n 14 October 1962, US Air Force Maj. Richard Heyser, flying a Lockheed U-2 Dragon Lady at 60,000 feet, captured images of a Soviet truck convoy and components of Soviet SS-4 intermediate range intercontinental ballistic missile batteries at San Cristobal, near Havana. Those images convinced CIA analysts that the Soviets were placing nuclear weapons in Cuba. Maj. Rudolf Anderson, during a U-2 flight on 15 October, photographed additional missile sites at Sagua la Grande. President John F. Kennedy was briefed on the images the morning of 16 October, precipitating the Cuban Missile Crisis.

On a day that would later be called Black Saturday, three U-2 flights were planned over Cuba, but Anderson lobbied for a fourth. The other three flights were later cancelled, but Anderson’s was approved. He took off from McCoy AFB, near Orlando, Florida, the morning of 27 October to obtain the latest photos of the missile launch sites near Guantanamo Naval Base.

As Anderson crossed the Cuban coastline at 0915, he was picked up on radar by the SA-2 surface-to-air missile site at Banes in eastern Cuba. The Soviet deputy missile battery chief gave the launch command—in violation of his direct orders. Anderson was killed at 1012 when two of the three SAMs launched struck his U-2 and destroyed it.

After the shootdown (and after a later incident at sea), Soviet Premier Nikita Khrushchev began to realize the situation in Cuba was getting out of hand. Soviet and American officials, who had started talking through back channels, reached an agreement to end the crisis. The Soviets agreed to remove the missiles in exchange for a US promise not to invade Cuba. Those thirteen days represent the closest those two superpowers would ever come to nuclear war.

At the personal direction of President Kennedy, Anderson (below) was posthumously awarded the Air Force Cross, the nation’s second highest award for valor. He was the first Airman to receive the newly created medal. He was also awarded the Air Force Distinguished Service Medal, the Purple Heart, and the Cheney Award, which is presented annually to aviators who demonstrate an act of valor, extreme fortitude, or self-sacrifice.
F-35 FLIGHT TESTING AT PAX
Testing The STOVL And Carrier Variants Of The F-35

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NEWS
The F-35 Integrated Test Force, or ITF, at Pax, one of multiple test sites for the F-35 program, is responsible for flight testing the seagoing variants of the F-35, which include the short takeoff/vertical landing F-35B variant and the F-35C carrier variant. As of fall 2012, the ITF at Pax operated eight F-35s—five B models and three C models with two more F-35Bs and a fourth F-35C slated to arrive before the end of the year.

NAS Patuxent River, located on the Maryland coast where the Patuxent River empties into the Chesapeake Bay, is home to Naval Air Systems Command and the Naval Air Warfare Center Aircraft Division. Long known as Pax River, this air station bills itself as "the place where the future of Naval Aviation begins." That future is being defined these days at Pax by the frequent takeoffs and landings of two variants of the F-35 Lightning II. By Eric Hehs

PHOTO BY ANDY WOLFE

F-35 Flight Testing
At Pax

PHOTO BY ANDY WOLFE
INTEGRATING THE TEST FORCE

The 900 personnel working at the Pax F-35 ITF represent a wide cross section of the aeronautical world. Test pilots, for example, represent the US Navy, US Marine Corps, Royal Air Force, Lockheed Martin, and British Aerospace. Similarly, aircraft are maintained by both military and civilian personnel. The US government as well as Lockheed Martin, British Aerospace, and Northrop Grumman provide flight test engineers.

“We are integrated across the board,” said Navy Capt. Erik Etz, the US government director of test for F-35 naval variants. “While previous test programs I’ve worked on have had integrated teams, I’d say this team is truly integrated,” Etz said. He pointed out that military maintainers work right next to civilian maintainers. The ITF at Pax is just one component of the overall F-35 ITF. “We feed information to the F-35 Joint Program Office, to Lockheed Martin in Fort Worth, to Edwards AFB, to Eglin AFB, and to all the subcontractors.”

“I’ve never worked anywhere in my career in an environment that is so interdependent,” added Joe Iorio, Lockheed Martin deputy director for operations at Pax. Iorio works with employees of Lockheed Martin, British Aerospace, and Northrop Grumman as well as with military and government personnel. “Nothing gets generated here without touching several of those organizations,” he continued. Iorio stressed the interdependence of the ITF as one team. “Just like the name says, we are an integrated test force.”
HIGH-LEVEL ATTENTION

The proximity of NAS Patuxent River to Washington, DC (about sixty-five miles to the northwest of Pax) generates a high level of high-level attention. Since receiving the first F-35 test aircraft at Pax in November 2009, the ITF has hosted more than 120 protocol-level visits and events including US and foreign military and civilian dignitaries, as well as numerous visits by industry officials, non-protocol government, media, and civic groups.

“We do get a lot of visitors,” said Iorio. “It’s easy for them to come down here from DC. But that’s actually a good thing.”


“Having someone of such stature deliver a positive message in person meant a lot to our workforce,” Iorio said.

Panetta lifted the probation early during his visit to Patuxent River on 20 January 2012, lauding the workforce and saying, “The STOVL variant is demonstrating the kind of performance and maturity that is in line with the other two variants of the Joint Strike Fighter.” The fighter program is in the System Development and Demonstration, or SDD, phase.

Etz, who briefed Panetta when he visited, labeled the current status of the F-35 flight test program green in most areas. “We are making significant progress in most technical areas in 2012 as we did in 2011. While progress in some technical areas has been delayed by some hardware challenges,” continued Etz, “our team is confident that we will meet the needs of the SDD phase of the program.”

MEASURING PROGRESS

The F-35 program measures and reports progress in many ways for the SDD phase. The most common measure consists of test points, which refer to specific points in the flight envelope as defined by speed, altitude, and g-forces. Test points and the flight envelope itself are also defined by other factors such as flying at night, carrying and releasing different weapon loads, refueling from various tanker aircraft, and flying with weapon bay doors open.

“Not all test points are created equal,” explained Etz. “Some are more difficult to capture than others. Some of the lower speed test points can be achieved fairly rapidly. Points associated with handling qualities and flying qualities at low speeds can be knocked off in a matter of minutes on some flights. Achieving test points becomes more difficult at higher speeds. Test points at Mach 1.4 and 1.5 and beyond may take twenty minutes or more of flight time based on the specific fuel and airspace requirements needed to reach that point.”

The test program also tracks progress in terms of overall flight hours, flights per month, test points per month, test points per flight, and abort rates for each aircraft. “We track reliability and maintainability metrics as well,” Etz added. “Our aircraft are unique test assets with unique needs for support, so a one-to-one maintenance correlation with the fleet may not be accurate. But I would view the relationship as parallel.”
ENVELOPE EXPANSION

As test points accumulate, the envelope of the F-35 expands, and the expanded envelope eventually filters out to the operational fleet. “Just because we go out and hit a point in the sky doesn’t mean the point is released the next day,” noted Etz. “Achieving a particular test point begins a train of analysis that must be completed before that point is released for fleet use.”

US Marine Corps Lt. Col. Matt Taylor, a test pilot at Pax who has been flying the F-35 since July 2010, explained the methodical nature of expanding the flight envelope: “We start at the center of the flight envelope and move out from there.” When the airplanes first arrived at Pax, they were flown at subsonic speeds, medium altitudes, and low g-forces. “This year we are exploring the high-speed, high-altitude, and high-g edges of the envelope.”

Those edges are defined as Mach 1.6, 50,000 feet, and up to 70 g’s for conventional flight for the F-35B; and Mach 1.6, 50,000 feet, and 7.5 g’s for the F-35C.

While many test points are shared across all three variants of the F-35, others are variant-specific. The vertical lift capability of the F-35B, for example, creates a unique flight envelope that goes all the way down to zero airspeed at zero feet altitude. “The F-35B can fly backward,” noted Eric Faidley, a Lockheed Martin flight test engineer assigned to BF-1. “In fact, its maximum backward speed is thirty knots.”

“The only time an F-35B might hover at thirty knots in reverse in an operational setting would involve an overshot landing,” Faidley explained. “In such instances, pilots would typically not back up and, instead, go back around in the pattern and attempt another landing,” he said.

The test team at Pax is also exploring the maximum speed end of the STOVL portion of the flight envelope, which is 250 knots. “The buffet and noise are significant when we have the upper lift fan door all the way open, which is an angle of sixty-five degrees, at that speed,” Faidley said. “That’s a flight condition that we can’t evaluate accurately in a simulator. It’s another reason why we do flight testing.”

