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WHAT USAF PILOTS THINK OF THE F-111A

Col. Ivan H. Dethman, Commander of the "Harvest Reaper" unit now flying the first operational F-111s, and crew chief SSgt. Miguel A. Ramirez, Jr., confer on the hardstand at Nellis AFB, Nev., before pre-flight check of No. 31—first production-configuration F-111A. Says one Harvest Reaper pilot: "The guys who bad-mouth this airplane are the guys who never got in the cockpit."

Pilots who are now flying the General Dynamics/USAF F-111A are enthusiastic in support of the new weapon system and consider it the greatest single technological jump designed for their mission since the marriage of the jet engine and modern avionics. These men are surprised by lingering criticism of this aircraft and maintain that critics would quickly change their minds if they had a chance to fly production models now coming off the line . . .

F-111A
THE MEN WHO FLY IT LIKE IT

By Claude Witze

SENIOR EDITOR, AIR FORCE/SPACE DIGEST

BORN and bred in an atmosphere of unprecedented controversy, the Air Force's General Dynamics F-111A now has combat veterans in the cockpit, and they are enthusiastic about the potential of their new airplane.

These Air Force pilots consider the F-111A weapon system the greatest single technological jump designed for their mission since the wedding of the jet engine and modern avionics. The F-111A, they predict, will let them hit tactical targets harder, with greater accuracy, and at longer ranges than any other airplane in the USAF inventory or likely to join it in the foreseeable future.

It must be made clear at the outset of this report that the subject is the USAF F-111A, and that airplane alone. The first production models, configured for operational use, are now being delivered to Nellis Air Force Base, near Las Vegas, Nev. The Tactical Air Command is using them to equip the 4480th Tactical Fighter Wing. The pioneering unit is Detachment 1, 4481st Tactical Fighter Squadron, commanded by Col. Ivan H. Dethman.

Equally important, from the standpoint of operational capability, is the test work under way at the Air Proving Ground Center at Eglin AFB in Florida. Here, USAF has come to realize that the F-111A is a vehicle incorporating advances in the state of the art that have outpaced the technology incorporated in the available weaponry it can carry.

Maj. Gen. Andrew J. Kinney, APGC Commander, speculates that improved bombs, equipped with terminal-guidance systems, may turn out to be the most important addition to airpower capability since World War II. As this issue goes to press, Defense Secretary Robert McNamara has made the first public disclosure of the fact that Walleye, a bomb that carries a TV camera to seek out its target, is being used in Vietnam. Earlier this year, veterans back from Southeast Asia were complaining loudly that they had seen no improvement in the technique of delivering iron bombs. Walleye, developed by the Navy, is now also being used by USAF. It is made by the Martin Marietta Corp.

Walleye, of course, has limitations imposed by night, bad weather, and other hindrances to visibility because of its TV "eye." So APGC is working hard on other more advanced projects, all of them highly classified. The urgency of these projects clearly has been compounded by the F-111A. Back at Nellis AFB, where the users are aiming for operational capability by early 1968, you can talk to pilots who say, first, that the new airplane is more accurate than the bombs it drops. Even before production airplanes started to arrive, they found the F-111A delivery of plain old-fashioned iron bombs to be twice as accurate as that of its predecessors, the F-105 and F-4.

Even this is not good enough, says General Kinney, nor as good as we can do. Further accuracy must be achieved and made operational as fast as possible. The point, of course, is that the avionics subsystems in the F-111A—both navigation and attack systems—can work together to position the plane in the air with un-

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F-111A on early cross-country flight from Fort Worth, Tex., to Edwards AFB, Calif. With wings straight out, pilot gets maximum lift for takeoff and landing on short runways.

As speed increases and lift turns to drag, span and surface areas are reduced by sweeping the wings 72.5 degrees until tips rest close to the tail for supersonic dash capability.

precedented accuracy. The pilot knows exactly where he is when the bomb is released. He still does not know exactly where the bomb will hit. Basically, that is why we have lost up to sixteen aircraft, flying 160 sorties to demolish one bridge in Vietnam. The cost/effectiveness of the improved F-111A system, with an aircraft that can position itself automatically in any kind of weather or visibility, if it can drop a bomb that can be steered to the target, is obvious.

The pilots at Nellis display no doubt that the F-111A will achieve this capability. At Nellis, as well as Eglin, Edwards AFB, the Aeronautical Systems Division at Wright-Patterson AFB in Dayton, and Air Force Systems Command Headquarters, Andrews AFB, Md., there is one common observation. It is put most succinctly by Brig. Gen. Ralph G. Taylor, Jr., Commander of the Tactical Fighter Weapons Center at Nellis:

"Nobody is qualified to pass judgment on the F-111A until he has flown it. I wish the critics who have not flown it would come out here and talk to our pilots."

One of his pilots, interviewed on the flight line, agreed with the boss in the kind of language you hear around a hangar:

"The guys who bad-mouth this airplane," he said, "are the guys who never got in the cockpit."

Nellis is where USAF makes Ph.D.s out of fighter pilots. The current F-111A program, called Harvest Reaper, is manned by veterans of the Korean and Vietnam Wars, men who have faced flak and Soviet MIGs in F-105s, F-4s, F-86s, F-104s, and F-84s. Harvest Reaper is the Accelerated Testing and Training Program for the F-111A, launched last July when the first of five aircraft, built for research, development, test, and evaluation (RDT&E), was shifted to the Nevada base from Edwards AFB in California.

By September, the new wing had set an unprecedented record. During that month, the five planes flew a total of 304.1 hours, an average utilization rate of 60.8 hours per aircraft. In October, the month in which the first production model was delivered and added to the Harvest Reaper stable, the rate hardly wavered. It was 59.7 hours per aircraft. The stated requirement for the F-111A is thirty hours per aircraft. The best previous records set at Nellis on other aircraft have been in the area of thirty-eight hours a month per aircraft. This has been with systems far less complex than those of the F-111A.

Colonel Dethman emphasizes that the five airplanes are all different, that they are not production models, and that they offer a type of disparity, both as to maintenance and the flight envelope, that his wing will not face when it has production aircraft. Airplane No. 31 (*see cover*), flown into Nellis on October 16 by Colonel Dethman, was the first F-111A to be delivered fully configured for operational use.

