Operation Iraqi Freedom

begin with two 2,000-pound GBU-24 precision-guided munitions dropped from a pair of F-117 Nighthawks from the 8th Expeditionary Fighter Squadron onto a leadership position on the outskirts of Baghdad. Since the start of the conflict, hundreds of coalition aircraft have been engaged in combat operations and combat support missions 24/7 across nearly every square mile of Iraq. More than 31,000 sorties were flown in the first twenty days of OIF. That total includes more than 6,300 air sorties, more than 6,400 attacking sorties, 240 combat search and rescue sorties, and almost 17,000 strike and counter air sorties. Code One welcomes F-16, F-17, U-2, C-130, KC-10, C-5, C-40, P-3, and S-3 operators and crew to send to their best (readable) first-hand accounts from OIF missions for potential use in an upcoming special issue. Please email them as well as digital photos to the editor at: eric.hoff@flying.com.

Thunderbirds Alumni Site

Former patch wearers of USAF Thunderbirds, Honorary Thunderbirds, and Honorary Crewchiefs are being asked to register on the USAF Thunderbird Association Internet site at thunderbirdalumni.com. The information will be used to prepare for the fiftieth anniversary air show season and reunion later this year.

Editorial Transitions

Code One staff sends its thanks and best wishes to longtime editorial assistant Mary Lou Vocale, who retired in March. She wrote many articles and wrote many others during her twelve years on the magazine. The staff welcomes new associate editor Jeff Rhodes, who will help cover activities of our many customers and programs.

National Geographic Coverage

A team from National Geographic recently spent two weeks in Marietta, Georgia, taking photographs and conducting interviews for an upcoming article. The F/A-22 will be a major focus of the article, which is tentatively titled "What's Next in the Air" and scheduled to run in December in conjunction with the 100th anniversary of powered flight.

Annual VIP Driver Reunion

The F-16 VIP Drivers Association is conducting its second stateside reunion 2 - 4 October in Washington, D.C. Events include a golf tournament, tailgate party, and football game (Naval Academy vs Air Force Academy). The scheduled guest speaker is Gen. Ralph Eberhart, Commander, North American Aerospace Defense Command, and Commander, US Northern Command. For more information, see www.f16vipdr.org.

Bill Garrett Dies

Bill W. Garrett, 73, who befriended thousands of F-16 pilots during his long career in the customer support department at General Dynamics and then Lockheed Martin, passed away 7 February in Fort Worth. Garrett took care of many Lockheed Martin customers by providing flight awards for all the F-16 pilots from the first 100 to the high timers of 5,000 hours in the F-16. Earlier in his career, he managed field offices for the company at Ogden, Utah, and Sacramento, California. Garrett, known as a dapper dresser and a collector of classic cars, had a unique ability to say anything while never offending anyone.

Patch Poster Update

Code One is collecting wing, squadron, and any specialty patches to update the F-16 Patch Poster, which can be viewed on the F-16 link on our website. Please send your latest patches to the Code One editorial office.

Poster Winners/New Incentive

Congratulations to the first fifty folks who subscribed to Code One or renewed their subscriptions online this year. The signed lithographs of the cover of the 3rd Quarter 2002 issue are in the mail. This quarter, we plan to give away one 1/72nd scale F-35A desk model signed by Tom Morganfeld, the test pilot of the first flight of the X-35A. The winner will be chosen at random from those subscribing or renewing online from 15 May to 15 July. Good luck.

Online Update

Codeonemagazine.com has been updated with new F/A-22, X-35, and F-117 photos. Drop by for a visit today.

ISAP 3 Meets In Dayton

The third annual International Symposium for Aviation Photography met in Dayton, Ohio, in late February. Hosted by Wright State University, the symposium featured presentations by noted aviation photographers Scott Andrews, John Dibb, Bill Fortney, Brian Shul, Chad Statterly, and Tom Twomey.
Hanoi Taxi Returns To Duty

The C-141 StarLifter, affectionately known as the Hanoi Taxi, received a makeover at the Warner Robins Air Logistics Center at Robins AFB, Georgia, before returning to its home at Wright-Patterson AFB, Ohio, last fall. The C-141 was the first aircraft to airlift American prisoners of war who were released on 12 February 1973 from North Vietnam. Air Force Reserve Maj. Gen. Edward J. Mechember, one of the POWs repatriated aboard the aircraft, piloted it back to Wright-Patterson. The aircraft, which has been upgraded to a C-141G, is one of four C-141s now flown by the 445th AW that was used in Operation Homecoming, as the Vietnam POW airlift was called. The Hanoi Taxi’s name comes from the POW signatures on the flight engineer’s panel, which now serves as the centerpiece of what is essentially a flying museum. The Hanoi Taxi has been selected for eventual display at the Air Force Museum.

Antarctic StarLifter

Reservists from Air Force Reserve Command’s 445th Airlift Wing left their base at Wright-Patterson AFB, Ohio, last February aboard a C-141 StarLifter to participate in Operation Deep Freeze, the passenger and cargo service for the US National Science Foundation’s research facilities in Antarctica. The Reservists flew to Christchurch, New Zealand, the staging point for deployment to Antarctica’s McMurdo Station. During their two weeks in New Zealand, they made several trips to Antarctica to transport people and supplies off the ice continent. The 445th AW has been participating in Operation Deep Freeze since October 2001 along with the 452nd Air Mobility Wing from March ARB, California. C-141 crews have been resupplying the National Science Foundation community in Antarctica since 1966.

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22 EVENTS
Squadron Inactivated After Three Decades

After more than thirty-four years of service, the 42nd Airborne Command and Control Squadron at Davis-Monthan AFB near Tucson, Arizona, was inactivated last September. The Air Force determined the mission of the EC-130H Airborne Battlefield Command, Control, and Communications unit could be successfully accomplished with E-3 and E-8 aircraft and ground systems. Four of the unit’s EC-130Es will be converted into HC-130s for combat search and rescue squadrons. Two other EC-130Es are being transferred to the 41st and 43rd Electronic Combat Squadrons at Davis-Monthan, and one is being retired. The 42nd arrived at Davis-Monthan in July 1994 from Keesler AFB, Mississippi, where it was known as the 7th Airborne Command and Control Squadron. The 7th ACCS began its mission in 1968 and served in Vietnam, Grenada, Panama, and Desert Storm. Before it was deactivated, squadron members were deployed for more than six years to Aviano AB, Italy, to support Operations Deny Flight and Allied Force.

Hotel Mode Demonstrated

Hotel mode, a unique capability of the C-130J propulsion system that provides for safer ground loading and unloading operations, was demonstrated in recent tests at MCAS Cherry Point, North Carolina. This capability puts the C-130J propellers in feathered position, which reduces both propeller blast and engine exhaust heat and, consequently, the amount of dust, dirt, and debris being kicked up behind the aircraft. The engines remain running in this mode enabling the pilot to spool them quickly up to military power.

During the test, a KC-130J in Hotel mode and a KC-130F in low-speed ground idle were placed side by side into a five-knot headwind with engines running at the same rate. Smoke flares were placed behind each aircraft to detect flow patterns. Smoke from the flare behind the KC-130J rose vertically and dispersed, while the areas directly behind the engines and the cargo ramp remained essentially unaffected. Smoke from the flare placed behind the KC-130F flowed nearly straight back.
F-16s Exercise In Thailand

More than 400 US airmen and Marines and 600 service members from Thailand and Singapore flew air-to-air and air-to-ground missions as part of the annual multilateral exercise Cope Tiger 2003 in Thailand last February. Cope Tiger is an annual joint(combined) air-to-air, air-to-ground and large force employment training exercise. The two-week exercise flown from Korat AB gave service members from eight different US bases and the two countries an opportunity to hone their deployment and employment skills, improve air combat techniques, and build stronger relationships.

Raptor Blaster

The US Air Force is deploying more than thirty Raptors to recruiting squadrons across the United States. Instead of the F/A-22, however, this Raptor is a GMC Yukon sporting a 2,400-watt stereo system and a customized paint job. The Air Force's newest recruiting tool, which includes an F/A-22 mini-jet and trailer, is designed to appeal to people between the ages of sixteen and twenty-four. "The Raptor gets you people to think about the Air Force and to ask questions," explained MSgt. Angel Newman, an Air Force recruiter who took the display on tour in South Carolina. "The Air Force offers many opportunities, and the Raptor sure beats a brochure."

Australia C-130s Evacuate Bali Victims

Five Royal Australian C-130 aircraft, crews, and associated aeromedical evacuation teams deployed from RAAF Richmond near Sydney to assist with the evacuation of victims from the Bali bomb blasts last October. The C-130s flew six sorties serving as an aeromedical shuttle between Bali and Darwin, Australia. The Australian Defence Force provided five medical teams, including full-time and reserve members, to assist in patient treatment, care, and prioritization and to coordinate transfer of casualties to Darwin.

Flight Testing

By Eric Hehs

The March sun rises over the Mojave Desert around six. The day's first light accentuates silver metal hangars against the beige backdrop of Rogers Dry Lake. The hangars are the home of the F/A-22 Combined Test Force. Even at this early hour, the buildings on the north end of the flight line at the Air Force Flight Test Center at Edwards AFB, California, bustle with activity as technicians ready their Raptors for the morning flights. The first flight of the day was briefed an hour ago and the pilots are ready. Just after daylight, twin Pratt & Whitney F119 engines disrupt the desert silence as they propel the world's most advanced fighter to the runway for another flight.

Ten Raptors call Edwards AFB home this spring. Two of these, Raptors 02 and 03, are categorized as flight sciences aircraft. Four others—Raptors 04, 05, 06, and 07—are used primarily for avionics testing. Raptors 08 through 11 are assigned to the Air Force Operational Test and Evaluation Center's Detachment 6, which is preparing for a yearlong operational evaluation formally called Dedicated Initial Operational Test and Evaluation, or DIOOTE for short.

Ten Lanni and others at the F/A-22 CTF are taking care of the business of transitioning the Raptor from developmental to operational status. That transition involves expanding the flight envelope, testing advanced avionics, and training DIOOTE personnel who will soon be evaluating the effectiveness of the Raptor.

Flight Sciences: Burning Down Test Points

With more than 900 and 800 flight hours respectively, Raptors 02 and 03 account for more than half of the total accumulated flight time on all F/A-22s built to date. The two airplanes have spent most of that time in some very demanding flight conditions.

"We have a flight envelope cleared on the clean aircraft up to nine G's, sixty degrees AOA, and out to Mach 2," Lanni explains. "We are now clearing the side and main weapon bays to those same extremes so we can launch missiles from the entire flight envelope. Almost all of the recent flight sciences testing has been conducted with open weapon bays."

Clearing a flight envelope for a high-performance fighter is no easy task. Clearing the same envelope for a low-observable fighter with internal weapon bays significantly adds to the challenge. "Other aircraft don't have to deal with opening doors with very thin diameter hinges at supersonic speeds," Lanni continues. "Acoustics create vibrations that stress internal equipment, doors, and..."
The flight sciences aircraft have flown as much as eleven hours in one day. "The current testing requires longer flights," Burton notes. "The points in the flight envelope we’re gathering data for these days are very hard to achieve. Once the airplanes are up and flying, we want to keep them airborne. Fortunately, we have the tanker support necessary to support longer flights at high speeds."

"The airplane is usually airborne before eight in the morning and down before lunch," says Law, explaining a typical day for the flight sciences F/A-22s at the CTE. "We then turn the jet for a two o’clock go. The second mission lasts until about five in the evening on a good day. Usually the plane comes back from the first mission with some issues we have to deal with. Flying at the edge of the envelope pushes this airplane harder than any operational F/A-22 will ever be pushed. We ferret out problems, but that is the purpose of flight testing. Instrumentation comes loose, or we have to troubleshoot a maintenance code. Engineering and the crew work together to get the airplane ready for the afternoon mission. A night shift preps the jets for the next day. Everyone here works hard, and our current flight envelope reflects the success of their labor."

Avionics Testing: Working Together

As the Raptors associated with flight sciences chip away at remaining test points to clear the flight envelope, the jets associated with avionics testing are getting all of the internal electronic systems to work together as a cohesive system.
USMC KC-130J Completes Rapid Ground Refueling Tests

Naval Air Systems Command successfully completed KC-130J Rapid Ground Refueling development testing last year at Naval Air Warfare Center Aircraft Division facilities at NAS Patuxent River, Maryland. In-flight refueling tests with both F/A-18 aircraft and CH-53 helicopters continue at Pax River.

