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A new supersonic jet trainer, the Northrop T-38 Talon, has been undergoing extensive testing before entering service with USAF. The plane has drawn praise from pilots, mechanics, engineers . . .

Northrop's T-38 Talon

This Trainer Can GO, GO, GO

Ed Mack Miller

FROM sunbaked Edwards AFB in California's Mojave Desert to the snowy winterscape of Malmstrom AFB, Mont., to Eglin AFB on Florida's Gulf Coast, Air Force test pilots have in recent months been getting to know a new supersonic jet that should one day become a familiar piece of hardware at USAF bases here and abroad.

The plane is the supersonic T-38 Talon trainer. Fifteen of the Northrop-produced aircraft are currently in operation in the far-ranging and intensive test program. The total present order includes 144 planes, with further orders expected to follow. Service planning is that the T-38, designed for training in supersonic and high-altitude flight, formation flying, acrobatics, multijet-engine operations, and night or instrument cross-country flying, will ultimately supplant the Lockheed T-33 Tee Bird jet trainer. The plane's high performance and versatility may also suit it to a number of other missions.

Through the test period, the plane has drawn praise from pilots, mechanics, and engineers. They have noted its simple maintenance, classic lines, impressive speed, range (1,150 miles), ceiling (60,000 feet). Among its important features as a trainer are runway-level ejection capability and excellent back-seat visibility for the instructor.

The only supersonic trainer adopted by a major air force and included in its inventory, the T-38 is forty-four feet long; twelve feet, ten inches high. Wingspan is twenty-five feet, three inches. Power plant is two lightweight, high-thrust General Electric J85-5 afterburning engines. Performance is comparable to combat aircraft weighing twice as much as T-38 takeoff weight of 11,500 pounds. The T-38 is capable of single-engine takeoff, go-around, and landing at maximum weight with gear and flaps down. Each engine weighs 525 pounds, delivers a maximum of 3,850 pounds of

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Air Force test pilot Capt. Swart Nelson, high-time pilot in T-38, describes the plane's flight characteristics to writer Ed Mack Miller in interview at Edwards AFB, Calif.

thrust, and has a thrust-to-weight ratio of 7.33 to 1.

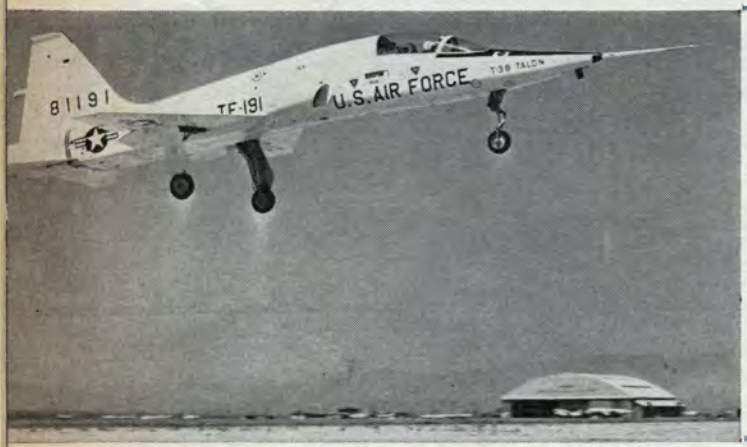
So far the T-38 has been powered by the "YJ" engine, which is rated at about 2,000 fewer pounds of thrust than the J85 engine which will power the plane later on. Best cruise with the "YJ" is Mach .86. Both speed and range will increase considerably with the "J" engine. Speed capability will be Mach 1.2 and mission endurance time better than two hours. Best afterburner climb speed of the aircraft is Mach .92. The afterburner can be used for more than twenty minutes.

attention was devoted to avoiding "built-in accidents" that might result from accident-prone electrical, hydraulic, and fuel systems.

The T-38's rear seat was placed ten inches higher than the front. The instructor, as one test pilot put it, "will have so much visibility that he will feel naked." The cockpit was put together with simplicity in mind. Everything is in front of the pilot and easily reached with either hand.

Fuselage lines on the Talon are characterized by "coke-bottle" curvature in line with the area-rule theory. Wings are placed in the rear section of the fuselage just aft of the engine air scoops. The swept leading-edge wing, with low-drag characteristics, is cambered at the front to prevent tip stall. The cambered nose of the fuselage, which gives the T-38 a distinctive "anteater" or "porpoise" look, allows excellent visibility while still providing low drag. The structural load limit factor of the airplane is better than seven Gs.

The wing is designed to let the plane transition to supersonic speeds without "tuck" or "pitch." The T-38



Talon leaves ground in test flight at Edwards. Extensive test program has been conducted at several bases.

Underbelly view shows T-38 design features including the contoured fuselage, flat afterbody, split between engines.

