Feature

F-35

JOINT STRIKE FIGHTER

Meeting Tomorrow's Defense Needs Today

A new fighter aircraft will be making its mark on the world fleet.

One hundred years from now, air and space historians will acknowledge two groundbreaking creations to emerge from the early years of the 21st century: the International Space Station and the Lockheed Martin F-35 Joint Strike Fighter.

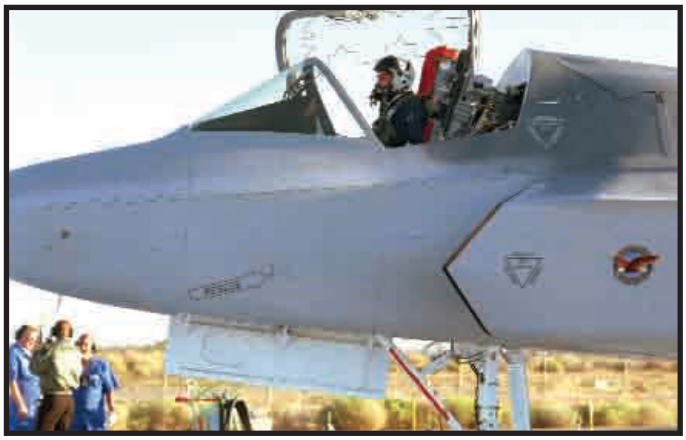
The F-35 JSF represents the perfect marriage of high-technology and efficiency to create a fighter aircraft that will be used around the world to protect the U.S. and its allies from as-yet-unknown enemies.

And Burns & McDonnell is assisting every step of the way. Lockheed Martin Aeronautics Company, the developer of the F-35, hired Burns & McDonnell to develop a master plan for new facilities needed for F-35 at Air Force Plant 4 in Fort Worth, Texas, which is operated by Lockheed Martin. Burns & McDonnell design-build teams are bringing that master plan to life with two highly technical facilities: the component finish facility and radar cross-section facility.

A Fighter for Many

The stealthy F-35 is designed to replace the A-10, the F-16 and the F/A-18, as well as the Harrier family of short-takeoff/vertical landing (STOVL) fighter aircraft. It will be used initially by the U.S. Air Force, Marine Corps and Navy, and the United Kingdom's Royal Navy and Royal Air Force. The U.S. Air Force plans for the F-35 to operate in conjunction with the Lockheed Martin F/A-22 Raptor – also a stealth fighter – while the U.S. Navy intends for the F-35 to complement the F/A-18/E/F Super Hornet. The F-35 also is designed to operate autonomously.

Its unique design meets the varying needs of the Armed Forces: The STOVL version will serve the Marine Corps and the United Kingdom forces; the carrier variant will fulfill the durability requirements of the Navy; and the conventional-takeoff-and-landing variant will meet the maneuverability needs of the Air Force. Despite the F-35's tailoring to the individual services, more than 80 percent of the parts and systems are common to all three variants to control costs.



The United Kingdom, Italy, the Netherlands, Turkey, Canada, Denmark, Norway and Australia are contributing to the program, both economically and technologically. The JSF program anticipates producing 2,593 of the aircraft for the U.S. and British armed forces alone.

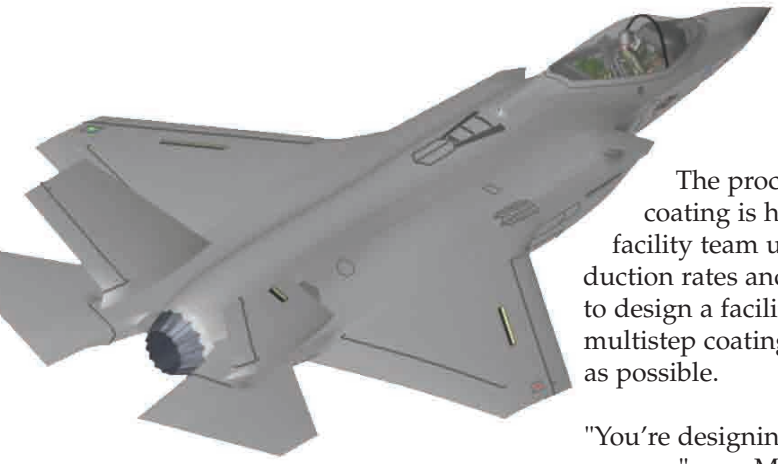
New Facilities Plan

Lockheed Martin chose to partner with Burns & McDonnell to develop and create the Joint Strike Fighter New Facilities Plan. The 120-page document lays out new facilities and facility improvements required to manufacture the F-35 at Air Force Plant 4. The Lockheed Martin-Burns & McDonnell document includes costs, schedules, site maps, site planning requirements, site alternatives, construction requirements, and modifications to facilities already in existence at the site.

"The New Facilities Plan is a critical decision-making document in support of the potential $200 billion JSF program," says Randy Pope, Burns & McDonnell associate vice president. "The planning process required Burns & McDonnell's combination of engineering and master planning to team with Lockheed Martin-directed criteria and requirements."