C-5 Fleet TCAS Installations Complete

The last of the 126 US Air Force operational C-5 Galaxies received the Traffic Collision Avoidance System last fall, thereby enabling all Galaxy pilots to reduce the threat of inflight collisions. Through TCAS, Galaxy pilots can identify aircraft flying in the area and maneuver to avoid them. The system is a first step in bringing the C-5 into compliance with DoD-mandated navigational capability and safety requirements. The system proved itself recently when a TCAS-equipped C-5 from the 436th AW at Dover, Delaware, flew into an air traffic control area shut down from a power outage. TCAS alerted the C-5 crew to a light aircraft near the flight path in time to allow the crew to take evasive maneuvers. Dover C-5Bs were the first to receive TCAS.

Alenia Partnership

Lockheed Martin Aeronautics Company President Dain Hankous and Alenia Aeronautica President and Chairman Giorgio Zappa met in February to review joint programs involving the two firms. They discussed future business goals and objectives on programs, such as the F-35 Joint Strike Fighter and the jointly developed C-27J Spartan.

Last year, Italy joined the Joint Strike Fighter program as a participant in the System Development and Demonstration phase. Lockheed Martin is providing technical, training, and spares support to F-16s provided by the US government to Italy under a hosting agreement signed in March 2001.

The C-27J Spartan transport is the result of a co-development partnership between Alenia Aeronautica and Lockheed Martin. Based on Alenia’s G.222 design, the C-27J incorporates advanced propulsion and cockpit technologies of the C-130J. First flight of the C-27J occurred in early 2000. Greece has ordered twelve C-27Js with an option for three more, and Italy has ordered twelve aircraft.

whole. "Like flight sciences, avionics testing has nothing left but the hard tests," notes Lanni. "For example, some of these tests involve the datalink, low observables, radar, radar warning, and expendables. If just one system doesn't work properly, we can't sign off that test point and move on to the next one. I don't think people understand the incredible complexity of some of these missions. All the systems involved and all the instrumentation have to work."

As manager of F/A-22 avionics testing at the Raptor CTF, Terry Toney understands the complexity. Still, he can readily cite a list of recent successes. "We have tested most of the systems on the airplane," he explains. "The radar is nearly fully tested and performing very well. The signature is better than expected. We have tested all of the modes of the electronic warfare system. We have started countermeasures testing. We have tested most of the modes of the communication and navigation system, which consists of radios, interrogator, tactical airborne navigation, and an instrument landing system. We have successfully fired four missiles for score—one AIM-9 Sidewinder and three AIM-120 AMRAAMs."

Most of the avionics testing is being conducted on Raptors 05, 06, and 07. The aircraft are used for a combination of radar, electronic warfare, expendables, and missile shots. Raptor 07, which has full-up low-observable finishes, is used for LO testing as well. The avionics jets are occasionally used for flight sciences tests since electrical and heat loads associated with avionics have to be tested at extremes of the flight envelope. (Raptors 02 and 03 do not have a full complement of F/A-22 avionics.) The F/A-22 CTF plans to borrow Raptors...
from the DIOT&E for avionics tests requiring multiple EO-treated aircraft.

Avionics testing faces two major challenges: software stability and missile shots. "We are struggling with some stability problems," Tomyen says. "The problems are similar to a home computer freezing when a program is launched. The computer has to be restarted. When our software works, it works very well. When the software related to a particular system freezes, we have to deal with restarts for that system. We're getting the bugs out of the system so it starts correctly and"

"I don't think people understand the incredible complexity of some of these missions. All the systems involved and all the instrumentation have to work."

works for the entire flight. These problems are encountered in every development program. We discover most of them in the lab and in the flying test bed. But other problems still crop up when we load software on the airplane. That, unfortunately, is the nature of software development."

Avionics testing must also complete at least twelve more live missile shots to complete this phase of the F/A-22 program. "All are aggressive shots performed at high speeds, high-gloads, high angles of attack, or combinations of these more severe conditions," Tomyen notes. "The program deleted many shots, relying instead on ground tests and modeling and simulation to
Air Mobility Support Team Launched

Lockheed Martin recently launched the Air Mobility Support team, a new intercompany program designed to provide rapid and responsive service to customers while meeting stringent criteria for cost, schedule, and performance. AMS is a specialized customer service organization designed to support the C-130, C-5, and C-141 transports as well as the P-3 and S-3 aircraft. The team integrates the capabilities of support areas, such as in-service engineering, technical publications, field service, supply support, field teams, modification, repair and overhaul, training, support equipment, and mission systems. Information on the Air Mobility Support team, which is based in Marietta, Georgia, can be found on the Internet at https://www.LMSupport.com.

Malaysia Stretch C-130H Enters Service

The Royal Malaysian Air Force recently began operating its first stretched C-130H-30 that has been modified with an extension kit produced by Lockheed Martin's Air Mobility Support team. The stretch kit extends the length of the C-130H cargo hold to fifty-six feet by increasing the fuselage 180 inches by adding sections forward and aft of the wings. The extended C-130H, designated C-130H-30, provides a thirty-two percent increase in the cargo volume capacity. This is the first of two stretch kits for Malaysia. More than sixty types and modernization kits have been developed and fielded by AMS.

“...reduce the risk of these edge-of-the-envelope missile launches.” This combination of ground and flight tests reduces the program schedule by lowering the total number of live launches to be executed during the flight test program.

Missile shots, especially AIM-120 shots, are time consuming and expensive. The CTF can’t plan a missile shot today and go out and perform it tomorrow. Each test requires one or more engineering runs to practice the mission profile. An F-16 acts as a target during these simulated runs. Data from these runs is thoroughly analyzed before the test team conducts the actual test. Range time has to be scheduled. The weather has to meet certain requirements. The team conducts a final dress rehearsal against the actual target before every shot. These rehearsals can be run during the same sortie as the actual test shot, but complex profiles may require a second flight. The average AIM-120 test from engineering to the actual shot, can take a month.

The more complex missile tests involve firing multiple AMRAAMs against multiple targets. Two tests involve simultaneous AIM-120 launches from two Raptors. Another involves a ripple launch in which three missiles are fired in quick succession. The final test, called the graduation shot, involves firing four AIM-120s from one F/A-22 against four targets.

DIOT&E: Evaluating Effectiveness

As envelope expansion and avionics testing boils down developmental test points, another group at the F/A-22 CTF prepares to set fire to a few test points of its own. This collection of...
pilots and maintainers has been selected from the ranks of Air Combat Command. They form Detachment 6, and they are at Edwards to make a formal assessment of the F/A-22's capabilities. The final report generated from DIOT&E testing goes to the Secretary of Defense and will form the basis for his decision to begin high-rate production for the F/A-22.

Lt. Col. Art McGurtrick, AFFTC Det 6 deputy for operations

"The goal of this operational testing is to tell the warfighters how well the Raptor performs," says Lt. Col. Art McGurtrick, AFFTC Det 6 deputy for operations. "We have to tell them what works well, what doesn't work well, and what we don't know about the airplane."

Edwards And Top Gun Get F-16s

The first two of nine refurbished F-16s joined the F-16 Combined Test Force at Edwards AFB, California, in January. The aircraft arrived from the Aerospace Maintenance and Regeneration Center at Davis-Monthan AFB, Arizona. The aircraft, low-hour A and B models built in the late 1980s and early 1990s, replace some of the older F-16s at Edwards. The aircraft will perform photo chase, high-alpha testing, and test support missions for various test forces. The jets will also be used to train students at the USAF Test Pilot School. Similarly, NAS Fallon in northern Nevada took delivery of the first of fourteen F-16s last October. These aircraft, also retrieved from storage, are being used as aggressors for dissimilar air combat training at the Naval Air Warfare Center at Fallon.

CC-130J Austere Field Landing Tests

The US Air Force has given the CC-130J high marks for austere field takeoff and landing operations. The trials, held last November at Yuma, Arizona, were the latest in a series of CC-130J developmental military utility tests before US Air Force-led operational testing and evaluation begins in 2003. The CC-130J trials included the first dirt landing by a US Air Force crew. The shorter-length C-130J completed the austere field trials in 1999.

The Yuma trials were conducted at Tyson Airfield, a dirt landing strip at the military's Yuma Proving Grounds. The strip was selected for its environmental representation of possible war zone landing conditions. The crew landed the aircraft, which weighed in at 135,000 pounds, in less than 2,000 feet.
**F/A-22 Datalink Demonstrated**

The F/A-22 intraflight datalink was successfully demonstrated for the first time last December. During the four-hour flight from Edwards AFB, California, two F/A-22 pilots flying Raptors 65 and 66 demonstrated the basic functionality of the datalink, which can broadcast and receive both voice transmissions and data. The datalink is essentially an encrypted radio and wireless communications medium that allows Raptor pilots to share information without being overheard by potential enemies. The datalink allows formations of Raptor pilots to share information provided by each other’s on-board and off-board sensors, including target tracking information provided by the F/A-22’s APG-77 radar.

**VISTA F-16 Tests Ground Collision Avoidance System**

The US Air Force Test Pilot School at Edwards AFB, with the support from neighboring NASA Dryden Flight Research Center, is testing an innovative system intended to help prevent midair collisions. Flight testing of the Automatic Air Collision Avoidance System, known as Auto ACAS, began in March. The system is installed in the Variable-Stability, Inflight Simulation and Test Aircraft F-16, better known as VISTA F-16. Auto ACAS is an algorithm that decides when an avoidance maneuver is required. The system predicts the recovery flight path and evaluates other aircraft flight paths to determine the best escape maneuver. The autopilot then executes the avoidance maneuver and descends as soon as the flight paths deconflict.

**Spangdahlem Drops JDAM**

The 3rd FS at Spangdahlem AB, Germany, successfully dropped its first GBU-31 Joint Direct Attack Munition last February. The squadron joins other F-16 Block 50/52 units with a demonstrated precision-guided munition capability.

DIOT&E pilots learn to fly the Raptor in a fourteen-flight syllabus preceded by twenty-nine hours of simulating time. The formal test plan begins after another dozen or so preparation flights. "We take tactics Air Combat Command has developed for the F/A-22 and simulate it to the max. The aircraft fly at 30,000 feet and 600 knots," McGrattan continues. "We're getting an early look at how the airplane performs in an operational environment.

The air-to-air portion of DIOT&E involves everything from flying one Raptor in basic air combat maneuvers to employing multiple Raptors with B-2s and other assets in large-scale strike packages against sophisticated ground defenses.

"The Air Force Chief of Staff has asked us to work a Global Strike Force concept of operations into the test," McGrattan explains. "The concept shapes how the United States will fight future wars. That is, we kick down the door with stealth assets. Once the door is down, we flow in legacy aircraft. We are going to practice that initial strike with the Raptors. We will take an F/A-22 with a B-2 and simulate going downtown in a hostile environment against a very high threat laydown of both air-to-air and surface-to-air threats. We have to prove that we can take down the threats, hit the ground targets, and come back out.

"DIOT&E consists of more than determining how fast the airplane can fly and how many bad guys it can shoot down," McGrattan continues. "We are evaluating maintenance, reliability, deployability, and survivability. DIOT&E maintains have been working on the WIP and fixing the jets with the developmental test airplanes for some time. We have to use our pilots and maintainers exclusively once DIOT&E formally begins. We will use our own pilots, our own maintainers, and our own jets out there on the ramp. By law, we can't use contractor help during our evaluation unless the assistance is specifically approved by Air Combat Command. Everything in the evaluation must be operationally representative.

**Milestones: 3,000 Hours And Counting**

No one broke out cupcakes, punch, and party hats when the F/A-22s at Edwards surpassed 3,000 flight hours in late February. The test team was too busy to celebrate. "We've made a huge amount of progress in the last year," Lanni says, "but we rarely take the time to sit back and reflect on our success. We were having trouble getting jets airborne twelve months ago. We were dealing with engine problems and fuel leaks. Now the jets are flying great. We've done a supersonic AIM-120 launch and a supersonic AIM-9 launch. We completed the high angle-of-attack portion of the envelope expansion; we can fly from plus to minus sixty degrees angle of attack. The speed and altitude portion of the envelope were completed before that. We have completed almost all of the 800-knot flutter points. We have accomplished a lot.

"We are turning a corner," adds Burton. "We are getting the Raptor into the hands of operational pilots. They, more than anyone else, are going to sell the F/A-22. If they don't like what they're flying, the program will suffer. But every pilot who flies the Raptor talks about how great it is. Operational test pilots tend to be perfectionists by trade. The airplane impresses them. It is that good."

-Brian Pyle is the editor of Code One.
Raptor High-G Missile Launch

The F/A-22 demonstrated its ability to launch an AIM-9 Sidewinder missile while performing elevated g turns during a late December mission. During the flight over the range at the Naval Air Warfare Center, China Lake, California, F/A-22 test pilot Fred Knox banked Raptor 03 sharply and successfully launched the AIM-9.

