



A United Arab Emirates F-16 Block 60 “Desert Falcon” conducts a training mission during a multinational exercise, Dec. 9, 2009. The UAE’s F-16s are arguably the most advanced Vipers in the world, and many of the aircraft’s features, such as its AESA radar and advanced sensors, are likely to find their way to other F-16 fleets as upgrades.

Under the Cloud

Uncertainty boosts the world market for aircraft/system modernization.

by JAN TEGLER

During a media availability in Hawaii on Nov. 12, 2012, Secretary of Defense Leon E. Panetta was asked for his thoughts on the threat of sequestration to U.S. defense and the possibility that if no agreement was reached to avoid the automatic cuts in spending it requires, the measure could be “kicked down the road.”

“If they just kick the can down the road, it’ll just continue to represent a cloud over the Defense Department [DoD],” Panetta said. “And that’s the last damn thing I need right now is to have more uncertainty.”

His remarks echoed the concern of the entire American defense establishment and followed warnings issued previously by the secretary and others that the effect of the sequester (the \$1.2 trillion in budget cuts over 10 years dictated by the 2011 Budget Control Act should Congress and the White House fail to agree on deficit reduction) would be to “hollow out the force.”

As Panetta feared, sequestration has been delayed until late March with no agreement reached, and the prospect of an additional \$500 billion across-the-board deduction over 10 years on top of the \$487 billion shaved from the Pentagon budget as 2012 began has cast a pall over the aerospace defense industry in the United States and reverberated worldwide.

Even if a budget deal were to be reached, American defense companies were reportedly preparing for a \$25 billion cut per year from current spending levels as 2012 drew to a close.

In Europe, the ongoing sovereign debt crisis continues to gut defense spending. Military expenditures now hover around just 2 percent of GDP for even the largest European economies. A 2012 study, "NATO and the Challenges of Austerity," executed by the RAND Corporation for the Office of the Secretary of Defense (OSD) concludes that planned defense budget cuts over the next decade for the seven European members of NATO "will have a serious impact on NATO's ability to deploy and sustain military power."

Meanwhile, defense spending in Asia remained strong despite economic headwinds. According to a 2012 study from the Center for Strategic and International Studies, military expenditures have doubled in Asia over the last decade, with spending increasing most rapidly over the last five years. Expenditures in the region totaled \$224 billion in 2011. China, Japan, India, South Korea, and Taiwan accounted for 87 percent of all expenditures, with China the top defense spender since 2005, when it overtook Japan.

Still, the Asian appetite for spending in aerospace defense isn't limited to new aircraft programs. The same holds true in Latin America where, notwithstanding the growth of economies like those in Brazil, Argentina, and Chile, modernization programs among the region's air forces went beyond new aircraft buys

Back in the United States, the DoD's 2013 budget request came under heavy scrutiny in June, with congressional committees introducing bills challenging some of the proposed cuts.

"Some of the bills seek to reverse the decisions to eliminate aging and lower-priority ships and aircraft," Panetta observed. "My concern is that if these decisions are totally reversed, then I've got to find money somewhere ... to maintain this old stuff."

In one thought, Panetta summed up a trend already well under way globally: the maintenance and upgrade of aging aerospace platforms. Faced with cancellations of many new aircraft programs with the prospect of more to come, air forces around the globe are holding onto legacy aircraft, turning to industry to regenerate, refurbish, and modernize their aging fleets.

Fighters

The largest global fighter upgrade programs are under way in the United States. Chief among these is the U.S. Air Force's (USAF's) \$2.8 billion upgrade program for more than 300 F-16C/Ds (Block 40, 42, 50, and 52 machines). First announced in the fall of 2011, the latest F-16 modernization program is an interim measure to mitigate the "fighter gap" brought on by ongoing delays with the F-35 Joint Strike Fighter.