The thirty-first F-111A and following aircraft now being delivered to Nellis incorporate two improved Pratt & Whitney TF30-P3 engines, modified engine air inlets, an attack radar, and other changes not included on all of the test aircraft.

These are changes that both air and ground crews await with a new kind of impatience. Of the features already aboard, in the preproduction models flown by Harvest Reaper pilots, the men are most enthusiastic about the avionics. The radar and navigation systems, all agree, are the best they have ever seen.

It is not difficult to find pilots at Nellis who entered the F-111A program with a high degree of skepticism. And it is not entirely gone. A typical major, an F-105 veteran of Vietnam who has shot down a MIG, says that so far he has been learning what he can do with a new and different kind of weapon system.

"It is not possible," he says, "to compare the F-111A with other planes I have flown—the F-105, RF-101, F-86, or F-84. This thing is entirely new and different, and I know there is no single answer to all our problems. The F-111A is easy to fly, but there have been some deficiencies in the RDT&E planes we have been using. But I expect they will be licked, for the most part, when we all have production models."

This man is struggling to get used to the side-by-side seating arrangement. The avionics systems are monitored, for the most part, by the man on the right. The pilot simply can't see out that side of the cockpit from his seat on the left. The veteran, of course, has been able to look right or left and over his shoulder on each side and past the tail. He does have a detector in the tail that can tell him when he is being followed, but it does not identify what it is that is coming up behind. This can be disquieting to a combat veteran who is used to single or tandem seating. The F-111A provides four eyes to look straight ahead, which has its advantages, and the electronic systems provide new low-level capability for day or night missions.

A recent illustration was provided by Colonel Dethman when he flew F-111A No. 31 from the General Dynamics plant at Fort Worth, Tex., to Nellis. It was an automatic flight, less than 1,000 feet above the ground for 1,047 miles. Colonel Dethman used the controls only on takeoff and landing.

The terrain-following radar (TFR) makes the F-111A capable of day or night low-altitude penetration at subsonic or supersonic speeds. It does not have to be automatic, but can be set for manual operation, which might be necessary to evade enemy defenses, particularly where they are as heavy and diverse as they are in North Vietnam. A safety feature is that the system continuously checks its own operation. If there is a malfunction, the aircraft goes to a higher altitude. The radar is the AN/APQ-110 made by Texas Instruments and is used in partnership with the flight control system made by General Electric.

One pilot, interviewed at Nellis, had drawn up his own list of what he considered good, fair, and poor about the F-111A. His opinion is based on close to 100 hours in the preproduction (RDT&E) models.