F/A-22 Expands Envelope

The F/A-22 flight test program continues to expand the Raptor's flight envelope. The aircraft reached its maximum speed of approximately 860 knots at 15,000 feet in late December. With this, the flight test program is progressing toward successfully clearing the remainder of the F/A-22's flight envelope.
Aviano Receives Colombian Trophy

Congratulations to the 31st FW at Aviano AB, Italy, for receiving the 2002 Colombian Trophy. The award recognizes the best flight safety achievement among all of USAF fighter, attack, and reconnaissance units. The 31st operates two squadrons of F-16s.

Raptor Tests Gun And Flares

A joint Air Force-industry team began airborne live-fire testing of the Raptor's 20mm cannon in February from Edwards AFB. The F/A-22 is equipped with a General Dynamics six-barrel M61A2 Gatling-type gun. The gun is installed on Raptor 02, which was used for the initial ground-based live-fire gun tests that began last December. The live gun function will be evaluated in approximately thirty live firings. In related news, the F/A-22's flare release system will be fly tested for the first time. During the test, MJU-10 flares were released from a Raptor test aircraft flown from Edwards AFB. All flares were released cleanly from the aircraft.

SUPER HERCULES 101

By Peter Simmons
Photos by John Rogers

The C-130J can carry 20,000 pounds of payload over distances of some 4,000 miles without refueling. These numbers, previously unheard of in tactical operations, put the Super Hercules firmly in the envelope for strategic operations.

The C-130J's predecessors, C-130A through C-130H models, set the standard for turboprop military transport aircraft since the first Hercules entered service in 1956. The new C-130J sets the bar even higher. Compared to earlier C-130 models, maximum speed of the J-model is increased twenty-one percent, climb time is reduced up to fifty percent, cruising altitude is increased up to forty percent, and range is extended up to forty percent. With its new engines and propellers, the C-130J has set fifty-four world records for altitude, time-to-climb, speed over a closed course, payload over distance, and short takeoff and landing.

Versatility, reliability, and ruggedness have made the C-130 the military transport of choice for sixty-nine nations on six continents. More than 2,200 of these aircraft have been delivered, making the Hercules the product of the longest continuous, active military aircraft assembly line in history. During the past five decades, virtually every system, component, and structural part of the aircraft has been upgraded to make the C-130 more durable and more cost-effective to operate and easier to maintain. The sum of that knowledge is evident in the C-130J.

The Hercules has carried out a large variety of missions. In addition to being tactical airlifter, variants of the C-130 perform aerial refueling (both in the air and on the ground), weather reconnaissance, surveillance, command and control, close air support, firefighting, electronic reconnaissance,erial broadcasting, search and rescue, and flying hospital.

The C-130J evolved from applying the latest technology to the proven C-130 design. The result offers improved performance and economy.

The design came after seventy-five formal trade studies, all of which were based on proven methods of reducing manpower and lowering life-cycle cost. Technical changes improved performance and operational characteristics over the C-130H.

For example, the C-130J's Rolls-Royce AE2100D3 engines, rated at 4,950 shaft horsepower each, coupled with the distinctive six-blade Detweil Aerospace 8391 all-composite propellers, substantially increase thrust, maximum speed, and fuel economy over the earlier Hercules. A Lucas full-authority digital electronic control unit controls this new propulsion system.
Performance Improvements

The operational benefits of the new propulsion system compared to the C-130H-30 (the longer fuselage length, or stretched model) include twenty-nine percent more takeoff thrust, fifteen percent lower fuel consumption, and nineteen percent more thrust at cruise speeds. The improved mission performance in the C-130J is both a tactical and a strategic airlift advantage. And it provides thirty-two percent reduction in takeoff distance, forty percent faster climb, sixteen percent higher cruise ceiling, and thirty knots faster maximum speed compared to the earlier models.

So what do all these percentages really mean? A reduced takeoff distance allows the C-130J to operate from shorter runways. A faster climb allows the C-130J to get to safe altitudes to avoid ground threats, such as shoulder-fired surface-to-air missiles. A higher cruise ceiling allows the C-130J to operate on routes that are more fuel-efficient. A faster cruise speed allows for more sorties per day per aircraft.

Up Front And In Back

The C-130J cockpit is one of the most highly integrated of any military or commercial transport flying today. The underlying design components and enabling technologies for a two-pilot cockpit that eliminates both the flight engineer and the navigator positions have been proven through a series of trade studies that began in 1982. The two-pilot cockpit is designed to decrease the workload of that of earlier C-130s while maintaining or enhancing the pilot's performance. The incorporation of a head-up display is an innovation in transport aircraft design. The C-130J HUD, which is certified by the FAA as a primary flight instrument, contributes directly to improved operational effectiveness and to overall flight safety.

First Flight For AMP C-5

The first C-5 Galaxy modified under the C-5 Avionics Modernization Program was flown for the first time on 21 December from Lockheed Martin in Marietta, Georgia, several weeks ahead of schedule. The combined Air Force/Lockheed Martin crew took off from Dobbins AFB. The five-hour flight consisted of flying qualities maneuvers, navigational system operation, verification of the new primary flight displays, and initial operation of the stability augmentation system. Work on modifying the aircraft with the AMP cockpit began in June 2002. The AMP contract, valued at $454 million, was awarded in January 1999 and is the first phase of the C-5 modernization program.

Army, Air Force Test Stryker

Senior DoD and congressional leaders witnessed firsthand the Air Force's capability to quickly deploy Stryker infantry vehicles to the most austere locations worldwide during a demonstration last fall at Andrews AFB, Maryland. Soldiers from the 3rd Battalion, 69th Infantry, Alpha Company from Fort Lewis, Washington, loaded a Styer while other soldiers configured another Stryker after unloading it from C-130H Hercules of the 165th Airlift Squadron, Kentucky ANG.

U-2s Deploy

Upgraded U-2s with sensors and datalinks that improve the aircraft's data-collecting capability deployed from Beale AFB, California, in January to support Operation Enduring Freedom and other reconnaissance operations overseas.
100th C-130J Rolls Out

The 100th member of the C-130J Super Hercules family rolled off the production line at Lockheed Martin in Marietta, Georgia, on 17 February, completing more than seven years after the inaugural flight of the first C-130J. The 100th aircraft, an HC-130J, is slated for delivery to the U.S. Coast Guard this spring. More than 1,300 employees in Marietta and hundreds of suppliers around the world work on the C-130J program, now the fifth most produced version of the Hercules lineage.

F-117 Team Wins Shingo

The F-117 program was honored with the 2003 Shingo Prize for Excellence in Manufacturing in March. "The F-117 program's strategic approach to lean process optimization and its Total System Sustainment Partnership with the US Air Force has made Lockheed Martin Aeronautics Company the benchmark for fighter support," said Gus Villanueva, F-117 program director. "This is a proud moment for the F-117 team. Effective manufacturing strategies employed by Lockheed Martin in the F-117 program have improved efficiency. The company has implemented lean practices to reduce cost and increase capacity. Administered by Utah State University, the Shingo Prize is considered one of three major industrial excellence awards, along with the Baldrige Award and the Deming Prize. The award is named in honor of the late Dr. Shigori Shingo, a creator of the Toyota production system.

Final Developmental Flight Test F/A-22 Ferried

The final developmental flight test F/A-22, Raptor 09, was flown from Lockheed Martin in Marietta, Georgia, to its plant in Palmdale, California, on 14 January. After receiving modifications required for Dedicated Initial Operational Test and Evaluation, the aircraft will be ferried to the Air Force Flight Test Center at Edwards AFB. At Edwards, Raptor 09 will be assigned to the Air Force Operational Test and Evaluation Center detachment. It will be used to demonstrate F/A-22 lethality, survivability, and reliability during DIOT&E, scheduled to begin later this year.

The J Family

The C-130 is being manufactured in several variants for customers around the world.

CC-130J

The stretched version of the Super Hercules was originally designated C-130J-30 but has been redesignated CC-130J by the US Air Force. This variant is gaining a reputation around the world for its tremendous range, speed, and lift capability. The CC-130J is based on the standard C-130 model but features a fuselage 180 inches longer that provides a greater lift capability required by many operators. When compared with the standard model, the CC-130J carries eight 463L pallets instead of six, ninety-seven medical liters instead of seventy-four, and twenty-four container delivery system bundles instead of sixteen. Most important, the CC-130J carries 128 combat troops instead of ninety-two for the standard model and ninety-two paratroopers instead of sixty-four for the standard-size aircraft.

SH-130J

The SH-130J long-range surveillance and rescue version will bolster the US Coast Guard's current early 1970s- and 1980s-vintage HC-130H fleet while reducing maintenance costs and increasing efficiency, performance, and operability. The Coast Guard will also see a twenty-five percent increase in mission endurance with the HC-130J. The HC-130, which is the Coast Guard's long-range aviation platform, is tasked to perform the services' most demanding missions. The current HC-130H crews perform search and rescue, law enforcement (fisheries and drug interdiction), international ice patrol, and environment incident response. These assignments will remain the same for the HC-130J, although the dramatic increase in workload for the crews and aircraft seen over the last decade is expected to continue.

WC-130J

The WC-130J is an Air Force Special Operations Command asset. It will be flown by the 193rd Special Operations Wing, the Pennsylvania Air National Guard unit based at Harrisburg, its mission is to carry out psychological warfare missions. The specially equipped WC-130J aircraft can broadcasts programming using all commercial AM and FM radio bands; TV and UHF television bands; and the military's VHF, HF, and FM frequencies. Broadcasts from the aircraft are carried out as areas of military conflict or political unrest either to inform or to influence both military and civilian citizens in the area. The wing's first modified aircraft will be delivered in 2003.

KC-130J

The KC-130J is the tanker variant of the J-model. It is currently in production for the US Marine Corps and for the Italian Air Force. Using only wing and external tanks, the KC-130J has a 57,500-pound (8,455 US gallons) fuel load capability, compared with 38,000 pounds (5,588 US gallons) for the current and nearly forty-year-old KC-130F fleet. The KC-130J has a mission radius of 500 nautical miles. The standard probe-and-drogue configuration is suited for both helicopters and jet aircraft. Internal provisions for its own refueling probe provide even greater flexibility if required. As an example, the Flight Refueling Ltd. (FRL) Mark32B-901E aerial refueling system delivers 270 to 350 gallons per minute at fifty psi without the fuselage tank, used on the legacy KC-130 fleet to routinely flies directly into the eye of a hurricane to carry out vital data gathering missions. This unit, commonly referred to as Hurricane Hunters, can monitor and track storm and hurricane movements. The Weatherbird program, as it is known, requires Lockheed Martin Aeronautics to test, develop, and integrate the specialized avionics, weather sensors, and structural modifications required for the weather reconnaissance mission into new C-130J airframes. To collect the necessary data, the WC-130J crew enters the storm at approximately 15,000 feet and repeatedly flies directly through the eye of the storm. The data allows forecasting centers to better predict the path of a storm or hurricane and its potential impact on population centers.

EC-130J Commando Solo

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Code One 13
Customers
US Government
The US government is the largest customer to date for the C-130J program with a total of fifty-six J-model variants on contract for the active duty Air Force, Air National Guard, Air Force Reserve Command, Marine Corps, and the Coast Guard. The Air Force currently has a requirement for 168 C-130Js. The 2003 US defense budget contains a request for a multiyear acquisition of forty aircraft over five years.

The US Marine Corps has a requirement for fifty-one tanks with approval to pursue a multiyear acquisition plan for twenty-four aircraft as well. The two acquisitions will be combined to realize tremendous cost savings of more than ten percent for both services.

In 1999, the first C-130J was delivered to Air Force Reserve Command's 403rd Wing at Keesler AFB, Mississippi. The 135th Airlift Group is the 135th Wing of the Baltimore-based unit of the Maryland Air National Guard which was the first C-130J. The 135th also received its first aircraft in 1999. In March 2001, the 135th led the testing to de-air the entire US fleet of C-130Js to carry passengers and cargo throughout the continental United States, Alaska, and Canada and to operate in a range of icing conditions.

In June of 2002, the US Air Force added overwater navigation and tactical airland operations to the C-130J’s list of permissable operations. In late 2001, the first CC-130J in Air Force service was delivered to the 143rd Airlift Wing, the ANG unit at Quonset Point, Rhode Island. Last summer, the first CC-130J was delivered to the 144th Wing of the California ANG. When equipped with the Airborne Fire Fighting System, or AFFS, a new state-of-the-art fire retardant delivery system developed by Aero-Union, the CC-130J will provide the fire fighting C-130 units (three National Guard and one Air Force Reserve Command) with the most advanced airborne firefighting capability in the world.

