Train like you maintain

Cutting-edge F-22 maintenance site will immerse trainees in flight-line realism

By Doug Cantwell

How long does it take to train a raw recruit to maintain the F-22 Raptor, the world's most advanced air dominance fighter? The state-of-the-art "schoolhouse" currently under construction at Sheppard Air Force Base, Texas, will take a total-immersion approach, packing the equivalent of a two-year college program into four busy months.

Starting in early 2008, airmen will arrive at Sheppard from boot camp. They'll spend eight-hour days interacting with the latest computer courseware and tuning their motor skills on high-fidelity training devices that might as well be chunks of an actual Raptor. Boeing leads the F-22 training effort for both pilots and maintenance technicians.

In designing the new trainers, Boeing engineers set their sights on achieving maximal realism—but without tying up precious operational aircraft. They reasoned if the cockpit needs to be serviced from atop a 15-foot ladder on the flight line, then that's what a specialist ought to train to at Sheppard.

For instructional purposes, the Boeing team has divided the airplane into seven full-scale training devices and tailored the schoolhouse floor plan to accommodate them. The facility will house classified and unclassified classrooms, a computer center and administrative offices as well as the trainer bays.

As a first-tier partner in the F-22 program, Boeing builds the wings and aft fuselage and integrates the aircraft's avionics. The company also has the lead on developing and administering training programs. As part of its maintenance technician-training assignment, Boeing is overseeing the planning of the Sheppard facility, including development and integration of the training devices.

TRAINERS TUNE MUSCLES

The seven training devices provide hands-on practice in inspection, operation, removal and installation, system-testing and fault-isolation. They range from simple to highly complex, covering as few as 14 to as many as 240 separate tasks.

The Armament trainer, for example, addresses 89 individual functions that technicians must perform in maintaining the F-22's weapon bays, missile launchers, wing pylons, countermeasures dispenser and 20mm cannon. Each component of the trainer must replicate its onboard counterpart as faithfully as possible in dimensions, weight, center of gravity, color and texture.

It's not enough simply to read about maintaining a Raptor or watch someone else doing it on a video. There's the kinetic aspect of training—i.e., getting physically attuned to the task. This is critical not only for efficient, timely execution but also for the technician's safety and comfort.

"If you've ever picked up a television set, you'll understand why center of gravity is a key training issue," said Tricia Morris, lead engineer for all seven of the Raptor training devices. "The center of gravity of the typical TV is nowhere near its dimensional center, which can catch you off guard the first time you pick one up. The same holds true for many tasks in the maintenance mission."

While authenticity is critical, engineers also must take into account the safety of new trainees. In most cases, they're able to address these issues by incorporating "blind" safety features—concealed shutoff or other devices cued by the instructor that protect trainees from injury without compromising the authenticity of a potentially hazardous task.

MODERNIZATION MOVES ENGINEERS

Another challenge is the ongoing modernization spirals that keep the Raptor current with technological advances.

To maintain authenticity of the training experience, engineers must continually update the trainers. In fact, at the conclusion of the engineering, manufacturing and development phase, the trainers simply didn't

U.S. AIR FORCE PHOTO BY STAFF SGT. ERIC T. SHELER

At Langley Air Force Base, Va., airmen with the 27th Aircraft Maintenance Unit of the U.S. Air Force inspect an F-22 Raptor before flight. Technicians who will train at Sheppard Air Force Base's new F-22 maintenance schoolhouse, for which Boeing is leading development, will do so under conditions that resemble an actual Raptor flight line.

Boeing is the lead on developing the F-22 maintenance training program, designing and integrating the Raptor training devices and planning the training facility at Sheppard Air Force Base, Texas. It's slated to accept its first students in January 2008.

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match the airplane. This was due in part to a design freeze placed on the trainers in November 2000 to control costs.

The trainers destined for Sheppard are being matched to the specifications of Raptor No. 41, the first fully operational aircraft, which was delivered to Langley Air Force Base, Va., in March. But trainer modernization will continue throughout the program's 40-year span, and the Boeing team currently is under contract to assess updates required to match Spiral 3A upgrades.

For the Armament trainer, 3A primarily involves integration of the Air Force's new Small Diameter Bomb (a Boeing-manufactured precision munition) and its corresponding carriage.

CONCURRENCY IS KEY

If you're going to provide effective maintenance training, you've got to keep your trainers and courseware current with the airplanes on the flight line. And you have to keep the equipment on line 16 hours a day, five days a week at the customer's prescribed 95 percent availability rating.

That's much easier said than done, said Pam Valdez, who manages both maintenance and pilot training programs for F-22.

"The airplane keeps getting modernized, systems get redesigned, and parts continually are being upgraded," she said, "so you're trying to lock on a moving target."

To throw another challenge into the mix, the Air Force requires any change to the airplane's design to be implemented in the corresponding trainer two months in advance. That's so students training today won't have to play catch-up when they start their duty assignments with the active squadrons.

In spite of the challenges, Valdez noted how smoothly the Sheppard schoolhouse is coming together.

"We've enjoyed an excellent spirit of cooperation among the F-22 program office, the folks at Sheppard, the Army Corps of Engineers, our trainer suppliers, the architectural design house and our construction company," she said. "You don't see that very often on a project of this scale, and we're not taking it for granted." ■

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