Under *good*, this veteran lists range, endurance,

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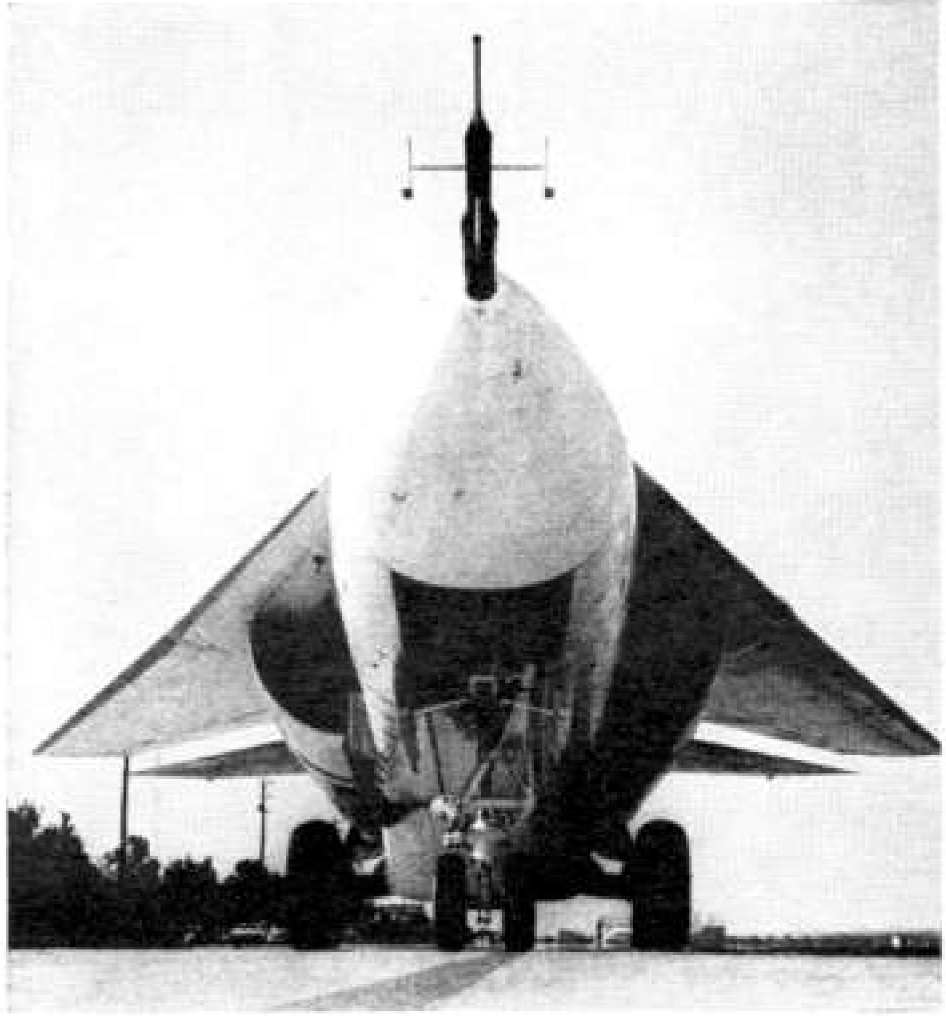
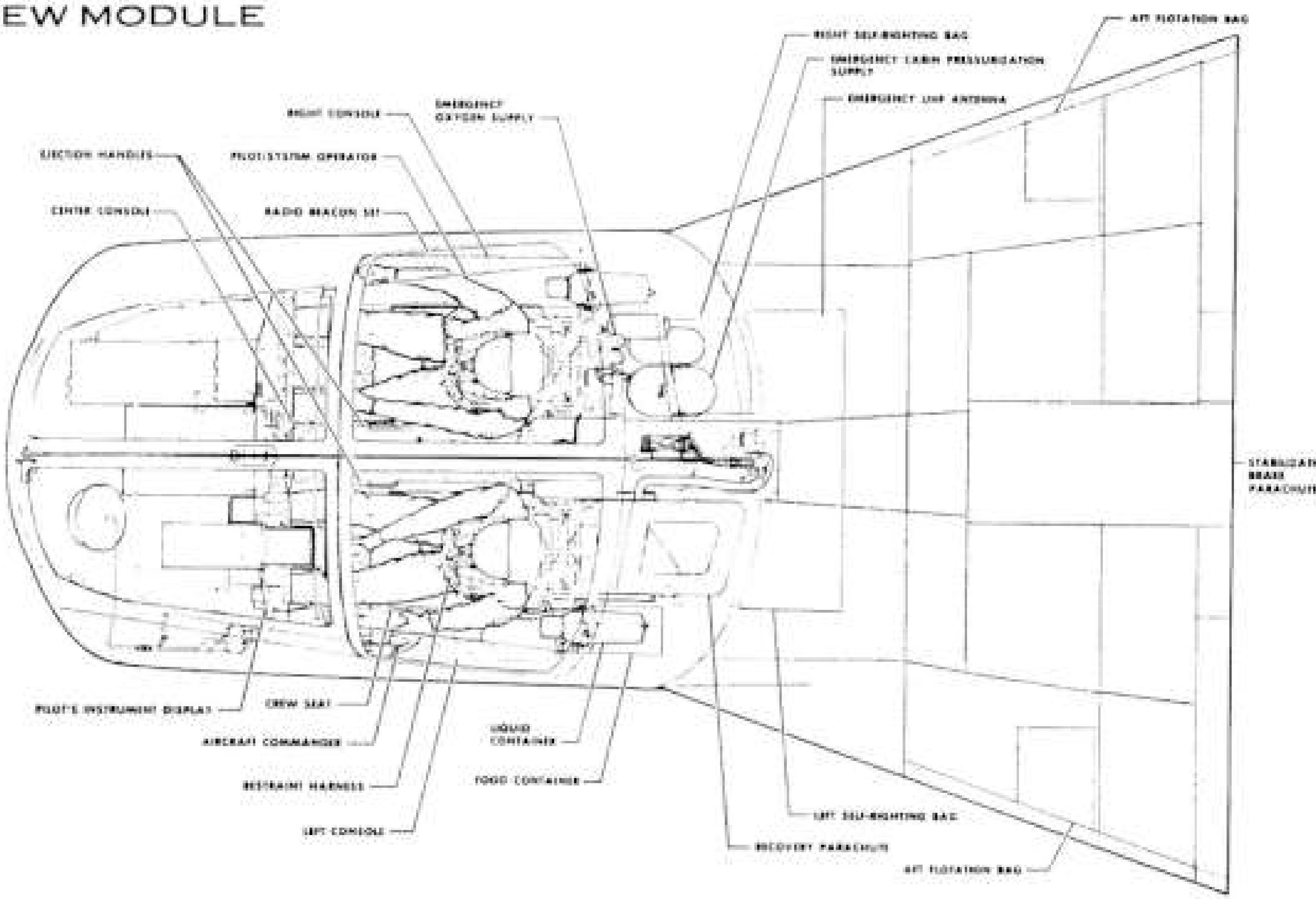
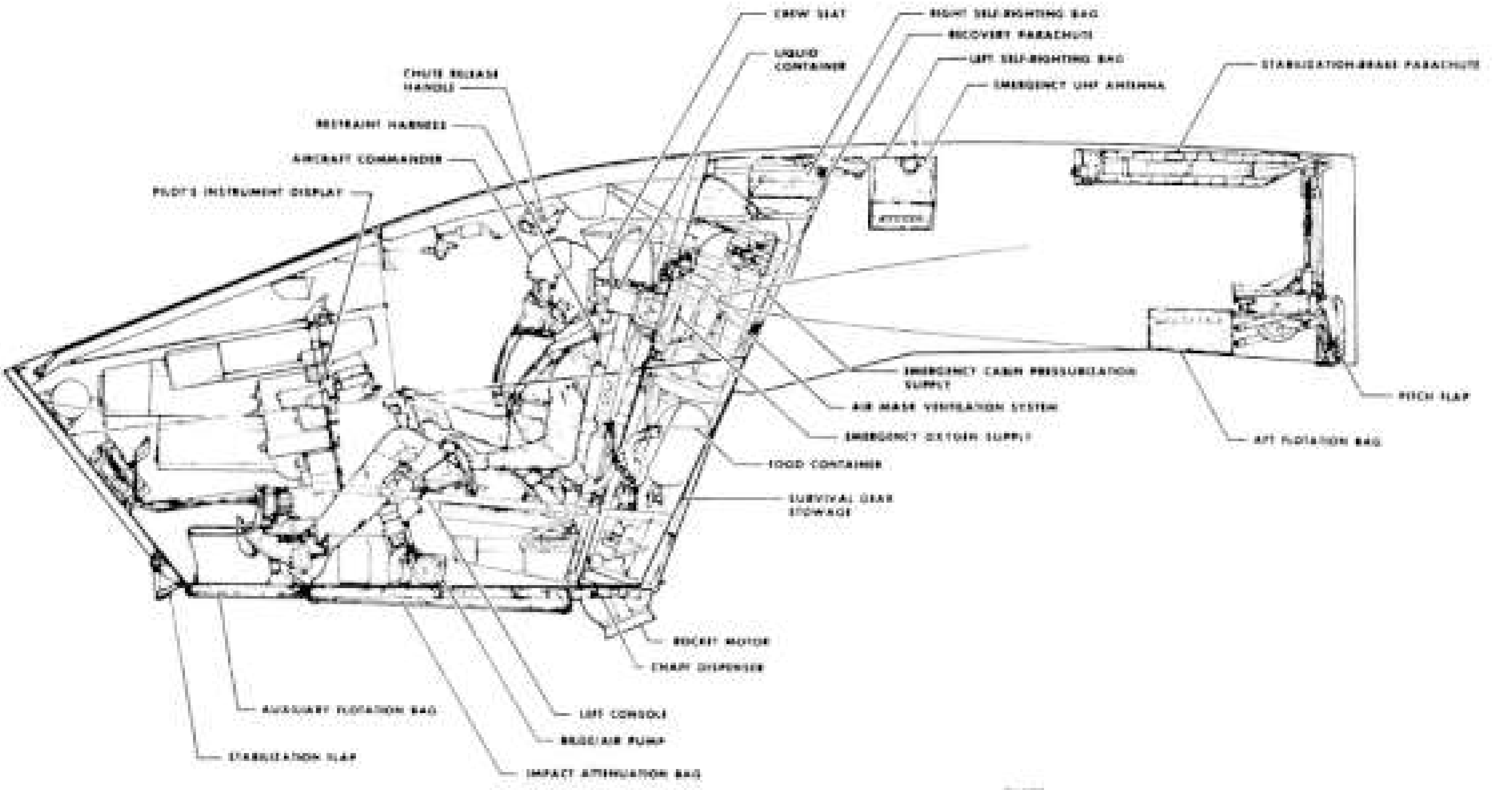