Although the US Army is not a direct customer of the C-130J program, it certainly has a strong interest in the program because the J-model will primarily be used to transport Army equipment and troops. In fact, the Army recently announced a new parameter for new artillery vehicle acquisitions requiring the vehicles to be transportable in a C-130.

While other airlifters, such as the newer C-17 and the older C-5, are much roomier, the C-130 is the dominant lift aircraft in the Air Force’s inventory,” said Gen. Eric Shinseki, Army Chief of Staff. The Stryker, the Army’s newest fighting vehicle gained permanent clearance last summer for loading and transport on the C-130.

The Coast Guard currently has six aircraft in order with the first HC-130J to be completed in 2003.

Royal Air Force
As the launch customer, the British Royal Air Force received the first C-130J off the production line. The first HC-130J program, actually a Hercules C. Mk. 4 (the RAF designation for the CC-130J), rolled out in October 1995. The same aircraft was used to make the type’s first flight on 5 April 1996.

The first C-130J aircraft was delivered in 1999 and the last in 2000. With twenty-five aircraft, fifteen Hercules C. Mk. 4 (CC-130J) and ten C. Mk. 5s, the RAF is the largest J-model operator in Europe. It also currently holds the only those aircraft in airlift wings around the country and allows the Marine Corps to continue its tanker modernization efforts at a steady rate. The Air Force will receive forty CC-130Js, the stretched fuselage version of the aircraft, and the Marines will receive twenty KC-130J tankers. Several days later, Lockheed Martin received a contract for an additional FY’03 CC-130J.

T-50 Goes Supersonic
The T-50 Golden Eagle advanced supersonic trainer achieved supersonic flight for the first time on 19 February. “The aircraft accelerated through the Mach smoothly and quickly,” said Maj. Cheong Hwan Lee, Republic of Korea Air Force test pilot for the flight. “I observed no adverse flight or handling characteristics. I was able to hold the target speed of Mach 1.05 with plenty of excess power available, so I have no doubt this aircraft will be able to achieve its maximum design speed of Mach 1.5.” The milestone flight was accomplished on the No. 1 flight test aircraft during a sixty-minute flight from Sacheon, South Korea. Top speed was Mach 1.05 at an altitude of 40,000 feet.
Events

European F-16s See Action Over Afghanistan

A European detachment of Dutch, Norwegian, and Danish F-16s participated in a large-scale action in southern Afghanistan in late January. Coalition ground troops requested air support after their convoy came under fire. In response, F-16s from the European Participating Air Forces were sent to the location. Dutch pilots were the first to arrive on the scene. The Dutch were relieved by the Norwegians, who later dropped laser-guided bombs on a target. The action was the largest military operation in the area since Operation Anaconda last year.

F/A-22 Passes 3,000-Hour Mark

The F/A-22 Raptor flight test force at Edwards AFB, California, recorded the program’s 3,000th flight test hour on 28 February. Eight Raptors currently call Edwards AFB home as the joint US Air Force-Lockheed Martin industry team continues developmental flight testing of the F/A-22 in anticipation of the program’s upcoming Dedicated Initial Operational Test and Evaluation phase, which is scheduled to begin later this year. As of 9 April, the F/A-22 test fleet had accumulated 3,220 hours on 1,501 sorties.

Royal Australian Air Force

The Royal Australian Air Force has more than four decades of experience flying the legacy Hercules. It became the first international C-130 customer in 1958. In 2000, the RAAF became the first J-model operator to deploy its C-130J fleet into military service in Afghanistan. The RAAF has been operating its J-models while assisting other operators to help develop the aircraft’s operational and technical capabilities. As one of the first fleets to see international operations, the RAAF C-130J’s participated in missions to East Timor as early as 2001.

Flyvverktøj Kommando

The latest customer to join the C-130 family is the Flyvverktøj Kommando, the Royal Danish Air Force. A contract for three CC-130Js with an option for a fourth was signed in December 2001. The first Danish aircraft began assembly in February of this year. Several of Denmark’s leading officials, including those who helped give birth to the Danish purchase, recently visited the Marietta, Georgia, site to view Lockheed Martin employees piece together the structural beginnings of their new next-generation Hercules. The first Danish aircraft, which will have the ECHS and a comprehensive electronic warfare system, is scheduled for delivery in the fourth quarter of 2003. The new aircraft will replace the current Danish fleet, which consists of three 1975-vintage C-130Hs.

Peter Simmons is program communicator at Lockheed Martin.
The Desert Hawk, a small unmanned aerial vehicle, could pass as something pulled off the shelf at your local Toys-"R"-Us. The seven-pound airplane is constructed of a white Styrofoam-like material. Velcro tabs secure the tail to the fuselage. The aircraft Launches into the air with a long bungee cord. A top speed of fifty knots, maximum altitude of 300 feet, range of ten kilometers, and endurance of about one hour places this reconnaissance platform at the lower end of the spectrum of aircraft developed by the same people who produced the P-80, F-104, U-2, and SR-71.

"You get paid for this?"

The question sounds familiar to David Eichholz, one of a half-dozen or so engineers working on Desert Hawk at Lockheed Martin Advanced Development Programs in Palmdale, California. However, the occasional ribbing from coworkers does not detract from the project. "The airplane may look like a toy, but it performs a serious mission," says Eichholz.

That mission is force protection. And this toy-like, very sophisticated device performs it very well. So well, in fact, that the Desert Hawk was the US Air Force's nominee for the 2002 Collier Trophy.

The Desert Hawk is the flying portion of a larger aerial reconnaissance system formally called the Force Protection Airborne Surveillance System, or FPASS for short. The aircraft, powered by an electric motor, acts as a flying sentry. It quietly surveys large areas with its three tiny internally mounted video cameras. A one-pound payload capability also accommodates an infrared imaging system, which provides night vision. A transmission on the Desert Hawk sends video images directly to a ground station in real time.

From there, the images can be shared over existing networks. FPASS is different from all other small UAV systems. "Operators basically launch and watch," Eichholz explains. "The system has no joystick and requires no pilot. Flight paths are set on a laptop control screen. The airplane navigates autonomously. An operator can change the flight path in flight, however, an 'orbit here now' button on the computer screen immediately sends the Desert Hawk into a circular pattern and keeps the cameras pointed at the center of the orbit."

Origins And Evolution

FPASS traces its origins to a 1996 Defense Advanced Research Projects Agency program called Micro Air Vehicle. The goal of the DARPA MAV program was to develop a reconnaissance airplane that has no dimension greater than six inches. The vehicles had to be able to conduct real-time imaging, have ranges of up to ten kilometers, and speeds up to thirty miles per hour for missions ranging from twenty minutes to two hours. Several micro UAVs resulted, including the MicroStar from Lockheed Martin and the Black Widow from AeroVironment.

Lockheed Martin engineers learned large from these minuscule beginnings. "We found that tiny vehicles get tossed..."
Women Warriors of Osan

Duke, Double, Shotgun, and Dirty—names never given to the daughters of America—are the call signs of four F-16 pilots who just happen to be women.

PHOTOS AND ARTICLE
BY
RENE EKMAN

The world is changing, and the faces of those who fight our wars are also changing. While women have been flying combat missions since the early 1990s, four female pilots in the same squadron at the same time is still rare, if not a first for an F-16 unit. The 56th FS at Osan AB, Republic of Korea, also known as the "Flying Fiends," welcomes the talent and dedication these four women bring to this F-16 squadron. What has always been the most exclusive of brotherhoods, that of the pilots privileged to fly the world's premier multirole fighter, is now becoming the brother-and-sisterhood of America's best and bravest. These females and their male colleagues uphold US commitments to the Republic of Korea and peace in northeast Asia.

So, what brought these four female Fiends to Osan? Two still aspire to become astronauts. One is the daughter of a career Navy man who served on aircraft carriers. Two graduated from the US Air Force Academy, class of 1996. One majored in math at the University of Georgia, and one graduated from Massachusetts Institute of Technology. Two are married to F-16 pilots stationed in the 8th FW at Kunsan AB, Korea. One is married to a T-37 instructor in Air Education and Training Command. One is single. Two are on their second operational F-16 assignments. Two are on their first assignment, after previously serving as T-38 instructors.

Like their male contemporaries, they were attracted to the F-16 by its multirole mission, single-seat, advanced avionics, and the challenge of pushing their own capabilities. Each of the four has developed the ability to fit into a male-dominated environment. "I learned at the Academy that the only way to fit in is to be yourself," says Kerre "Duke" Scarborough. "Women who choose to fly fighters are much like men who choose to fly fighters," says Steff "Double" Orr. "As soon as male pilots see that female pilots are just as capable as they are, most of the problems go away."
around in the wind," notes Eichstedt. "Image quality suffers. So, we built a series of larger vehicles to determine an optimum size."

The six-inch MicroStar began platforms of increasing wingspan of nine, fifteen, and twenty-four inches. "We found that the bigger the vehicle, the greater its operational utility," says Eichstedt. "Larger wingspans can, of course, carry more weight. More importantly, the aerodynamic damping characteristics create a more stable platform as well. The minimum size for a stable operational vehicle has a wingspan of about two feet."

The DARPA MAV program did not spawn any production decisions, but Lockheed Martin continued developing MAV technology, including an autopilot system.

**Surfing The Net**

Many of the technologies developed for MAV were applied to the PPASS program by chance when a Skunk Works engineer ran across a request for information in 2001. Joe Wurts, a top configuration designer who happens to be a world champion radio-control glider pilot, was out surfing an Air Force opportunities website and noticed a request for information for a small, inexpensive UAV, recounts Eichstedt.

Wurts and a small group of engineers replied to the request with information they had developed in their own MAV studies. The Air Force asked for a flying demonstration based on the response.

During the demonstration, one of the USAF evaluators asked the Lockheed Martin team to redirect the airplane to orbit a cluster of static airplanes he had spotted on the laptop display. After a simple keyboard command, the UAV began orbiting the parked aircraft and sent back clear and steady video. "The system did a great job of retasking and keeping the area of interest in sight," says Eichstedt. "The evaluators realized our system was a step beyond other systems. None of the others approach the autonomy and ease of use we've achieved."

Furthermore, the Skunk Works was the only team that could deliver the system in a short timeframe. The Air Force signed a contract letter in late February 2002. Lockheed Martin delivered the first two systems 127 days later to Electronic Systems Center at Hanscom AFB in Massachusetts, which is responsible for force protection for USAF forces. Six more systems were delivered in October.

Each system consists of six airplanes, a ground control station, a remote viewing terminal, and a field support kit that has spare items, such as servos, motors, patch kits, battery chargers, and the bunker launcher. The ground control station includes a commercially available ruggedized laptop. In fact, the program uses as much off-the-shelf and non-developmental hardware as possible, PPASS is fitted in ruggedized and waterproof shipping containers. A complete system takes up a space of only eight by eight by four feet and weighs about 520 pounds.

The Desert Hawk itself has a wingspan of fifty-two inches and measures thirty-four inches from nose to tail. Payload and the flight duration requirements set the size. The engine and propeller are rear-mounted to soften landings. The Skywalker-like material is mold-injected expanded polyethylene foam, which is more durable than expanded polyurethane (better known by its brand name of Styrofoam). Kevlar skids on the nose and tail improve durability as well. The sensors are carried in the middle of the fuselage. A notched area in the lower fuselage provides operating space for the color or infrared cameras. GPS and other antennas are mounted on the wings.

We can train enlisted personnel to operate the system in about one week," notes Eichstedt. "Since the system doesn’t need a pilot in the loop, operators don’t have to learn how to fly a radio-controlled airplane, which is an acquired skill. Since we aren’t using the imagery from the airplane to fly it, operators can focus their attention on finding targets."

**Future**

The success of the Desert Hawk spurred interest from a variety of potential customers. "We’ve demonstrated the system for several agencies that fall under the new Department of Homeland Defense," notes Kent Burns, the PPASS program manager for Lockheed Martin. "We see a large market for the system. Other potential customers include local police forces and other security agencies that monitor pipelines, aqueducts, and harbors. Engineers in Palmdale are looking at ways to improve the system. "We can drive out a lot of the cost by moving to a mass manufacturing environment," Burns continues. "We’re monitoring improvements in battery and fuel cell technology as well as sensor technology. Software improvements will allow multiple UAV’s to work together so the system can cover a wider path of ground and find targets faster."

**Collier Candidate**

While PPASS didn’t win the 2002 Collier Trophy (the Sikorsky S-92 helicopter did), being the US Air Force’s nomination for that prestigious award was an honor in itself. "We didn’t really expect to win," Eichstedt admits. "But having our customer nominate us is a huge compliment."