Some of the flight test aircraft have special software that allows the pilot to override the standard control laws that actuate the various doors and nozzle angles. The flight control laws for the STOVL variant have six modes that are associated with specific actuations. Mode 1 defines conventional flight. Mode 4 defines STOVL. The other four modes define transitional states between the two primary modes. “If a pilot loses a hydraulic system in Mode 2, we know that the doors associated with STOVL flight will be positioned a certain way,” Faidley explained. “We are seeing how well the airplane flies in those conditions.”
SHIP SUITABILITY

Ship suitability testing creates another set of unique test points for both the F-35B and F-35C. Many of the initial suitability tests are conducted on land instead of at sea on a ship. Teams from Pax have taken the F-35C to JB McGuire-Dix-Lakehurst, New Jersey, several times since June 2011 for a series of carrier-suitability tests. Loads and handling qualities have been evaluated in catapult launches from three types of launch systems, including from two standard steam-powered systems.

Loads and handling qualities have also been evaluated from the US Navy’s first Electromagnetic Aircraft Launch System, or EMALS, which will eventually replace the existing steam catapults on current and future aircraft carriers. The C-model has gone through jet blast deflector testing at Lakehurst as well. The deflector, located behind the catapults aboard aircraft carriers, diverts high-energy exhaust from the engine to prevent damage and injury to other aircraft and personnel located in close proximity. Microphones, thermometers, and other sensors have been placed around the aircraft at various engine power settings as part of environmental tests. The F-35C has also gone through some initial tests of the arresting gear at Lakehurst. The tests uncovered an issue with the tailhook, which is being addressed with some redesign and additional testing.

Jennifer Chisler, a civilian employee for NAVAIR, is a member of the team assigned to evaluate ship suitability for the F-35. The team looks at all the fixed-wing aircraft that go aboard ships. “We check the aircraft structurally to see if they will survive short takeoffs and vertical landings or catapult takeoffs and arrested landings,” she explained. “Catapult takeoffs generate a big acceleration impulse and transmit a lot of vibrations to the structure through the launch bar,” she continued. “Equipment inside the aircraft sometimes doesn’t respond well to that impulse. It’s our job to make sure it does.”

Chisler and Faidley were part of the team sent to the amphibious assault ship USS Wasp (LHD-1) in October 2011 for the initial sea trials of the F-35B. The tests were used to collect data on the aircraft’s ability to perform short takeoffs and vertical landings on a ship at sea. The team also determined how well the F-35B integrates with the ship’s landing systems and deck and hangar operations. While under way, the F-35B pilots logged more than twenty-eight hours of flight time and completed seventy-two short takeoffs and seventy-two vertical landings.

“The experience was one of the highlights of my career,” said Faidley, the test conductor for the first vertical landing of the F-35 on a ship. “Not only was it the first time an F-35 landed on and operated from a ship, it was also the first time we set up a flight test control room at sea.”

Faidley, Chisler, and the rest of the team lived on the Wasp for three weeks as it operated in the Atlantic fifty to sixty miles from the coast. “We can test how the F-35B deals with crosswinds more easily at sea because we can position the ship at whatever angle we want,” said Faidley. “We also evaluated how the F-35 affects ship operations, for example, by measuring temperatures of the flight deck and structural loads on rooms directly below the flight deck during takeoffs and landings.”
WEAPON SEPARATIONS

More recently, the test team at Pax has been focusing on dropping weapons from the internal bays of the F-35. The F-35B dropped its first 1,000-pound GBU-32 Joint Direct Attack Munition on 8 August 2012, shortly after Code One visited Pax. Duriel Holley, lead flight test engineer for CF-1, is involved in the planning of dropping the same weapon from the F-35C. “While CF-1 is used primarily for envelope expansion and flutter testing,” he explained, “it is also being used for weapons environment tests.”

Just as all the other testing, weapon separation tests build up from basic to complex. On the ground, engineers check clearances of the weapons after they are loaded into the bay. Clearances are checked again dynamically in pit testing, which involves ejecting a weapon from a parked aircraft into a cushioned pit.

The flying portion of the testing begins with installing the weapons into the aircraft weapon bay and flying it with the doors closed. The final step before actual weapon separation test involves the aircraft flying with weapons and opened bay doors. “We place a variety of sensors in the bay to collect vibration, temperature, and acoustical data,” Holley said. “The weapon itself will have instrumentation on it as well. We do weapon testing for every weapon and weapon combination the airplanes can carry. Some of these loadings are worst case, maximum loads. Our test plans cover JDAMs, GBU-31, GBU-32, and the AIM-120 AMRAAM.”
MISSION SYSTEMS

All of the testing described so far deals with how the aircraft behaves under certain prescribed conditions, or flight sciences testing. The other category of flight testing, called mission systems testing, deals with how the aircraft detects what is going on around it and how well it conveys that information to the pilot.

Mission systems tests are used to evaluate the functionality of the various electronic systems and sensors on the aircraft, including communications (datalinks and satellite communications), radar, countermeasures, distributed apertures, and electro-optical targeting. Before these systems are tested in an F-35, they are checked out on the ground in the mission systems integration laboratory in Fort Worth, Texas, and in the air in the Cooperative Avionics Test Bed (referred to as CATB, or the CATBird), which is also based in Fort Worth.

Because they lack a radar and other sensors, BF-1, BF-2, BF-3, CF-1, and CF-2 are used exclusively for flight sciences testing. BF-4, BF-5, and CF-3 have the hardware and software needed for mission systems testing, though they are often used for certain flight sciences tests as well.

“The capabilities of legacy fighters evolved as sensor technology evolved,” explained Taylor. “But the sensors usually evolved independently. So the cockpit devotes individual displays for a given new technology.” The pilot may be running the radar from one set of displays and a datalink from a different set of displays. The two different displays don’t interact. “Sensors can evolve cooperatively in the F-35,” he continued. “The display shows the tactical environment to the pilot. We may be unaware of which sensor or sensors were used to provide that information, though we can find out if we want to. But we usually don’t care. We want to know the location of the bad guys and the target—and when we can shoot them.”

Capabilities associated with mission systems are being developed in a series of software blocks. Block 1 covers basic functions of the navigation system, communication systems, and sensors. With Block 1, the aircraft are limited to subsonic airspeeds, an altitude of 40,000 feet, maximum g-force of 4.5, and a maximum angle of attack of eighteen degrees. Block 2A, which as of the summer of 2012 was being flown at Pax on BF-5, covers Multifunction Advanced Datalink, the current Link-16, maintenance datalink, and a mission debriefing system.

Block 2B, which is the initial warfighting version of the software, adds capabilities associated with air-to-air and air-to-ground missions. It also has the complete set of maintenance functions. With Block 2B, the aircraft can be flown at supersonic speeds (up to Mach 1.2 for B- and C-models); a maximum g-force of 5.5 and 7.5 for B- and C-models, respectively; and a maximum angle of attack of fifty degrees.

The software also covers various loadings of the AIM-120 air-to-air missile, 2,000-pound JDAM GPS-guided bombs, and 500-pound GBU-12 laser guided bombs. Block 3 is the full warfighting version of the software, which is scheduled to be installed on production F-35s beginning with the eighth production lot called Low-Rate Initial Production 9, or LRIP 9. Mission systems testing will pick up speed when BF-17, BF-18, and CF-8, all mission systems aircraft, join the test fleet in late 2012 and early 2013.
PILOT PERSPECTIVES

All the F-35 test pilots at Pax are qualified to fly both variants. A subset has the qualifications necessary for executing STOVL test missions, that is short takeoffs and vertical landings. The ease of operating the aircraft in STOVL mode allows that test capability to be distributed broadly among the pilots. “A number of our pilots came here with no STOVL experience, but now they are flying STOVL test missions,” noted Etz.

“The ease of landing the B-model in STOVL mode is unprecedented,” explained Taylor, who had no STOVL experience before joining the F-35 ITF at Pax. “In the Harrier world, learning to operate in STOVL mode takes months of training. For us, it is a couple of flights in the simulator and one, maybe two, flights in the airplane, because it is so intuitive. It is easy to land the F-35B in STOVL mode. We will never hear a Harrier pilot say the AV-8 is easy to land. The F-35B will hold whatever condition you command it to hold. It is like driving a perfectly aligned car down a perfectly straight highway with no wind. The F-35B will go straight until you tell it to do something else.”

“One of the beauties of this airplane is that it is so simple to land,” added Dan Levin, a Lockheed Martin test pilot and lead test pilot for the ITF at Pax. “Harrier airframes burn up about half their life in training pilots to land vertically.

Landing vertically in a Harrier is a complex task. I’m a fixed-wing fast-mover pilot, and I was ready to perform STOVL operations after ten minutes in the simulator. STOVL operations are simple and intuitive. The flight control system is automated in the right ways. The pilot doesn’t even notice the transition between conventional flight and STOVL mode.”

