Restoring A Veteran

Heavily damaged F-111 aircraft are being returned to service thanks to a special restoration program by General Dynamics.

By KARL D. FORTH
Associate Editor

It was a big day in the career of F-111D No. 90. The Air Force jet fighter was about to leave the General Dynamics factory for the second time.

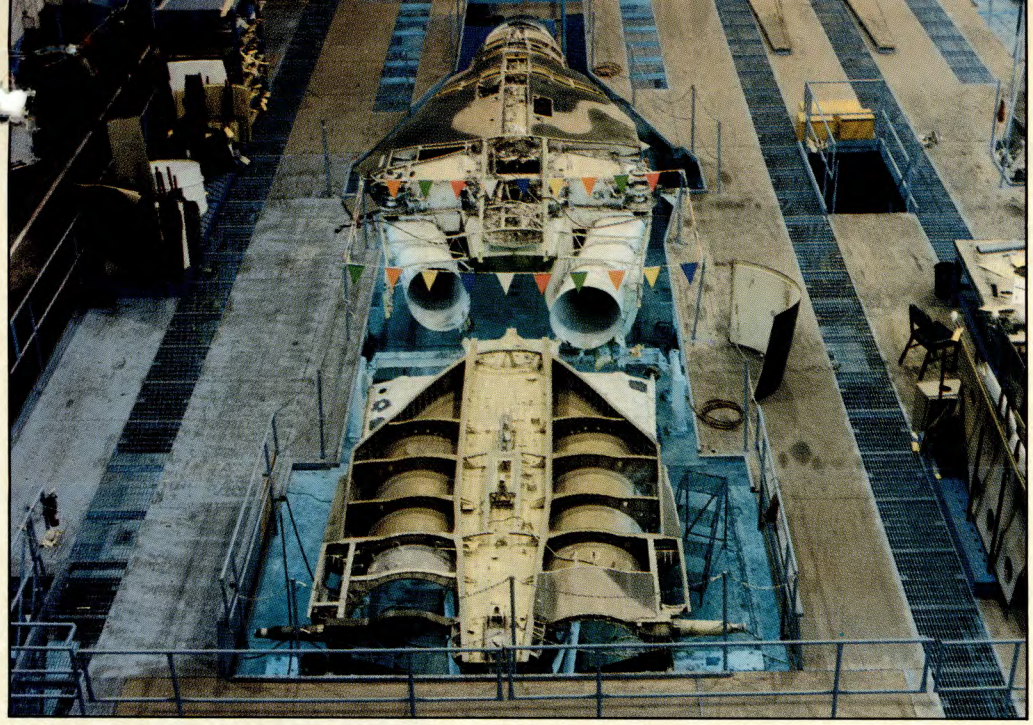
F-111D No. 90 had left the Fort Worth factory over a decade earlier as a brand new airplane. The second time it left the doors of the assembly plant as the product of an elaborate restoration program by General Dynamics, the original manufacturer of the aircraft, and the United States Air Force.

This particular F-111 suffered an engine blade failure that damaged the aircraft significantly. The failed blade ripped through the fuselage, starting a serious in-flight fire. The damage was so great that outside repair depots could not perform all of the work. The Air Force could retire the aircraft, or go back to the factory, back to Fort Worth, and use some of the original manufacturing technology and much of the tooling to rebuild the aircraft.

It was not a quick fix. The restoration of this heavily damaged aircraft took three years and cost about eight million dollars. But that's a fraction of the cost of a brand new F-111 if it were built today. And the Air Force needs these aircraft because they have a number of special capabilities that keep them in front-line service around the world (see accompanying story).

Restoration of F-111D No. 90, and 10 other F-111s, was carried out by the Fort Worth Division of General Dynamics in its mile-long assembly plant in Fort Worth, Texas. This plant has produced many other famous warplanes, dating back to the B-24 Liberator bomber of World War II. Today, the factory is primarily engaged in the production of the F-16 Fighting Falcon advanced jet fighter. With orders for more than 4,000 of these airplanes from 16 countries to date, the General Dynamics assembly line will be busy for years to come.