In response, the Air Force crafted a dual-purpose update to allow the Fighting Falcon, more popularly known as the Viper, to serve into the mid-2020s. Under a sole-source contract planned to begin in 2018, Lockheed Martin will embark on a service life extension program (SLEP) aimed at extending the Viper's airframe life (currently 8,000 hours) by 2,000 to 4,000 additional hours and a combat avionics

update known as "CAPES, for Combat Avionics Programmed Extension Suite."

Fatigue tests are already under way to determine what improvements F-16 airframes will need to achieve the desired SLEP. Meanwhile, CAPES improvements will include new active electronically scanned array (AESA) radar, a new Terma ALQ-213 electronic warfare system, an integrated broadcast system (IBS), and a new center display unit (CDU).

The USAF F-15 fleet is due for similar upgrades expected to keep the fleet flying through at least 2035. The latest planned updates to F-15Cs and F-15E Strike Eagles include new radars, radios, and helmets, and structural integrity tests to inform efforts aimed at almost doubling the service life of the aircraft.

Air superiority Eagles will get a new AESA radar for 150 of the 214 F-15C models, beyond-line-of-sight and secure line-of-sight radio updates, and also Sniper advanced targeting pod integration on 177 Cs through fiscal 2016.

Strike Eagles will receive AESA radar upgrades beginning in 2013 along with the latest military GPS capability. F-15E pilots are set to receive a new helmet in fiscal 2013 to help them spot targets earlier. The E-model is also slated to deploy the Joint Air-to-Surface Standoff Missile (JASSM). JASSM integration-testing, completed midway through 2012, sees the F-15 join

An F-15 Eagle from Kadena Air Base, Japan, takes off during Red Flag Oct. 22, 2009, at Nellis Air Force Base, Nev. Pacific-based squadrons have been the first to receive upgrades to their F-15Cs.





the B-1, B-2, B-52, and F-16 in operation of the autonomous, air-to-ground, precision-guided standoff missile.

America is far from the only country augmenting its F-16 and F-15 fleets. Lockheed Martin's hugely successful fighter (the 4,500th example was built last spring) has a new variant, the F-16V. Enhancements include an AESA radar, an upgraded mission computer and architecture, and improvements to the cockpit. Intended as new production jets, Lockheed says elements of the new configuration are available as an upgrade to earlier model F-16s.

Debuting early in 2012, the F-16V was immediately a candidate for the South Korean and Taiwanese fighter competitions. By October, Lockheed Martin announced it had won a \$1.85 billion contract to upgrade 145 Block 20 F-16A/B aircraft for the Republic of China. The retrofit program includes the addition of an AESA radar and embedded global positioning, as well as upgrades to the electronic warfare and other avionics systems of Taiwan's F-16s.

Elsewhere in Asia, Indonesia was proceeding with an arrangement brokered by the Obama administration in late 2011 to transfer 24 retired F-16C/Ds from U.S. surplus to the Indonesian air force for free. The Block 24/25 Vipers will be upgraded to Block-52 standard.

In Europe, the Royal Netherlands Air Force committed to upgrade its F-16AM/BMs via a buy of a limited number of "B-kits" with upgraded self-protection and targeting capabilities to be shared among its 68-aircraft fleet. Weapons upgrades, including a new air-to-air missile, are under discussion as well.

In South America, Chile's mixed force of F-16A/Bs (including several ex-Dutch examples) and Block 50/52 C/Ds is a candidate for upgrades to standardize the fleet. Lockheed Martin is working with Chile to find a strategy to upgrade older models with the intention of bringing all aircraft up to a Block 50-like standard. The F-16 is also a candidate to replace Chile's remaining F-5Es, which are to be phased out in 2015.

An SU-27SM aircraft at the celebration of the 100th anniversary of the Russian air force. Russia is upgrading a dozen older SU-27s to SU-27SM standard.

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In addition to a buy of 84 new F-15SAs, Middle Eastern Eagle operator Saudi Arabia has contracted Boeing to refurbish and upgrade 70 older models to SA configuration. The new variant includes an AESA radar, Goodrich DB-110 sensors (a version of the Senior Year Electro-Optical Reconnaissance System flown on the U-2), an infrared search-and-track capability, Sniper and LANTIRN targeting and navigation pods, and a digital electronic warfare system.