The Projects – Component Finish Facility

The $40 million component finish facility applies major sections of the F-35 with specialized coatings. Each individual component of the plane is coated separately in massive booths. The largest booth is 65 feet long, 40 feet wide and 24 feet high. In all, the facility coats four of the major components of the aircraft and more than 100 panels and doors. The parts range in size from over 40 feet long and 17 feet wide, to parts that are less than 1 square foot in area.



The process for applying the coating is highly structured. The facility team used anticipated production rates and space requirements to design a facility that makes the multistep coating process as efficient as possible.

"You're designing to fit a developing process," says Mike Fenske, project manager. "Creating a one-of-a-kind facility involves careful study of the activities required to meet production, with some vision toward the unexpected, to assure the facility meets the process needs."

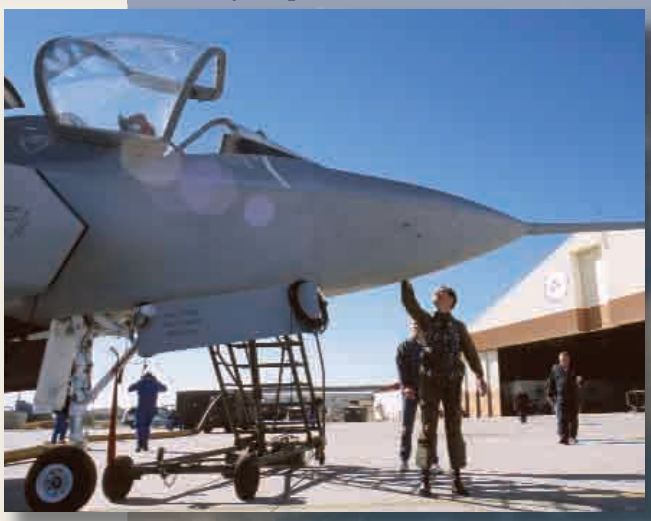
Energy Savings

Among the triumphs of the component finish facility design is its attention to energy savings.

"The process required in this facility has the potential to consume a lot of energy," Fenske says. "Our emphasis on an 'energy strategy' produced a facility that saves the client thousands in capital and operating costs."

Among the component finish facility's energy-saving measures:

- A chilled-water reheat and exhaust heat recovery system that decreases heating and cooling energy use by 40 percent
- An airflow control system that automatically decreases airflow in the painting booths when they are not in use
- A condensate recovery system that reduces domestic water use and wastewater by 10,000 gallons per day



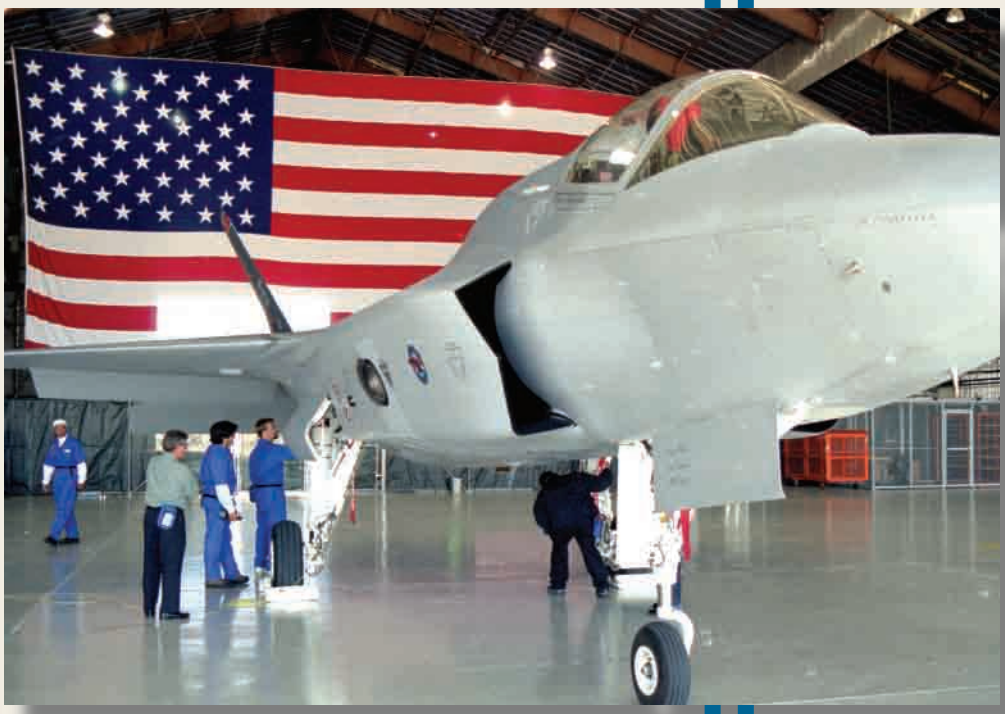
Overall, the energy-saving measures will decrease the capacity of the chiller plant serving the facility by 40 percent, which will lead to a similar reduction in capital and energy-saving costs. The chiller plant, also designed by Burns & McDonnell, will initially include two 2,000-ton chillers, and is expected to expand to 20,000 tons to meet the production phase facility requirements of the JSF program.