The F-111 restoration and modification projects share one end of the vast assembly plant. General Dynamics has space for five F-111s



The General Dynamics factory in Fort Worth has many of the production fixtures needed for complicated F-111 repairs.

Some of the damaged F-111 aircraft were in long-term storage before the restoration program was started.

here at any one time in a 100,000-square foot work area with major production fixtures, tooling and five workstands in place. During a recent visit to the plant, three aircraft were being restored and two were in for modification. (In addition to the restoration efforts, several modification and improvement programs on the F-111 are being carried out, including avionics modernization and weapons system upgrades.)

The average cost of restoration for the first 10 aircraft in the program was $4.1 million, and it took an average of 20.7 months to complete a restoration project. The cost is about one-tenth the estimated cost of a new F-111, if it were possible to build one today. That makes the program worthwhile from the Air Force's point of view, especially when the aircraft's expected service life, which extends beyond 2010, is taken into account.

Because the Fort Worth factory has many of the production fixtures, tooling, and the greatest concentration of experts on the aircraft, it is the logical place for such a complicated repair job. But repairing a heavily damaged aircraft is not the same as building a new one, even if the two jobs are performed in the same location.

"This work is not repetitive," explains Harry Stucker, F-111 deputy program director, modification and support. "The production line is disciplined and repetitive. But in restoration every job is a little bit different."

Jim Carlisle, General Dynamics' program manager, F-111 restoration, believes the program itself is unique. "We've always had mod activity and change proposals where we're modifying airplanes to new configurations," he says. "But now we're taking a production airplane and repairing damage. I don't know of any other aircraft manufacturer that has done this."

Carlisle says that it is easy to determine whether a damaged aircraft is a candidate for restoration. "It's pretty obvious right up front," he states. "We look at the basic structure to see if it is intact and usable. Most of the candidates had an in-flight problem and they managed to get the airplane back on the ground. If it was fire-related, they got the fire out."

The F-111 restoration program began in 1978 as an experiment with the repair of a single badly-damaged aircraft. This airplane, FB-111A No. 8, suffered structural and fire damage and a partially-destroyed fuselage after a landing accident two years earlier. The wreckage was stored at the Air Force's F-111 depot at McClellan Air Force Base in Sacramento, California, while the Air Force and General Dynamics looked into the possibility of restoring the aircraft to airworthy condition.

The General Dynamics Fort

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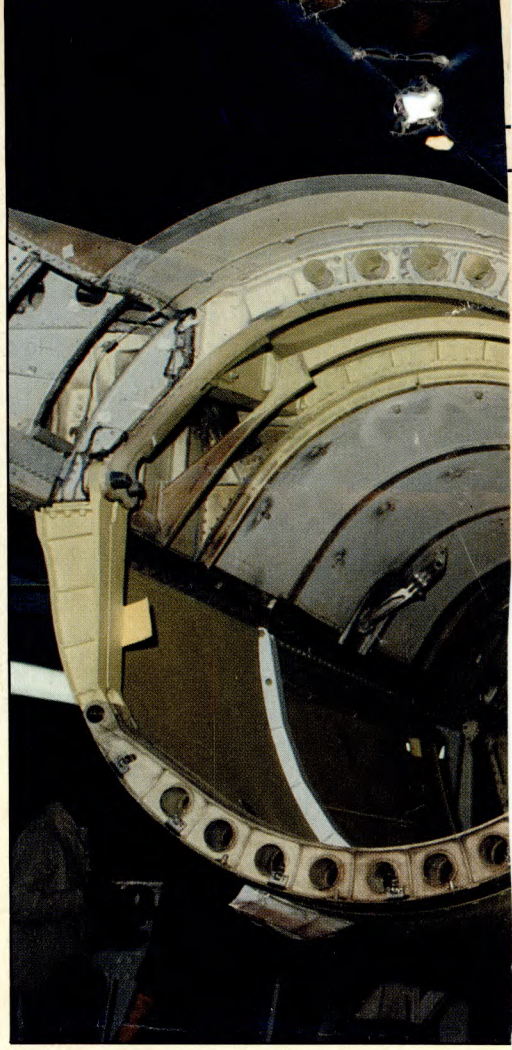