Levin is one of a handful of pilots who have flown all three variants of the F-35. “All three variants are remarkably similar in terms of pilot-vehicle interface,” he said. “That is one of the beauties of this program. A pilot can go from one aircraft to another almost seamlessly. As for flying qualities, the A- and B-models are very similar. The C is a little different because of the larger wing. But none of the differences jump out. Landings in the A and B are similar to the F-16 in terms of speed and angle of attack. The C-model is as solid as a rock, and pilots land at a much slower speed—high 120s to low 130s [knots]. The angle of attack for landing is much lower in the C-model so the pilot can see over the nose. The angle of attack control is very precise.”

Ease of vertical and carrier landings promises to significantly reduce the training time needed for these operations with the F-35B and F-35C, when compared to the aircraft the two variants are replacing. “The training required to keep a pilot comfortable in the STOVL environment is going to go to near zero,” Levin said. “The slow speed handling qualities of the C-model will decimate the training requirements needed to get pilots to land safely on the aircraft carrier deck. Eliminating those training requirements will skyrocket the value of the F-35C to the US Navy. Operating these airplanes will be cheaper and safer.”

“The ease of taking off and landing these aircraft is impressive,” added Taylor. “However, the ability to execute the mission is more important. That is, can the aircraft get pilots to the target, help them destroy it, and get them out safely? That is where the F-35 will really be impressive.”

Eric Hehs is the editor of Code One.
The message received by the battalion watch officer in the operations center was as urgent as it was precise: “Second Platoon is in sustained contact. Ground commander is requesting Harvest Hawk for an immediate priority J-TAR [Joint Tactical Air Request]. Advise estimated arrival time when able.”

The US Marines taking enemy fire in Afghanistan who sent that message weren’t making a general request for close air support. They weren’t trying to flag down a fighter in the area with a couple of bombs to spare, although any help would have been appreciated. What those ground troops wanted was one specific aircraft overhead to make their problem go away—and make it go away right now.

The specially configured armed intelligence, surveillance, and reconnaissance, or ISR, variant of the KC-130J Super Hercules tanker called Harvest Hawk was soon on scene, and the crew took care of the problem. Crews flying this aircraft have been busy since its combat debut in October 2010.

With its long loiter time, multiple radios, sensor to find and track insurgents or vehicles, and, most importantly to the Marines on the ground, its ability to launch a laser-guided Hellfire or Griffin missile and have those weapons hit exactly where and when needed, Harvest Hawk quickly became a Big Stick.

“The close air support [CAS] tasking for Harvest Hawk will make your eyes water,” noted Maj. John Butler, the Marine Aerial Refueler Transport Squadron 252 (VMGR-252) detachment commander in Afghanistan in 2011–2012. “Our launch total was considerably more than Marine
Harriers, Navy Hornets, and even Air Force A-10s. With only one aircraft, we shot close to half of all the kinetic weapons launched in theater in the nine months we were there."

"Before Harvest Hawk got to Afghanistan, naysayers called it useless," added Capt. Dusty Cook, a VMGR-252 Harvest Hawk pilot. "But we have effectively connected Harvest Hawk to the Marine ground force. While we were in Afghanistan, we flew just about every day watching, relaying information, or prosecuting targets. Units all over Helmand Province regularly began requesting us by name. The British began calling us the Helmand Rock Stars."
AN URGENT NEED

Harvest Hawk is the latest in a series of military aircraft modification efforts developed under the broad name “Harvest.” HAWK is actually an acronym that stands for Hercules Airborne Weapons Kit, but Harvest Hawk has become the generic, and much more generally used, name.

“Harvest Hawk is an accelerated Marine Corps program to meet an urgent needs statement from the Marine ground combat element in theater,” said Lt. Col. Jeff Moses, then the commander of VMGR-252, the oldest continually active squadron in the Marine Corps. “It is MIR [multi-sensor imagery reconnaissance] tied to CAS in a permissive air environment that is persistent beyond any other platform.”

That persistence was the main reason the KC-130J was chosen. “A fighter pilot has maybe forty-five minutes on station before having to refuel,” observed Capt. Thane Norman, a VMGR-252 Harvest Hawk fire control officer, or FCO. “In Harvest Hawk, we can be up for ten or more hours. We can stay with a foot patrol from the time they start until the time they finish.”

The Super Hercules, known as a Battleherk to the Marines, also has sufficient electrical power and room for the Harvest Hawk equipment.

“Using existing components, the Harvest Hawk kit was developed in eighteen months by a joint Marine Corps, Lockheed Martin, and Naval Air Systems Command team. “Development was only supposed to take six months,” noted Moses. “Integration of the separate elements proved to be a bigger challenge than expected. Still, Harvest Hawk took a lot less time to get into the field than similar programs.”

Three aircraft have been modified, with one currently assigned to the Naval Air Warfare Center Aircraft Division test facility at NAS Patuxent River, Maryland; one with VMGR-352 at MCAS Miramar, California; and one with VMGR-252 at MCAS Cherry Point, North Carolina. Current plans call for three additional Harvest Hawk kits, making a total of six operational aircraft. Four additional operational KC-130Js will be wired to accept the Harvest Hawk equipment.
Externally, what sets Harvest Hawk apart from other KC-130Js is underneath the left wing. Instead of a KC-130J hose refueling pod on the outboard wing station, there is an M299 quad-mount Hellfire missile launcher from an AH-1 Cobra attack helicopter. The AGM-114P Hellfire II, with a twenty-pound high-explosive antitank warhead, is the primary weapon. In the first two Harvest Hawk deployments, one each from VMGR-352 and VMGR-252, crews launched more than 100 Hellfires, recording nearly all direct hits. “It’s a somewhat choreographed routine to get the four missiles loaded,” notes Sgt. Robert Etczyzm, a VMGR-252 load crew team leader. “We use a four-man team and a special trailer and load platform. Loading Harvest Hawk is different. At certain points, we have to lift the missiles over our heads.”

The electro-optical, infrared, and laser targeting sensor, called a Target Sight Sensor, or TSS, comes from an AH-1Z Super Cobra and is mounted in an empty external fuel tank on the left inboard station. The sensor can see individual targets clearly from more than ten miles away.

Internally, the fire control console, or FCC, and the mission computer from the Navy’s SH-60 Seahawk multipurpose helicopter are mounted to a reinforced 463L cargo system pallet installed in the KC-130J’s cargo compartment. Two additional display monitors are permanently installed on the flight deck primarily to allow the pilot to see the sensor images the FCO is watching and to allow the copilot to look at the FalconView display that combines aeronautical charts, satellite images, and elevation maps along with other information. The pilot also has a consent-to-lase and fire button located near the throttles.

The final component in the Harvest Hawk kit is the launcher, avionics, and associated equipment for the AGM-175 Griffin missiles. These missiles, which have a smaller warhead and less powerful rocket motor than Hellfire, were originally housed in a cargo ramp-mounted box launcher. To fire this missile, crews would have to go on oxygen and depressurize the aircraft prior to lowering the ramp for launch. Because of the increased difficulty and the missile’s shorter range, Griffins were launched against targets only about ten percent of the time.
“Even on the days we didn’t shoot, any ground Marine would tell you that just having us up there with eyes-on was enough. Many times, keeping guys out of an engagement was just as important as firing on range.”

– MAJ. JOHN BUTLER

Harvest Hawk aircraft now have a dual missile launcher for Griffin located in the left paratroop door along with what is called a wine rack that holds ten missile launch tubes. This launcher, called a Derringer Door, allows the crew to keep the aircraft pressurized during launch. A third type of weapon, the GBU-44 Viper Strike glide bomb, is now being tested on Harvest Hawk. Viper Strike, which is used primarily by Special Operations Forces, is also launched through the Derringer Door.

“With four Hellfire and ten Griffin, Harvest Hawk can carry more precision guided munitions than any other aircraft in the Marine Corps,” said Wyrsch, who, before becoming an FCO on Harvest Hawk, was a Harrier pilot. “We can still refuel other aircraft from the aircraft’s right hose if necessary. We did that several times to help fighters during poor weather. We even refueled Harriers from my old sister squadron.”

IN THE SANDBOX

“Harvest Hawk is a roll-on/roll-off kit, but we never rolled it off,” noted Moses. “We were in such demand, we ended up making one long flight per day. We weren’t figuring that kind of demand for the aircraft. Our maintainers did an amazing job. We only missed a couple of missions and those were because of problems with the TSS, not the aircraft.”

The VMGR-252 Harvest Hawk detachment flew as hard crews during its deployment, with three FCOs, two aircraft commanders, and two copilots, with a day-on, day-off flight schedule for flight deck crews and two-days-on, two-days-off schedule for FCOs. Crews, including loadmasters and what the Marines call crewmasters, were averaging approximately 110 flight hours per month, well above the overall in-theater norm for all US forces. During poor weather, Harvest Hawk was sometimes the only aircraft airborne.