"We have received attention far greater than the contract value," Eichstedt continues. "Part of that attention can be attributed to the PPASS unclassified status. We happen to be one of the few programs the company can talk about in public. On the other hand, we delivered a capable system in a very short timeframe. We are also the only fully operational, totally autonomous UAV. We really do have something special here."

Burns, Eichstedt, and others working on PPASS didn’t need a Collier Trophy for motivation. "The program was conducted under a letter of urgent and compelling need from the customer," Eichstedt explains. "They had to get these systems in the field as soon as possible. Everyone understood that PPASS would directly protect American lives. The technology itself is fun. The work of bringing together the components and suppliers to meet the specs and aggressive schedule is somewhat stressful. But knowing that we might be saving some lives is the real payoff."

**In addition to the ability to change the vehicle’s flight path with the click of a mouse, the operator can mark targets with GPS coordinates and record the entire flight on mini-DV camcorder tape.**

The Desert Hawk is launched with a long bungee cord. Once airborne, the UAV executes its flight path and feeds data back to the operator at a mobile ground station. In addition to the ability to change the vehicle’s flight path with the click of a mouse, the operator can mark targets with GPS coordinate and record the entire flight on mini-DV camcorder tape. A single system as delivered can support 24/7 flight operations.

Eric Hiko is the editor of Code One.
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That mission is force protection. And this toy-like, very sophisticated device performs it very well. So well, in fact, that the Desert Hawk was the US Air Force's nominee for the 2002 Collier Trophy.

The Desert Hawk is the flying portion of a larger aerial reconnaissance system formally called the Force Protection Airborne Surveillance System, or FPASS for short. The aircraft, powered by an electric motor, acts as a flying sentry. It quietly surveys large areas with its three very tiny internally mounted video cameras. A one-pound payload capability also accommodates an infrared imaging system, which provides night vision. A transmitter on the Desert hawk sends video images directly to a ground station in real time.

From there, the images can be shared over existing networks. FPASS is different from all other small UAV systems. "Operators basically launch and watch," Eichtelt explains. "The system has no joystick and requires no pilot. Flight paths are set on a laptop control screen. The airplane navigates autonomously. An operator can change the flight path in flight, however. An 'orbit here now' button on the computer screen immediately sends the Desert Hawk into a circular pattern and keeps the cameras pointed at the center of the orbit."

Origins And Evolution

FPASS traces its origins to a 1996 Defense Advanced Research Projects Agency program called Micro Air Vehicle. The goal of the DARPA MAV program was to develop a reconnaissance airplane that has no dimension greater than six inches. The vehicles had to be able to conduct real-time imaging, have ranges of up to ten kilometers, and speeds up to thirty miles per hour for missions ranging from twenty minutes to two hours. Several micro UAVs resulted, including the MicroStar from Lockheed Martin and the Black Widow from AeroVironment.

Lockheed Martin engineers learned large from these miniscule beginnings. "We found that tiny vehicles get tossed around a lot," says John D. "Dirty" Hokaj. "It is a good idea to have several in play at the same time, so that when one is lost, you are not out of business for days or weeks."

"Women fighter pilots need to be tough," says Dawn "Shotgun" McElhinney. "To succeed in this career, they have to be able to dish out what the men can dish out. They need a fighter pilot mentality. They have to be open to honest criticism. If I have a bad flight, my fellow pilots let me know about it."

"Women need a thick skin," explains Dawn "Dirty" Hokaj. "The guys need a thick skin, too. We come back from every mission and watch the tapes. In those debriefings, we basically destroy each other for two hours. We detail everything we did wrong to try to improve our skills. No one sugarcoats these debriefings because a woman is in the room."

These four pilots all think like warriors. "I fell in love with the absolute concept of the military and of knowing that I was going to serve my country," says McElhinney. "Going to war is my job. It's also what I can give back to my country."

"They shouldn't blame the Air Force if something happens to me," says Hokaj. "This is my choice. We have to be as safe as we can in combat. But we have to get the mission done."

"I've spent two deployments flying over Iraq," says McElhinney. "While they weren't exactly combat deployments, I was shot at many times. When it comes down to it, everyone is here to do a job. Who cares whether the pilot is male or female? This job is not harder for women; it is just different. We share those hardships with the people we love and trust. We get up every day, put on our flight suits, and walk proudly into our fighter squadron knowing how blessed we are to have the opportunity to serve our country and a cause greater than ourselves."

Rose Elmore is an aviation photographer based in Japan.
European F-16s See Action Over Afghanistan

A European detachment of Dutch, Norwegian, and Danish F-16s participated in a large-scale action in southern Afghanistan in late January. Coalition ground troops requested air support after their convoy came under fire. In response, F-16s from the European Participating Air Forces were sent to the location. Dutch pilots were the first to arrive on the scene. The Dutch were relieved by the Norwegians, who later dropped laser-guided bombs on a target. The action was the largest military operation in the area since Operation Anaconda last year.

F/A-22 Passes 3,000-Hour Mark

The F/A-22 Raptor flight test force at Edwards AFB, California, recorded the program's 3,000th flight test hour on 28 February. Eight Raptors currently call Edwards AFB home as the joint US Air Force-Lockheed Martin industry team continues developmental flight testing of the F/A-22 in anticipation of the program's upcoming Dedicated Initial Operational Test and Evaluation phase, which is scheduled to begin later this year. As of 9 April, the F/A-22 test fleet had accumulated 3,220 hours on 1,501 sorties.

Royal Australian Air Force

The Royal Australian Air Force has more than four decades of experience flying the legacy Hercules. It became the first international C-130J customer in 1958. In 2000, the RAAF became the first J-model operator to deploy its C-130J fleet into military service in Afghanistan.

Aeronautica Militare Italiana

The Aeronautica Militare Italiana (the Italian Air Force), or AMI, is Europe's second largest C-130 operator, with a total of twenty-two C-130J, CC-130J, and KC-130J aircraft on order. The National Training Center at Pisa AB opened in 2002. The Italian configuration of the C-130J is among the most sophisticated C-130Js yet developed. It has a highly advanced communications and defensive systems suite that includes UHF/VHF combined multifunction radios and a laser warning receiver system. The AMI received its first aircraft in 2000. The AMI chose the operational C-130J training and support facility, which resides at its main transport base, RAF Lyneham, England. No. 24 and 30 Squadrons are the two current RAF units flying the C-130J. The Red Arrows, the RAF's jet demonstration team, use a J-model as its support aircraft. The RAF's E-model C-130Hs are used in aerobatic display teams.

C-130J because of its advanced defensive systems to return Mohamed Zahir Shah, the former king of Afghanistan, and Hamid Karzai, the interim head of the Afghan Administration, to Kabul. The AMI also assisted the US Air Force with defensive systems trials last summer. In addition, the AMI has the first C-130J receiver-tanker built, a tanker that can take on fuel itself. The AMI will be the first air force to use the Special Avionics Mission Strap-On-New C-130 Open Skies Pod System, or SAMSON COPS, with the C-130J to support the Treaty on Open Skies.

Flyvermakt Kommando

The latest customer to the C-130J family is the Flyvermakt Kommando, the Royal Danish Air Force. A contract for three CC-130Js with an option for a fourth was signed in December 2001. The first Danish aircraft began assembly in February of this year. Several of Denmark's leading officials, including those who helped give birth to the Danish purchase, recently visited the Marietta, Georgia, site to view Lockheed Martin employees piece together the structural beginnings of their new next-generation Hercules. The first Danish aircraft, which will have the ECHS and a comprehensive electronic warfare system, is scheduled for delivery in the fourth quarter of 2003. The new aircraft will replace the current Danish fleet, which consists of three 1975-vintage C-130Hs.

Pete Simmons is a program communicator at Lockheed Martin.
Customers

US Government

The US government is the largest customer to date for the C-130J program. Customers have a total of fifty-six J-model variants on contract for the active duty Air Force, Air National Guard, Air Force Reserve Command, Marine Corps, and the Coast Guard. The Air Force currently has a requirement for 168 C-130Js. The 2003 US defense budget contains a request for a multiyear acquisition of forty aircraft over five years.

The US Marine Corps has a requirement for fifty-one aircraft, with approval to pursue a multiyear acquisition plan for twenty-four aircraft as well. The two acquisitions will be combined to realize tremendous cost savings of more than ten percent for both services.

In 1999, the first C-130J was delivered to Air Force Reserve Command's 403rd Wing at Keesler AFB, Mississippi. The 403rd Wing Group of the 135th Wing of the Baltimore-based unit of the Maryland Air National Guard was the first ANG unit to operate the C-130J. The 135th also received its first aircraft in 1999. In March 2001, the 135th led the testing to clear the entire US fleet of C-130Js to carry passengers and cargo throughout the continental United States, Alaska, and Canada and to operate in a range of icing conditions.

In June of 2002, the US Air Force added overwater navigation and tactical airland operations to the C-130J's list of permissible operations. In late 2001, the first C-130J in Air Force service was delivered to the 146th Air Wing, the ANG unit at Quonset Point, Rhode Island. Last summer, the first C-130J was delivered to the 146th Wing of the California ANG. Equipped with the Airborne Fire Fighting System, or AFFS, a new state-of-the-art fire retardant delivery system developed by Aero-Union, the C-130J will provide the four firefighting C-130 units (three Air National Guard and one Air Force Reserve Command) with the most advanced airborne firefighting capability in the world. Although the US Army is not a direct customer of the C-130J program, it certainly has a strong interest in the program because the J-model will primarily be used to transport Army equipment and troops. In fact, the Army recently announced a new parameter for new artillery vehicle acquisitions requiring the vehicles to be transportable in a C-130.

"While other airlifters, such as the newer C-17 and the older C-5, are much roomier, the C-130 is the dominant lift aircraft in the Air Force's inventory," said Gen. Eric Shinseki, Army Chief of Staff. The Stryker, the Army's newest fighting vehicle gained permanent clearance last summer for loading and transporting on the C-130. The Coast Guard currently has six aircraft on order with the first HC-130J to be completed in 2003.

Royal Air Force

As the launch customer, the Royal Air Force received the first C-130J off the production line. The first Royal Air Force (RAF) aircraft, the first C-130J, was delivered to RAF Akrotiri in Cyprus in October 1995. The same aircraft was used to make the type's first flight on 5 April 1996. The first RAF aircraft was delivered in 1999 and the last in 2000. With twenty-five aircraft, fifteen Heros C. MK. 4 (C-130J) and ten C. Mk. 5s, the RAF is the largest J-model operator in Europe. It also currently holds the only inventory of C-130J aircraft in Royal Air Force service.

Multyyear Acquisition For C-130J

Lockheed Martin received a $4 billion US Air Force contract in mid-March for the multiyear acquisition of six C-130J aircraft for the US Air Force and Marine Corps. The six-year program runs from FY'03 through FY'08. Acquiring a larger aircraft in larger, long-term quantities allows the Air Force to better plan the placement of those aircraft in airlift wings around the country and allows the Marine Corps to continue its tanker modernization efforts as a steady rate. The Air Force will receive forty CC-130Js, the stretched fuselage version of the aircraft, and the Marines will receive twenty KC-130J tankers. Several days later, Lockheed Martin received a contract for an additional FY'03 CC-130J. This CC-130J, which will be delivered in 2005, will replace a C-130J that will be transferred from the 403rd Wing at Keesler AFB, Mississippi, to the KC-130J Commando Solo program. This latest order brings the number of C-130Js and CC-130Js ordered by the Air Force to seventy-seven.

T-50 Goes Supersonic

The T-50 Golden Eagle advanced supersonic trainer achieved supersonic flight for the first time on 19 February. "The aircraft accelerated through the Mach smoothly and quickly," said Maj. Choong Hwan Lee, Republic of Korea Air Force test pilot for the flight. "I observed no adverse flight or handling characteristics. I was able to hold the target speed of Mach 1.05 with plenty of excess power available, so I have no doubt this aircraft will be able to achieve its maximum design speed of Mach 1.5." The milestone flight was accomplished on the No. 1 flight test aircraft during a sixty-minute flight from Sacheon, South Korea. Top speed was Mach 1.05 at an altitude of 40,000 feet.
100th C-130J Rolls Out

The 100th member of the C-130J Super Hercules family rolled off the production line at Lockheed Martin in Marietta, Georgia, on 17 February. Company officials estimate that more than seven years after the inaugural flight of the first C-130J, the CJ-30 variant, an HC-130J is slated for delivery to the US Coast Guard this spring. More than 1,300 employees in Marietta and hundreds of suppliers around the world work on the C-130J program, now the fifth most produced version in the Hercules lineage.