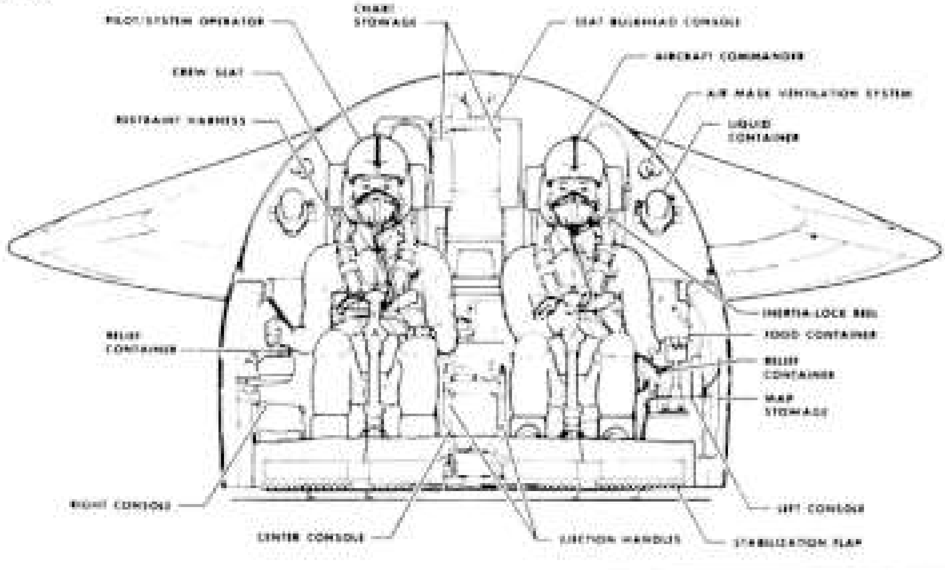
Head-on shot gives idea of F-111A's size. The tail stands 17 feet above ground. The aircraft is 73 feet, 6 inches long. Wingspan can vary from 31 feet, 11 inches to 63 feet.

USAF pilots find no major difficulty in transition over to the new F-111A. Abundance of automatic features turns much of the usual flying chore into a push-button activity. Most men find they need diligent practice to learn how to correctly read attack radar. Once target is spotted on this screen, navigation system takes over for countdown and bomb release.

