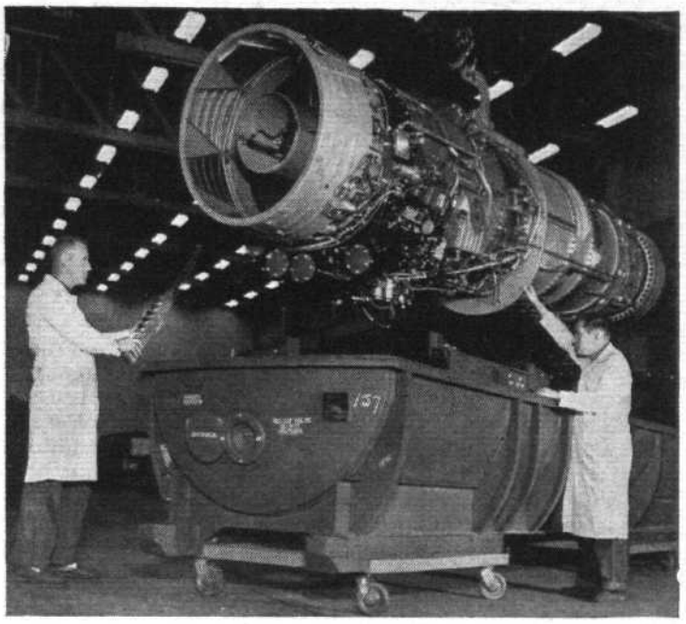


J71

Allison's Big Axial Turbojet

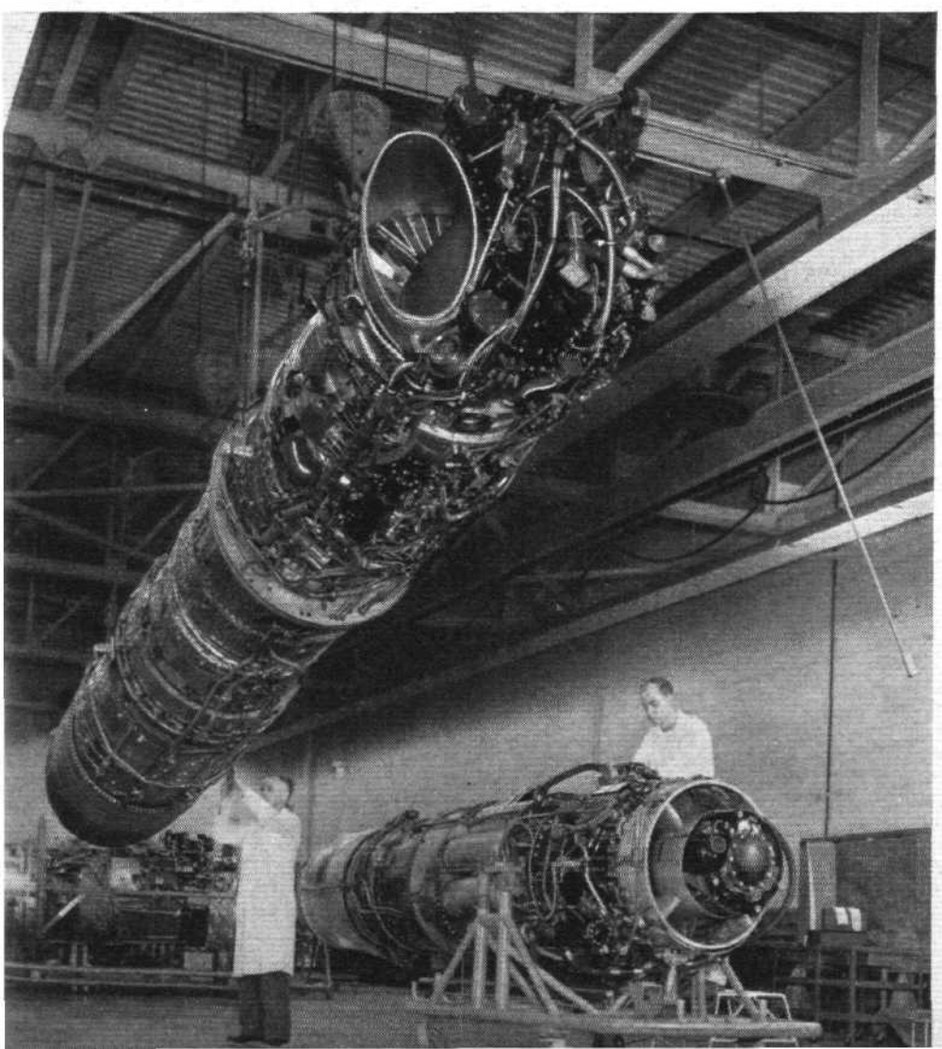
ALTHOUGH the ground-work of American jet development was largely laid by G.E.C., the first large American axial design, the TG-180, was passed to the Allison Division of General Motors who were better placed to undertake large-scale production. Previously Allison had been noted for their range of 1,710cu in V-12 piston engines.

