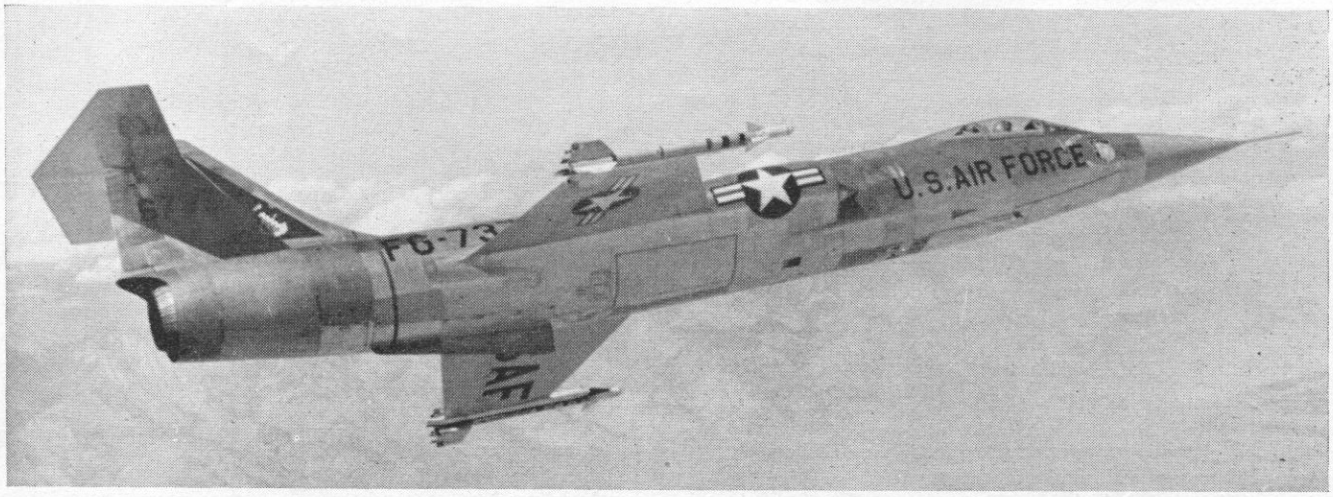


The F-104A with Sidewinder missiles on wingtips.

The Lockheed F-104A Starfighter

By Gert W. Heumann

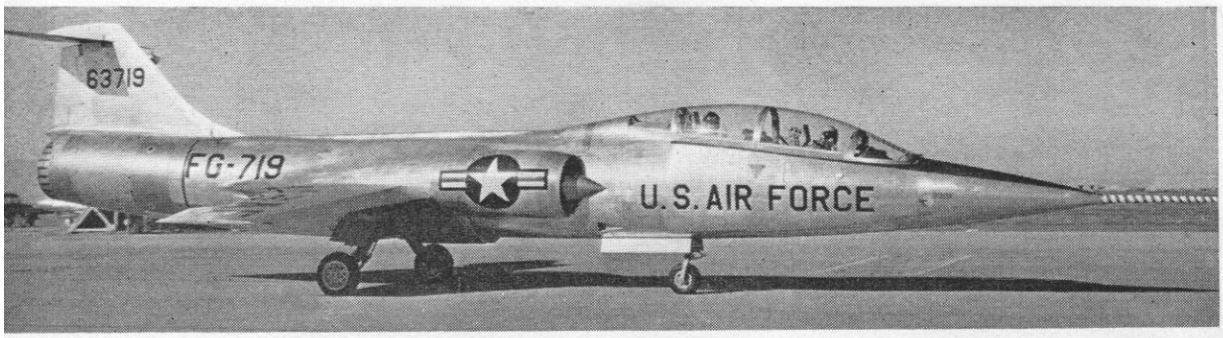
Perhaps one of the most controversial combat aircraft ever to enter service and without a doubt one of the most significant, the radical Lockheed Starfighter is the first aeroplane in the history of aviation to gain world records for both absolute speed and altitude; a unique feat all the more remarkable for the fact that it was achieved by a standard operational aircraft in full service. The concrete evidence of the Starfighter's performance capabilities now provided by these officially observed flights has confounded this fantastic warplane's numerous critics, who regarded the claims made by its manufacturer as merely the outpourings of another highly publicity-minded American public relations department. But it should not be thought that the Starfighter's gestation has been unchequered. Indeed, so radical a machine might be expected to suffer its full share of teething troubles. But the variety of structural and aerodynamic problems encountered by the Starfighter during its development now seem to be past history, and the U.S.A.F. squadrons operating this aircraft are undoubtedly flying the fastest service fighters in the world.