The T-38 is a high-sink-rate aircraft. Power must be used throughout the normal landing approach, which makes it an appropriate trainer for supersonic aircraft such as the B-58, Century-series fighters, and such foreign-built high-performance craft as France's Dassault Mirage III jet fighter.

Three prime requirements were taken into consideration in design of the T-38: performance capability similar to supersonic combat aircraft; flying qualities consistent with safety requirements for trainer aircraft; and economy of maintenance and operation.

Safety and maintenance factors designed into the T-38 are a result of comprehensive study by USAF and Northrop. An effort was made to identify the frequency of failures in jet trainers, where they took place, and where most man-hours were put in in trouble-shooting and maintenance. The components that seemed to be the weakest were made easiest to get at for repair. Emphasis has been on making black boxes readily accessible for maintenance. Considerable uses conventional ailerons and rudder. All surfaces are hydraulically powered. The all-movable horizontal stabilizer is of aluminum-alloy honeycomb with a steel spar. The vertical stabilizer is a semimonocoque, one-spar structure.

The designers believe the T-38's fuel system to be almost goof-proof. The cockpit fuel panel has only three switches—two "supply," one "cross-feed." Each engine normally receives fuel from its own fuel tanks. However, a cross-feed connection permits either engine to receive fuel from the other supply when necessary. Fuel is carried aft of the cockpits and is normally pumped by electrically powered boost pumps. Gravity feed will continue to furnish fuel at altitudes above 30,000 feet. Each system has 300 gallons for a total of 3,880 pounds of fuel. When fuel is down to 300 pounds in either tank, the pilot gets an indicator light. Test pilots say it's no sweat to go around even when down to 300 pounds.

Electrical power for the T-38 is supplied by two independent AC systems and a DC system that ob-

tains power through two transformer-rectifiers in the AC system. During normal operation, each generator carries half the load. If one fails, uninterrupted performance is maintained by automatic switchover of affected loads to the other generator. A small twenty-four-volt battery is also provided for emergency air-starts, stand-by instrument-panel lighting, and ground starts where no auxiliary power unit is available.

The T-38 also has two hydraulic systems, identical in operation but differing in the units they supply. Each system provides half the power required by the flight controls. The primary "utility" system also supplies all power needed by the landing gear, the nose-wheel-steering system, the stability-augmenter, and the speed brakes. Flaps are electrically driven. If either system fails, the other will automatically provide adequate flight control power. Even when flamed-out and windmilling, the engines should generate enough hydraulic power to maintain flight control for glide and landing. Normal windmill speed is twenty-two percent.

The T-38's windshield is hinged so that it can be swung up out of the way for facility of cockpit maintenance. A pilot bonus: no scratches on the glass. An engine can be changed on the T-38 in about twenty minutes. A complete double-engine change should take about two hours.

Engine-driven accessories are mounted in the airframe—not the engine—to provide maximum accessibility. Below and forward of each engine is an integrated power package consisting of a two-speed, automatic-shifting gear box, an AC generator, and a hydraulic pump. The engine can be removed from this power package almost like unscrewing a light bulb or pulling the cork from a bottle, or the power package can be removed as a unit through a forward access door without removing the engine. Removal or installation of engines is facilitated by a built-in overhead track and roller arrangement in the aircraft engine base itself.

One or two men are needed to handle the uni-

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Instructor, student sit in tandem in T-38 cockpit, with instructor behind and ten inches higher than the student.

Flight line of T-38s at Edwards. Supersonic, twin-engine Talons will join the Air Training Command in numbers.

versal-lift trailer and several tubular steel adapters that mount on the trailer for support of the engine, after-fuselage, wing, or gear-box. Each adapter can be used for removal and installation of a component, for maintenance, inspection, transportation, and storage. The engine adapter can even be used in a test cell as an engine run-up stand.

From a pilot's standpoint, accessibility of cockpit controls is an outstanding feature; no controls are aft of the pilot's elbows. Greenhouse visibility has been obtained in both cockpits, which have individual jettisoning canopies. There is also a plastic chauffeur's divider panel between cockpits, so that if the student pilot in the front seat ejects, the pilot in the rear seat is protected from wind blast. The aircraft has all-white instrument panel lighting, with annunciator panel and master warning lights to alert the pilot to malfunctions. The plane will be fully instrumented with the same general panel as the latest Century-series fighters, with ILS-VOR and TACAN, and the new horizontal situation and latitude display indicators used in the F-105 and F-106.