Worth Division began its restoration of FB-111A No. 8 in September 1978. Number 8's fuselage was disassembled and reconstructed with part of a test FB-111A fuselage recovered from storage at Davis-Monthan Air Force Base, Arizona, and a few parts that were manufactured specifically for the repair. Two years later, the restoration was completed and FB-111A No. 8 was returned to the Air Force at a fraction of the cost of tooling up and building a brand new airplane.

The restoration program was officially started in 1981, and 11 airplanes have been repaired and returned to service as of mid-1987. Before the program, aircraft such as FB-111A No. 8 would be used for parts salvage or placed in long-term storage at Davis-Monthan Air Force Base.

The types of damage in the aircraft that have followed No. 8 have all been a little different. For example, a high pressure bottle exploded in a parked F-111E. That caused heavy damage to the crew module aft bulkhead, crew module floor and forward fuel tank bulkhead. In another accident, a parachute from a practice bomb deployed in an FB-111A, resulting in major structural damage in the weapons bay aft bulkhead, and the main landing gear wheel well forward bulkhead. The electronic equipment and electrical harnesses were also heavily damaged. Another airplane, an F-111A, managed to make an emergency landing after an inflight wheel well fire. The fire resulted in heavy structural damage.

But no matter how severe the damage, Carlisle emphasizes that the restored aircraft are not "hangar queens." Once the restoration is complete, the airplanes are treated the same as any other front-line aircraft.

Because each restoration project is different, workers involved with the projects need to have special skills and some experience with the aircraft. Carlisle says that many of the people in the F-111 restoration program have factory-type skills in electrical, structural and hydraulic systems. Some of those in the restoration program were involved in production of the aircraft, so they are very familiar with its systems and functions. The restoration program employs 120 to 150 people. A total of 900 work in the whole F-111 department, a small part of the 24,500 employed at the General Dynamics Fort Worth Division.

Since the restoration personnel often work on a single repair project from start to finish over a period of many months, they take a great deal of interest in the individual aircraft and come out to see its first flight after the restoration is completed.

The Air Force is also very interested in the success of the program. "The Air Force has certain areas that require their inspection and approval," Carlisle explains. "As we go along in the restoration process, they come in and do their inspections and make their okays before we proceed."

Even though the program has demonstrated a cost savings when compared to building a new F-111, the Air Force still has some guidelines to follow.

"The cost was estimated on all of these programs, even though each one was a unique experiment in itself," Stucker explains. "Before the restoration starts, we make our best estimate of the total funds that are required. And so far, we've underrun every one of the jobs."

The Air Force also determines what will be repaired and replaced. "The contract indicates that we are not supposed to repair anything that will cost more than 75 percent of the cost of the new item," Carlisle says. "So we have to watch that and make sure that when we decide to repair, we stay within that guideline."