“We had been tracking a target for several hours when the call came in that a ground unit in another area needed immediate help,” recalled Wyrsch. “We got the tasking, transited to the area, got the nine-line (the standard radio format
for transmitting ground target location and description information] while we were still twenty-five miles out, got the sensors correlated, made the attack plan, confirmed we were looking at the right thing, cleared the airspace, and took out the target in nine minutes. We got back to tracking the original target after about fifteen minutes elapsed time."

The Harvest Hawk radio callsign quickly became widely known. “The ground community liked us a lot. One time, a ground unit heard us when we radioed in during a maintenance check flight,” said Cook. “They asked if we happened to have ordnance. Fortunately, we did and were able to help them.”

Squadron crews launched approximately sixty Hellfires during their deployment with a near 100 percent success rate without a single civilian casualty. But launching missiles wasn’t all the Harvest Hawk crews did. “Even on the days we didn’t shoot, any ground Marine would tell you that just having us up there with eyes-on was enough,” noted Butler. “Many times, keeping guys out of an engagement was just as important as firing on range.”

Sometimes just showing up was enough. Harvest Hawk crews generally fly at medium altitudes to maximize time on station. On one mission, the crew was observing a group of insurgents engaging a Marine ground unit. The insurgents had a central gathering point where they were using children as a buffer and forcing the children to resupply the snipers with ammunition.

After several hours of watching this battle play out, the crew came up with a plan. They received clearance and then made a high speed pass—slightly below minimums—and popped self-defense flares normally used to defeat heat-seeking missiles. The startled insurgents dispersed, and the Marine ground unit was able to accomplish its mission.

**COORDINATED CREW**

“We flew with the same guys over and over in Afghanistan. I knew what they were thinking,
and they knew what I was thinking," noted Wyrshc, who now has more flight time in Herks than he does in any other aircraft. "We just about got to the point that we could communicate with hand signals and grunts."

The seven-member Harvest Hawk crews, by necessity, become an integrated team. The aircraft commander is the airborne supervisor of flying, deconflicting the airspace and clearing out friendlies—other US or coalition aircraft prior to a missile launch. He also helps develop the target attack plan with the FCO and, once the aircraft is in position, gives consent first to fire the targeting laser and then to launch the missile.

The copilot is in charge of the basics—navigating and flying the aircraft, using the aircraft’s seven radios to communicate with air assets, ground commanders, and, as necessary, higher command headquarters. The crewmaster, a flying crew chief who normally runs the refueling panel, changes the radio frequencies and looks out the window as another set of eyes.

In the aircraft’s cargo compartment, the primary FCO locates, tracks, and designates the targets; coordinates surveillance; and talks directly with troops on the ground. The second FCO, sitting next to the primary FCO at the FCC, is the backup. "We have to swap out jobs over the course of the mission," noted Norman. "Our job would be very difficult if we didn’t. Staring at the screen for hours, it’s very easy to fixate and miss something."

In addition to their usual job, the two loadmasters act as scanners or as different sets of eyes to help the FCOs scan the sensor picture. They now also load the Griffin launch tubes into the Derringer Door. "There is nothing like reloading missiles in flight and then shooting them, particularly when bad guys are shooting at our guys," noted SSgt. Debusk Lau, a Harvest Hawk loadmaster. "It’s very rewarding. We normally don’t get to see the end result unloading pallets."

During an attack, the combined job of the flight deck crew and the FCOs is to get the aircraft in the optimal position to shoot. The aircrew adjusts each attack depending on the target.

Once the target is designated and locked, the aircraft is in position, and the pilot has received permission from battalion to fire and then has given his consent to fire, the FCO lifts the cover on the Hellfire launch button and pushes it. "After all the radio chatter and making sure we have the target correlated, it gets very quiet when the FCO says ‘Rifle’ and the missile goes off the rail," says Capt. Josh Mallon, a Harvest Hawk pilot and the squadron weapons officer. "It’s an adrenaline rush."

Hellfire missiles quickly reach supersonic speeds coming off the launch rail and have a very short time of flight. "The FCO has to take the sonic boom from the Hellfire into account," noted Norman. "Shoot too far out, and the bad guys will hear it before the missile impacts."

The AGM-114P Hellfire II, shown here in a launch in Afghanistan, is the primary weapon on Harvest Hawk.

"After a shot, we’d get instant feedback. The messages changed from ‘We’re taking effective fire’ to ‘Yeah! Take that,’ although not in those exact words,” noted Cpl. Tom Wiklow, a Harvest Hawk loadmaster. "We know we made a difference."

**BATTLEFIELD INNOVATION**

“I truly believe if you give a capability to professional Marine aviators, they will come up with better ways to get the job done," said Moses.

Originally deployed to Camp Dwyer, where the Marine combat jets were based, VMGR-252 later moved to Kandahar, the main C-130 base in Afghanistan. "When we arrived in Kandahar, we found a ROVER [Remotely Operated Video Enhanced Receiver] screen in a box," noted Cook. "ROVER is designed for a ground control center, but it gives an incredible view of the entire battlefield. So we put the screen on the aircraft to see if it would work."

"Our airframe guys built a stand for the ROVER screen and put the antenna in the bubble [in combat, the C-130 flight deck escape hatch is often replaced with a clear bubble that gives a crew member an unrestricted view around the aircraft], zip tied the wires out of the way, and turned it on," Cook recalled. "We were getting the Scan Eagle feeds, the Predator feeds, and even the Harrier feeds. We could follow a battle in a different area of operations. With ROVER, we were able to talk to the Forward Air Controller and the Combat Operations Center to track the firefight through the people who were fighting it. ROVER really helped us maintain situational awareness."

The I in ISR stands for intelligence. "When we started, the Intel guys would look at our tapes and take several days to get a package back to us," noted Wyrshc. "We put Intel troops on the aircraft, and they started looking at the tapes in near real time. We could get an Intel package back in just several hours."

"We had a table ratcheted down on a pallet in the back of the aircraft to work from," recalled 1st Lt. Ben Reekes, one of the 2nd Marine Aircraft Wing intelligence specialists. "We were giving on-the-spot imagery interpretation. We could determine if the subject of interest was a person or a dog and why that subject was doing what it was doing. We would also look for what we call patterns of life. Insurgents often had ‘tells’ so that we could pretty much figure they had hidden an IED, for instance. We could build an intelligence highlight package on the aircraft and ship it off to other units shortly after landing. We were able to quickly exploit what we were seeing."

The lessons learned by the Cherry Point crew were passed to the Miramar crews for their second Harvest Hawk deployment in 2012, just as VMGR-352 had passed lessons learned from its first deployment to Afghanistan in 2010. The two units overlapped each other for about a week to pass knowledge and complete the mission handover. "Every detachment has made this mission better," noted Moses.

**GOING FORWARD**

One major lesson learned is that, with the very heavy tasking in theater and as many as 140 flight hours in one month—the maximum allowed, more than one Harvest Hawk crew is needed on future deployments. A formal training program has now been established at both operational units.

"We want to bring the KC-130J community up to speed and depend less and less on TACAIR personnel for Harvest Hawk," noted Wyrshc. "I left my Harrier squadron, went to Miramar for a month to train on the KC-130J, got familiar with the Harvest Hawk system, got my live training shots, and was out the door for Afghanistan. That’s not going to work anymore. We have to grow the community from within."
“Every ground unit at Camp Lejeune wants to train with Harvest Hawk. There is high demand to train with us. One British unit is making a special trip to North Carolina to train with us.” – CAPT. THAN NORMAN

“We had seven officers and six enlisted personnel on our Harvest Hawk deployment,” said Butler. “Now, we are training ten officers with only two FCOs coming from the fighter community. We know what’s needed. We will have four dedicated FCOs on the next det, for instance, so the same guys are not flying day after day. Eventually, we’ll have crew members with hundreds of hours in this aircraft before we deploy. We have quality, but we’re not there yet on quantity.”

Harvest Hawk ground school consists of twenty-two classes in three days on close air support and multi-image reconnaissance; on the FCC and the TSS; on what the forces on the ground are doing and why; on radio procedures, particularly communicating with ground forces; and on aircraft basics, such as where the crash axe is located.

A recently installed desktop FCC simulator prepares the crew members for the five qualification flights. The second simulator event for a new FCO is with the aircraft commander, and the two train side by side. The simulator schooling covers the same profiles as the actual training flights: day weapons employment; integrating with ground forces on CAS and MIR missions; and urban CAS where shot geometry and zero civilian casualties are important considerations. The capstone is a live fire mission in which each FCO launches a Hellfire and a Griffin.