CREW MODULE





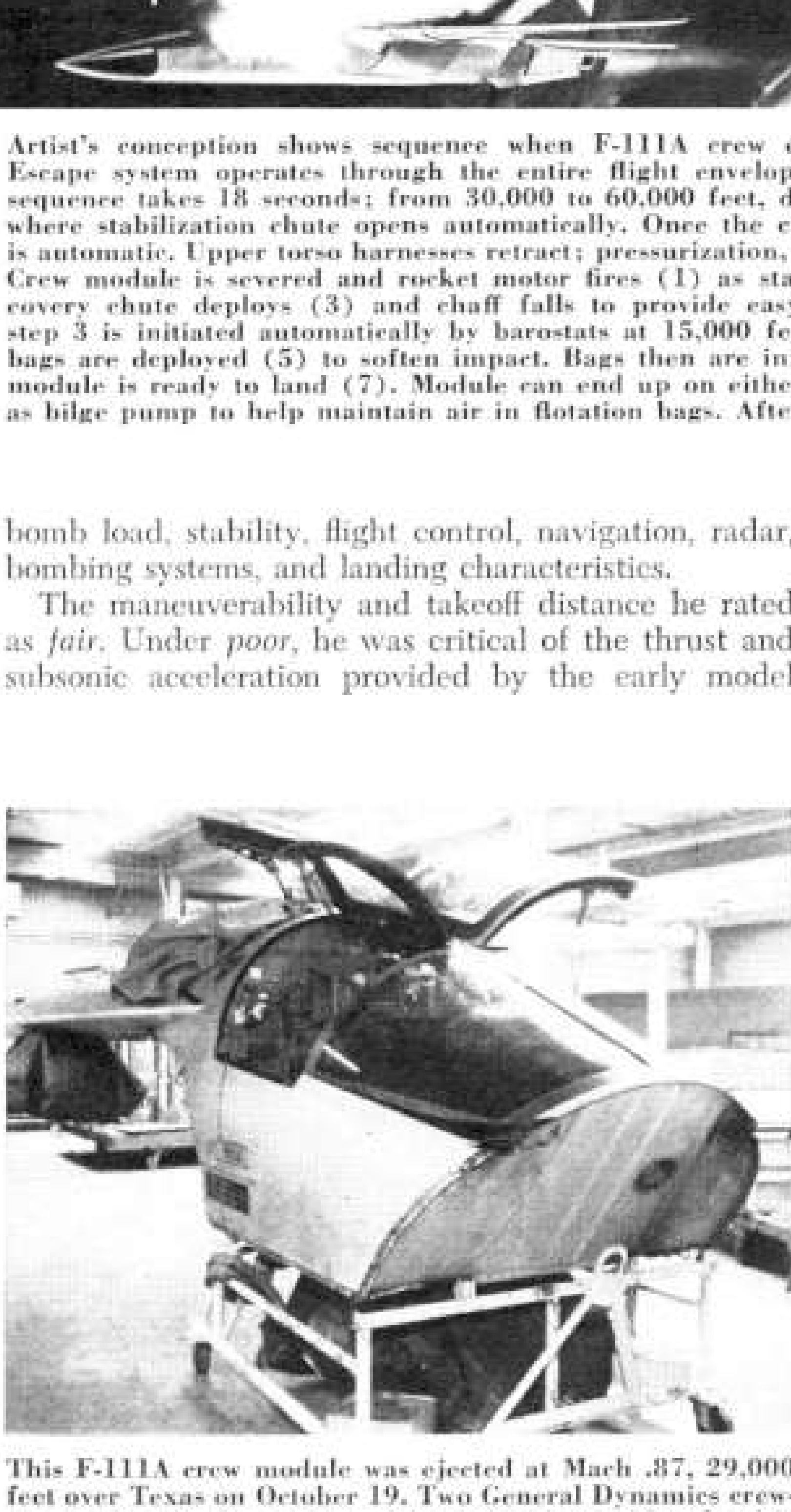


Charts show ingenious stowage of gear and apparatus to make two men comfortable and able to survive in F-111A crew module. An integrated part of the forward fuselage, the module is a pressurized emergency escape vehicle. It can be used at any time, right down to zero speed and altitude, over land or water. The men carry out their mission in a "shirtsleeve" environment. There are upper and lower harnesses but no requirement for personal parachutes or survival gear, the usual cockpit encumbrances. If the crew is forced to abandon the aircraft, an explosive cutting cord shears the module from the fuselage, along with a portion of the wing, which serves as a stabilizer for the module in its flight. A rocket ejects it upward, and the module descends by parachute. Flotation bags would keep the module afloat at sea.

Artist's conception shows sequence when F-111A crew ejects in escape module, which is made by McDonnell Douglas. Escape system operates through the entire flight envelope, even when F-111A is on the runway. From ground level, the sequence takes 18 seconds; from 30,000 to 60,000 feet, duration is about ten minutes because of free fall to 15,000 feet, where stabilization chute opens automatically. Once the crew pulls either of two ejection handles, the rest of the sequence is automatic. Upper torso harnesses retract; pressurization, emergency oxygen, and chaff dispenser mechanisms are actuated. Crew module is severed and rocket motor fires (1) as stabilization chute deploys. As rocket motor burns out (2) the recovery chute deploys (3) and chaff falls to provide easy target for rescue radar. When the ejection is at high altitude, step 3 is initiated automatically by barostats at 15,000 feet, after free fall. The recovery chute lines stretch out (4) and bags are deployed (5) to soften impact. Bags then are inflated as the recovery chute blossoms overhead (6) and the crew module is ready to land (7). Module can end up on either land or water. If water landing is made, control stick functions as bilge pump to help maintain air in flotation bags. After landing, module serves as shelter with full kit of survival aids.

bomb load, stability, flight control, navigation, radar, bombing systems, and landing characteristics.

The maneuverability and takeoff distance he rated as *fair*. Under *poor*, he was critical of the thrust and subsonic acceleration provided by the early model engine, the air-to-air radar capability, and the manual operation of the scope camera.



This F-111A crew module was ejected at Mach .87, 29,000 feet over Texas on October 19. Two General Dynamics crewmen rode to safety in it and landed unhurt. After leaving capsule, one cut his finger on nearby barbed-wire fence.

This brings up the whole subject of the Pratt & Whitney engines, their role in the development problems, and the various versions of the engine. The first five aircraft at Nellis, RDT&E models, are powered by the TF30-P1. The production airplanes have the TF30-P3, with modified air inlets.

Maj. Gen. John L. Zoeckler, Deputy Chief of Staff for Systems at AFSC and former director of the F-111 program, is first to admit that the most serious deficiency at the outset was the matching of the airplane and the engine. There were compressor stalls, especially at high speeds and altitudes. He is confident this has been corrected and that the TF30's combination of turbofan and afterburner will guarantee low fuel consumption for long-range subsonic flight. The feature was demonstrated when an early F-111A was flown nonstop to the Paris Air Show last June.

The unusual thing about the F-111A afterburner is that the pilot is not restricted to using it for a "kick-in-the-pants" approach to higher speed levels. For the first time, he can use more than "power-on" and "power-off" settings for the afterburner. He can take advantage of a smooth range of thrust augmentation, going through five zones of afterburner application.

The experience at Eglin AFB and Edwards AFB also shows that the graduated afterburner contributes

