



For additional information
or copies of this publication,
visit the NAE web page at
<http://www.cnaf.navy.mil/nae>

Approved for public release.

Distribution is unlimited.





NAVAL AVIATION VISION
JANUARY 2012

LETTER FROM THE LEADERSHIP OF NAVAL AVIATION

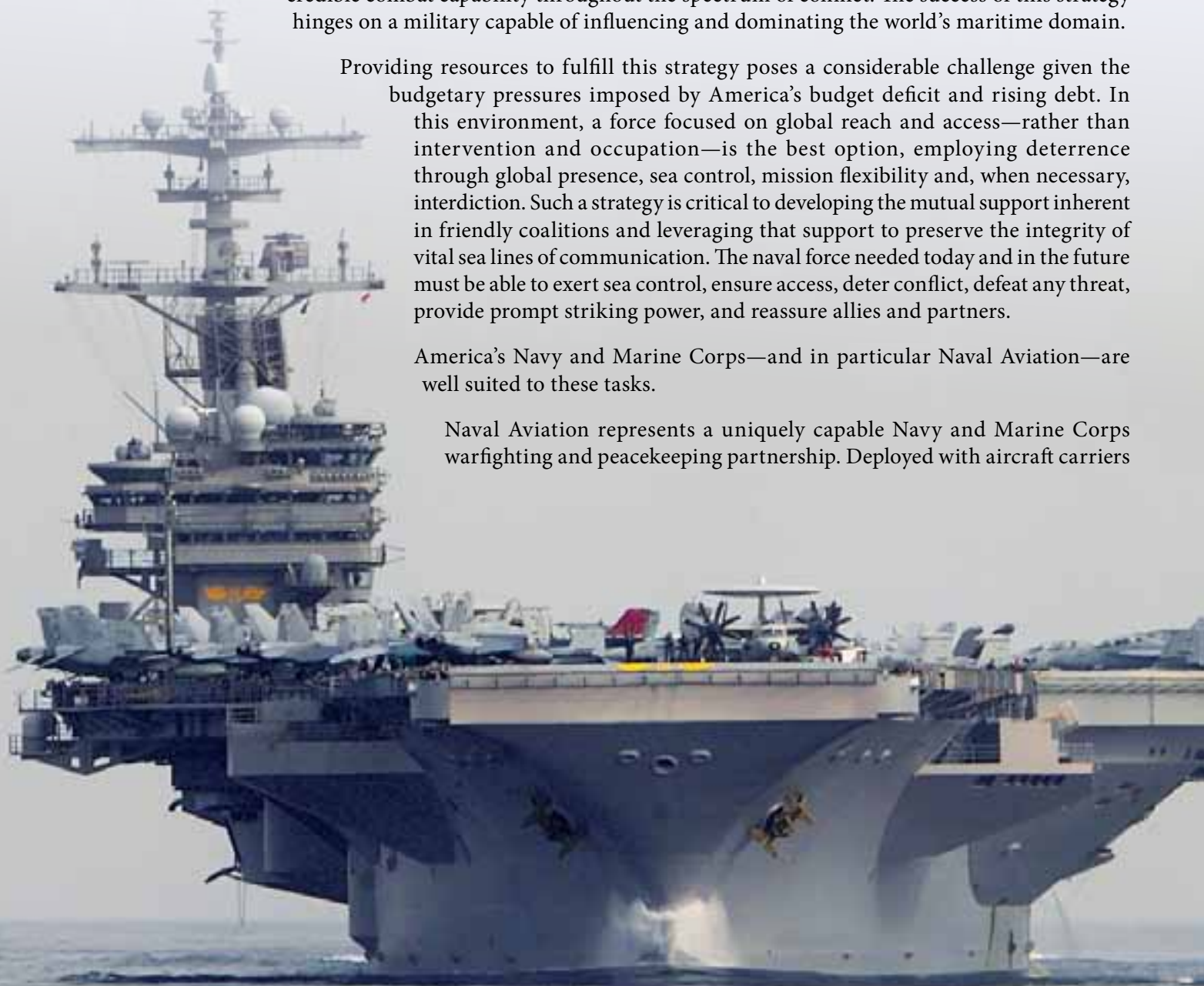
We serve at a time when our nation is simultaneously at war and facing a financial environment never before witnessed by those currently serving in uniform. Balancing the challenges of war and the needs for national defense amidst fiscal realities demands that Naval Aviation fulfill more global commitments while it operates within the margins of tighter budget constraints. These challenges will be successfully overcome. As the Honorable Leon Panetta said when he became the 23rd Secretary of Defense on 1 July 2011: “While tough budget choices will need to be made, I do not believe in the false choice between fiscal discipline and a strong national defense. We will all work together to achieve both.”