Japan has committed to operating its F-15J/DJs until mid-century, holding the view that the 42 F-35s it is purchasing are not air superiority fighters. Planned upgrades to the Japanese Eagle fleet include AESA radar, new cockpit displays, and a new central computer. The nation's indigenously built Mitsubishi

“Service priorities, inadequate science and technology and development funding, execution issues and ‘requirements creep’ have all led to an industry that is surviving to a large extent on modification programs.”

F-2 fighters will receive updates as well. Sixty aircraft will be equipped with the Mitsubishi Electric Corp. AAM-4B missile for a significant boost in counter-air capability due to its integrated AESA seeker. The fighter’s J/APG-1 radar will be updated to the new standard J/APG-2.

Competitive Russian fighter aircraft are also receiving updates. In January, the government announced plans to upgrade at least 60 MiG-31s through 2020 to enhance their ability to intercept aircraft and cruise missiles. The resulting MiG-31BMs will enable pilots to detect targets at up to 200 miles and engage them at 174 miles. Fighters will singly be able to track 10 targets and engage six simultaneously. Twelve older SU-27s are also being updated to the latest SU-27SM configuration.

The apparent selection of Dassault’s Rafale as India’s new MMRCA (Medium Multi Role Combat Aircraft) is not the only Indian business for the French manufacturer. Dassault is continuing with the nine-year, \$2.4 billion program to upgrade 51 Indian Mirage 2000s it began in 2011. India is also continuing with plans to update approximately 120 of its aged Jaguar IB/IM/IS strike aircraft. Proposed updates include new engines, an autopilot, multifunction displays and other new avionics, fly-by-wire flight controls, EW upgrades, and provisions for new precision-guided munitions.

Fall 2012 saw the U.S. Navy award contracts for the development of an embedded global positioning/inertial navigation system for the U.S. Navy’s F/A-18E/F Super Hornet and EA-18G

Growler aircraft. The new GPS/INS will demonstrate fiber-optic gyro performance suitability for F/A-18E/F and EA-18G Joint Precision Approach and Landing System (JPALS) needs. JPALS is a next-generation aircraft landing system that will utilize GPS data and replace radar-based systems.

In other Super Hornet news, the Australian government confirmed its intention in August to convert 12 of the 24 F/A-18E/F Super Hornets it committed to buy in 2006 into EA-18G Growlers for \$1.5 billion. RAAF Growlers are expected in-service by 2018.

Plans to trim America’s fleet of A-10 Thunderbolt IIs by 120 aircraft were announced in the 2013 defense budget, but the 2013 budget authorization passed by Congress mandated retention of some of the aircraft. Upgrades for the remaining Warthogs, including structural integrity improvements, continue, however, under the A-10 Thunderbolt II Life-cycle Program Support.

Helicopters

In January, the DoD/industry Vertical Lift Consortium noted, “service priorities, inadequate science and technology and development funding, execution issues and ‘requirements creep’ have all led to an industry that is surviving to a large extent on modification programs.”

The largest upgrade modification/upgrade program of 2012 is the AH-64 (Block III) Apache effort. Approved for full rate production in August, the E combines more than 25 technology upgrades, including upgraded engines for “hot/high” operation and unique unmanned air system (UAS) interoperability, allowing pilots to control a drone in flight, tap into its streaming video, and use its sensors for target engagement.

It was unknown how sequestration might affect AH-64E production, but the U.S. Army Acquisition Objective

The AH-64 Apache Block III upgrade program boasts more than two dozen technology upgrades, including provision to control unmanned aerial vehicles.



calls for 690 Block IIIs through 2026. Of those, 56 will be new builds, 634 remanufactured. Taiwan is the first foreign customer for the E model Apache, though potential sales to Qatar, Indonesia, and India were in the offing.

The Army's Armed Aerial Scout program to replace the aging OH-58D Kiowa Warrior in the manned reconnaissance role pits several upgraded versions of existing helicopters against a version of Sikorsky Aircraft's proposed all-new S-97.