Basically, the F-104A Starfighter is a mid-wing cantilever monoplane, and it is largely the diminutive size of the wing that gives the fighter is startling, missile-like appearance. Possessing a thickness-chord ratio of only 3.4 per cent, the wing is nevertheless a conventional structure with 20 degrees sweepback at the quarter-chord line. Departing from current trends in sporting no boundary-layer fences or vortex generators on its surfaces, the wing carries slightly inset, simple ailerons, blown flaps—air from the main engine compressor being blown through slots over the complete flap span—and drooping leading edges which are depressed to maintain the airflow at high attack angles. The wing is so thin that it accommodates only the leads to carry fuel from the tip or pylon tanks and the wiring for underwing stores. Overall span is a mere 21 ft. 11 in., and wing area is 179 sq. ft. —approximating to that of the Gnat Trainer!

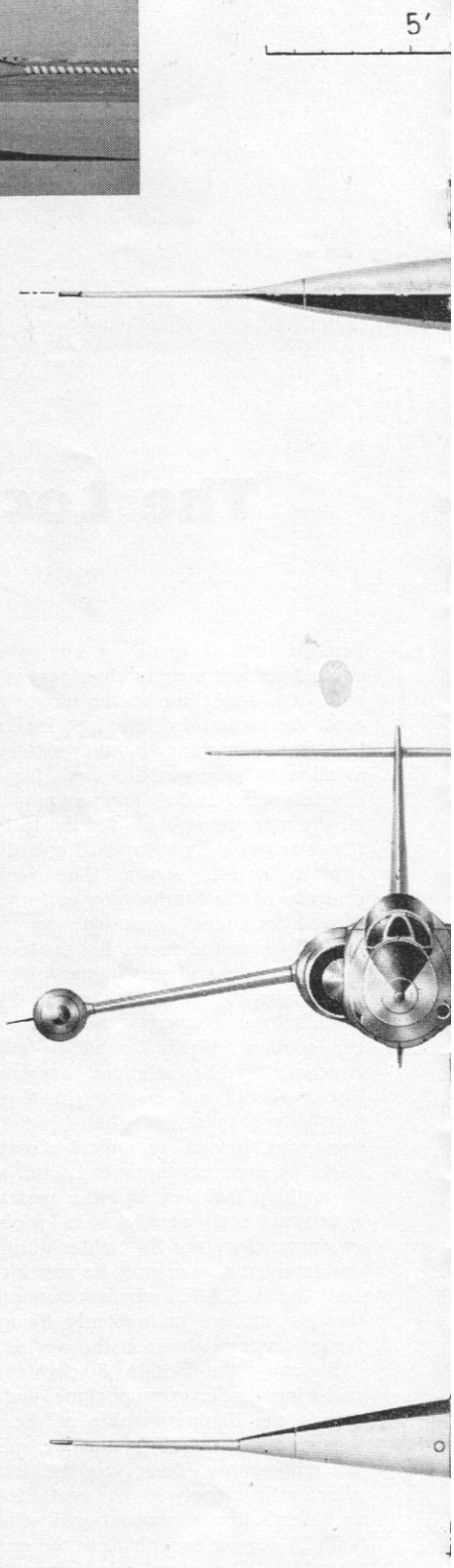
In direct contrast to the wing, the slim, pointed fuselage possesses an overall length of no less than 54 ft. 9 in. from the tip of its erosion-resistant dielectric nose to the end of the horizontal tail surface. An all-metal monocoque structure, the fuselage houses a General Electric J.79-GE-3 or GE-3A single-shaft variable-incidence-stator turbojet which, providing 10,500-lb. s.t. and 16,000 lb. with afterburning, is fed via sophisticated air intakes which, standing proud of the fuselage sides, feature movable half-conical centre bodies so designed that they give the exact shock-wave angle called for by various speeds. This turbojet is reputedly an exceptionally fine power plant, offering rapid acceleration and throttle response, although all Starfighters fitted with the J.79-GE-3A were grounded recently after a series of accidents had been traced to roughness and flameout in the afterburner, necessitating modifications to the electrical controls and nozzle areas. At the present time, a further development of the basic engine, the J.79-GE-7, is undergoing tests, and this will probably be installed in the model supplied to the Luftwaffe if present negotiations reach fruition.