America has a preeminent leadership role in an interconnected world sustained by the confluence of its diplomatic, intelligence, economic, and military resources. Preserving this role helps protect America’s national interests, which are global in character and realized in part by a military strategy aligned with the nation’s diplomatic strategy. The United States must contend with the emergence of near-peer states that can, and will, challenge global economic and regional order, and we must continue to meet the challenges of extremism by non-state entities for many years to come. A military strategy that addresses both of these challenges is one that: provides capabilities for global reach and dominance of the sea as well as the air and space above it, builds and sustains coalitions with other nations, and is supported by credible combat capability throughout the spectrum of conflict. The success of this strategy hinges on a military capable of influencing and dominating the world’s maritime domain.

Providing resources to fulfill this strategy poses a considerable challenge given the budgetary pressures imposed by America’s budget deficit and rising debt. In this environment, a force focused on global reach and access—rather than intervention and occupation—is the best option, employing deterrence through global presence, sea control, mission flexibility and, when necessary, interdiction. Such a strategy is critical to developing the mutual support inherent in friendly coalitions and leveraging that support to preserve the integrity of vital sea lines of communication. The naval force needed today and in the future must be able to exert sea control, ensure access, deter conflict, defeat any threat, provide prompt striking power, and reassure allies and partners.

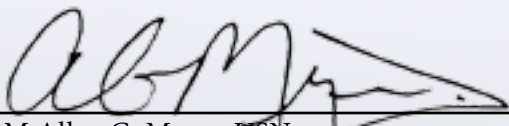
America’s Navy and Marine Corps—and in particular Naval Aviation—are well suited to these tasks.

Naval Aviation represents a uniquely capable Navy and Marine Corps warfighting and peacekeeping partnership. Deployed with aircraft carriers

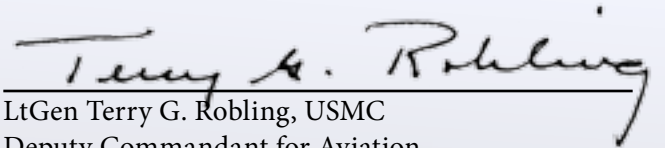


and amphibious assault ships or as expeditionary units, Naval Aviation forces require no permanent overseas bases. They move at will across the world's oceans, seas, and littorals, and they extend the effects of the sea base deep inland. They provide our nation's leaders with "offshore options." These manned and unmanned multimission forces are trained, equipped, and deployed to provide a range of responses to threats and crises, and their presence fosters coalitions in peace and war.

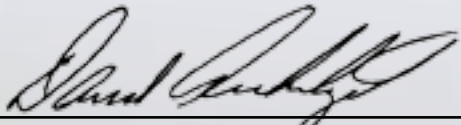
Naval Aviation is critical to an evolving military shaped by war and fiscal pressures. The vision of Naval Aviation conveyed in this document is aligned to meet international responsibilities and national imperatives. As the architecture for near- and long-term strategic, operational, and fiscal decisions, it describes where Naval Aviation is today, outlines the transitions necessary for tomorrow, acknowledges the people at the heart of every operational success, and emphasizes the enterprise culture necessary to unveil efficiencies in the name of force sustainment. We share this vision to inform and guide the actions of those serving Naval Aviation today, and those whose support is critical to our continued success.