The instructors, who sit on the flight deck or behind the student FCOs, often simulate communications from the ground forces. But more and more, training flights are with actual ground forces the Harvest Hawk crew will be working with in theater. “Every ground unit at Camp Lejeune wants to train with Harvest Hawk,” noted Norman, a former F/A-18 backseater. “There is high demand to train with us. One British unit is making a special trip to North Carolina to train with us.”

During a detailed debrief after a flight, students own up to mistakes, review the attack profiles with the instructors, and go over how each mission element could have been done better. Details are important. After one mission, Wyrsch told students what level to set the volume on the radios—the more important radios should be kept at a higher volume.

The urgency of the Harvest Hawk mission is emphasized during training. “It’s important for a crew to get a well-planned shot off quickly,” said Wyrsch, who will soon enter F-35 pilot training. “The consequences of a missile being on target thirty seconds late versus being on target three minutes late because the aircraft had to go around are dramatic for that Marine on the ground.”

“I helped, but I was also able to facilitate help when the ground Marines needed it,” concluded Cook, who will be one of three pilots flying Fat Albert, the C-130 support aircraft for the Navy’s Blue Angels aerobatic team in 2014. “Harvest Hawk has become a real partner to the Marine air and ground forces. But we’re just getting started. Anything we can do to make the good guys’ jobs easier, we’re going to do it.”

Jeff Rhodes is the associate editor of Code One.
Measuring F-35 antenna performance, or pole testing, began at Rome Research Lab eight years ago. The joint Lockheed Martin-F-35 Joint Program Office engineering team realized in the early stages of the F-35 program that a computer simulation could not adequately test the range, isolation, and overall performance of the aircraft’s antennas. And testing the antennas before the program finished building the first production aircraft was crucial.

“We needed to validate the antenna performance and ensure no major issues existed long before the first aircraft were finished,” said David Hamre, F-35 Radio Frequency Integration and Spectrum lead engineer for Lockheed Martin. “Continued testing allows us to tweak the design of the antennas and make modifications to the aircraft before full-rate production begins.”

By testing the F-35 antennas before the jet was flying, the team could determine if the antennas were meeting range and accuracy requirements, likely avoiding serious, and potentially costly, design modifications. The team of engineers quickly determined that, to get the data they needed before an actual F-35 was produced, they would have to build an exact replica of the jet, install the antennas, and begin testing antenna performance.

The team went to work constructing the first model—an F-35 frame that would represent both the F-35A conventional takeoff and landing, or CTOL, and the short takeoff/vertical landing, or STOVL, variants. The fiberglass and aluminum frame was subcontracted to ATI and designed so that different antennas can be installed at various positions to validate and test gain patterns and performance. The team completed the model, replete with traditional Air Force markings and
unique crest of the Air Force Research Lab Test Directorate, in ten months. Testing began in 2004—a full two years before the first flight of F-35 AA-1, the first test aircraft.

Once the joint Lockheed Martin-USAF JPO team completed the model, the first sets of antennas were installed. The 8,500-pound model was then hoisted atop the fifty-foot tower to begin testing. In its new location, the model is put through thousands of antenna pattern tests to determine if each antenna is working as predicted by the design team.

“The model will stay up there for weeks or even months at a time,” Hamre said. “We wire it for multiple antennas—normally four to six different sets of antennas—and walk through all sorts of tests. We even roll the model upside down to test the antenna function when the aircraft is inverted.”

During the first few rounds of testing, a fixed antenna 5,000 feet away continuously radiated the CTOL model while the model was tilted and spun 360 degrees. By placing the model fifty feet above the ground and rotating it, the engineering team can get an accurate spherical picture of how the antennas operated from different angles. The team could then ensure the antennas would still function properly during rolls and maneuvering. The engineers then used antenna gain patterns to verify antenna positioning to determine if the antennas were blocked or obscured by the vertical tails. Antenna gain patterns could also verify if the aircraft emitted any unwanted reflections.

During some of the early testing, the team found an undesired reflection off the aircraft’s surface that needed to be corrected through a physical antenna redesign. Mission Systems engineers made changes in the design, tested those changes on the model, and ensured antenna performance was achieved before feeding the engineering changes into the F-35 production line.

“Without testing antennas on these models before the F-35 production began, we wouldn't have found performance issues until flight tests were conducted many years later,” Hamre said. “These models saved us from having to retrofit antennas and from making serious changes after the aircraft were deployed.”

After the initial testing was complete, the team continued to use the CTOL model to isolate antennas, verify range requirements, and test antenna switching patterns.

“At any given time, we may have upward of twenty antennas on the airframe,” continued Hamre. “We need to see how much energy these antennas are putting into each other so we can have simultaneous operation of systems without interference. We were able to use this data to determine when to switch to different antennas and to validate how the antennas were working to design.”

Testing the CTOL model was a continuous process; the team completed tests as new antennas became available and as the program needed new information. With the majority of the CTOL testing now complete, Hamre and his team began constructing an F-35C carrier variant model to test how the larger wings and slightly different airframe may impact the aircraft’s additional antennas.

Perched atop the pattern tower since May 2012, the Jolly Roger CV model has completed most of its right-side-up testing. It is now undergoing inverted testing, which is scheduled to be completed by late 2013.

“Testing the CV won’t take as long because most of the basic testing was already done during previous tests on the CTOL model,” Hamre said. “With the CV, we are trying to characterize the larger wing and tail surfaces to see how obscuration is impacted. So far all of the antennas have been working as predicted.”

Over the past eight years, the team has compiled more than 1.5 million pattern files, verified multiple antenna positions, and made preproduction design modifications to ensure the early production models have the final features and capabilities. The models aren’t done making an impact just yet. As the program continues to grow and more F-35s are produced and flying, the CTOL and CV models will continue to perch atop the tower in upstate New York testing antenna patterns and performance of F-35s for international operators. ♦

Sarah Shenk is a communications representative for Lockheed Martin.
The F-35 Flight Test Update in the Volume 27, Number 2 issue of Code One closed with the record-setting month of June 2012 with the Integrated Test Force completing 114 test flights and 1,118 test points. Since then, the team set new records of 135 System Development and Demonstration, or SDD, flights for 239 SDD flight hours and more than 1,100 test points in August 2012. With training pilot checkouts at Eglin AFB, Florida, and test pilot qualifications at NAS Patuxent River, Maryland, fifty-four pilots have now flown the F-35 Lightning II.

Weapon testing has progressed since the last issue as F-35 pilots dropped the program’s first 1,000- and 2,000-pound inert Joint Direct Attack Munitions, or JDAMs, and the first AIM-120 AMRAAM separation test was carried out. The team also completed airstart testing for the F-35A and F-35B variants to collect critical data for upcoming high angle of attack tests. Through 20 October 2012, the F-35 program had accrued 986 test flights for more than 7,800 test points in 2012.

9 July 2012
First F-35B Night Flight
Marine Corps Maj. Richard Rusnok took off in F-35B BF-2 at 9:57 p.m. EDT for the B-model’s first night flight. The one-hour flight from NAS Patuxent River, Maryland, in BF-2 evaluated the aircraft’s exterior lighting. It was Flight 204 for BF-2.

17 July 2012
First F-35C Flight With Block 2A Software
The first F-35C test mission with updated Block 2A software was piloted by Navy Lt. Chris Tabert in F-35C CF-3 for 1.1 hours from NAS Patuxent River, Maryland. Block 2A software provides additional capabilities for the F-35, such as the Multifunction Advanced Datalink, the current Link-16, maintenance datalink, and a mission debriefing system. The mission marked CF-3 Flight 68. Photo by Andy Wolfe
27 July 2012
F-35A Airstart Testing Complete
Lockheed Martin test pilot David Nelson completed airstart testing in F-35A AF-4 during Flight 131 over the Edwards AFB, California, test range. The 2.3-hour mission included the final four required airstrikes, a critical step prior to the start of high angle of attack tests. Photo by Tom Reynolds

1 August 2012
First Air-To-Air MADL Exchange
F-35As AF-3 and AF-6 accomplished a high data rate exchange with the first F-35 air-to-air communication over the Multifunction Advanced Datalink, or MADL. Air Force Lt. Col. George Schwartz flew AF-3 on Flight 128 for two hours from Edwards AFB, California. Mark Ward piloted the 1.8-hour AF-6 Flight 104. Photo by Matthew Short

7 August 2012
First F-35B Airstart Mission
Marine Corps Lt. Col. Matt Kelly piloted the three first F-35B engine spooldowns over the Edwards AFB, California, test range to signal the beginning of F-35B airstart testing. The 1.3-hour mission marked F-35B BF-2 Flight 212. Photo by Michael D. Jackson

8 August 2012
First Weapons Separation
Traveling at 400 knots at 4,200 feet altitude in F-35B BF3, Lockheed Martin test pilot Dan Levin dropped an inert 1,000-pound GBU-32 JDAM over the Atlantic test range. The 0.8-hour mission was the F-35 program’s first weapon separation. The milestone flight was BF-3 Flight 224. Photo by Andy Wolfe