The fuselage nose houses the AN/ASG-14TI packaged fire-control unit, and the primary armament consists of a single rotary-firing 20-mm. General Electric T-171E3 Vulcan six-barrel cannon which, possessing a fire rate of 6,000 r.p.m., is mounted in the fuselage port side and fires through a port situated below the cockpit. This cannon can be supplemented by two additional T-171s which, together with their ammunition, can be carried in underwing pods. Secondary armament comprises GE/Philco GAR-8 Sidewinder infra-red homing missiles which are attached to the extreme wingtips.

The pilot's cockpit, which is mounted well forward in the nose, is of relatively conventional arrangement but one unconventional item of equipment is the downward ejection seat, the first of its type to be installed in a fighter. This has presumably been selected in preference to the conventional ejector seat in order to ensure that the pilot will clear the tail assembly, and the ejection sequence after the release handle is pulled is as follows: (1) cockpit is depressurised and control column is moved forward; (2) the parachute harness is tightened and ankle clamps secure feet in position; (3) an explosive cartridge releases the escape hatch and ejects the seat downwards. The



The F-104B two-seat training version of the Starfighter.

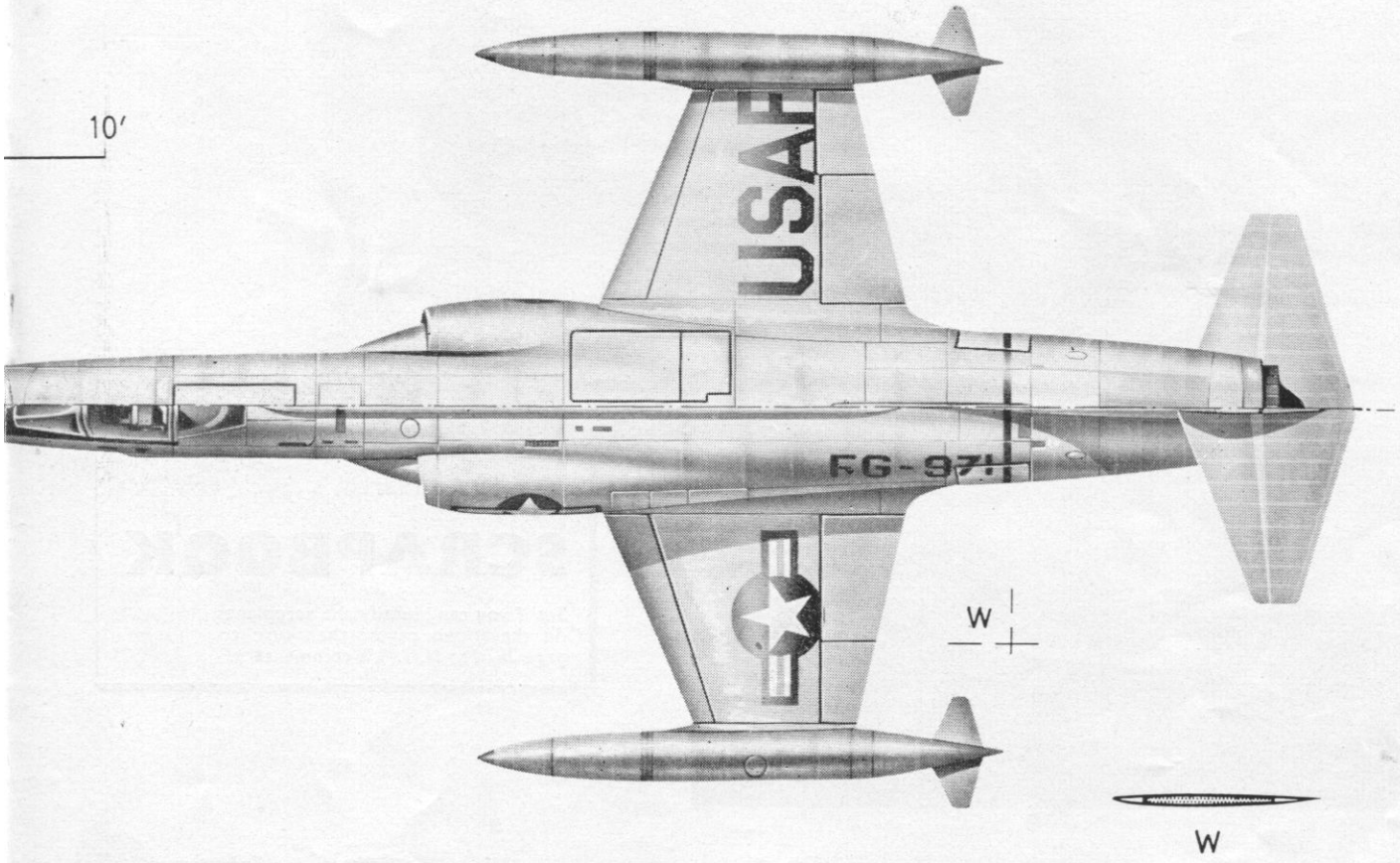


adoption of a downward ejector seat has undoubtedly permitted the simplification of the cockpit canopy which is not power-operated, has no heavy roller, screwjacks or framing, and needs no nitrogen bottles to jettison the canopy in the event of a screwjack failure.