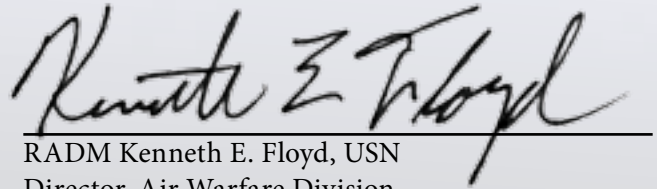
VADM Allen G. Myers, USN
Commander, Naval Air Forces



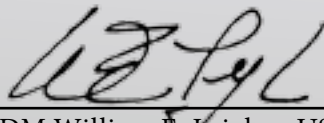
LtGen Terry G. Robling, USMC
Deputy Commandant for Aviation



VADM David Architzel, USN
Commander, Naval Air Systems Command



RADM Kenneth E. Floyd, USN
Director, Air Warfare Division



RADM William B. Leigher, USN
Director of Warfare Integration



TABLE OF CONTENTS

Letter from the Leadership of Naval Aviation	i
Naval Aviation Today	1
A TALE OF TWO CENTENNIALS	3
NAVAL AVIATION IN ACTION	5
Naval Aviation Tomorrow	13
WHERE WE ARE GOING	15
TRANSFORMATION ROADMAPS	17
SHIPS	17
AIRCRAFT CARRIERS	17
FUTURE CARRIER AIR WING	19
AMPHIBIOUS ASSAULT SHIPS	21
FUTURE AVIATION COMBAT ELEMENT	27
MANNED AND UNMANNED AIRCRAFT	29
UNMANNED SYSTEMS	29
NAVY TACTICAL AIRCRAFT	31
MARINE CORPS TACTICAL AIRCRAFT	35
NAVY HELICOPTERS	37
MARINE CORPS ASSAULT SUPPORT AIRCRAFT	41
MARINE CORPS UNMANNED TACTICAL SUPPORT SYSTEMS	45
NAVY MARITIME PATROL AND RECONNAISSANCE AIRCRAFT	47
NAVY AND MARINE CORPS TRAINING, LOGISTICS, AND OPERATIONAL SUPPORT AIRCRAFT	49
SPECIALIZED NAVAL AIRCRAFT	59
WEAPONS	63
LONG-RANGE STANDOFF WEAPONS	63
MID-RANGE STANDOFF WEAPONS	65
DIRECT-ATTACK WEAPONS	67
TORPEDOES	71
AIR-TO-AIR WEAPONS	73
NON-KINETIC WEAPONS	75
Making Our Vision Real	77
THE CHALLENGES OF TRANSITIONS	79
INITIATIVES AND CONCEPTS	81
AIR-SEA BATTLE	81
NETWORKING AND INFORMATION DOMINANCE	83
INTEGRATION AND INTEROPERABILITY	85
REDUCING TOTAL OWNERSHIP COSTS	87
AIR SPEED	90
MARINE CORPS COMMAND AND CONTROL TRANSFORMATION	91
MARINE CORPS LOGISTICS TRANSFORMATION	91

CAPABILITIES93
FLEET READINESS CENTERS93
RESEARCH, DEVELOPMENT, TEST, AND EVALUATION95
NAVAL AIR WARFARE CENTER WEAPONS DIVISION95
NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION97
SCIENCE AND TECHNOLOGY99
NAVAL AVIATION ENTERPRISE S&T OBJECTIVES	102
NAVAL AVIATION AND GREEN ENERGY	103
PEOPLE	105
THE FACES OF NAVAL AVIATION	107
NAVAL AVIATION ENTERPRISE	111
CROSS-FUNCTIONAL TEAMS	113
CONTRIBUTIONS TO READINESS	115
Summary	117
Image Credits	119
Acknowledgments	121



NAVAL AVIATION TODAY





A Tale of Two Centennials

The year 2011 marked the 100th anniversary of the birth of U.S. Naval Aviation, an organization founded under quite humble circumstances. It began, literally, with the stroke of a pen. Spectacular takeoffs and landings heralded the coming of aircraft at sea in late 1910 and early 1911—but Naval Aviation officially started on the desk of Captain Washington I. Chambers, who on 8 May 1911 prepared a requisition for two aircraft to be purchased from the Curtiss Company—the Navy’s first aircraft. U.S. Marine Corps Aviation measures its origins somewhat differently, by commemorating the date (22 May 1912) on which its first pilot—1st Lieutenant Alfred A. Cunningham—reported for training at Marblehead, Mass.