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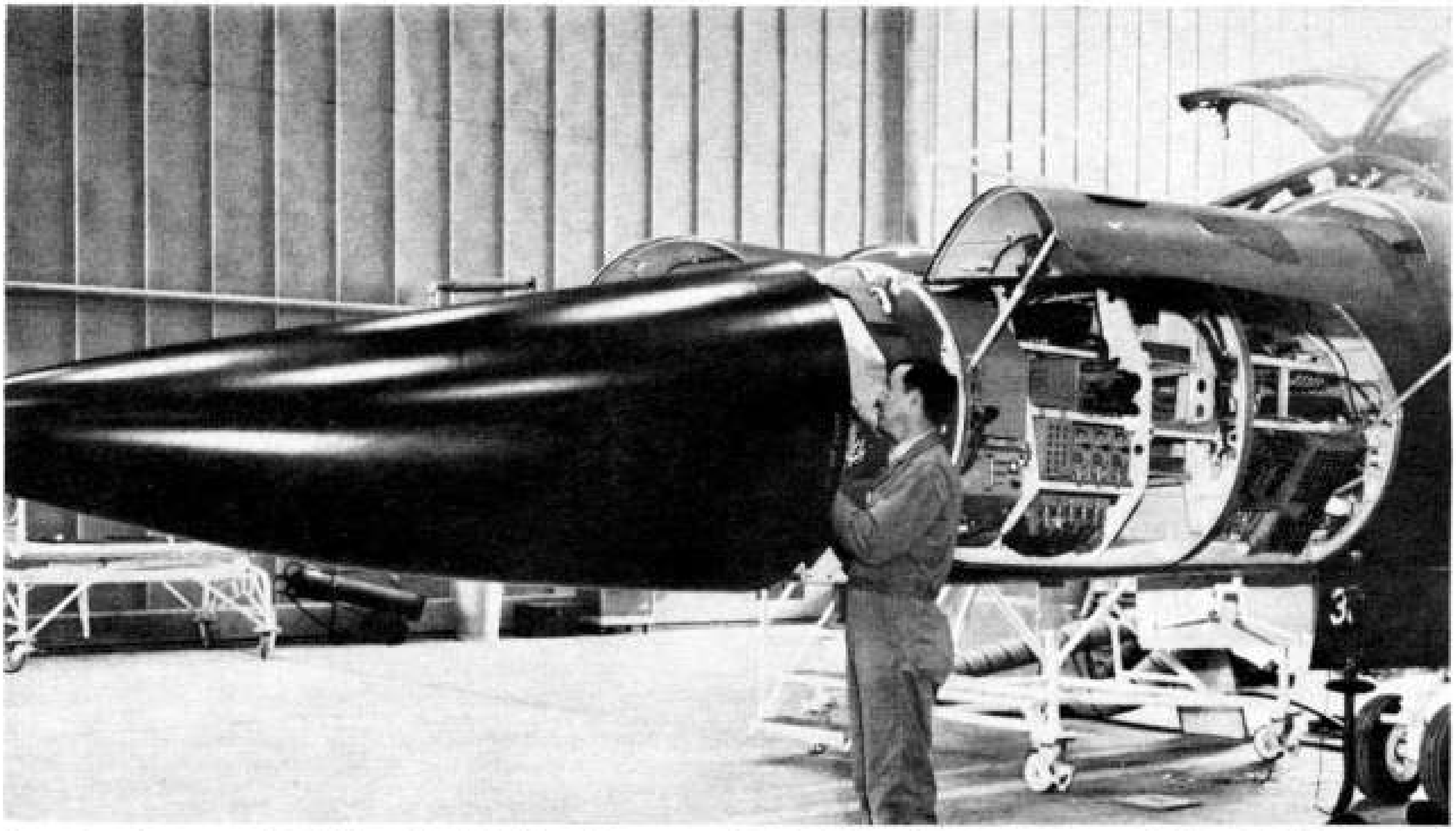
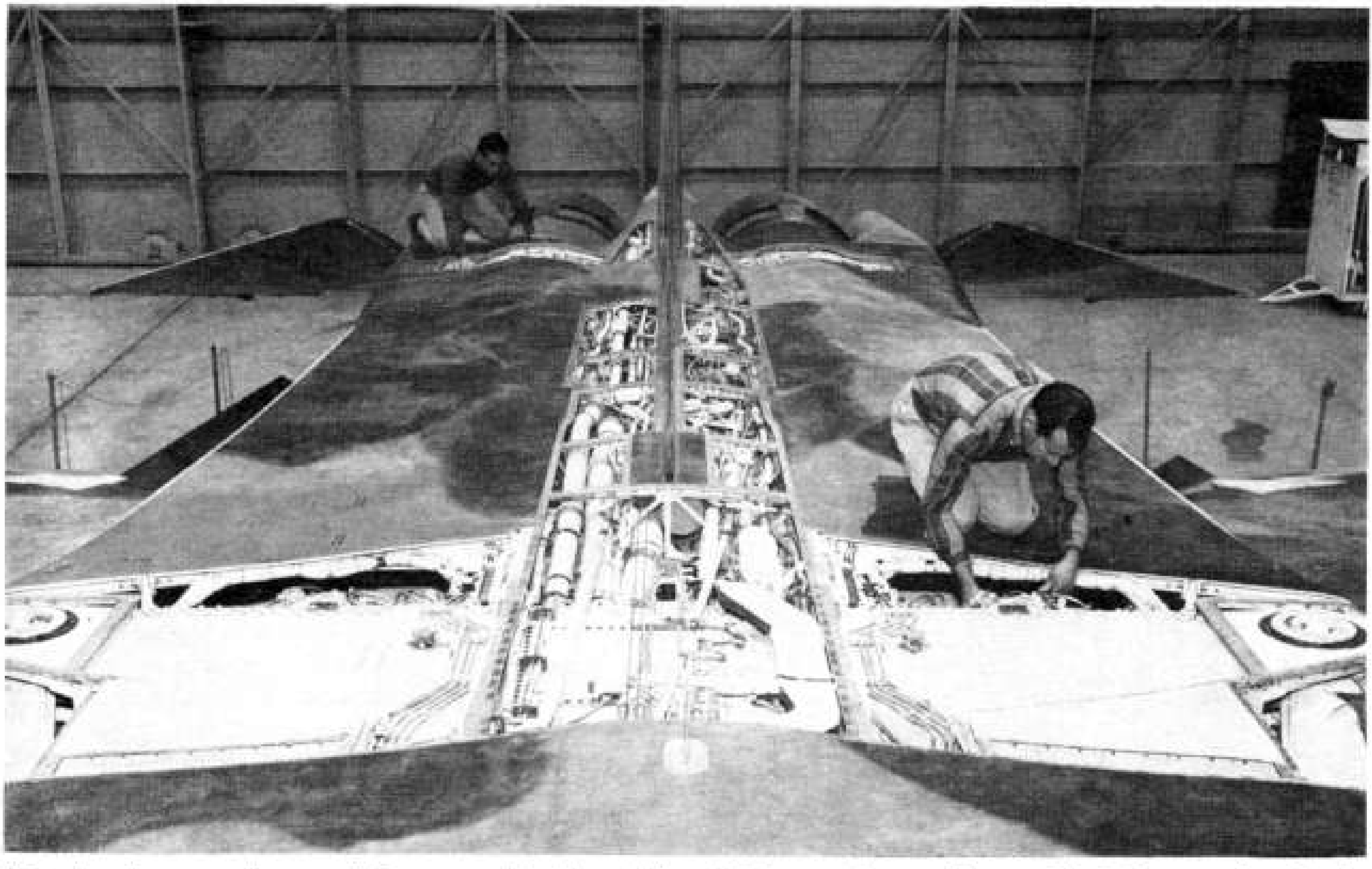


Ease of maintenance is built into the F-111A, and it gets credit for high utilization rate set at Nellis AFB. Here radome is partially open as well as forward equipment bay for electronic gear. Note readily available electrical power connection.