F-117 Team Wins Shingo

The F-117 program was honored with the 2003 Shingo Prize for Excellence in Manufacturing in March. "The F-117 program's strategic approach to lean process optimization and its Total System Sustainment Partnership with the US Air Force has made Lockheed Martin Aeronautics Company the benchmark for fighter support," said Gas Villanueva, F-117 program director. "This is a proud moment for the F-117 team. Effective manufacturing strategies employed by Lockheed Martin in the F-117 program have improved efficiency. The company has implemented lean practices to reduce cost and increase capacity. Administered by Utah State University, the Shingo Prize is considered one of three major industrial excellence awards, along with the Baldrige Award and the Deming Prize. The award is named in honor of the late Dr. Shoige Shingo, a creator of the Toyota production system.

Final Developmental Flight Test F/A-22 Ferried

The final developmental flight test F/A-22, Raptor 09, was flown from Edwards AFB in California, its engine in Palmhala, California, on 14 January. After receiving modifications required for Dedicated Initial Operational Test and Evaluation, the aircraft will be ferried to the Air Force Flight Test Center at Edwards AFB. At Edwards, Raptor 09 will be assigned to the Active AFB Operational Test and Evaluation Center detachment. It will be used to demonstrate F/A-22 lethality, survivability, and reliability during DIOT&E, scheduled to begin later this year.

The J Family

The C-130 is being manufactured in several variants for customers around the world.

CC-130J

The stretched version of the Super Hercules was originally designated C-130J-30 but has been redesignated CC-130J by the US Air Force. This variant is gaining a reputation around the world for its tremendous range, speed, and lift capability. The CC-130J is based on the standard C-130 model but features a fuselage 180 inches longer that provides a greater lift capability required by many operators. When compared with the standard model, the CC-130J carries eight 4555 pallets instead of six, ninety-seven medical liters instead of seventy-four, and twenty-four container delivery system bundles instead of sixteen. Most important, the CC-130J carries 129 combat troops instead of ninety-two for the standard model and ninety-two paratroops instead of sixty-four for the standard-size aircraft.

HC-130J

The HC-130J long-range surveillance and rescue version will bolster the US Coast Guard's current early 1970s- and 1980s-vintage HC-130H fleet while reducing maintenance costs and increasing efficiency, performance, and operability. The Coast Guard will also see a twenty-five percent increase in mission endurance with the HC-130J. The HC-130, which is the Coast Guard's long-range aviation platform, is tasked to perform the services most demanding missions. The current HC-130H crews perform search and rescue, law enforcement (fisheries and drug interdiction), international ice patrol, and environmental incident response. These assignments will remain the same for the HC-130J, though the dramatic increase in workload for the crews and aircraft seen over the last decade is expected to continue.

WC-130J

The WC-130J are assigned to the 53rd Weather Reconnaissance Squadron at Keesler AFB in Biloxi, Mississippi. It is the only unit in the world that routinely flies directly into the eye of a hurricane to carry out vital data gathering missions. This unit, commonly referred to as Hurricane Hunters, can monitor and track storm and hurricane movements. The Weatherbird program, as it is known, requires Lockheed Martin Aeronautics to test, develop, and integrate the specialized avionics, weather sensors, and structural modifications required for the weather reconnaissance mission into new C-130J airframes. To collect the necessary data, the WC-130J crew enters the storm at approximately 10,000 feet and repeatedly flies directly through the eye of the storm. The data allows forecasting centers to better predict the path of a storm or hurricane and its potential impact on population centers.

EC-130J Commando Solo

The EC-130J is an Air Force Special Operations Command asset. It will be flown by the 123rd Special Operations Wing, the Pennsylvania Air National Guard unit based at Harrisburg, its mission is to carry out psychological warfare missions. The specially equipped EC-130J aircraft can broadcast programming using all commercial AM and FM radio bands; VHF and UHF television bands; and the military's VHF, HF, and FM frequencies. Broadcasts from the aircraft are carried out in areas of military conflict or political unrest either to inform or to influence both military and civilian audiences in the area. The wing's first modified aircraft will be delivered in 2003.

KC-130J

The KC-130J is the tanker variant of the J-model. It is currently in production for the US Marine Corps and for the Italian Air Force. Using only wing and external tanks, the KC-130J has a 57,500-pound (8,455 US gallons) fuel offload capability, compared with 38,000 pounds (5,588 US gallons) for the current and nearly forty-year-old KC-130F fleet. The KC-130J has a mission radius of 500 nautical miles. The standard probe-and-drogue configuration is suited for both helicopters and jet aircraft. Internal provisions for its own refueling probe provide even greater flexibility if required. As an example, the Flight Refueling Ltd. (FRL) Mark23B-901E aerial refueling system delivers 270 to 350 gallons per minute at fifty wing fuel tanks, the fuselage tank, used on the legacy KC-130 fleet to provide pressure. The new propulsion system enhances ground refueling. The KC-130J, like all J-models, has a function that features the props while the turboprops continue to run. Called Hotel Mode, this feature eliminates prop blast behind the aircraft so ground forces can operate in relative calm while the aircraft is being fueled. The KC-130J can offload up to 600 gallons of fuel per minute—nearly four times the current offload rate.
Performance Improvements

The operational benefits of the new propulsion system compared to the C-130H-30 (the longer fuselage length, or stretched model) include twenty-nine percent more takeoff thrust, fifteen percent lower fuel consumption, and nineteen percent more thrust at cruise speeds. The improved mission performance in the C-130J is both a tactical and a strategic airlift advantage. And it provides thirty-two percent reduction in takeoff distance, forty percent faster climb, sixteen percent higher cruise ceiling, and thirty knots faster maximum speed compared to the earlier models.

So what do all these percentages really mean? A reduced takeoff distance allows the C-130J to operate from shorter runways. A faster climb allows the C-130J to get to safe altitudes to avoid ground threats, such as shoulder-fired surface-to-air missiles. A higher cruise ceiling allows the C-130J to operate on routes that are more fuel-efficient. A faster cruise speed allows for more sorties per day per aircraft.

Cockpit

Compared to the C-130E model, the C-130J can carry forty percent more cargo a distance of 2,500 nautical miles. With a 35,000-pound payload, the C-130J has forty percent greater range. The improvements in C-130J cargo capability are even more dramatic when the J-model operates in a hot weather environment.

Up Front And In Back

The C-130J cockpit is one of the most highly integrated of any military or commercial transport flying today. The underlying design components and enabling technologies for a two-pilot cockpit that eliminates both the flight engineer and the navigator positions have been proven through a series of trade studies that began in 1982. The two-pilot cockpit is designed to decrease the workload of that of earlier C-130s while maintaining or enhancing the pilot's performance. The incorporation of a head-up display is an innovation in transport aircraft design. The C-130J HUD, which is certified by the FAA as a primary flight instrument, contributes directly to improved operational effectiveness and to overall flight safety.

The infusion of technology in the flight deck is dramatic. The C-130J's cockpit features include dual HUDs, a 1553B data bus architecture, modern, reliable, digital avionics; four color multifunction liquid crystal displays compatible with eight video imaging systems; automated “set and forget” panels and controls; autothrottles and auto-slims; dual mission computers; an integrated diagnostics system; an integrated communications, navigation, and identification system; dual global positioning system and inertial navigation systems; color weather/ground mapping radar; and a color digital map display.

The Enhanced Cargo Handling System, or ECS, increases airdrop accuracy by controlling cargo exit parameters better. In addition, safety has also been enhanced. The loadmaster station, located up front in what had been the crew rest compartment, permits control of the load forward of the load throughout unload, offload, and airdrop missions. The handling system allows for more efficient use of the cargo compartment, which, like previous Hercules models, is ten feet wide by nine feet high by fifty-five feet long. The cargo compartment provides for fast, straight, all loading of many types of heavy cargo, including wheeled and tracked vehicles, mobile equipment, or Air Force and NATO standard 463L, pallets, which are eighty-eight inches wide by 108 inches long. The cargo ramp is adjustable to ground level, to truck bed height, or for freight dock level. The ramp has been redesigned to allow for airloads at speeds up to 250 knots. The number of troop seats or litter racks in the cargo compartment of either the standard or the stretched C-130J models remains the same—128 and ninety-seven on the CC-130J.

The primary components of the ECS are flip-to-stow roller conveyors; an underfloor variable-speed winch for pulling cargo on to the aircraft; a recessed tow plate; and the loadmaster's console, which is tied into the 1553B data bus.

The C-130J offers greater performance and value when compared to any other tactical airlifter. The two-pilot cockpit, reliable digital avionics, and new propulsion system are key factors for improving system reliability and maintainability; reducing maintenance man-hours per flight hour; and reducing flight and maintenance manpower. These improvements result in lower squadron operating and support costs, though the specific cost savings depend upon fleet size and maintenance concepts unique to each operator.

First Flight For AMP C-5

The first C-5 Galaxy modified under the C-5 Avionics Modernization Program was flown for the first time on 21 December from Lockheed Martin in Marietta, Georgia, several weeks ahead of schedule. The combined Air Force/Lockheed Martin crew took off from Edwards AFB. The five-hour flight consisted of flying qualities maneuvers, navigational system operation, verification of the new primary flight displays, and initial operation of the stability augmentation system. Work on modifying the aircraft with the AMP cockpit began in June 2002. The AMP contract, valued at $454 million, was awarded in January 1999 and is the first phase of the C-5 modernization program.

Army, Air Force Test Stryker

Senior DoD and congressional leaders witnessed firsthand the Air Force's capability to quickly deploy Stryker infantry vehicles to the most austere locations worldwide during a demonstration last fall at Andrews AFB, Maryland. Soldiers from the 3rd Battalion, 30th Infantry, Alpha Company from Fort Lewis, Washington, uploaded a Stryker while other soldiers configured another Stryker after offloading it from C-130H Hercules of the 166th Airlift Squadron, Kentucky ANG.

U-2s Deploy

Upgraded U-2s with sensors and datalinks that improve the aircraft's data-collecting capability deployed from Beale AFB, California, in January to support Operation Enduring Freedom and other reconnaissance operations overseas.
Aviano Receives Colombian Trophy

Congratulations to the 31st FW at Aviano AB, Italy, for receiving the 2002 Colombian Trophy. The award recognizes the best flight safety achievement among all of USAF fighter, attack, and reconnaissance units. The 31st operates two squadrons of Block 40 F-16s.

Raptor Tests Gun And Flares

A joint Air Force-industry team began airborne test-firing of the Raptor’s 25mm cannon in February from Edwards AFB. The F/A-22 is equipped with a General Dynamics six-barrel M61/A2 GAU-8/A Gallington-type gun. The gun is installed on Raptor 02, which was used for the initial ground-based live-fire gun tests that began last December. The three-gun additional will be evaluated in approximately thirty airborne firings. In related news, the F/A-22’s flare dispenser was recently flight tested for the first time. During the test, MJU-10 flares were released from a Raptor test aircraft flown from Edwards AFB. All flares separated cleanly from the aircraft.

SUPER HERCULES

BY PETER SIMMONS
PHOTOS BY JOHN ROGERS

The C-130J can carry 20,000 pounds of payload over distances of some 4,000 miles without refueling. These numbers, previously unheard of in tactical operations, put the Super Hercules firmly in the envelope for strategic operations.

The C-130J’s predecessors, C-130A through C-130H models, set the standard for turboprop military transport aircraft since the first Hercules entered service in 1956. The new C-130J sets the bar even higher. Compared to earlier C-130 models, maximum speed of the J-model is increased twenty-one percent, climb time is reduced up to fifty percent, cruising altitude is increased up to forty percent, and range is extended up to forty percent. With its new engines and propellers, the C-130J has set fifty-four world records for altitude, time-to-climb, speed over a closed course, payload over distance, and short takeoff and landing.

Versatility, reliability, and ruggedness have made the C-130 the military transport of choice for sixty-nine nations on six continents. More than 2,260 of these aircraft have been delivered, making the Hercules the product of the longest continuous, active military aircraft assembly line in history. During the past five decades, virtually every system, component, and structural part of the aircraft has been upgraded to make the C-130 more durable and more cost-effective to operate and easier to maintain. The sum of that knowledge is evident in the C-130J.

The Hercules has carried out a large variety of missions. In addition to being tactical airlift, variants of the C-130 perform aerial refueling (both in the air and on the ground), weather reconnaissance, surveillance, command and control, close air support, firefighting, electronic reconnaissance, aerial broadcasting studios, search and rescue, and flying hospital.

The C-130J evolved from applying the latest technology to the proven C-130 design. The result offers improved performance and economy.

The design came after seventy-five formal trade studies, all of which were based on proven methods of reducing manpower and lowering life-cycle cost. Technical changes improved performance and operational characteristics over the C-130J.