The many commemorative events of the Naval Aviation centennial in 2011 invited us to contemplate the ways in which aviation has affected the development of modern sea power and contributed to the story of the United States in the 20th and 21st centuries. Both of these are perhaps best illustrated by the Battle of Midway—the 70th anniversary of which this year will be commemorated alongside the Marine Corps Aviation centennial. This engagement between Japanese and American naval forces in June 1942 unlocked the potential of modern weaponry to bring a decisive decision at sea—aviation proved it could win battles akin to Trafalgar or Tsushima. And it shifted the strategic momentum in the Pacific to the United States, with ramifications not only for the course of the war but for the politics and economy of the world. Although it was the Navy that brought the most forces to bear, the Marine Corps was there as well—and the two services would rarely be apart from each other afterward.

As Marine Corps Aviation celebrates its own centennial in a series of events throughout 2012, it is worthwhile to ponder how the Marine Corps’s use of aircraft in its amphibious and expeditionary strategies has transformed how air, sea, and land power interact and combine with each other. In the past

century, Navy and Marine Corps Aviation grew and developed alongside each other—they shared many of the same aircraft and training facilities, they went into battle together against the same foes, and they took losses and shed blood together. The unique nature of expeditionary warfare, however, dictated that the two air services would also diverge in many important ways.

The Marine Corps can rightfully claim its own firsts and significant accomplishments in the air. Marines conducted U.S. Naval Aviation's first bombing raid in force on 14 October 1918, when Marine Day Squadron 9 dropped 17 bombs on a railroad junction in German-occupied Belgium. Although others had developed the tactic, Marine pilots were the first to implement the new idea of dive-bombing in organized combat during an attack on Sandinista forces in Nicaragua on 17 July 1927. Marine aviators served alongside their fellow leathernecks on the front line in places such as Guadalcanal during World War II, where the "Cactus Air Force" not only struck well-defended Japanese targets from the air, but also had to endure air attacks and nightly shellings from Japanese naval forces in return. Marine pilots have flown from aircraft carriers, amphibious assault ships, and small combatants; they have flown from jungle strips, mountainous fire support bases, and desert airfields; and they have gone into combat in nearly every clime on the planet, from the frigid mountains of Korea, to the steaming jungles of Central America, Southeast Asia, and the Pacific, to the low deserts of Iraq and the high deserts of Afghanistan. And Marines have also gone into space, from John Glenn, the first American to orbit the Earth in 1962, to George Zamka, commander aboard Shuttle *Endeavor* in 2010.

Marine Corps Aviation's chief mission has always been to support Marine infantry on the ground—in the Solomons Islands, at Okinawa, at the Chosin Reservoir, at Khe Sanh, at Kuwait City, at Fallujah, and in Kandahar Province. Marine Corps Aviation is an integral part of the Marine 9-1-1 force—a fact well-illustrated in March 2011, when an amphibious ready group and its expeditionary unit were the primary forces to execute strikes as part of Operation *Odyssey Dawn* off the coast of Libya. As two centennials come to an end, representing the combined service lives of two distinct yet conjoined armed forces, a new set of centennials beckons. This document outlines where Navy and Marine Corps Aviation are today—and where they are going in the first few decades of the next 100 years.



Naval Aviation In Action

Every day, 365 days a year, Naval Aviation is at sea, forward deployed, and ready to respond to crises anywhere within reach of the world's oceans. The stories here document the various ways Naval Aviation makes sea power relevant today.



EA-18G GROWLER MAKES COMBAT DEBUT IN OPERATION ODYSSEY DAWN

Operation *Odyssey Dawn*, the U.S. component of the U.N.-sanctioned effort to protect Libyan civilians from the forces of Moammar Gadhafi, commenced on 19 March 2011 with a large salvo of *Tomahawk* missiles fired from U.S. Navy ships and submarines. U.S. Naval Aviation forces entered the fray the following day, striking more than 20 integrated air defense systems and facilities ashore in Libya.