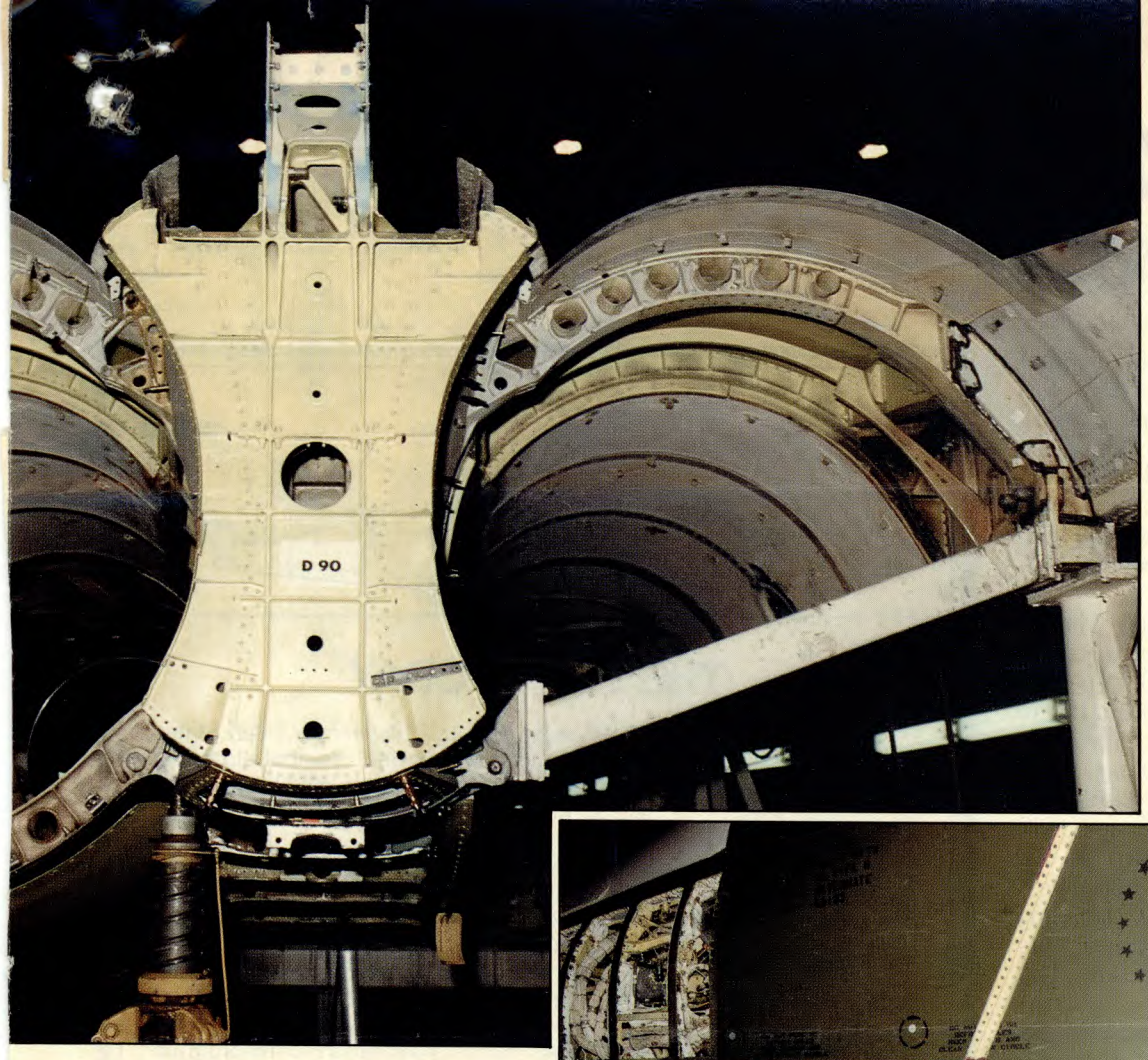
The cost of the program is also kept down because many of the parts come from Air Force inventory rather than General Dynamics parts stock. "We don't maintain parts in inventory," Stucker says. "The government depot in Sacramento is the source. They maintain a complete inventory of parts."

But the Air Force does not have all the parts necessary for a complete restoration. "In many cases we have managed to salvage key structural parts from surplus airplanes we have just for that purpose," Carlisle explains.