High-time pilot on the plane thus far is Air Force Capt. Swart H. Nelson. A native of Phoenix who's been an engineering test pilot for the Air Force at Edwards since 1955, he is now Operations Officer for ARDC's joint test force for category II evaluation on the airplane. Captain Nelson has worked in test programs on all the Century-series planes before being assigned to the T-38 program. Captain Nelson is extremely impressed with the T-38. USAF Capt. Russell Rogers has been another prime member of the T-38 test team. A Northrop Talon task force of civilian pilots has carried its share of the load.

In all, more than 100 pilots have been checked out in the T-38. The plane has been flown in formation acrobatics as well as the full run of individual tests under widely varying climatic conditions.

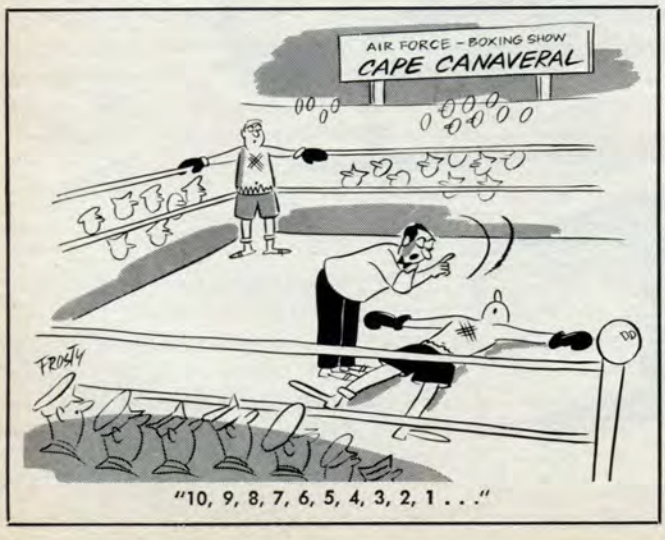
The Air Training Command, primary using command for the T-38, has participated in test work to date. It has also engaged in training of mechanics and pilots. By the start of the year, the testing program was a little ahead of schedule. Most of the remaining hours of test time were scheduled to be used checking out Air Training Command people and setting up the ATC program. The category III program, starting at the ATC Instructor School at Randolph AFB, Tex. this month, will run for a year. A group of twenty-five students of Randolph's class 62F will be the first students trained in the plane about a year from now. Other ATC bases currently scheduled to get T-38s for basic training are Moody, Ga.; Craig, Ala.; Williams, Ariz.; Vance, Okla.; Reese, Tex.; and Webb, Tex.

The student flying officer will get about 150 hours in the Cessna T-37 primary jet trainer, and something less than that in the T-38. The plane might also be used in more advanced training for Air Force pilots in interception, fighter tactics, and varied jet techniques.

The Air Force initially ordered three, then six, then thirteen, then fifteen, and then 144 T-38s. The total order may come to approximately 750 for training alone. There are, in addition, other uses that may suggest themselves. SAC is understood to be considering use of the T-38 for proficiency flying training by combat crews. With fast new bombers expensive to fly, their crews might conceivably "stay in practice" at much smaller cost in the T-38. The T-38, persons close to its development point out, could be used for spotting and reconnaissance, low-level interdiction, or as a genuine interceptor aircraft. A single-seat fighter version, the N-156F Freedom Fighter, was rolled out in mid-1959. The US Navy has been considering a version of the T-38 as an aircraft carrier trainer. A number of our overseas allies have also been taking a long look at the T-38.

As set up in the preliminary syllabus, the first mission for a student in the T-38 would be an afterburner takeoff and an afterburner climb to 36,000 feet. This would take about three and one-half minutes. It would be followed by practice 180-degree turns and an acceleration to the supersonic state, with several supersonic rolls and a "wind-up (descending and rolling) turn" with increasing forces up to four Gs supersonically. These maneuvers would take about six minutes.

Then the instructor would take the engines out of afterburner and demonstrate the stability augmenter at Mach .9—the most sensitive trim area—showing longitudinal and latitudinal pulses and correction with the damper on and off. Then they would drop down to 20,000 feet, doing lazy-eights, rolls, and other precision maneuvers. At 20,000 they would do a clean stall and a power-approach stall with gears and flaps down, then clean up the airplane and do several loops. Returning to the field, they would then shoot three or four landings. The entire flight would take about one hour. —END



"10, 9, 8, 7, 6, 5, 4, 3, 2, 1 . . ."

The author, Ed Mack Miller, is an aviator-writer who has contributed frequently to these pages. Readers will recall in particular his word-pictures of Vandenberg AFB and the USAF School of Aviation Medicine, Brooks AFB, Tex., his lengthy report on the Air Force Academy at the time its first class graduated in 1959, and his hard-hitting, definitive defense of the B-70 Valkyrie bomber program when it became a temporary victim of government fiscal measures last year. Mr. Miller is a Denverite, an Air Guardsman, a commercial pilot, and a prolific author.