10 August 2012
First F-35C Fly-In Arrestment
Navy Lt. Chris Tabert accomplished the first fly-in arrestment into the MK-7 arresting gear cable by an F-35C at JB McGuire-Dix-Lakehurst, New Jersey. Using an interim arresting hook system, an engineering team composed of F-35 Joint Program Office, Naval Air Systems Command, and industry officials conducted tests to assess cable dynamics, aircraft loads, and performance on F-35C CF-3. During testing, Tabert achieved five of eight attempts into the arresting gear. Completing these tests enabled the F-35 program to improve the redesigned arresting hook system. Engineering design reviews will continue, culminating in initial sea trials projected for spring 2014. Photo by Layne Laughter

13 August 2012
New Record 19 Flights In One Day
The F-35 program set a new record of nineteen flights in one day in production flights and test flights at five bases across the United States. F-35s were flown from Edwards AFB, California; NAS Patuxent River, Maryland; JB McGuire-Dix-Lakehurst, New Jersey; NAS Fort Worth JRB, Texas; and Eglin AFB, Florida. Photo by Layne Laughter
15 August 2012
F-35B Airstarts Complete
Dan Canin piloted F-35B BF-2 for Flight 217 to perform the F-35B’s final airstart test mission. Pilots accomplished twenty-seven F-35B airstarts over the Edwards AFB, California, test range to complete the prerequisite for next year’s F-35B high angle of attack tests. Photo by Michael D. Jackson

17 August 2012
BF-2 Returns To Pax
The F-35B test aircraft BF-2 was ferried back to NAS Patuxent River, Maryland, with Dan Canin at the controls following the completion of airstart testing. After an overnight stop at NAS Fort Worth JRB, Texas, Canin completed the trip from Edwards AFB, California, with 3.4-hour BF-2 Flight 219. Photo by Andy Wolfe

22 August 2012
F-35B Formation Flight
Marine Corps Maj. C. R. Clift and Navy Lt. Cmdr. Michael Burks flew F-35B test aircraft BF-2 and BF-4 in formation over the Atlantic Test Range. The flight, which originated from NAS Patuxent River, Maryland, tested formation flying qualities at subsonic and supersonic speeds to provide data on F-35B handling characteristics. The 1.9-hour mission marked BF-2 Flight 221 and BF-4 Flight 130. Photo by Andy Wolfe

20,000th Test Point Complete
The SDD team accomplished 20,000 test points since the beginning of the test program with two F-35A test flights at Edwards AFB, California, and three F-35B test flights at NAS Patuxent River, Maryland. The overall F-35 SDD flight test program plan calls for 59,585 test points to be verified through developmental test flights by 31 December 2016. Photo by Matthew Short

23 August 2012
1,000th F-35A Test Flight
The F-35A test fleet marked the program’s 1,000th conventional takeoff and landing test flight during three test missions at Edwards AFB, California. Photo by Matthew Short

27 August 2012
F-35B Radar Cross Section Testing Complete
Marine Corps Maj. Richard Rusnok piloted F-35B BF-5 for a 1.2-hour flight to complete baseline testing of the aircraft’s radar cross section on a series of flights from NAS Patuxent River, Maryland. The flight marked BF-5 Flight 51. Photo by Andy Wolfe

31 August 2012
New Flight Test Records
The F-35 test team accomplished 135 SDD flights for 239 SDD flight hours and more than 1,100 test points for a record-setting month in August. Photo by Layne Laughter
Five Jets Airborne At Pax
The Integrated Test Force at NAS Patuxent River, Maryland, flew five simultaneous test missions: F-35B BF-2, BF-3, BF-4, and BF-5; and F-35C CF-2. Photo by Michael D. Jackson

2,000 F-35A Flight Hours
The F-35 program’s 2,000th F-35A conventional takeoff and landing test flight hour on a 1.9-hour mission systems sortie occurred in F-35A AF-7 on its 123rd flight. Air Force Maj. Eric Schultz was at the controls for the milestone flight from Edwards AFB, California. Photo by Paul Weatherman

External Weapons Formation Flight
Air Force Maj. Eric Schultz and Maj. Brent Reinhardt flew F-35A aircraft AF-1 and AF-2 in formation with external inert AIM-9X missiles. The 1.3-hour test flight measured formation flying qualities. The sorties, AF-1 Flight 250 and AF-2 Flight 279, originated from Edwards AFB, California. Photo by Paul Weatherman

Pax Adds A Pilot
Marine Corps Capt. Michael Kingen joined the test pilot roster at NAS Patuxent River, Maryland, with his 0.9-hour check flight. The first flight for the fifty-fourth F-35 pilot was F-35C CF-3 Flight 85. Photo by Andy Wolfe

Production Jet Joins Pax Fleet
An F-35 production jet landed at NAS Patuxent River, Maryland, for the first time when F-35B BF-17 was ferried from NAS Fort Worth JRB, Texas, with Bill Gigliotti at the controls. BF-17 will temporarily support the Integrated Test Force at Pax until it joins the Operational Test team at Edwards AFB, California. The 3.1-hour ferry flight marked BF-17 Flight 8. Photo by Andy Wolfe

First F-35A Weapon Release
The F-35A completed the conventional takeoff and landing variant’s first inflight weapon release at China Lake, California. The weapon release followed the first F-35B weapon release in August. Air Force Maj. Eric Schultz released an inert, instrumented 2,000-pound GBU-31 from the aircraft’s left weapon bay over the Naval Air Warfare Center Weapons Division ranges. The 1.3-hour mission, originating from Edwards AFB, California, marked F-35A AF-1 Flight 254. Photo by Tom Reynolds

First F-35 AMRAAM Jettison
F-35A test aircraft AF-1 accomplished another testing milestone with the program’s first aerial release of an AIM-120 AMRAAM. Air Force Maj. Matthew Phillips jettisoned the instrumented AIM-120 from the aircraft’s internal weapon bay over the Naval Air Warfare Center Weapons Division test range at China Lake, California, during a one-hour mission. AF-1 Flight 255 originated from Edwards AFB, California. Photo by Matt Short

Sydney Carroll is a communications representative for the F-35 program at Lockheed Martin and is webmaster of F35.com.
More than 150 US Air National Guardsmen from the 187th Fighter Wing, the Alabama Air National Guard unit at Dannelly Field ANGB in Montgomery, deployed to Romania in August to participate in Dacian Viper 2012, a three-week joint exercise with the Romanian Air Force.

The Guard contingent, which included nearly twenty fighter pilots and eight F-16s, exercised with approximately 200 Romanian soldiers, technical staff, and pilots flying six MiG-21 Lancers at 71st Air Base, located near the town of Câmpia Turzii in the northwestern part of Romania.

The Alabama National Guard has had a relationship with Romania since 1994 as part of the State Partnership Program. This wide-ranging program pairs Guard units with sixty-five
different nations to improve both military and civil understanding and cooperation. Romania subsequently became a member country of NATO in 2004. Because of the long-standing relationship between the Romanian Air Force and the Alabama National Guard, the 187th Fighter Wing was a natural choice for the exercise.

“Our wing has to be able to deploy our F-16 aircraft anywhere in the world and on short notice in defense of our nation’s interest,” explained Col. Samuel Black, commander of the 187th Fighter Wing. “To do that, everyone in our wing has to work together in a closely coordinated way with each other and with other organizations. For Dacian Viper, we demonstrated that we can safely transport our people, planes, and equipment to a theater of operations more than 5,500 miles away.”

Once in Romania, the unit participated in training flights to enhance interoperability with NATO allies. “While we learn lessons from every trip, this trip went very smoothly,” said Black. “We’ve deployed many times over the years for training and combat operations, so this was a chance to keep our skills and processes sharp.”

The flying portion of Dacian Viper enhanced the tactical skills of the US and Romanian fighter pilots by providing an opportunity to perform common flight and training activities. The aerial missions also allowed for an exchange of experience on tactics, techniques, and procedures for basic fighter maneuvers, air combat maneuvers, intelligence, tactical command, and cross-service logistics support.

“We always welcome opportunities for our pilots to experience new environments,” said Guard Lt. Col. William Sparrow, commander of the 100th Fighter Squadron. “Participating in Dacian Viper provided our younger pilots with some great opportunities they would not ordinarily have here.
at home. Operating in an unfamiliar airspace, including taking off and landing in any place other than home station, makes our pilots better and stronger. The deployment undoubtedly enhanced our warfighting capability.

The final days of the exercise focused on combined air operations, in which US forces partnered with Romania pilots to exercise common air operations procedures. “Both units benefited from the joint training,” added Sparrow. “Exercises like Dacian Viper improve the integration between our nations. We were impressed with the proficiency and capabilities of the Romanian pilots. They are a lot like us.”