This view shows panels removed from top of fuselage while technicians work on easily accessible flight controls and other equipment. Maintenance and reliability standards for the F-111A are the strictest ever laid down by USAF for industry.

F-111A engine-access panels here are removed. Both engines are identical and interchangeable, left and right. Lines and accessories can be reached with the package installed. Another feature is that engines can be started if necessary at remote fields with their own self-contained cartridge charges, ending requirement for ground power cart.

to fuel economy, when that is important to a mission.

General Kinney, at Eglin, has his own list of major advantages he sees in the F-111A. On one of his first flights, with a contractor pilot, he was instructed to set the TFR dial for fifty feet and let the plane go to that altitude and skim the ground. At the moment he got the instruction he was at 20,000 feet. General Kinney says it was difficult to resist grabbing the stick as the aircraft started to go down fast, seeking the fifty-foot level. He managed to leave it alone, and the F-111A leveled out at fifty feet and continued the mission, automatically. The General says he was convinced that the plane is safer and puts the pilot in a better position to do his job, visually or blind, than any other aircraft he has seen.

The F-111A can operate from short runways. It needs 1,500 to 3,000 feet to land. With a heavy load it can take off in less than 5,000, usually about 3,500 feet. The landing speed is in the range of 125 to 130 miles an hour, with no drag chute employed. Outside of what it contributes to safety, this feature increases the flexibility of the F-111A by permitting it to operate out of available airports in more undeveloped countries. It is attributable, of course, to the variable-sweep wing, which lets the pilot redesign the airplane in flight for a range of speeds from slow to supersonic.

The aspect ratio of the F-111A wing, a characteristic that is important in achieving long range, is on the order of 6.9 with the wing at cruise position. Aspect ratio of a 727 airliner is 7.1, and that of the military F-4 fighter is 2.82.

Those who have never flown the airplane have been free with criticism of the F-111A. For this report, the men who have flown it were asked to assess some typical fault-finding. Here is a résumé of their answers, compiled from sources at five USAF commands:

• *The first thirty F-111As have performed so poorly they will never be fit for active service.* The first thirty never were intended for active service. They are for RDT&E. No two are entirely alike. Hundreds of changes were made before No. 31, the first production aircraft, was built, and more changes will come. The deficiency lists on the early aircraft are no longer than and no different from the same lists for other aircraft now in the fighting inventory. This is routine in the development of new weapon systems. If it were not true, it would be an indication that the aircraft would be obsolescent before it was operational.

• *The thirty-first F-111A still falls short of several requirements.* Correct, if you substitute *specifications* for requirements. With the changes that were incorporated in the design, weaponry, and subsystems, some original performance specifications had to be revised. The substitution of iron bombs, hanging on pylons under the wings, for internally carried nuclear weaponry, is an example. This has increased the versatility of the F-111A and thus its effectiveness. The airplane also falls short in low-level dash range, but still is acceptable to the using commands and will carry out its mission. It is not unusual for the user to ask, initially, for more than he can get. But it is a good way to make

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progress, and the F-111A still has a supersonic dash capability superior to that of any other aircraft in the world today.

• *USAF specified a 40,000-foot ceiling. No. 31 will not be able to operate above 30,000 feet with a bomb load.* USAF specified much more than 40,000 feet, but not with a bomb load. There was no requirement fixed for a ceiling with externally mounted iron bombs. The F-111A can carry up to forty-eight of them hanging on four pylons under each wing. Work is under way at Eglin AFB to provide bombs with guidance and better aerodynamic properties.

• *Because of buffeting, the size of the speed brakes was reduced until they are largely ineffective.* The speed brakes are effective. The buffeting is undesirable but not uncontrollable. This is not a major problem. From a practical viewpoint, the variable-sweep wing is the best speed brake on the airplane.

• *Takeoff weight of the F-111A has increased from 69,000 pounds to nearly 90,000 pounds.* This is true when the aircraft is fully loaded with iron bombs. The 69,000-pound figure was for a load of one nuclear bomb and two GAR-8 rockets. The aircraft can take off weighing up to 98,000 pounds. USAF now wants tires qualified to support a weight of 100,000 pounds.

• *The ferry range is 800 miles less than USAF required.* Wrong. The F-111A can remain on patrol hours longer than any other fighter. The flight to the Paris Air Show was 2,900 miles. On arrival, there were two hours of fuel remaining.

• *There are engine troubles still unfixed.* The TF30-P3 will resolve afterburner problems encountered in the RDT&E aircraft, as well as thrust deficiencies. There is confidence that most basic development problems in the engine have been solved.

Anyone who seeks out the men most familiar with the F-111A will come up with scores of observations and related experiences that they use to express their high hopes for the new system. Here are some examples:

• A General Dynamics pilot, at Eglin, had a malfunction in his bomb-release mechanism, after releasing one bomb. If he dumped the remainder in the Gulf of Mexico, he might lose all clues about the malfunction. He elected to land with nineteen 750-pound bombs under his wings. The plane stopped in less than 5,000 feet of runway. The bombs were loaded with cement.

• The TFR equipment astounds the veterans. For the first time, pilots have had the experience, flying automatically at 200 feet, of passing *beneath* the level of a TACAN station.

• Every pilot in the program knows that the F-111A was not intended to perform up to specifications, or meet requirements, until aircraft No. 31 was delivered in October. They feel that criticism before this date was premature and that the aircraft follows the pattern set for all earlier weapon systems. In many cases, the first test results were identical with those experienced on other aircraft. Specifications were much higher than requirements; that also is normal.

• The airplane, in its test program, has set an extraordinary record for safety. Far fewer aircraft have been lost than USAF experienced in previous similar programs (*see accompanying table*).

The high utilization rate of the first five aircraft at Nellis is attributed almost entirely to the maintenance and reliability features of the F-111A. General Dynamics officials point out that their contract is the first one to include "specific quantitative maintainability requirements." This means that reliability and ease of maintenance had to be designed into the aircraft. Ninety-five percent of the components that need service are at eye level when the mechanics remove the fuselage plates.