As the J35, the basic TG-180 has now been made by Allison in enormous numbers. During the past ten years, the company have also developed a family of turboprops which are beginning to reach military service and have also tackled the problem of developing a large turbojet to succeed the J35 on the production lines. This new turbojet is the Allison J71, the fact that it has an odd number indicating that the initial design was sponsored by the U.S. Air Force and not the Navy.

The basic design of the J71 was virtually complete by 1950 and early examples of the engine were run in that year. Since then, considerable development has taken place, and present engines have the following features. The compressor has 16 stages, all mounted on the same shaft as the three-stage turbine. The combustion system is of the cannular type, consisting of a two-piece stainless-steel chamber housing ten interconnected flame tubes. Concurrently with the basic engine has been evolved an exceptional variety of auxiliary devices, including a variable-area tailpipe, an electro-mechanical control system, automatic intake screens to prevent the ingress of ice and foreign material, an integral oil and hydraulic system, and a comprehensive range of engine and airframe accessories including a power-pack driven by an air-turbine motor. The J71 is also available with at least two types of afterburner, both of which are completely cleared for service. One afterburner is employed for take-off and low-altitude boosting and another is specifically for increasing the performance of fighters at high altitudes.

The principal bone of contention in the J71 design is that it is a single-shaft engine. According to Allison, the design was specifically intended to meet the need for "a single-compressor engine with high compression ratio which would match good fuel economy with maximum thrust"; Mr. E. B. Newill, general manager of the Allison Division and vice president of General Motors, recently stated that the J71 had "demonstrated thrust in excess of 10,000 lb with the highest pressure ratio of a single-compressor engine yet developed. In addition, this engine develops more thrust per square foot of frontal area than any jet engine ever produced." (The last sentence is incorrect, if Mr. Newill's statement is based on his company's published figures; the later Sapphire and Olympus can both achieve better thrust per unit frontal area, even on type-tested ratings.) The diameter is 39.5in, and the basic engine (without afterburner) weighs about 4,100 lb and is 191.4in long. Several 150-hr tests have been run at 10,000 lb at 6,100 r.p.m., with an s.f.c. of just under 0.9lb/hr/lb.

The mass-flow and pressure-ratio are, respectively, of the order of 172 lb/sec and 8.75 : 1, figures which are well up to the best values achieved by other type-tested turbojets. The establishment of a single-shaft pressure-ratio of this order (in an engine used by such aircraft as all-weather carrier-based fighters) is a remarkable achievement. After a lengthy incubation, Allison now seemed pleased with the engine and would, no doubt, strongly deny regret at the acceptance of such a layout.



The illustrations show two representative types of engines at present in production at Indianapolis. The larger picture shows the J71-A-2, which is installed in the McDonnell F3H-2N Demon, a transonic carrier-based all-weather machine. A point of interest (apart from the engine's immense size and complexity) is the jungle of accessories between the bifurcated intake ducts. The −2 engine has the long type of afterburner, which raises the thrust to 15,000 lb. Without afterburning the J71 gives 44 per cent more thrust than the earlier J35, also seen in the large photograph, which is of roughly the same diameter.

The smaller photograph shows the J71-A-11 for the Douglas B-66 and RB-66 tactical and reconnaissance bombers. This engine is considerably shorter than the other, principally owing to the fact that it has no afterburner. It picks up at four points inside a single nacelle, one such power-installation being pod-mounted under each wing of the Douglas bomber. Accessories in this engine are spread around the lower half of the compressor; the starter is an air-turbine motor, which draws compressed air from a Solar gas-turbine/compressor trolley. In the photograph the nose-drive pad is not yet occupied and the intake fairing has not yet been fitted, in order to reduce the overall length for shipment. The retracted intake screens are visible.

One type of J71 with the short afterburner is fitted to the Martin XP6M SeaMaster. These engines, designated J71-A-4, are mounted above the wing in two paired nacelles, the afterburners projecting behind the trailing-edge. Full afterburning thrust is employed in this aircraft for take-off and also to increase the performance at low altitudes during mine-laying or photographic missions.