During the exercise, 100th Fighter Squadron pilots were allowed to fly in the back seat of the MiG-21s, and Romanian fighter pilots were allowed to fly in the back seat of the F-16s.

Lt. Col. Ryan Barker, the project officer for the deployment for the 100th, received one of those back-seat rides. “The Romanian Air Force has taken the MiG-21 as far as that aircraft can go technologically,” Barker said. “They have done a great job doing everything in their power to remain relevant and act as key players in any NATO air plan. Their pilots have attended the Tactical Leadership Program in a non-flying status. Their air force is also actively seeking other venues to enhance their tactical knowledge and expertise. Dacian Viper was just such a venue.”

“We had a very productive trip, both in terms of the training gained and the personal relationships formed or strengthened,” added Black. “We have a great appreciation for the abilities of the Romanian Air Force. I believe they were able to see some of the strengths we bring to the table as an Air National Guard unit. They were particularly impressed with the maturity, professionalism, and technical expertise we have in the Guard because of the long tenure of our Airmen relative to active duty forces.”

Maj. Clare Reed is the public affairs officer for the 187th Fighter Wing.
“Both units benefited from the joint training. Exercises like Dacian Viper improve the integration between our nations. We were impressed with the proficiency and capabilities of the Romanian pilots. They are a lot like us.”

– Guard Lt. Col. William Sparrow, commander of the 100th Fighter Squadron
**New Super Hercules For Norway**

Royal Norwegian Air Force officials formally accepted a new C-130J Super Hercules on 27 September 2012 in ceremonies at the Lockheed Martin facility in Marietta, Georgia. This aircraft replaces a C-130J that was tragically lost in a March 2012 accident. Through an agreement between the governments of the United States and Norway, a C-130J originally destined for Dyess AFB, Texas, was redirected to become the replacement Norwegian aircraft. The new Super Hercules, which will be based at Gardermoen AS, near Oslo, was christened Frøya after the Norse goddess of love, fertility, war, and death. The four Norwegian C-130Js are all named after the wives of Norse gods.

**Taiwan Upgrade**

The US Government announced on 1 October 2012 that a contract had been awarded to Lockheed Martin to upgrade 145 Block 20 F-16A/B aircraft for the Republic of China. This retrofit program will include the addition of an active electronically scanned array radar, embedded global positioning equipment, as well as upgrades to the electronic warfare and other avionics systems of Taiwan’s F-16s. Lockheed Martin has upgraded more than 1,000 existing F-16s for the US Air Force and international operators combined. Lockheed Martin was recently named the prime integrator to upgrade the US Air Force F-16 fleet.

**F-35 Training At Luke**

US Air Force Secretary Michael Donley announced 2 August 2012 that Luke AFB outside of Phoenix, Arizona, has been chosen as the location of the Air Force’s F-35A Lightning II pilot training center. The base will receive seventy-two aircraft split among three squadrons. Deliveries are expected to begin in late 2013. Construction to support aircraft beddown is expected to begin by late 2012. In addition to training US pilots, Luke will also train F-35A pilots from international operators. The Record of Decision cited Luke's ramp capacity, ranges, weather, and potential for future growth. The decision culminates a nearly three-year process that included an extensive Environmental Impact Statement that examined effects on air quality, noise, land use, and socioeconomic issues.

**Power By Laser**

The Lockheed Martin Skunk Works and LaserMotive demonstrated an innovative laser power system to significantly extend the Stalker Unmanned Aerial System flight time during testing in June and July 2012. The UAS was modified to incorporate LaserMotive’s proprietary system that makes it possible to wirelessly transfer energy over long distances using laser light to provide a continual source of power. At the conclusion of the first test, conducted in a wind tunnel, the battery on the Stalker had more energy stored than it did at the beginning of the test. The second set of tests proved the system would work in open air, at night, and in desert conditions. Stalker is a small UAS used to perform intelligence, surveillance, and reconnaissance missions.
**RIMPAC 2012**

An AGM-65 Maverick tactical missile is mounted on the wing of a US Navy P-3C Orion at MCB Hawaii, near Kaneohe, Oahu, prior to a scheduled launch exercise mission against a surface target at sea during the Rim of the Pacific, or RIMPAC, exercise on 14 July 2012. Twenty-two nations, more than forty ships and submarines, and more than 200 aircraft and 25,000 personnel participated in the biennial RIMPAC exercise, which ran from 29 June to 3 August. RIMPAC is the world’s largest international maritime exercise. RIMPAC 2012 was the twenty-third iteration in the series that began in 1971. The two P-3s in the photo are both assigned to Patrol Squadron 4 (VP-4) at Kaneohe.

**Raptor Surge**

The 43rd Fighter Squadron at Tyndall AFB, Florida, the F-22 training unit, set a new flying record on 24 September 2012, accomplishing fifty-three local sorties in one day. The squadron normally averages from eighteen to twenty-four sorties per day. The surge began in the morning, launching roughly three sets of ten F-22s in the morning and three sets of eight F-22s in the afternoon. Pilots flew, landed, taxied to a hot pit to refuel, and then returned to flight. Only instructor pilots took part in the surge to ensure they met currency and proficiency requirements before the end of the fiscal year in October. The previous flying record by one F-22 fighter squadron was believed to be forty-six sorties in one day.

**First Tanking**

Two US Marine Corps pilots, Maj. Ty Bachman and Maj. Paul Holst, carried out the first two operational aerial refuelings of the F-35B Lightning II on 2 October 2012 during a flight over the Florida panhandle. Previous aerial refueling operations with the F-35 have been conducted only with test aircraft. The two F-35B pilots are assigned to Marine Fighter Attack Training Squadron 501 (VMFAT-501) at Eglin AFB, Florida, the F-35 Integrated Training Center. Holst is also the first non-instructor pilot or test pilot to perform an aerial refueling in the F-35B. The KC-130J Super Hercules tanker crew on the flight is assigned to Marine Aerial Refueler Transport Squadron 252 (VMGR-252) at MCAS Cherry Point, North Carolina.

**JASDF Pilots In Arizona**

The March 2011 earthquake and resulting tsunami in Japan destroyed a number of Japan Air Self-Defense Force F-2 fighters. To help compensate for the loss of aircraft, JASDF pilots have begun training with the 162nd Fighter Wing, the Arizona Air National Guard unit in Tucson that serves as the Guard’s international F-16 training unit. Although there are no F-16s in the JASDF inventory, the F-2 is a derivative of the F-16, and the aircraft are similar. Tucson also offers training opportunities the pilots do not have in Japan. Instructors at the 162nd FW average more than 2,400 flying hours in the F-16, and as a unit, the wing has graduated more than 2,000 pilots during twenty-three years of international military training.
Bolstering The Fleet

The US Coast Guard will receive three HC-130J Super Hercules rescue aircraft under a contract announced by Lockheed Martin on 1 October 2012. This purchase will increase the Coast Guard fleet of HC-130Js from six to nine aircraft. The contract also includes funding for two mission suites—each consisting of a mission system operator station located behind the pilot and copilot, a belly-mounted 360-degree long range search radar, a nose-mounted, forward-looking infrared radar, and an advanced mission communications suite.

The current Coast Guard HC-130J fleet is based at CGAS Elizabeth City, North Carolina. The new HC-130Js are scheduled to be delivered in early 2015.

Complex Joint Rescue

California Air National Guardsmen from the 129th Rescue Wing at Moffett Federal Airfield near Sunnyvale, in a joint effort with the US Coast Guard, successfully rescued two ill crewmen from the Ecuadorian vessel Mirelur 1,400 miles off Acapulco, Mexico, on 2-5 September 2012. An MC-130P Combat Shadow tanker and two HH-60G Pave Hawk helicopters were flown to the vessel so that four pararescuemen could jump into the Pacific and board the Mirelur to treat the patients. The fishermen and pararescuemen were then transferred to the USCGC Morgenthau (WHEC-722). From there, the patients and pararescuemen were hoisted onto two HH-60s and flown to Cabo San Lucas, Mexico, where the fishermen were hospitalized. Two MC-130P crews provided tanker and communications support on the inbound flight.

Guard F-35 Instructor Pilot

Maj. Jay Spohn, an Air National Guardsman assigned to the 33rd Fighter Wing at Eglin AFB, Florida, became the first Guard pilot to qualify in the F-35 Lightning II on 3 August 2012. Spohn completed six qualification flights and is now approved to teach other F-35A pilots as an instructor pilot. He was selected in November of 2009 to join the initial F-35A cadre. He helped pave the way for student pilots by developing the syllabus for flight training. Spohn serves as the assistant director of operations for the 58th Fighter Squadron and the chief of standardization and evaluation for the 33rd Operations Group at Eglin.