The hydraulically-operated tricycle-type undercarriage is of narrow track and housed entirely in the fuselage; the main-wheel legs, which raise in and forward, being hinged on oblique axes so that the wheels lie flush within the fuselage skin when retracted. The steerable nosewheel retracts forward into the fuselage just aft of the cockpit. Behind the cockpit what space in the fuselage is not taken up with ammunition tanks, the undercarriage and the power plant, is occupied by two-ply nylon fuel cells. These contain sufficient fuel for a tactical radius of 600 miles, although with tip tanks and pylon tanks for ferrying, maximum range is extended to 2,200 miles. The equi-tapered slab-type tailplane is pivoted aft of mid-chord and is set almost at the tip of the vertical tail surfaces to avoid wing wake. The tail-plane is nearly a quarter of the total wing area and is driven by an actuator in the forepart of the fin. Overall height on the ground is 13 ft. 6 in.

The F-104A Starfighter is believed to weigh somewhat less than the Hunter F.6, empty weight being 11,500 lb. and normal loaded weight (clean) being 17,000 lb. With tip tanks fitted loaded weight rises to 19,200 lb., and in maximum loaded condition (for ferrying) is as high as 22,500 lb. Maximum speed is Mach 2.2 (1,475 m.p.h. at 35,000 ft.), and some idea of the Starfighter's climb and altitude ability is given by the performance shown during the recently-established world altitude record. For this record, the Starfighter was climbing at a constant Mach 2.1 at 40,000 ft. at a rate of 20,000 ft./min. At 45,000 ft. the machine zoomed up at a 35-degree angle at approximately 80,000 ft./min., attaining no less than 91,249 ft. at the top of the zoom. For the absolute speed record two runs were made at 1,465.41 m.p.h. and 1,342.97 m.p.h., giving an average speed of 1,404.19 m.p.h.