With only 47 hours to plan for their first combat mission, Navy EA-18G *Growlers* from the Scorpions of Electronic Attack Squadron (VAQ) 132, diverted from Operation *New Dawn* in Iraq, provided high-powered electronic jamming against communication networks and radars, and launched AGM-88 High Speed Anti-Radiation missiles against Libyan air defense systems around airfields and munitions sites. This force was augmented by air crews from the Vikings of VAQ-129. *Growlers* engaged surface-to-air missile sites while supporting



Marine Corps AV-8B *Harriers* from the 26th Marine Expeditionary Unit aboard USS *Kearsarge* (LHD 3). The *Harriers* conducted air strikes on Gadhafi loyalist ground forces, halting an armored column 10 miles south of the rebel stronghold of Benghazi. The *Growlers* shared sensor data with French *Rafales*, British *Tornados*, U.S. Air Force F-16s, and aircraft from other NATO countries.

“We were the only NATO airborne electronic attack platform” during *Odyssey Dawn*, said Lieutenant Matthew Driskill, an electronic systems operator with VAQ-129. “We’re made to be plugged into any sort of multinational conflict or air operation and used effectively to support those assets. The ability to network with other allied aircraft proved invaluable.”

Another first for *Odyssey Dawn* was the engagement of P-3C *Orions* against the Libyan Coast Guard vessel *Vittoria* and two smaller craft firing indiscriminately at merchant vessels in the port of Misrata on 28 March. The *Orions* struck with AGM-65 *Maverick* missiles, the first time this ordnance has been fired on a hostile vessel by a P-3C.

The Navy’s strong presence in the Mediterranean positioned naval forces to participate in *Odyssey Dawn* on short notice. Then Chief of Naval Operations Admiral Gary Roughead stated, “That’s what you get when you have a global Navy that’s forward all the time. We don’t surge, and we don’t ride to the sound of the guns. We’re there . . . ready to conduct combat operations.”

FIRE SCOUT HEADS TO SEA

USS *Halyburton* (FFG 40), its two embarked MQ-8B *Fire Scout* vertical takeoff unmanned aerial vehicles, and one SH-60B *Seahawk* returned from a seven-month deployment on 3 August 2011. The warship's aviation detachment was part of Helicopter Anti-Submarine Squadron Light (HSL) 42, Det. 2. This detachment coordinated manned and unmanned flight operations during *Halyburton's* patrols through the Strait of Hormuz, the Arabian Sea, and Bab Al Mandeb, the entrance to the Gulf of Aden. *Fire Scout* was pushed to its operational limits during the deployment, setting records for maximum altitude, range, and endurance and recording 438 total flight hours. HSL-42, Det. 2, supported counterpiracy operations in the Gulf of Aden, with *Fire Scout* supplying valuable intelligence, surveillance, and reconnaissance (ISR) proof of concept data to special operations forces while operating under Combined Task Force 508. *Fire Scout's* capabilities played an important role in the freeing of 13 people captured by pirates aboard M/V *Irene SL* on 19 March 2011. A *Fire Scout* was also used to shadow a ship believed to have been boarded by pirates.

While in the Mediterranean Sea, battle-tested *Fire Scouts* from HSL-42, Det. 2, supported operating forces as part of NATO Operation *Unified Protector* during patrols off the Libyan coast to ensure illegal weapons did not fall into the hands of pro-Gadhafi forces.

Working in the joint maritime environments of the 5th and 6th Fleets, *Fire Scout* demonstrated improved dependability and reliability. "The success of this deployment has given leverage to the *Fire Scout* program as a viable platform to conduct ISR operations in a maritime environment," said Cmdr. John Schmidt, commanding officer of *Halyburton*.