For example, the C-130J’s Rolls-Royce AE2100D3 engines, rated at 4,591 shaft horsepower each, coupled with the distinctive six-blade Dowty Aerospace 8391 all-composite propellers, substantially increase thrust, maximum speed, and fuel economy over the earlier Hercules. A Lucas full-authority digital electronic control unit controls this new propulsion system.
F/A-22 Expands Envelope

The F/A-22 flight test program continues to expand the Raptor's flight envelope. The aircraft reached its maximum speed of approximately 860 knots at 15,000 feet in late December. With this, the flight test program is progressing toward successfully clearing the remainder of the F/A-22's flight envelope.

Raptor High-G Missile Launch

The F/A-22 demonstrated its ability to launch an AIM-9 Sidewinder missile while performing elevated 9 turns during a late December mission. During the flight over the range at the Naval Air Warfare Center, China Lake, California, F/A-22 test pilot Fred Knox banked Raptor 05 sharply and successfully launched the AIM-9.
F/A-22 Datalink Demonstrated

The F/A-22 intraship datalink was successfully demonstrated for the first time last December. During the four-hour flight from Edwards AFB, California, two F/A-22 pilots flying Raptors 65 and 66 demonstrated the basic functionality of the datalink, which can transmit and receive voice communications and data. The datalink is essentially a encrypted radio and wireless communications medium that allows Raptor pilots to share information without being overheard by potential enemies. The datalink allows formation of Raptor pilots to share information provided by each other’s onboard and offboard sensors, including target tracking information provided by the F/A-22’s APG-77 radar.

VISTA F-16 Tests Ground Collision Avoidance System

The US Air Force Test Pilot School at Edwards AFB, with the support from neighboring NASA Dryden Flight Research Center, is testing an innovative system intended to help prevent midair collisions. Flight testing of the Automatic Air Collision Avoidance System, known as Auto ACAS, began in March. The system is installed in the Variable-Stability, Inflight Simulation and Test Aircraft F-16, better known as VISTA F-16 Auto ACAS, an algorithm that determines if an aircraft maneuver is required to avoid a collision. They predict the recovery flight path and evaluate other aircraft flight paths to determine the best escape maneuver. The autopilot then executes the avoidance maneuver and discengages as soon as the flight paths deconflict.

Spangdahlem Drops JDAM

The 23rd FS at Spangdahlem AB, Germany, successfully dropped its first QGRU-31 Joint Direct Attack Munition last February. The squadron joined other F-16 Block 50/52 units, demonstrating the accuracy of navigation capability.

DIOT&E pilots learn to fly the Raptor in a fourteen-flight syllabus preceded by nearly nine hours of simulator time. The formal test plan begins after another dozen or so preparation flights. We take test Air Combat Command has developed for the F/A-22, in the simulators and employ them in the actual aircraft. "We've been getting an early look at how the airplane performs in an operational environment.

The air-to-air portion of DIOT&E involves everything from flying one Raptor in basic air combat maneuvers against another adversary to employing multiple Raptors with B-52 and other assets in large-scale strike packages against supersonic ground defenses.

"The Air Force Chief of Staff has asked us to work a Global Strike Force concept of operations into the test," McGrath explains. "The concept shapes how the United States will fight future wars. That is, we avoid the door with stealth assets. Once the door is down, we fly in low aircraft. We are going to practice that initial strike with the Raptor. We will take an F/A-22 with a B-2 and simulate going down in a hostile environment against a very high threat laydown of both air and surface-to-air threats. We have to prove that we can take down the threats, hit the ground targets, and come back out.

"DIOT&E consists of more than determining how fast the airplane can fly and how many bad guys it can shoot down." McGrath says. "We are evaluating maintenance, reliability, deployability, and survivability. DIOT&E maintainers have been checking the wrenches and fixing the jets with developmental test airplanes for some time. We have to use our pilots and maintainers exclusively once DIOT&E formally begins. We will use our own pilots, our own maintainers, and our jets out there on the ramp. By law, we can't use contractor help during our evaluation unless the assistance is specifically approved by Air Combat Command. Everything in the evaluation must be operationally representative.

Milestones: 3,000 Hours And Counting

No one broke out cupcakes, punch, and party hats when the F/A-22s at Edwards surpassed 3,000 flight hours in late February. The test team was too busy to celebrate. "We've made a huge amount of progress in the last year," Lanni says. "This is a new phase for us to begin to turn around our success. We're working to get jets airborne twelve months ago. We were dealing with engine problems and fuel leaks. Now the jets are flying great. We've done a supersonic AIM-120 launch and a supersonic AIM-9 launch. We completed the high angle of attack portion of the envelope expansion, we can fly from plus to minus sixty degrees of angle of attack. The speed and altitude portion of the envelope were completed before that. We have completed almost all of the 800-knot flutter points. We have accomplished a lot.

"We are turning a corner," adds Burton. "We are getting the Raptor into the hands of operational pilots. They're more than anyone else is going to sell the F/A-22. If they don't like what they're flying, the program will suffer. But every pilot who flies the Raptor talks about how great it is. Operational test pilots tend to be perfectionists by trade. The airplane impresses them. It is that good."

Eric Pyle is the author of Code One.
pilots and maintainers has been selected from the ranks of Air Combat Command. They form Detachment 6, and they are at Edwards to make a formal assessment of the F/A-22’s capabilities. The final report generated from DIOA&E testing goes to the Secretary of Defense and will form the basis for his decision to begin high-rate production for the F/A-22.

Lt. Col. Art McGrattan, AFOETEC Det 6 deputy for operations

"The goal of this operational testing is to tell the warfighters how well the Raptor performs," says Lt. Col. Art McGrattan, AFOETEC Det 6 deputy for operations. "We have to tell them what works well, what doesn’t work well, and what we don’t know about the airplane."

Edwards And Top Gun Get F-16s
The first two of nine refurbished F-16s joined the F-16 Combined Test Force at Edwards AFB, California, in January. The aircraft arrived from the Aerospace Maintenance and Regeneration Center at Davis-Monthan AFB, Arizona. The aircraft, low-hour A and B models built in the late 1980s and early 1990s, replace some of the older F-16s at Edwards. The aircraft will perform photo chase, high-alpha testing, and test support missions for various test forces. The jets will also be used to train students at the USAF Test Pilot School. Similarly, NAS Fallon in northern Nevada took delivery of the first of fourteen F-16s last October. These aircraft, also retrieved from storage, are being used as aggressors for dissimilar aircraft training at the Naval Air Warfare Center at Fallon.

CC-130J Austere Field Landing Tests
The US Air Force has given the CC-130J high marks for austere field takeoff and landing operations. The trials, held last November at Yuma, Arizona, were the latest in a series of CC-130J developmental military utility tests before US Air Force-led operational testing and evaluation begins in 2003. The CC-130J trials included the first dirt landing by a USAF crew. The shorter-length C-130J completed the austere field trials in 1999. The Yuma trials were conducted at Tyson Airfield, a dirt landing strip at the military's Yuma Proving Grounds. The strip was selected for its environmental representation of possible warzone landing conditions. The crew landed the aircraft, which weighed in at 155,000 pounds, in less than 2,000 feet.
reduce the risk of these edge-of-the-envelope missile launches." This combination of ground and flight tests reduces the program schedule by lowering the total number of live launches to be executed during the flight test program.

Missile shots, especially AIM-120 shots, are time consuming and expensive. The CTF can’t plan a missile shot today and go out and perform it tomorrow. Each test requires one or more engineering runs to practice the mission profile. An F-16 acts as a target during these simulated runs. Data from these runs is thoroughly analyzed before the test team conducts the actual test. Range time has to be scheduled. The weather has to meet certain requirements. The team conducts a final dress rehearsal against the actual target before every shot. These rehearsals can be run during the same sortie as the actual test shot, but complex profiles may require a second flight. The average AIM-120 test, from engineering to the actual shot, can take a month.

The more complex missile tests involve firing multiple AMRAAMs against multiple targets. Two tests involve simultaneous AIM-120 launches from two Raptors. Another involves a ripple launch in which three missiles are fired in quick succession. The final test, called the graduation shot, involves firing four AIM-120s from one F/A-22 against four targets.

**DIOT&E: Evaluating Effectiveness**

As envelope expansion and avionics testing burn down developmental test points, another group at the F/A-22 CTF prepares to set fire to a few test points of its own. This collection of

"We have completed all of our flutter testing above 10,000 feet on a clean aircraft with the weapon bay doors open out to 800 knots."
from the DIOT&E for avionics tests
requiring multiple EO-treated aircraft.
Avionics testing faces two major chal-
lenge; software stability and missile
shots. "We are struggling with some
stability problems," Tomeny says. "The
problems are similar to a home
computer freezing when a program is
launched. The computer has to be
restared. When our software works, it
works very well. When the software
related to a particular system freezes,
we have to deal with restarts for that
system. We're getting the bugs out of
the system so it starts correctly and

"I don't think
people understand
the incredible
complexity
of some of these
missions. All the
systems involved
and all the
instrumentation
have to work."

works for the entire flight. These prob-
lems are encountered in every develop-
ment program. We discover most of
them in the lab and in the flying test
bed. But other problems still crop up
when we load software on the airplane.
That, unfortunately, is the nature of
software development."

Avionics testing must also complete
at least twelve more live missile shots
to complete this phase of the IVA-22
program. "All are aggressive shots
performed at high speeds, high-gloads,
high angles of attack, or combinatios
of these more severe conditions," Tomeny notes. "The program deleted
many shots, relying instead on ground
tests and modeling and simulation to

US-Italian Team Tests C-130J Defensive Systems

The US Air Force, Italian Air Force, and Lockheed Martin recently conducted joint
tests as part of the US Air Force's planned C-130J defensive systems upgrade
program. The tests were conducted to ensure the software upgrade functions with the
new radar warning receivers and the other upgraded elements. The Italian Air
Force provided a C-130J already equipped with an active radar warning receiver
capability for the US Air Force-sponsored trials. Lockheed Martin served as the tech-
nical and support advisor. Software integration in the US C-130Js is to be completed
in the fourth quarter of 2003.

C-130J Open Skies Treaty Testing

Lockheed Martin Aeronautics
Company and the Italian Air Force
successfully completed the first series
of tests last fall that will allow the Italian
C-130J fleet to participate in Treaty for
Open Skies observation missions. The
Open Skies Treaty, which went into
effect in 1992, gives each of the twenty-
seven signatory countries the right to
gather information about the military
forces and activities of each member
through reciprocal, unarmed observa-

and a mission pod with the same
external dimensions as the C-130H
standard underwing fuel tank. Inte-
grating SAMSON COPS with the
C-130J was requested and funded by
Italy which will be the first country to
use the existing pods with the C-130J.
Testing will continue to ensure Italy's
participation in the treaty observation
flights in 2003.
USMC KC-130J Completes Rapid Ground Refueling Tests

Naval Air Systems Command successfully completed KC-130J Rapid Ground Refueling development testing last year at Naval Air Warfare Center Aircraft Division facilities at NAS Patuxent River, Maryland. Inflight refueling tests with both F/A-18 aircraft and CH-53 helicopters continue at Pax River.

C-5 Fleet TCAS Installations Complete

The last of the 126 US Air Force operational C-5 Galaxies received the Traffic Collision Avoidance System last fall, thereby enabling all Galaxy pilots to reduce the threat of inflight collisions. Through TCAS, Galaxy pilots can identify aircraft flying in the area and maneuver to avoid them. The system is a first step in bringing the C-5 into compliance with DoD-mandated navigational capability and safety requirements. The system proved itself recently when a TCAS-equipped C-5 from the 436th AW at Dover, Delaware, flew into an air traffic control area shut down from a power outage. TCAS alerted the C-5 crew to a light aircraft near the flight path in time to allow the crew to take evasive maneuvers. Dover C-5Bs were the first to receive TCAS.

Alenia Partnership

Lockheed Martin Aeronautics Company President Dan Hancock and Alenia Aeronautica President and Chairman Giorgio Zappa met in February to review joint programs involving the two firms. They discussed future business goals and objectives on programs, such as the F-35 Joint Strike Fighter and the jointly developed C-27J Spartan.

Last year, Italy joined the Joint Strike Fighter program as a participant in the System Development and Demonstration phase. Lockheed Martin is providing technical, training, and spares support to F-16s provided by the US government to Italy under a leasing agreement signed in March 2001.

The C-27J Spartan transport is the result of a co-development partnership between Alenia Aeronautica and Lockheed Martin. Based on Alenia's G.222 design, the C-27J incorporates advanced propulsion and cockpit technologies of the C-130J. First flight of the C-27J occurred in early 2000. Greece has ordered twelve C-27Js with an option for three more, and Italy has ordered twelve aircraft.

whole. "Like flight sciences, avionics testing has nothing left but the hard tests," notes Lanni. "For example, some of these tests involve the datalink, low observables, radar, radar warning, and expendables. If just one system doesn't work properly, we can't sign off that test point and move on to the next one. I don't think people understand the incredible complexity of some of these missions. All the systems involved and all the instrumentation have to work."