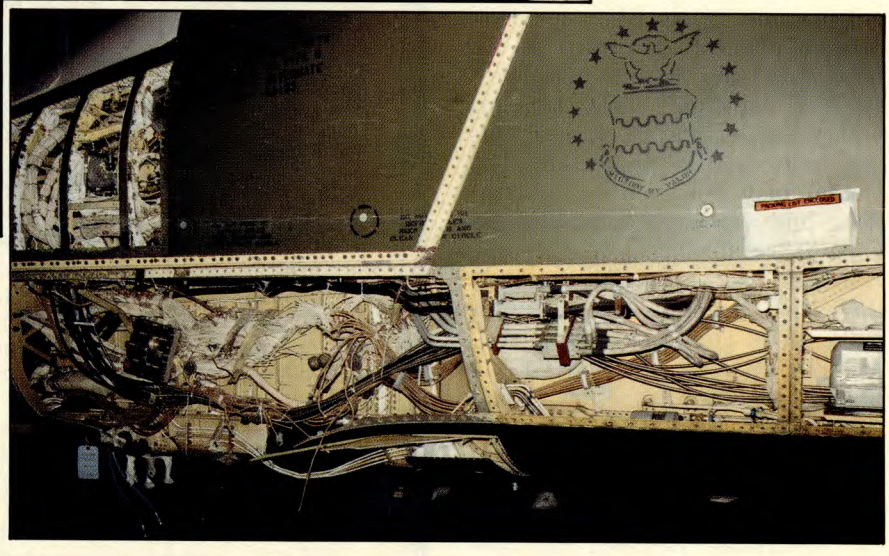
If the part needed is not available from the Air Force or any other outside source, General Dynamics will have to make a new part from scratch. Although it does not maintain the parts inventory, General Dynamics does have thousands of tools in Fort Worth that can be used to produce new parts.

"We have all sorts of different types of tooling," Carlisle says. "We have the tools for assembling the airframe and tools for making the detail parts."

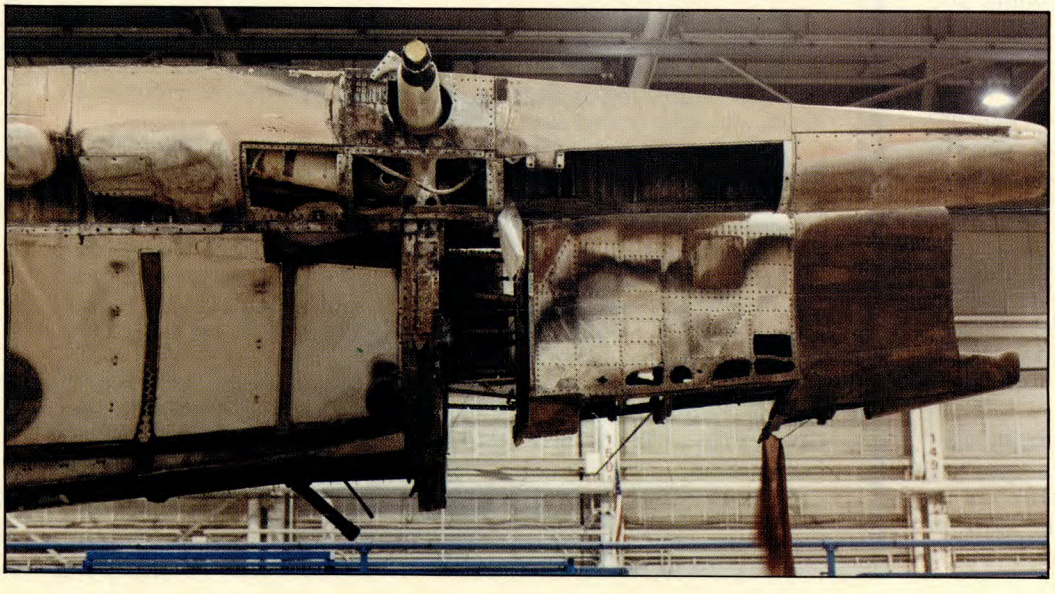
At the time the F-111 was designed, the Air Force required a



The average F-111 restoration has cost $4.1 million and taken 20.7 months to complete.



General Dynamics makes some of the parts needed for repair from scratch, using the original tooling.



Part of an F-111 fuselage showing the extent of the damage from an in-flight fire in an engine.

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very tight specification for component interchangeability that was never made on previous aircraft. "Tolerances generally aren't so tight in commercial and other aircraft," Stucker explains. "The new part fits because our original specification required that interchangeability."

General Dynamics does not attempt to redesign or change the airplanes that come through the restoration program. The goal is to make the components as similar as possible to the original items.