HARVEST HAWK SWOOPS DOWN ON AFGHANISTAN

Helmand Province in southern Afghanistan—with its dispersed settlements, rough terrain, and limited infrastructure—offers ideal places for insurgents to conduct guerrilla warfare. To fight more effectively in this demanding environment, Marines on the ground turned to Naval Aviation for a precise weapon that could be fielded as rapidly as possible and deliver persistent presence, intelligence, and high-volume fire. Responding to a mission requirement in record time, Naval Aviation integrated the Harvest Airborne Weapons Kit (HAWK) with intelligence, surveillance, reconnaissance, and weapon systems that allow KC-130J *Super Hercules* to provide close air support while taking advantage of the aircraft's ability to stay on station for up to three hours.

The Harvest HAWK is a modular weapons/sensor kit consisting of a fire-control console located in the aircraft's cargo compartment, an AN/AAQ-30 target sight system with infrared, electro-optic sensors, and a TV camera. Munitions consist of a launcher for four *Hellfire* missiles and a 10-shot *Griffin* missile launcher in the cargo compartment. Harvest HAWK also provides surveillance to disrupt improvised explosive device emplacements.





Harvest HAWK deployed to Afghanistan for the first time in October 2010 with Marine Aerial Refueler Transport Squadron (VMGR) 352. The system saw its first combat on 4 November, supporting Marines in Sangin. One *Hellfire* was fired and five enemy insurgents were killed, with no civilian casualties or property damage during the firefight. By August 2011, Harvest HAWK systems had fired 42 *Hellfire* and 11 *Griffin* missiles, flown more than 1,300 flight hours, and spotted 11 roadside bombs.

Television monitors provide detailed ground images, allowing operators to engage targets with laser-guided bombs with pinpoint accuracy. Harvest HAWK was the weapon of choice to neutralize insurgents in Marjah, where civilian casualties and property damage were major concerns. The system is capable of hitting time-sensitive as well as stationary targets. During night operations, Marines can track insurgents back to their bases and then take out an entire roadside bomb operation. “Our Marines now have their very own eye in the sky able to track and eliminate enemy threats, shortening the kill chain,” said Captain Michelle Guidry, program manager for the KC-130J and Harvest HAWK.

OPERATION TOMODACHI PROVIDES CRITICAL RELIEF

Within hours following the magnitude 9.0 earthquake and tsunami that struck Japan in March 2011, air operations from Naval Air Facility Atsugi, Japan, and USS *Ronald Reagan* (CVN 76) identified survivors in need of assistance and delivered water, blankets, and food. Additional helicopters and land-based aircraft surveyed the seaborne debris fields for survivors and conducted search-and-rescue missions along the coastline.

On 17 March, less than a week after the first earthquake, 14 U.S. ships and their aircraft and 17,000 Sailors and Marines were involved in the assistance and relief efforts in and around Japan. These efforts included 132 helicopter sorties and 641 fixed-wing sorties moving both people and supplies, assisting in search-and-rescue efforts, and delivering 129,000 gallons of water and 4,200 pounds of food. A total of 24 vessels and 140 Navy and Marine Corps aircraft delivered relief supplies and supported rescues during six weeks of operations.

Damage to the Fukushima Daiichi nuclear power plant and several other power stations added a layer of complexity and danger to assistance operations that U.S. naval forces were inherently prepared to meet. On March 15, sensitive instrumentation on the USS *George Washington* (CVN 73) in Yokosuka, Japan, detected low levels of radioactivity from the Fukushima

plant. *Ronald Reagan* also encountered radioactive contamination during relief flight operations off northern Japan. U.S. forces were nonetheless able to conduct operations without pause. The fleet delivered five high-pressure water pumps from Sasebo and 100 nuclear, biological, and chemical suits and masks to the government of Japan for employment at the troubled plant.

The *Ronald Reagan* Carrier Strike Group diverted from its planned mission in the Central Command area of responsibility to conduct operations off the coast of east Honshu. *Ronald Reagan*, with 3,200 Sailors, 2,480 aviators and air wing personnel, and 85 aircraft, conducted flight operations and served as a refueling platform for helicopters from the Japan Self-Defense Force and Coast Guard and civilian authorities involved in rescue and recovery efforts. Commander, U.S. Pacific Fleet, Admiral Patrick M. Walsh, emphasized the importance of U.S. forward presence in the region to support humanitarian crises and deter aggression. "When you think about what you can do with a force that is forward, ready, and has relationships already established in the region, look at Operation *Tomodachi*."