Radar Cross-Section Facility

After aircraft emerge from the final finish facility, their special coatings must be tested for effectiveness and completeness. Lockheed Martin proposed a cost-effective test environment that would simulate the F-35 hurtling through the skies toward battle.

This function is performed by the $11 million radar cross-section facility, a 90-foot-high, 60,000-square-foot facility. Aircraft are towed into the facility, positioned onto a 40-foot-diameter turntable, and hoisted 30 feet off the ground. The aircraft is supported at three points: one from an overhead hoist and two from the turntable below. The aircraft and turntable rotate at a pace of one revolution per hour, and the aircraft is bombarded by radar to validate the coatings.

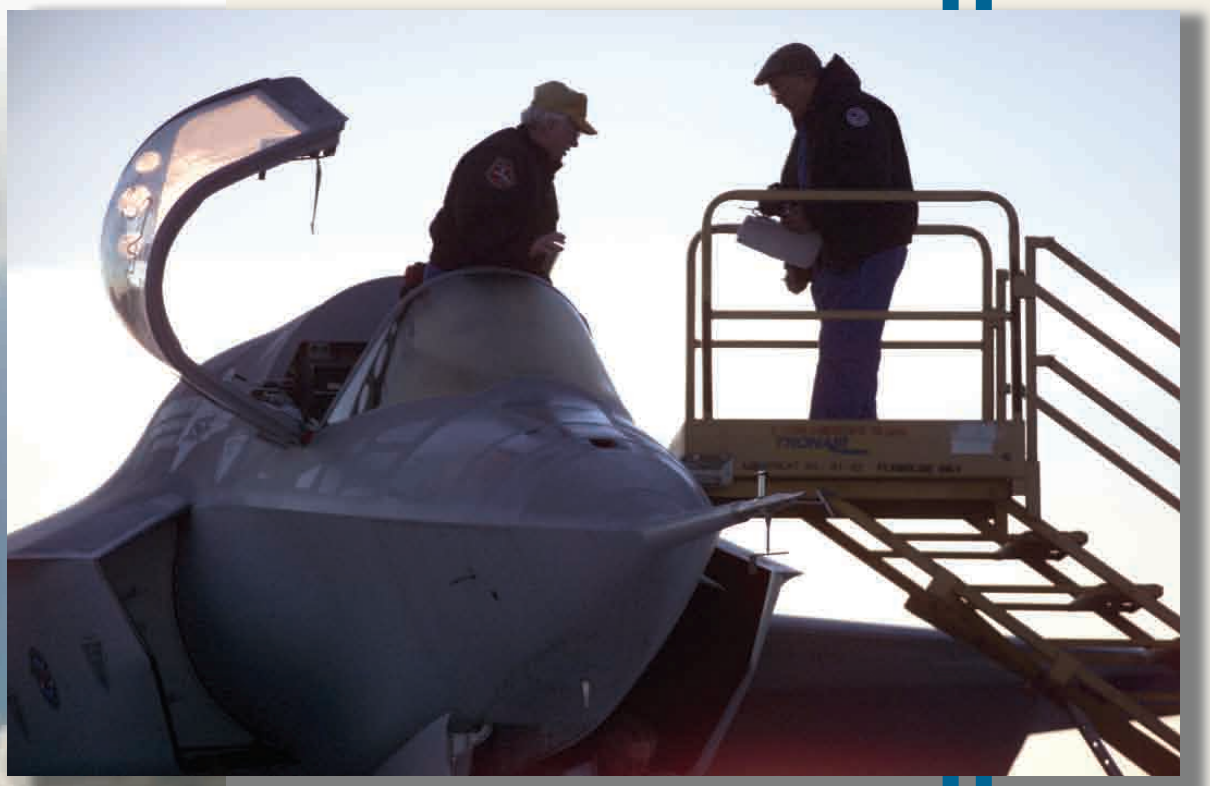
"Clearly, design was a critical element for this facility," says Mark Zimmerman, project manager. "In addition to simulating a natural environment for the aircraft, the facility had to eliminate all outside influences on the work going on inside."



Special coatings will be used on the turntable, walls and ceiling of the facility to confine the radar's energy. In addition, radar absorbing materials (RAM) will be used in the facility in certain locations. The design also incorporates special construction methods to minimize physical discontinuities, which are known to adversely affect testing.

Another critical design goal is to eliminate the potential of environmental elements such as wind and thunder to cause vibrations that would affect the work going on inside the building.

To prevent this, the facility will consist of three independent structures, Zimmerman says: an outside "skin" that keeps out the elements, an inner shell that provides the background for testing, and a truss between the two layers that supports the aircraft hoist. All the structures are supported by concrete piles that extend to the rock subgrade.



Most of the equipment required to rotate the turntable will be located several feet below the ground. Access to the equipment will be provided by way of a concrete tunnel and stairs.

The component finish and radar cross-section facilities are both design-build projects on aggressive schedules – construction is estimated to take about a year for each.