SPACE

F-111 Gives and Takes

New innovations—the crew escape capsule, adjustable wings and low-level navigation system—highlight the recently unveiled F-111 supersonic fighter plane—By Jonathan Eberhart

See Front Cover

➤ THE F-111 SUPERSONIC FIGHTER plane, better known as the controversial TFX, borrows substantially from the nation's manned space program, and, in turn, is making some contributions of its own.

The most spectacular item in the F-111 to come out of space research is the remarkable crew escape module, in which the two-man crew would be ejected from the aircraft in case of an emergency.

The capsule is similar in many ways to the Mercury and Gemini space vehicles. In fact, McDonnell Aircraft Company, St. Louis, designer-builder of the capsule, was picked for the job by F-111 contractor General Dynamics because of its experience in crew capsule design for such programs as Projects Mercury and Gemini.

Emergency landing of the capsule is very much like that of the space-going versions. A parachute is shot out of the top of the capsule after a rocket motor has blasted the capsule clear of the plane.

A group of inflatable "balloons" beneath the capsule enable it to land "softly" on either land or water.

The capsule is designed to stay right side up as it hangs from the parachute, but it will also automatically right itself if it should somehow land upside down in the water.

The capsule is similar to the Russian "Sunrise," in that it provides a "shirtsleeve environment," requiring no pressure suits even at maximum altitudes above 60,000 feet. The crew of the F-111 will wear no oxygen masks, pressure suits or parachutes.

Unfortunately, the many spectators and officials at the first rollout of the plane at Fort Worth, Texas, Oct 15 were not able to see the capsule. Due to its complicated design, the capsule will be in the hands of McDonnell for some months.

The capsule-less aircraft is shown on this week's front cover.

Though the space-age crew escape module is unique to the F-111, the feature by which the plane will no doubt be identified is the variable-sweep wing. The wing, adjustable in flight from an almost straight-out sweep angle of 16 degrees to a radically swept 72.5 degrees, is not a borrower from the space program, but rather a possible future benefactor of it.

The reason for the adjustable wing is that it enables high performance of the plane both at subsonic speeds and at maximums above mach 2.5.

Similar variable-wing designs have been suggested by many experts as the basis for future earth-orbital "shuttles"—vehicles that would perform well at the outermost fringes of the atmosphere, as well as throughout the descent to earth. Such vehicles have been proposed for use in tasks ranging from changing the crews of long-life space stations to performing emergency space rescue operations.

As America's (and the world's) first variable-wing airplane, the F-111 will be an invaluable proving ground for numerous applications.

Still another of the ties between the "earthbound" F-111 and the exploration of space is the navigation system. Among the F-111's numerous electronic devices is a bizarre gadget called "terrain-following radar," which could be just the thing to help Project Apollo astronauts land the Lunar Excursion Module (LEM) on the moon.

Terrain-following radar is essentially a conventional, low-level radar system, coupled to an elaborate electronic computer, which in turn is coupled to the altitude controls of the plane. It enables the pilot to fly right down at the "nap of the earth," below the level of enemy radar detection systems. If a hill or some other obstacle suddenly looms up in front of the plane, the system will automatically lift the plane over the obstacle, reacting much more quickly than the pilot ever could.

What help can this be on the moon? When the LEM and its crew are preparing to land, they will have enough fuel to travel horizontally for one quarter of a mile, looking, through actual windows, for the exact spot. On a completely unknown planet, such a terrain-following system as that of the F-111 might prevent a major catastrophe.

The F-111 is a true "idea plane," and could be responsible for benefits far beyond the scope of its own performance.

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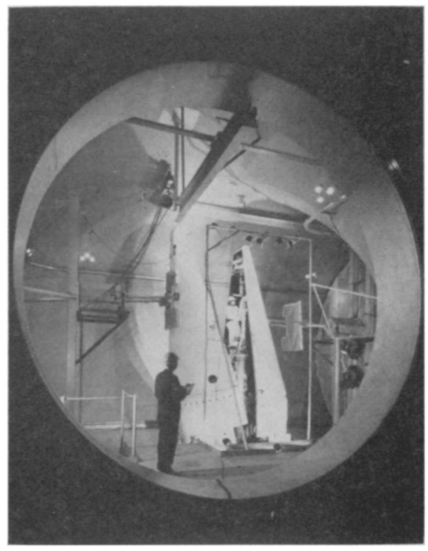

National Aeronautics and Space Administration

SIMULATED SPACE—The nose fairing for the Surveyor spacecraft expected to soft-land on the moon's surface is undergoing tests in this space environment chamber at NASA's Lewis Research Center in Cleveland, Ohio

SPACE

Map Interplanetary Field

➤ A SATELLITE IN SPACE and an observatory instrument on the ground have joined forces and "mapped" the shape and strength of the lines of force in the interplanetary magnetic field.

The satellite is the first Interplanetary Monitoring Probe, IMP-I, launched last Nov. 26. The other half of the team is the solar magnetograph at the Mount Wilson Observatory, near Pasadena, Calif.

The data from the joint experiment have indicated that the magnetic field near the earth closely "mimics" the field at the visible surface of the sun, the photosphere.

Changes in the direction of the field on the sun, detected by the Mt. Wilson magnetometer, are followed four and a half days later by similar changes in the magnetic field near the earth, which are measured by the magnetometers aboard the satellite. This indicates that the lines of force extend continuously across the 93 million miles of space between sun and earth.

The information from IMP confirms a theory called the "water-sprinkler" hypothesis which says that the lines of force emanating from the sun in the plane of the earth's orbit behave like streams of water whipping out from the whirling head of a lawn sprinkler, due to the spinning of the sun and to the flow of the "solar wind."

Dr. Norman F. Ness of the Federal space agency's Goddard Space Flight Center, Greenbelt, Md., developed the IMP-I experiment. The solar magnetograph was the combined project of Drs. Harold and Horace Babcock of Mt. Wilson, and is operated by Dr. Robert Howard of the observatory staff.

Their research has revealed that the magnetic field changes direction over a 27-day cycle, with the change near the earth following the one at the sun by four and a half days. The time delay indicates that the average velocity of the solar wind is 230 miles per second.

The rotation of the sun tends to curve the lines of force which are dragged out from the sun by the solar wind. The faster the "wind," the straighter are the lines of force. At very high speeds, the lines would extend almost straight out, like the spokes of a wheel.

The data from satellite and observatory are the latest in a series of findings showing that outer space is not space at all, but a sea of ionized gases, atomic particles, shifting magnetic fields and planetary debris.

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