large JT9D and JTF17A turbofans, the smaller JTF16B turbofan and a diverted-thrust V/STOL engine of unspecified configuration. These are in addition to normal in-service development of earlier-series engines.

In June last year the company announced a campaign to recruit an additional 18,000 personnel by this spring, to bring P&W's total payroll to somewhere in the region of 60,000. Via its parent company, the United Aircraft Corporation, P&W has gained major access to the production facilities of Orenda Ltd, a new joint enterprise in which UAC has a 40 per cent holding. P&W has also purchased the 730,000 sq ft Connecticut Advanced Nuclear Engineering Laboratory (CANEL) previously owned by the USAF and operated by P&W for its government-sponsored nuclear-power-for-space activities. This establishment is now devoted to engine component manufacture and development. Further afield, P&W last year initiated arrangements for BSE and Snecma to participate in JT9D development and manufacture.

Major production engines are the TF30 and JT8D turbofans. The TF30-P-1 of 20,000lb with afterburning, powers the General Dynamics F-111, and the non-augmented TF30-P-6 of 11,350lb powers the Ling-Temco-Vought A-7A Corsair II. A new lighter version of the engine, the TF30-P-12, is under development for the F-111 and has a 17 per cent higher rating than the P-1. Problems with overloading of the compressor have been incurred and are involving major re-design and re-matching of the compressor blading. The larger JT8D civil turbofan powers the Boeing 727 and 737, Douglas DC-9, and Sud Aviation Caravelle IOR of which close on 1,100 aircraft have been ordered. Against this requirement for some 3,500 to 4,000 engines, considerably more than 1,200 JT8Ds have

already been delivered. Present variants include the 14,000lb JT8D-1, 12,000lb D-5 flat-rated to 90°F, the 14,000lb D-7 flat-rated to 84°F and the 14,500lb D-9. Maximum t.b.o. now exceeds 4,800hr and total flying time is approaching three million hours.

Of the other traditional engines, the JT3D-3B flew last year in the new Douglas DC-8 Series 61 and 62. Maximum t.b.o. of JT3D is now 9,000hr, and for the JT4A, 8,000hr. The 3,300lb JT12A-8 for the Lockheed Dash 8 JetStar and North American Sabre Commuter, received FAA certification in October. For the larger military J52-P-8A of 9,300lb thrust, USN contracts were placed early last year to meet the Navy's requirements for 73 additional Douglas TA-4E Skyhawk trainers.

P&W's big new civil turbofan, the 41,000lb JT9D-1 for the Boeing 747, was scheduled to start development testing last month. This engine is based on company experience with the similarly rated JTF14E, loser in the C-5A engine competition, and P&W's pioneering STF200 advanced-technology engine. The JT9D embodies many new features, including a reduction in the number of main bearings from the normal seven, down to four; a reduction in the number of basic structural elements from five to three; elimination of the inlet casing and entry guide vanes; and the introduction of new assembly techniques to facilitate easy and extensive field servicing and maintenance. The engine has an initial growth rating of 44,000lb, followed six years after entry into airline operation, by 47,000lb. The JT9D is also being offered for the various US and European airbus projects—where, if its size is adequate, its early development programme places it at an advantage relative to the Rolls-Royce series of triple-spool engines still in the design stage.

The JTF17A, P&W's remarkable duct-burning turbofan for the American SST competition is now well into its second hundred hours of testing. First run in March last year, the engine has two versions, the earlier 57,000lb JTF17A-20 and the more powerful 61,000lb JTF17A-21. Three A-20 demonstrators have been built and tests have included simulated flight

Lycoming T53-L-11 free-turbine turboshaft. Five-stage axial plus single-stage centrifugal compressor. Annular reverse-flow combustion system. Single-stage axial h-p turbine. Single-stage axial i-p power-turbine. Air mass flow, 10.7lb/sec. Pressure ratio, 6.0:1. Rating, 1,100 s.h.p. Weight, 496lb. Diameter, 23.0in. (Development version illustrated)