Reliance on ground-support equipment (GSE) is reduced by self-testers built into the aircraft's subsystems. In contracting for these subsystems, General Dynamics has passed the basic USAF requirement along to the subcontractors. The reliability and ease of maintenance was not easily achieved. No supplier met the demand on the first design effort. As a rule, it took three exercises, back at the drawing board, to satisfy the prime contractor that the results would suit the customer.

Another factor, according to General Dynamics, was that, in this case, full funding was provided for the ground-support equipment early in the program. This is not always so and in the past has resulted in the delivery of new weapon systems that could not be properly maintained until all GSE was available.

So far as the self-test equipment is concerned, some of it can be operated directly from the cockpit, giving the aircraft commander and pilot an instant check. The remainder is available through test stations, manually operated after fuselage panels have been removed. The built-in test circuits make it possible for a technician to locate a malfunction quickly. Then, a line replaceable unit (LRU) can be pulled and replaced. The LRUs are sent to the avionics shop for repair.

HOW THE F-111'S SAFETY RECORD STACKS UP

Major Accidents During First 5,000 Flying Hours of Test Program

F-111*	
A	2
B	1
F-100 Supersabre	7
F-101 Voodoo	11
F-102 Delta Dagger	9
F-104 Starfighter	14
F-105 Thunderchief	8
F-106 Delta Dart	7
F-4 Phantom II	6

* Two of the three major accidents in the F-111's first 5,000 hours are blamed on procedures rather than on aircraft deficiencies.

Chart shows graphically that new aircraft's record for safety in its first 5,000 hours of test flying has been exceptionally good. Well over twenty percent of all F-111 flights were at supersonic speeds, many at Mach 2.0 or above.

THE F-111 INDUSTRY TEAM

Prime Contractor

General Dynamics Corp.
Fort Worth Div.
Fort Worth, Tex.

Associate Contractor

Hughes Aircraft Co.
Culver City, Calif.
Phoenix missile system

Associate Contractor

United Aircraft Corp.
Pratt & Whitney Aircraft Div.
East Hartford, Conn.
Engines

Subcontractor: Principal and Associate

Grumman Aircraft Engineering Corp.
Bethpage, N. Y.
Aft fuselage sections and F-111B assembly

Subcontractors: Major Subsystems

AVCO Corp.
Electronics Div.
Cincinnati, Ohio
Countermeasures receiving systems

The Bendix Corp.
Electrodynamics Div.
North Hollywood, Calif.
Servo actuator for horizontal tail, rudder, and spoilers
Navigation and Control Div.
Teterboro, N. J.
Air data computer

Collins Radio Co.
Cedar Rapids Div.
Cedar Rapids, Iowa
Antenna coupler

The Garrett Corp.
AiResearch Manufacturing Co.
Los Angeles, Calif.
Air-conditioning system, engine starter (pneumatic)

General Precision, Inc.
Link Group
Binghamton, N. Y.
Mission simulator
GPL Div.
Pleasantville, N. Y.
Doppler radar

General Electric Co.
Defense Electronics Div.
Aerospace Electronics Dept.
Utica N. Y.
Attack radar
Defense Electronics Div.
Avionics Controls Dept.
Johnson City, N. Y.
Flight control, lead computing optical sight set, and the optical display sight set
Missile and Space Div.
Armament Dept.
Burlington, Vt.
Ammunition handling system

Honeywell, Inc.
Aeronautical Div.
Minneapolis Minn.
Low-altitude radar altimeter

Litton Industries, Inc.
Guidance and Controls Systems Div.
Woodland Hills, Calif.
Navigation and attack system, astrocompass

McDonnell Douglas Corp.
St. Louis, Mo.
Crew module and escape system

Motorola, Inc.
Aerospace Center
Scottsdale, Ariz.
X-Band transponder

North American Aviation, Inc.
Autonetics Div.
Anaheim, Calif.
Mark II and Mark IIB avionics

Sanders Associates, Inc.
Nashua, N. H.
ECM group

Sundstrand Corp.
Sundstrand Aviation Div.
Rockford, Ill.
Constant speed drive engine starter (cartridge), emergency power unit

Texas Instruments, Inc.
Apparatus Div.
Dallas, Tex.
Terrain-following radar

Textron, Inc.
Dalmo Victor Co.
Belmont, Calif.
Radar homing and warning

United Aircraft Corp.
Hamilton Standard Div.
Windsor Locks, Conn.
Air inlet and cabin pressure equipment

Westinghouse Electric Corp.
Aerospace Electrical Div.
Lima, Ohio
AC power system

All of this makes the location of trouble swift and easy and cuts ground time on the airplane.

Because the F-111A program is so young and most of the aircraft are RDT&E models, there are no sound figures available at Nellis on the maintenance man-hours per flight-hour. The design requirement is for not more than thirty-five hours of ground work for each hour in the air, and the high utilization record set at Nellis indicates it will be easily met. In one test run, the figure was down to 12.6 hours, but this was not considered definitive. The September utilization record of 60.8 hours per aircraft, set at Nellis, is at least twice as good as the requirement, which was set in the contract at thirty flight-hours per month per aircraft.

There has been no attempt in this report to examine other versions of the F-111, programmed for the US Navy, Australia, Great Britain, or the Strategic Air Command. USAF is not concerned at this point with the inferno that surrounded the selection of General Dynamics as the contractor, the virtues of the design as opposed to that offered by the Boeing Co., or the role, if any, played by politicians when the F-111 was known, in the embryo, as the TFX. Neither have we investigated the choice of materials in the aircraft, the extent of commonality, the location of engine inlets, or the degree of competence displayed in estimating costs.

All of these subjects, and others, have been involved in the brouhaha that has been raging about this aircraft for years. The men most intimate with its performance as USAF's F-111A read the newspaper and congressional comments with astonishment. A national weekly calls the airplane a "lemon." In the Senate, a Claghorn-type speech declared it "a poor strategic bomber and an even poorer tactical fighter," a statement the pilots say is at least half wrong.

So far as USAF is concerned, the pudding now is ready for eating. So far as the crew at the table is concerned, the question is out of the kitchen and away from the cook, except for seasoning. The F-111A is a weapon system in being.—END