Bell's offering is a remanufactured OH-58D featuring the HTS900 engine, Model 407 blades and transmission, and the tail rotor from the Model 427. Boeing has submitted its AH-6, a light attack helo extensively evolved from the original Hughes OH-6A with a new six-blade rotor system, upgraded engine, and sensors.

EADS North America throws its hat in the ring with an armed, upgraded version of the twin-engine UH-72A Lakota utility helicopter the Army is currently fielding. Dubbed the AA-72X+, it is augmented by more powerful engines and a new sensor suite. AgustaWestland is proposing a military variant of its AW169, while AVX Aircraft Company of Fort Worth, Texas, has forwarded a substantial redesign of the OH-58 to incorporate a coaxial main rotor and two ducted fans in place of a tail rotor.

U.S. Navy (USN) helicopter upgrades include a \$1.05 billion, five-year contract for MH-60R/S cockpits and integrated systems awarded to Lockheed Martin in April. More than 200 digital cockpits and integrated mission systems will be installed in the antisurface and antisubmarine warfare "Romeo" and the ship-to-ship cargo resupply, search and rescue "Sierra."

Transports

Upgrades and service life extensions for medium and heavy transport aircraft continue to be a priority for many of the world's militaries.

The USAF kept pace with the recapitalization of its HC, MC, and AC-130 fleets. Lockheed Martin is under contract for 27 MC-130Js and 15 HC-130Js. Sixteen AC-130Js are planned, with IOC scheduled for 2015. The HC-130J is

the personnel recovery/combat search and rescue (SAR) aircraft for Air Combat Command, and the MC-130J is the Special Operations tanker aircraft for Air Force Special Operations Command (AFSOC), while the AC-130J will augment AFSOC's gunship fleet.

"This further demonstrates the amazing flexibility of the C-130J. We took a KC-130J tanker and, through in-line production design changes and significant capability enhancements, produced the current HC and MC aircraft," said George Shultz, Lockheed Martin vice president and general manager for C-130 Programs.

The first AC-130J went into production in midsummer at Lockheed's Marietta, Ga., facility. The aircraft are actually conversions of MC-130Js and will enable AFSOC to increase its overall gunship fleet from 25 to 33 platforms.

Lockheed Martin is also offering a reduced-cost C-130J aimed at customers requiring a small fleet of aircraft capable of performing special missions in addition to tactical transport. Ten to 20 percent cheaper than the fully combat capable "combat delivery" 130J, the C-130XJ would have a reduced initial equipment set with features not in the standard J-model, including a nose mount for an EO/IR (electro-optical/infrared) sensor enabling SAR-type missions and ISR (intelligence, surveillance, reconnaissance). Also under development are roll on/roll off packages allowing operators to equip their 130J as a field hospital or for other missions including firefighting, armed ISR, and SIGINT (signals intelligence)/electronic intelligence.

The U.S. Air Force is also funding flight test development of upgraded Rolls-Royce T56 engines. The T56-15 Series 3.5 enhancement kit is aimed at increasing reliability and service life while cutting fuel consumption by close to 8 percent, with the larger objective of helping the USAF meet its target of reducing fuel usage by 10 percent in 2015 and increasing component life by 30 percent for supposed savings of up to \$3.5 billion over life of fleet.

In early 2012, Japan made a request to purchase six second-hand USMC KC-130R

aerial refueling tankers. The Hercs are intended to replace 10 of the Japanese Maritime Self-Defense Force's aged YS-11 transports. The aircraft will be converted to standard C-130R transport configuration with overhaul and modifications to be done by U.S. personnel.

South of the border, Lockheed Martin is exploring options for the supply of small numbers of upgraded C-130s to Latin American countries. Ex-American Hercules and the C-130XJ are being considered by several nations.