First F-35 For United Kingdom

The United Kingdom accepted the first F-35 Lightning II for an international operator in ceremonies on 19 July 2012 at the Lockheed Martin facility in Fort Worth, Texas. The United Kingdom was represented by the Secretary of State for Defence, The Right Honourable Philip Hammond, and the United States was represented by the Under Secretary of Defense for Acquisition, Technology, and Logistics, Frank Kendall. The United Kingdom, the first of eight international partners to join the F-35 program, plans to acquire the F-35Bs. Shortly after the ceremony, the first F-35B for the United Kingdom (RAF serial number ZM135) was flown on a local area flight with RAF Sqdn. Ldr. Jim Schofield at the controls. The aircraft was delivered to Eglin AFB, Florida, on 23 July.

PHOTO BY MAJ. KAREN ROGERS
PHOTO BY A1C JOHN D. PARR, III
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**Raptors In The Pacific**

In mid September 2012, F-22 pilots and maintainers from JB Elmendorf-Richardson, Alaska, deployed to the western Pacific, joining an expeditionary contingent of Raptors from JB Langley-Eustis, Virginia, that deployed to the region in late July. The Elmendorf F-22s were flown to Andersen AFB, Guam, while the Langley Raptors operated from Kadena AB, Japan. The twin deployments are the Raptor’s first to the region since the F-22 fleet returned to flight in 2011. The Elmendorf contingent included Airmen from the active duty 3rd Wing and Air Force Reserve Command’s 477th Fighter Group.

**Three Rs Delivery**

An aircrew from the 39th Airlift Squadron at Dyess AFB, Texas, scheduled to deploy to Afghanistan on an aircraft tail-swap mission, transported more than 11,000 pounds of schoolbooks to Afghanistan on 18 September 2012. The Dyess aircrew flew to Charleston AFB, South Carolina, to pick up the books before continuing to Kandahar Airfield, Afghanistan, for delivery. A private organization in Wisconsin organized the collection of books and expects that some 3,000 Afghan children will benefit. The delivery was made under the Denton Program, a Secretary of Defense initiative that allows supplies furnished by a nongovernmental source and intended for humanitarian assistance to be transported to any country without charge on a space-available basis.

**H-Model Farewell**

The last two C-130H Hercules assigned to the 317th Airlift Group at Dyess AFB, Texas, were flown off together after ceremonies at the base near Abilene on 26 September 2012. The aircraft (Air Force serial numbers 74-1667 and 74-2063) were transferred to their new home at the C-130 schoolhouse at Little Rock AFB, Arkansas. The 317th AG, which is scheduled to receive its twenty-eighth and final C-130J in early 2013, flew C-130Hs for thirty-seven years. On 31 March 1975, Dyess received the very first C-130H to roll off the then-Lockheed assembly line. Over the next two years, the base eventually had fifty-three H-models assigned there.

**Door-To-Deck Delivery**

A US Customs and Border Protection P-3 Orion crew drops mission-essential parts to the US Navy guided missile frigate USS Carr (FFG-52), not shown, on 15 August 2012, while supporting Operation Martillo in the Caribbean. Operation Martillo is a joint interagency and multinational collaborative effort to deny transnational criminal organizations air and maritime access to the littoral regions of the Central American isthmus.
Upgraded Powerplant

Rolls-Royce and the US Air Force began flight testing of an upgraded T56 turboprop engine for the C-130H Hercules during a sortie at the Air Force Test Center at Edwards AFB, California, on 14 September 2012. The T56 Series 3.5 Engine Enhancement is expected to increase fuel savings and improve reliability. The Series 3.5, with new materials and new-design turbine blades and vanes, will also improve performance in hot and high operating conditions. This upgrade has already demonstrated greater than eight percent fuel burn improvement in ground tests. The engine improvements can be installed as part of a conventional engine overhaul and do not require any aircraft or engine control system modifications.

Nordic Air Meet

US Air Force F-16 Fighting Falcons from the 480th Fighter Squadron at Spangdahlem AB, Germany, are prepped before the day’s sorties at an airfield in Finland on 3 September 2012 as part of Nordic Air Meet 2012. Nordic Air Meet is a multinational aerial training exercise designed to share new combat tactics with allied countries. Participants included the US Air Force and military forces from Sweden, Finland, Switzerland, Denmark, and the United Kingdom.

Big Apple Raptors

A pair of F-22 Raptor pilots assigned to 43rd Fighter Squadron at Tyndall AFB, Florida, fly in formation after refueling from a KC-135 Stratotanker on 21 August 2012 near New York City. The Raptor pilots carried out a flyover before a Brooklyn Cyclones minor league baseball game during Air Force Week, a series of events held throughout the year in US cities without a significant Air Force presence. The events provide an opportunity for citizens to interact with Airmen and learn about the Air Force and its capabilities.

We Can Rebuild It

Two branches of the newly named Air Force Life Cycle Management Center at Robins AFB, Georgia, are working together to fully repair a damaged U-2S Dragon Lady high altitude reconnaissance aircraft to return it to service. The Command and Control, Intelligence, Surveillance, and Reconnaissance Division, which manages the U-2 program, is partnering with the Warner Robins Air Logistics Complex to explore options for in-house repair of a U-2 that was damaged in 2008. The aircraft was transported by truck to Robins and arrived on 24 August 2012. This aircraft was the last U-2 to come off the then-Lockheed assembly line in the early 1980s. Approximately fifty of the larger U-2Rs were built and later converted to the U-2S configuration.

MRAPs To Korea

The second shipment of two Mine-Resistant, Ambush-Protected, or MRAP, vehicles was delivered to South Korea on 7 July 2012. A C-5B Galaxy crew from the 22nd Airlift Squadron at Travis AFB, California, flew the vehicles, weighing a combined 29,000 pounds, from the base near Sacramento to Osan AB, outside of Seoul. The MRAPs augment the capability of US Army units stationed in Korea.
Chief’s Fini Flight
US Air Force Chief of Staff Gen. Norton Schwartz made the last flight of his active duty career on 12 July 2012 as he piloted an MC-130E Combat Talon I on a training mission from Hurlburt Field, Florida. The MC-130E he flew (Air Force serial number 64-0568) is assigned to the 919th Special Operations Wing, the Air Force Reserve Command wing at nearby Duke Field. Many of the flight crew on Schwartz’s last flight had either flown with him or served under him during his tours in Special Operations. After landing, Schwartz received a ceremonial hosing down before greeting friends and colleagues. Schwartz piloted this aircraft on a memorable, but arduous, mission in 1982. He retired on 10 August.

Teak Knife 12-3
Two AC-130U Spooky gunship crews and approximately 100 US Special Operations and support personnel from the 4th Special Operations Squadron at Hurlburt Field, Florida, deployed to Osan AB, Korea, from 2–14 September 2012 for Teak Knife 12-3, a joint forces training exercise with South Korean forces. During the exercise, Republic of Korea Special Warfare Command Special Operations Teams from around the peninsula controlled air strikes from the AC-130s along with strikes from A-10 and F-16 pilots assigned to the 51st Fighter Wing at Osan. During the exercise, US and South Korean forces practiced specialized techniques, tactics, and procedures associated with radioing in targets, dropping ordnance, targeting enemy threat capabilities, teaching allied aircraft capabilities, and practicing aircraft deconfliction measures.

Shaw 'Vark
A dedication ceremony for a refurbished F-111E now on static display at Shaw AFB, South Carolina, was held on 12 September 2012. The aircraft (Air Force serial number 68-0039), nicknamed Baghdad Express, was assigned to the 20th Fighter Wing from 1970 to 1993 before the unit moved from RAF Upper Heyford, England, to Shaw in 1994. Crews flew this F-111 on twenty-one missions during Operation Desert Storm. It had been in storage at the Aerospace Maintenance and Regeneration Group at Davis-Monthan AFB, Arizona, prior to being trucked to Shaw in February 2012. Refurbishment of the Aardvark, which included reassembly and repainting, took four months. The aircraft was installed in the Shaw airpark in late August.

Winnie Mae Up In The Air Again
A new exhibition at the National Air and Space Museum called Time and Navigation will feature the Lockheed Model 5B Vega flown by famed aviator Wiley Post. The aircraft, known as Winnie Mae, was recently partially disassembled, transported to the museum, and then reassembled and installed. Post circled the globe in this aircraft in 1931 with Harold Gatty as navigator and then again two years later on a solo flight assisted by one of the world’s first practical autopilots, known as Mechanical Mike. Time and Navigation, which will open in March 2013, will also feature the Astro Navigation System used on the Museum’s SR-71 Blackbird during its record-breaking transcontinental flight from California to Dulles International Airport outside Washington in 1990.