Supercritical Wing Fighter Applications to Be Tested

Washington—Joint National Aeronautics and Space Administration/Air Force transonic aircraft technology (TACT) study will test fighter applications of a supercritical wing at Edwards AFB in late September using a General Dynamics/Convair Aerospace F-111.

NASA/USAF selected the fighter-bomber as a testbed for its variable-geometry configuration, transonic and supersonic characteristics.

Flight tests with the supercritical wing will be designed to gather data on aircraft maneuverability with new airfoil shapes at high-g loads.

Investigators anticipate significant performance improvement in the transonic region in drag rise Mach number with the new wings on the F-111.

Flight tests with the supercritical wing on the aircraft are scheduled to continue into early 1975.

The wings have spoilers, Krueger flaps on the leading edge, and conventional single-slotted flaps on the trailing edges. The F-111's original wing has double-slotted trailing edge flaps.

Supercritical wings have been installed on the aircraft and it has undergone ground vibration testing, to determine flutter characteristics for comparison with earlier NASA wind tunnel test data.

Bending and torsion stress on aircraft surfaces is being created with a series of shakers in the vibration tests at the Flight Research Center by NASA. The tests are for safety during actual flight testing and accelerometers have been positioned on the aircraft to detect load variance problems.

The same type of airfoils used in TACT testing of an LTV Aerospace F-8 Crusader fighter is being used in the supersonic wing tests on the F-111 (AIAA May 7, cover).

Air Force provided $1.5 million for funding the study with the fighter-bomber from Fiscal 1973 funds. A $9 million contract was awarded General Dynamics by USAF for the project in March, 1971. A major part of early F-111 testing was conducted at NASA's Ames and Langley research centers with a portion of the tests including proof loading at the Air Force's Flight Dynamics Laboratory at Wright-Patterson AFB.

NASA has requested $250,000 in Fiscal 1974 for the TACT study and Air Force is seeking $500,000.

A supercritical wing was stressed by USAF in proof-loading to 100% of design load in the structural test facility using waffle tree linkage and tension pads to distribute load factors to the wings. The tests were designed to match 100% load factors with the wing airborne based on wind tunnel data, but actual flight tests will not exceed 80% of load design on the wings.

In the proof-loading tests, the left wing was deflected as much as 27 in. under conditions that recreated 7.33g forces. Wing structural validation and verification resulted from the tests, USAF said.

Wind tunnel tests indicate the supercritical wings will be able to pull more g-forces at various wing sweep angles than anticipated before buffeting sets in, USAF and NASA said.

Conventional base-line flight tests with the F-111 were conducted in 23 flights between July and November, 1972, at Edwards Flight Research Center using the same instrumentation package that will be employed for the supersonic wing flight tests.

Other tests at Edwards will verify proper sweep angles and right and left tracking at various degrees of sweep when lowering the flaps.

All the tests already conducted—NASA's wind tunnel and USAF's proof loading for flexibility—indicate a drag rise at a higher Mach number and excellent performance in maneuverability, NASA said, without any degradation of performance in the supersonic and subsonic regimes.

During flight testing, pressure distribution over the airfoils, shock locations and predicted shock locations at various angles of attack, from takeoff up to supersonic Mach numbers, will be measured to seek characteristics with the supercritical wings but concentration will be on dynamics in the transonic area.

High-frequency pressure transducers will be used to research detailed wing buffet characteristics in flight. Thirty 20-cycle transducers, 15 above and 15 below, will be mounted 6 in. off center line on the right side of the fuselage to gather samples at each location. Data will be used to determine buoyancy factors for wind tunnel correlation in cofining Mach numbers in transonic flight, NASA and USAF said.
used on the An-14. All except the last are turboprop engines. The AI-25 is the factory's sole turbojet engine in production to date.

According to Omelchenko the Yakovlev request for the D-36 engine, transmitted via the Aviation Production Ministry, was not a welcome assignment because the plant is currently swamped with work. The Oil Production Ministry, particularly, has called on the plant to supply ground-based engines for pumping operations in connection with major new oil extraction programs in western Siberia.

Another demand, from the Power Ministry, has been for used aircraft engines to be modified and used in peak power generating stations.

Omelchenko said that because of these demands he could not start cutting metal on prototype D-36 high-bypass engines until the second half of 1974 at the earliest. The D-36 will be Russia's first high-bypass engine, with a ratio of 5.34:1. It is to be used on the planned Yakovlev Yak-42 120-passenger trijet.

Main production facility at Zaporozye is a single building approximately 100 yards wide and 350 yards long. Most of the machining and assembly is done there.

The works themselves cover 20 acres and include heat-treating buildings, forging works, storage facilities, test building and the design and prototype section. More than 10,000 workers are employed there.

Section of final assembly line of the Yakovlev Yak-40 trijet feederliner at Saratov, 450 mi. southeast of Moscow, is shown (below) with four aircraft in view. About 400 Yak-40s have been built so far, and current production rate is one every other day. Saratov plant is changing over to digital controlled tooling in a move aimed at increasing production rate. Current plans call for production of about 2,000 Yak-40s. Detail of installation work on AI-25 turbofan engine and wing tanks for the Yak-40 is shown above.