This identicality is occasionally not possible. "Only when we can't procure the original design do we have to look at an alternate," Carlisle explains. "That happens with fasteners, special screws, nuts and bolts used in production. The vendor may not even be in business, and we have to look at an alternate part."

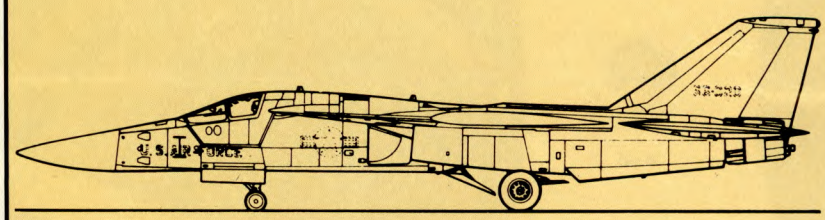
It may also be difficult to obtain the basic materials necessary to make a part identical to one manufactured 20 years ago. "The F-111 has a lot of different high-stress steel parts," Stucker explains. "It's occasionally hard to get some of those alloys."

In addition to damaged aircraft, the restoration program has also repaired damaged F-111 wings and has started production of wing boxes for the aircraft.

It's difficult to predict the future of the restoration program because accidents can't be forecast. The Air Force has gone through all of 1985 and 1986 without an accident with the airplane.

But General Dynamics is committed to what has been a successful program so far. "We're going to keep at it as long as the Air Force wants the support and needs the support," Stucker states.

With the first swing-wing combat aircraft expected to be in service beyond 2010, they could be restoring F-111s in the big barn in Fort Worth for quite a while.



THE F-111 TODAY

The General Dynamics F-111 celebrates its 20th year in United States Air Force service next month. The first "swing wing" combat aircraft is still considered front-line equipment—and it's likely to stay that way for quite a few years.

The F-111 made its first flight in December 1964. General Dynamics built 562 F-111s at its Fort Worth assembly plant before the last one was delivered in September 1976. In addition to the F-111 restoration program, General Dynamics continues to support the active aircraft with spares and modification programs.

The F-111 grew out of a Department of Defense requirement for an advanced variable-geometry wing aircraft that was to be used by both the U.S. Air Force and the U.S. Navy. General Dynamics developed what would become the F-111A for the Air Force. Grumman's F-111B program for the Navy was cancelled after a long period of trials in the mid-1960s.

The first F-111A was delivered to the Air Force in October 1967, and saw action in Vietnam the following year. After some early losses, modifications and improvements were made and the F-111 now has one of the best safety records of Air Force combat aircraft.

The F-111E and -D followed the -A model. These aircraft had modified engine air inlets, improved avionics and higher engine thrust. The F-111F was the ultimate tactical version of the aircraft, with still higher thrust engines and guided weapon capability.

A strategic bomber version, the FB-111A, was built from 1968 to 1971 with extended wing tips and strengthened landing gear to carry bombs or short range attack missiles for the Strategic Air Command.

Forty-two F-111A airplanes were modified by Grumman to EF-111A standards. These electronic warfare aircraft are equipped with jamming equipment in the fin cap fairing and in a radome under the fuselage. This electronic equipment is designed to neutralize enemy radar during an attack with other armed aircraft.

The Royal Australian Air Force is the only foreign operator of the aircraft, designated F-111C. A total of 22 F-111C and RF-111C (reconnaissance/strike version) airplanes are based at Amberley, Australia.

In the United States, 69 F-111D aircraft are based at Cannon Air Force Base, New Mexico, as the 27th Tactical Fighter Wing. Thirty-seven F-111A and 22 EF-111A airplanes comprise the 366th Tactical Fighter Wing at Mountain Home AFB, Idaho. The 380th Bomb Wing uses 28 FB-111A bombers at Plattsburgh AFB, New York; and 22 FB-111A's are in the 509th Bomb Wing at Pease AFB, New Hampshire.

The Air Force also operates 83 F-111F aircraft in the 48th Tactical Fighter Wing in Lakenheath, England. Upper Heyford, England is the base for 75 F-111F and 13 EF-111A aircraft that make up the 20th Tactical Fighter Wing.

