Tony LeVier, Lockheed's director of flying operations and F-104 test pilot, poses in partial pressure suit with a prototype F-104. Production machines have forward-retracting nosewheel, intake shock-bullets, landing and taxying lights, and many other refinements. Span is 21ft 11in, length 54ft 9in and height 13ft 6in.

Some Operating Characteristics of the F-104A Revealed

"GET WITH THE STARFIGHTER"

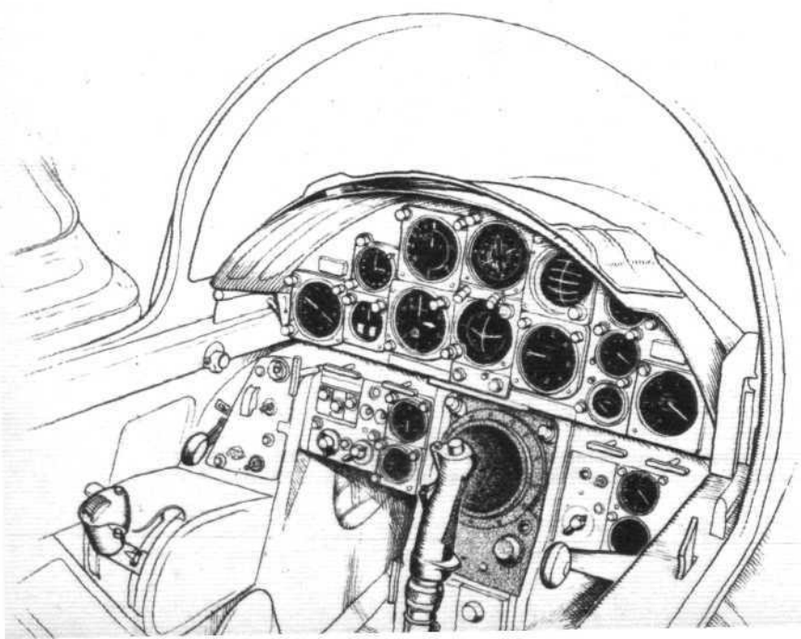
WHEN people had regained their breath after the unveiling (two years after its first flight) of the U.S.A.F.'s "hottest shape," the Lockheed F-104 Starfighter, rumours began to spread. The aircraft had limited capability. It was too small to carry the equipment necessary for an all-weather interception or tactical strike role. Endurance and range were too restricted. The internal armament of the unorthodox B.1 "Gatling" gun was light in weight, but not suited to air combat because of its extremely short firing time.

All this Lockheeds vigorously deny and continue to claim that the Starfighter is the world's fastest combat aircraft—which indeed it is.

Little official information on the Starfighter has been released even now (though a detailed analysis of the aircraft by the Technical Editor appeared in *Flight* on April 20). The more remarkable, therefore, is a feature article in the November issue of *Flying Safety*, an official U.S.A.F. publication. It is written by Tony LeVier, Lockheed's director of flying operations and test pilot responsible for the F-104's first and many subsequent flights. Couched in real U.S.A.F. pilots' language, it gives some intriguing "poop" on the aircraft and goes to some lengths to point out that "pilot transition" will be "no sweat." "The F-104," LeVier says, "is a bird in which the pilot can really get with it."

About the cockpit he says "everything is compact, built snugly around you . . . the pilot is properly placed, visibility is excellent and everything is real handy." Desired cockpit temperature can be set on a single dial and then disregarded. Fuel-system management is like that of a car, unless external fuel is being carried; then a single switch has to be thrown.

A major consideration in the design stage was to achieve simplicity in the interests of safety; and electronic equipment was included (from the start of the design) to make the machine behave naturally. A Lear three-axis, transistorized stability augmentation unit, weighing 18 lb complete, senses and corrects movements of "a tiny fraction of a second" to prevent gusts and turbulence from upsetting stability. "The F-104's fineness of control is the finest."



Despite its extremely high altitude and speed capabilities, the F-104 is quite straightforward in the circuit, according to LeVier. It touches down at 135 to 150 kt, depending on weight, and the circuit speed is 200 kt—just about the same as for other century-series fighters. The addition of leading-edge flaps has provided ample deceleration for approaches and the aircraft can comfortably use 6,000-7,000ft runways. Such a favourable combination of high- and low-speed performance was achieved to a great extent by keeping the gross weight down. Yet the small, thin wing is stressed to take dynamic loadings of over a ton per square foot. The airbrake housing, for example, had to be strong to support the air loads on surface extension; but the strength of the fitting was used to provide in addition an engine mounting point and a fuselage-break attachment. The strength of the housing itself was partly achieved by stressing the hydraulic actuating cylinder.

The pilot-ejection seat leaves the aircraft downwards through a large floor panel. This is claimed as a safer method of escape, since the ejection velocity need not be high enough to clear the fin at high speed. The low-level bale-out case is not discussed. As a result of this system, the canopy is a side-hinged structure, free of the weight and complication of actuating motors, rails and jettisoning devices. LeVier calls it a "do it yourself" canopy, because it is entirely manually operated.

There are two completely separate hydraulic systems, supplied by two engine-driven pumps. With the engine idling or windmilling, pump output is still sufficient for all normal needs. If the engine stops dead, a ram-air turbine driving a generator and hydraulic pump can be extended. Most of the hydraulic components are laid out like a diagram on a very large underfuselage panel which hinges down aft of the mainwheel bays.

During early testing, LeVier had a flame-out at altitude and glided 50 miles back to Muroc for a dead-stick landing. With the aircraft in clean condition the gliding performance is fair, glide ratio being ten to one. A remarkable advantage in this situation is that the forward-retracting undercarriage will extend and lock down under gravity in three to four seconds so that it can be lowered without hydraulics during the roundout of a dead-stick landing. This must considerably simplify emergency landings, apart from doing away with the need for an emergency lowering system. During a power-on approach, the throttle response is very fast and precise.

Col. "Chuck" Yeager was the first pilot outside Lockheed to fly the F-104 and he immediately enthused about its handling qualities. He himself told *Flight* that it had the best powered-control system he had ever known. Another U.S.A.F. test pilot, who specialized in control characteristics, also flew the aircraft. At about 45,000ft he nosed over into a dive and took his hands and feet off the controls. He reached a Mach number well above unity and only had to take the controls again in order to pull out when the ground was coming up. He is reported to have said it was "just like riding an elevator." Yeager had called it "a real tiger"—a compliment in American terminology.

Features of the F-104 cockpit include I.L.S. meter; combined logarithmic A.S.I./Machmeter; miniaturized turn-and-slip; clock; V.S.I. reading to 6,000ft/min; fire-control radar scope; and very large fuel gauge at right. Dials are individually lit and panel background colour is pale grey.