The Starfighter is currently in production for the U.S.A.F. in two versions, the single-seat F-104A and the two-seat F-104B, the latter being used for instrument and transition training as well as for normal operations, retaining the same armament and radar as the single-seat variant. Development of the Starfighter was initiated in the spring of 1953 when a contract was awarded for two prototype aircraft. The first of these, designated XF-104 and powered by a Wright J.65-W-6 turbojet which gave an after-burning thrust of 10,500 lb., flew for the first time on 7 February 1954. Fifteen YF-104s were ordered for development trials and service evaluation, and various changes were progressively incorporated in these machines leading to the production F-104A, the first example of which flew on 17 February 1956. The production Starfighter differed from the XF-104 in having the new J.79 turbojet, central shock-forming ramps in the air intakes, a forward-retracting nosewheel leg, and additional fuselage sections immediately aft of the cockpit and the wing trailing edge. The F-104B, which flew for the first time in January 1957, is in production alongside the A model and differs principally in having a cockpit extending back into the bays formerly occupied by fuel cells. Originally very substantial orders were placed for the Starfighter which was to be extensively used by the air superiority squadrons of the U.S.A.F. Tactical Air Command. A cut-back in the number of T.A.C. wings resulted in substantial reductions in orders for the Starfighter, and at the present time less than 300 machines have been ordered, the majority of which have now been delivered. At the present time, the West German Governments is negotiating for a quantity of machines, likely to be between 120 and 150 aircraft, but a recent Royal Australian Air Force decision to adopt the Starfighter was reversed when it was concluded that longer-ranging, multi-seat fighters would be more suitable for Australia's needs.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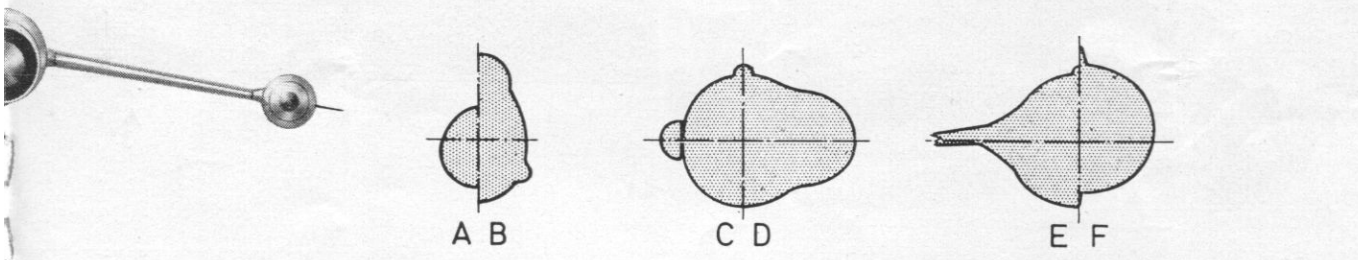
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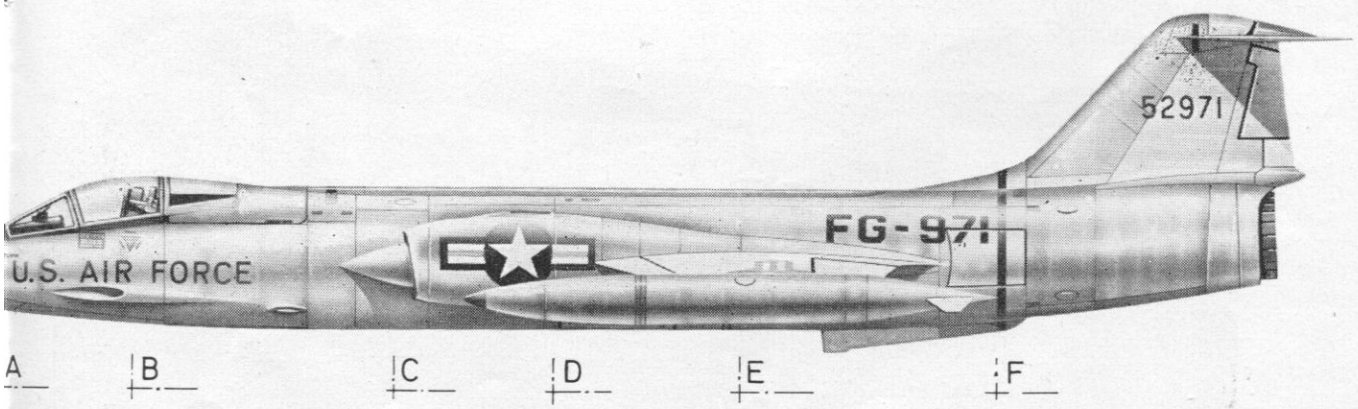
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