Because of the importance of the F-111 to the Air Force, many of these aircraft will be in service for a long time.

"Er, about your F-111, Colonel..."

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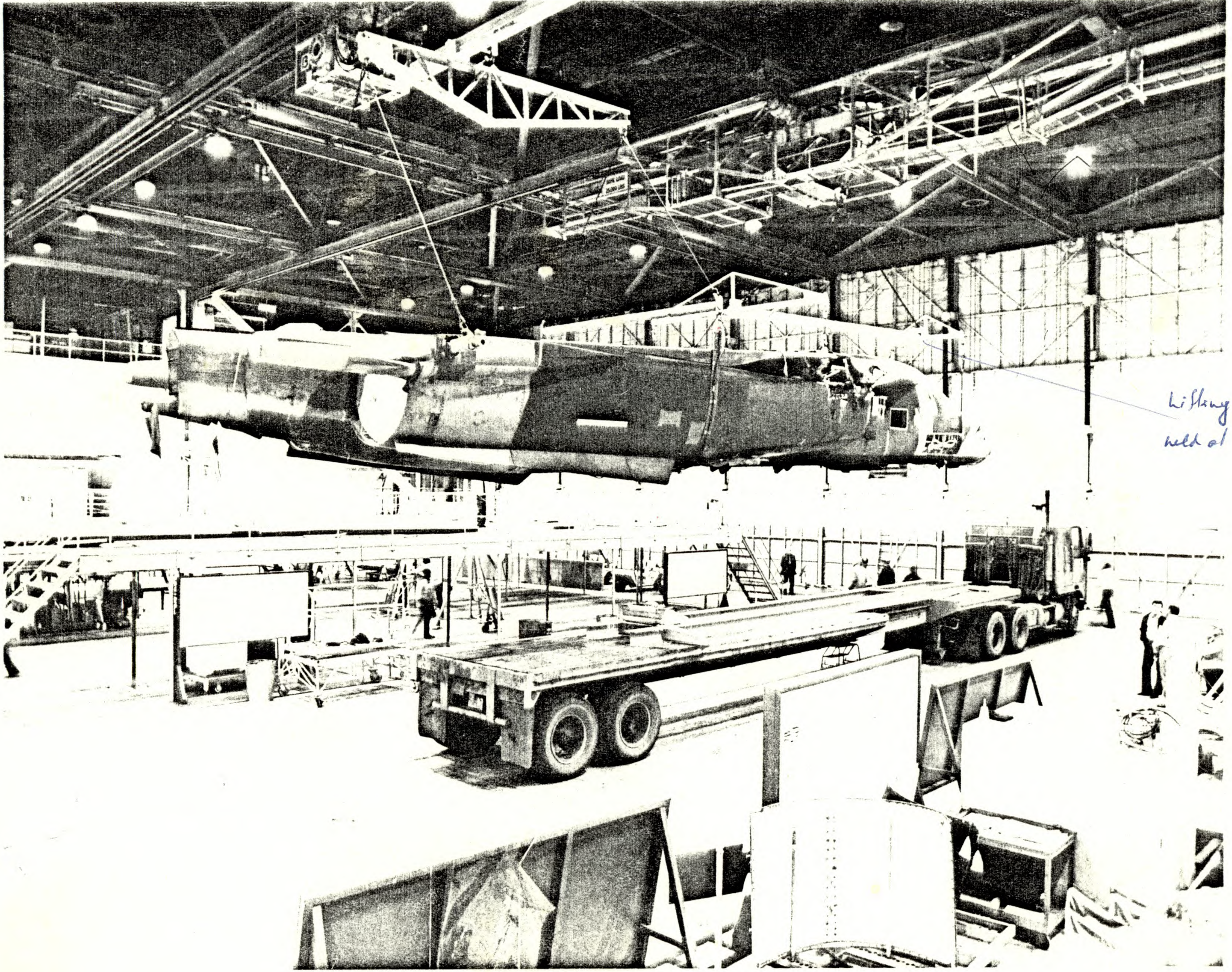