As manager of F/A-22 avionics testing at the Raptor CTF, Terry Tornay understands the complexity. Still, he can readily cite a list of recent successes. "We have tested most of the systems on the airplane," he explains. "The radar is nearly fully tested and performing very well. The signature is better than expected. We have tested all of the modes of the electronic warfare system. We have started countermeasures testing. We have tested most of the modes of the communication and navigation system, which consists of radios, interrogator, tactical airborne navigation, and an instrument landing system. We have successfully fired four missiles for score—one AIM-9 Sidewinder and three AIM-132 AMRAAMs."

Most of the avionics testing is being conducted on Raptors 05, 06, and 07. The aircraft are used for a combination of radar, electronic warfare, expendables, and missile shots. Raptor 07, which has full-up low-observable finishes, is used for LO testing as well. The avionics jets are occasionally used for flight sciences tests since electrical and heat loads associated with avionics have to be tested at extremes of the flight envelope. (Raptors 02 and 03 do not have a full complement of F/A-22 avionics.) The F/A-22 CTF plans to borrow Raptors
The flight sciences aircraft have flown as much as eleven hours in one day. “The current testing requires longer flights,” Burton notes. “The points in the flight envelope we’re gathering data for these days are very hard to achieve. Once the airplanes are up and flying, we want to keep them airborne. Fortunately, we have the tanker support necessary to support longer flights at high speeds.”

“The airplane is usually airborne before eight in the morning and down before lunch,” says Law, explaining a typical day for the flight sciences F/A-22s at the CTE. “We then turn the jet for a two o’clock go. The second mission lasts until about five in the evening on a good day. Usually the plane comes back from the first mission with some issues we have to deal with. Flying at the edge of the envelope pushes this aircraft harder than any operational F/A-22 will ever be pushed. We ferret out problems, but that is the purpose of flight testing. Instrumentation comes loose, or we have to troubleshoot a maintenance code. Engineering and the crew work together to get the airplane ready for the afternoon mission. A night shift preps the jets for the next day. Everyone here works hard, and our current flight envelope reflects the success of their labor.”

Avionics Testing: Working Together

As the Raptors associated with flight sciences chip away at remaining test points to clear the flight envelope, the jets associated with avionics testing are getting all of the internal electronic systems to work together as a cohesive unit.

F-16s Featured On Leaflets

Coalition aircraft enforcing the no-fly zone in northern Iraq dropped informational leaflets near Iraqi antiaircraft artillery batteries in early March. The front message on the leaflets warns the Iraqi military in Arabic, “Do not track or fire on coalition aircraft.” The backside of the leaflets reads, “Any hostile action by Iraqi air defenses toward coalition aircraft will be answered by immediate retaliation. Iraqi air defense positions that fire on coalition aircraft or activate air defense radio will be attacked and destroyed.” The leaflet drop was the second in the twelve-year history of enforcing the northern no-fly zone.
F-16s Exercise In Thailand

More than 400 US airmen and Marines and 600 service members from Thailand and Singapore flew air-to-air and air-to-ground missions as part of the annual multinational exercise Cope Tiger 2003 in Thailand last February. Cope Tiger is an annual joint/combined air-to-air, air-to-ground and large force employment training exercise. The two-week exercise flown from Korat AB gave service members from eight different US bases and the two countries an opportunity to hone their deployment and employment skills, improve air combat techniques, and build stronger relationships.

Raptor Blaster

The US Air Force is deploying more than thirty Raptors to recruiting squadrons across the United States. Instead of the F/A-22, however, this Raptor is a GMC Yukon sporting a 2,400-watt stereo system and a customized paint job. The Air Force's newest recruiting tool, which includes an F/A-22 mini-jet and trailer, is designed to appeal to people between the ages of sixteen and twenty-four. "The Raptor gets young people to think about the Air Force and to ask questions," explained MSgt. Angel Newman, an Air Force recruiter who took the display on tour in South Carolina. "The Air Force offers many opportunities, and the Raptor sure beats a brochure."

Australia C-130s Evacuate Bali Victims

Five Royal Australian C-130 aircraft, crews, and associated aeromedical evacuation teams deployed from RAAF Richmond near Sydney to assist with the evacuation of victims from the Bali bomb blasts last October. The C-130s flew six sorties serving as an aeromedical shuttle between Bali and Darwin, Australia. The Australian Defence Force provided five medical teams, including full-time and reserve members, to assist in patient treatment, care, and prioritization and to coordinate transfer of casualties to Darwin.

Flight Testing The Raptor

The March sun rises over the Mojave Desert around six. The day’s first light accentuates silver metal hangars against the beige backdrop of Rogers Dry Lake. The hangars are the home of the F/A-22 Combined Test Force. Even at this early hour, the buildings on the north end of the flight line at the Air Force Flight Test Center at Edwards AFB, California, bustle with activity as technicians ready their Raptors for the morning flights. The first flight of the day was briefed an hour ago and the pilots are ready. Just after daybreak, twin Pratt & Whitney F119 engines disrupt the desert silence as they propel the world’s most advanced fighter to the runway for another flight.

Lanni and others at the F/A-22 CTF are taking care of the business of transitioning the Raptor from developmental to operational status. That transition involves expanding the flight envelope, testing advanced avionics, and training DITRE personnel who will soon be evaluating the effectiveness of the Raptor.

Flight Sciences: Burning Down Test Points

With more than 900 and 800 flight hours respectively, Raptors 02 and 03 account for more than half of the total accumulated flight time on all F/A-22s built to date. The two airplanes have spent most of that time in some very demanding flight conditions.

"We have a flight envelope cleared on the clean aircraft up to nine g's, sixty degrees AOA, and out to Mach 2," Lanni explains. "We are now clearing the side and main weapon bays to those same extremes so we can launch missiles from the entire flight envelope. Almost all of the recent flight sciences testing has been conducted with open weapon bays."

Clearing a flight envelope for a high-performance fighter is no easy task. Clearing the same envelope for a low-observable fighter with internal weapon bays significantly adds to the challenge. "Other aircraft don’t have to deal with opening doors with very thin diameter hinges at supersonic speeds," Lanni continues. "Acoustics create vibrations that stress internal equipment, doors, and..."
Squadron Inactivated After Three Decades

After more than thirty-four years of service, the 42nd Airborne Command and Control Squadron at Davis-Monthan AFB near Tucson, Arizona, was inactivated last September. The Air Force determined the mission of the EC-130H Airborne Battlefield Command, Control, and Communications unit could be successfully accomplished with E-3 and E-8 aircraft and ground systems. Four of the unit’s EC-130Es will be converted into HC-130s for combat search and rescue squadrons. Two other EC-130Es are being transferred to the 41st and 43rd Electronic Combat Squadrons at Davis-Monthan, and one is being retired. The 42nd arrived at Davis-Monthan in July 1994 from Keesler AFB, Mississippi, where it was known as the 7th Airborne Command and Control Squadron. The 7th ACCS began its mission in 1968 and served in Vietnam, Grenada, Panama, and Desert Storm. Before it was deactivated, squadron members were deployed for more than six years to Aviano AB, Italy, to support Operations Deny Flight and Allied Force.

Hotel Mode Demonstrated

Hotel mode, a unique capability of the C-130J propulsion system that provides for safer ground loading and unloading operations, was demonstrated in recent tests at MCAS Cherry Point, North Carolina. This capability puts the C-130J propellers in feathered position, which reduces both propeller blast and engine exhaust heat and, consequently, the amount of dust, dirt, and debris being kicked up behind the aircraft. The engines remain running in this mode enabling the pilot to spool them quickly up to military power.

During the test, a KC-130J in Hotel mode and a KC-130F in low-speed ground idle were placed side by side into a five-knot headwind with engines running at the same rate. Smoke flares were placed behind each aircraft to detect flow patterns. Smoke from the flare behind the KC-130J rose vertically and dispersed, while the areas directly behind the engines and the cargo ramp remained essentially unaffected. Smoke from the flare placed behind the KC-130F flowed nearly straight back.
Antarctic StarLifter

Reservists from Air Force Reserve Command's 445th Airlift Wing left their base at Wright-Patterson AFB, Ohio, last February aboard a C-141 StarLifter to participate in Operation Deep Freeze, the passenger and cargo service for the US National Science Foundation's research facilities in Antarctica. The Reservists flew to Christchurch, New Zealand, the staging point for deployment to Antarctica's McMurdo Station. During their two weeks in New Zealand, they made several trips to Antarctica to transport people and supplies off the ice continent. The 445th AW has been participating in Operation Deep Freeze since October 2001 along with the 452nd Air Mobility Wing from March ARB, California. C-141 crews have been resupplying the National Science Foundation community in Antarctica since 1966.
Operation Iraqi Freedom

begun with two 2,000-pound GBU-24 precision-guided munitions dropped from a pair of F-117 Nighthawks from the 8th Expeditionary Fighter Squadron onto a leadership position on the outskirts of Baghdad. Since the start of the conflict, hundreds of coalition aircraft have been engaged in combat operations and combat support missions 24/7 across nearly every square mile of Iraq. More than 31,000 sorties were flown in the first twenty days of OIF. That total includes more than 6,300 air-to-air sorties, more than 6,400 refueling sorties, 240 combat search and rescue sorties, and almost 17,000 strike and counter air sorties. Code One welcomes F-16, F-17, U-2, C-130, KC-135, C-5, C-141, F-3, and S-3 operators and crew to send us their best (releasable) first-hand accounts from OIF missions for potential use in an upcoming special issue. Please email them as well as digital photos to the editor at: eric.holthoff@mc.com.

Thunderbirds Alumni Site

Former patch wearers of the USAF Thunderbirds, Honorary Thunderbirds, and Honorary Crewchiefs are being asked to register on the USAF Thunderbird Association Internet site at thunderbirdalumni.com. The information will be used to prepare for the fiftieth anniversary air show season and reunion later this year.

Editorial Transitions

Code One staff sends its thanks and best wishes to longtime editorial assistant Mary Lou Vocale, who retired in March. She wrote many articles and rewrote many others during her twelve years on the magazine. The staff welcomes new associate editor Jeff Rhodes, who will help coordinating activities of our many customers and programs.

Patch Poster Update

Code One is collecting wing, squadron, and specialty patches to update the F-16 Patch Poster, which can be viewed on the F-16 link on our website. Please send your latest patches to the Code One editorial office.

Online Update

Codeonemagazine.com has been updated with new F/A-22, X-35, and F-117 photos. Drop by for a visit today.

ISAP 3 Meets In Dayton

The third annual International Symposium for Aviation Photography met in Dayton, Ohio, in late February. Hosted by Wright State University, the symposium featured presentations by noted aviation photographers Scott Andrews, John Dibbs, Bill Fortney, Brian Shul, Chad Slattery, and Tom Tomey.

National Geographic Coverage

A team from National Geographic recently spent two weeks in Marietta, Georgia, taking photographs and conducting interviews for an upcoming article. The F-22 will be a major focus of the article, which is tentatively titled "What's Next in the Air" and scheduled to run in December in conjunction with the 100th anniversary of powered flight.

Anniversary Drivers Reunion

The F-16 Viper Pilots Association is conducting its second statewide reunion 2 - 4 October in Washington, D.C. Events include a golf tournament, tailgate party, and football game (Naval Academy vs Air Force Academy). The scheduled guest speaker is Gen. Ralph Eberhart, Commander, North American Aerospace Defense Command, and Commander, US Northern Command. For more information, see www.f16viperr.org.

Bill Garrett Dies

Bill W. Garrett, 73, who befriended thousands of F-16 pilots during his long career in the customer support department at General Dynamics and then Lockheed Martin, passed away 7 February in Fort Worth.

Garrett took care of many Lockheed Martin customers by providing flight awards for all the F-16 pilots from the first 100 to the high timers of 5,000 hours in the F-16. Earlier in his career, he managed field offices for the company at Ogden, Utah, and Sacramento, California. Garrett, known as a dapper dresser and a collector of classic cars, had a unique ability to say anything while never offending anyone.

Poster Winners/New Incentive

Congratulations to the first fifty folks who subscribed to Code One or renewed their subscriptions online this year. The signed lithographs of the cover of the 3rd Quarter 2002 issue are in the mail. This quarter, we plan to give away one 1/22nd scale F-35A desk model signed by Tom Morganfield, the test pilot of the first flight of the X-35A. The winner will be chosen at random from those subscribing or renewing online from 15 May to 15 July. Good luck.