Upgrades to America's only strategic airlifter, the C-5 Galaxy, continue. The C-5M Super Galaxy is the result of a two-phase modernization effort – the Avionics Modernization Program (AMP) and the Reliability Enhancement and Re-engining Program (RERP). Lockheed Martin delivered the 79th and final AMP C-5 last April and the eighth C-5M Super Galaxy to the USAF in July. The Air Force is upgrading 52 C-5s to C-5M configuration, with all to be operational by 2016 and expected to serve until 2040.

Bombers

Upgrades to bomber aircraft have largely been an American affair in 2012. The USAF's high-value B-1B Lancers and B-2 Spirit bombers are receiving significant combat system updates.

The B-1B is undergoing the most advanced hardware and software upgrades the bomber has had to date as part of the Sustainment-Block 16 program. Upgrades include a fully integrated data link in the aft station and vertical situation display upgrade in the front station as well as updates to navigation, radar, and diagnostic systems.

Extensive upgrades to the Air Force's B-2 Spirit fleet are ongoing. By the fall of 2012, Northrop Grumman had completed installation of a new classified radar system for the service's 20 B-2s. The Radar Modernization Program joins other upgrades improving the B-2's ability to receive updated target information during a mission and its ability to collect, process, and disseminate battlefield information with joint force commanders or other local first responders worldwide.



A Lockheed Martin C-5M Super Galaxy takes off. The company delivered the eighth C-5M to the Air Force in July 2012.

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In September, Northrop Grumman began low rate initial production of extremely high frequency (EHF) satellite communications subsystems for integration into the B-2. EHF Increment 1 subsystems include an integrated processing unit (IPU) to replace the B-2's existing stand-alone avionics computer and a disk drive unit for allowing transmission of EHF data onto and off the aircraft, as well as a fiber-optic cable network to support high-speed data transfers within the aircraft.

The upgrades are expected to provide the bomber with a high-speed data handling infrastructure that improves its ability to conduct advanced communications and weapons delivery operations.

Electronic Warfare

A new trend is emerging in the marketplace for airborne intelligence gathering platforms. Smaller, cheaper aircraft are being developed globally to take on the mission. The USAF is

already an enthusiastic user of Hawker Beechcraft's MC-12W, an ISR platform based on the firm's civilian Super King Air 350 and Super King Air 350ER.

Forty-two MC-12Ws are in service with the Air Force and Hawker Beechcraft is reportedly fitting a version of the Super King Air 350ER with new sensors for tactical intelligence. The company is also developing a Baron G58-based intelligence collection aircraft.

Israel's IAI-Elta Systems has begun marketing of its multimission airborne reconnaissance and surveillance system (Mars2) based on the Gulfstream G550 business jet. The sensor suite would combine SAR and ground moving-target indicator radar plus EO/IR, SIGINT, and C3 capability. The Mars2 builds on the company's experience developing dedicated SIGINT and conformal airborne early warning (AEW) systems for the Israeli air force, on the Gulfstream G500 and G550.

Lockheed Martin is partnering with Austria's Diamond Aircraft Industries on further development of its DA 42 MPP (multipurpose platform) Guardian, a surveillance platform based on the maker's twin-engine general aviation DA 42 NG. The aircraft is specially designed for carrying easily interchangeable,

multifunctional aerial sensor equipment including EO/IR gimbals for surveillance and reconnaissance missions, airborne laser scanners, or large format digital aerial cameras. The LM/Diamond Aircraft ISR version is being offered for the European Union's Frontex border security coordination entity.

Among more conventional large EW platforms, Northrop Grumman's E-8C Joint Surveillance Target Attack Radar System (JSTARS) airborne battle management and command and control platform continues to receive sensor upgrades. The latest is the introduction of the Enhanced Land/Maritime Mode to improve accuracy of finding and fixing small targets at sea for precision-guided weapons.

The USN's E-6B Mercury TACAMO airborne command and control aircraft are receiving integrated high-speed, secure communications and networking systems as part of a Block II modification program. The mods will allow E-6Bs to connect to secure DoD networks at high data rates while still in flight. The upgrade will enable users on board to access mission-essential, near-real-time information from worldwide sources without affecting the operational performance of the aircraft. ■