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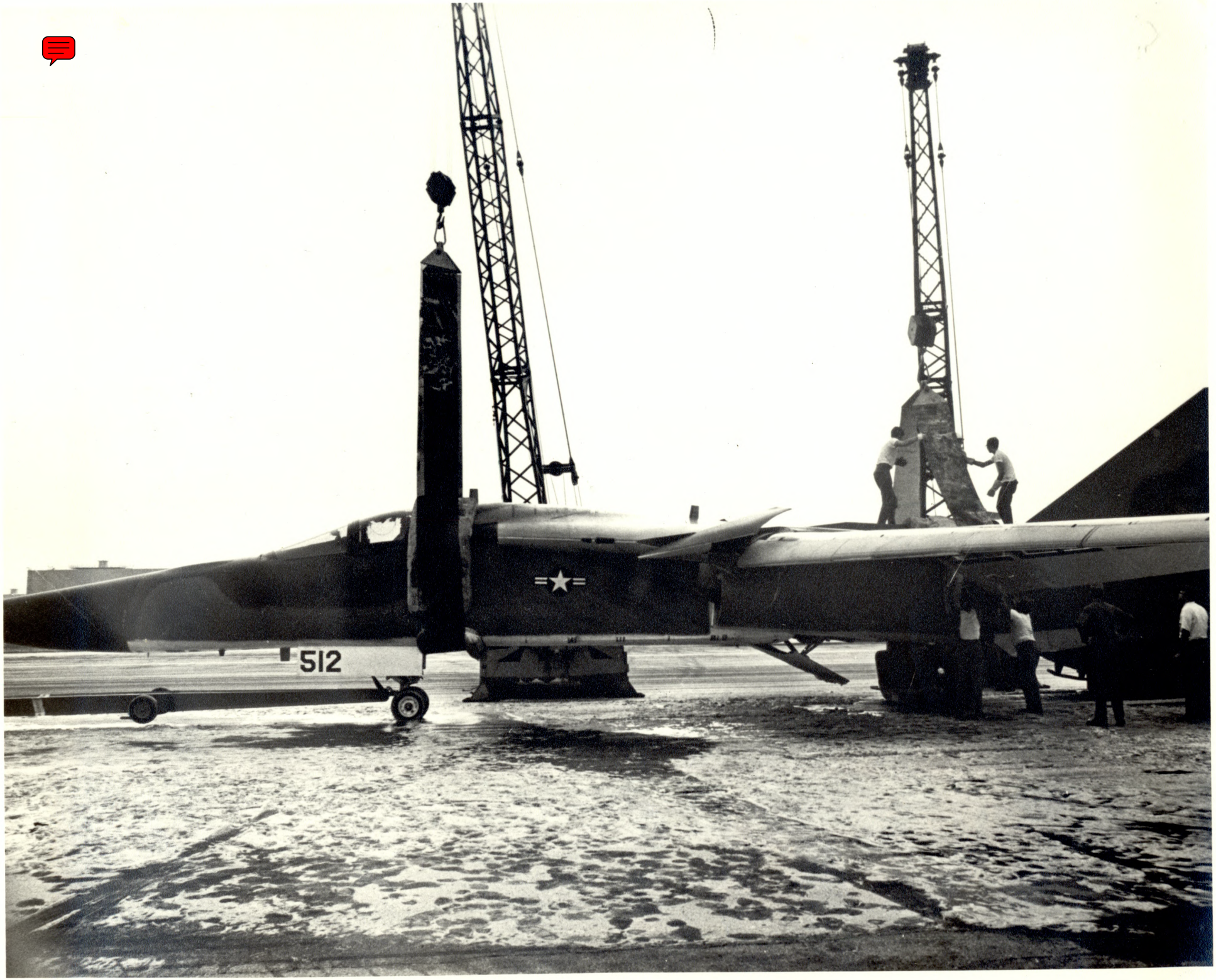
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