NAVAL AVIATION TOMORROW





Where We Are Going

Naval Aviation is executing one of the largest aircraft transitions in its history. In the past two years, new platforms have moved from development to production and test. Several test aircraft are currently on the line at Naval Air Station Patuxent River, Md., home to the Naval Air Systems Command—Naval Aviation’s organization for research, development, test, evaluation, acquisition, and program management. The P-8A *Poseidon*, the E-2D *Advanced Hawkeye*, and the F-35B and C versions of the Joint Strike Fighter are being evaluated by test pilots and naval flight officers so they are fully mission ready when they join the fleet. On the systems front, the Electromagnetic Aircraft Launch System (EMALS)—a completely new all electric carrier-based aircraft launch system designed for the *Gerald R. Ford* (CVN 78)-class aircraft carrier—is progressing on schedule. EMALS uses stored kinetic energy and solid-state electrical power conversion technology, which permits a high degree of computer control, monitoring, and automation. The system will provide the capability to launch all current and future carrier air wing platforms, from lightweight unmanned aerial vehicles to heavy strike fighters. It is designed to achieve increased sortie rates, improve reliability, lower operating costs, and better control launch forces resulting in reduced wear and tear on our aircraft. The first EMALS test launch, an F/A-18E *Super Hornet*, was conducted at Naval Air Engineering Station Lakehurst, N.J., on 18 December 2010. Compatibility testing has continued with additional F/A-18E, E-2D *Advanced Hawkeye*, T-45 *Goshawk*, and C-2A *Greyhound* launches. The first set of EMALS components were delivered to CVN 78 in May 2011. Developing alongside EMALS, an equally revolutionary aircraft recovery system, Advanced Arresting Gear (AAG), is under development and testing at Lakehurst. AAG will be installed on *Ford*-class carriers and has the potential to be retrofitted on *Nimitz*-class carriers. Like EMALS, AAG will contribute to increased sortie generation rates, reduced manning, and lower total ownership costs.





The first AAG dead-load arrestment at the test site occurred in March 2011, and delivery of AAG system subcomponents for CVN 78 construction are scheduled to begin in the spring of 2012. In addition to traditional aircraft and advanced systems, unmanned aircraft are an increasingly important part of Naval Aviation, supplementing manned systems in nearly every mission category. In the coming decades, successors to the current MQ-4C system will provide improved capability in the maritime surveillance role, and unmanned aircraft will also play a greater part in combat missions as technologies currently being developed for the X-47B and Unmanned Carrier-Launched Airborne Surveillance and Strike systems continue to mature. These examples are just a few of the many critical programs in Naval Aviation's sweeping recapitalization.

The platforms, systems, weapons, and personnel described in this section represent Naval Aviation's future. Advancing and sustaining Naval Aviation warfighting capabilities at an affordable cost is essential to national defense. Collectively and collaboratively, Naval Aviation leaders will work diligently to bring these new capabilities to the fleet while preserving our current readiness.

Transformation Roadmaps

SHIPS

AIRCRAFT CARRIERS

The U.S. Navy's aircraft carriers, with their embarked carrier air wings, provide the right balance of forward presence and surge capability to conduct warfighting and peacetime operations around the globe in support of national priorities. Sailing the world's oceans, each carrier strike group possesses a versatile, independent, and deadly striking force capable of engaging targets hundreds of miles at sea or inland. The mobility and operational independence of aircraft carriers provides a unique level of access that does not require host-nation support. Nuclear-powered aircraft carriers can remain on-station for months at a time, replenishing ordnance, spare parts, food, consumables, and aircraft fuel while conducting air strikes and other critical missions. This capability demonstrates the carrier's remarkable operational flexibility and self-reliance that is so vital to conducting time-critical strike operations. Aircraft carriers and their strike groups are always within reach of where they need to be and are ready on arrival.

The Navy's 11 aircraft carriers became a completely nuclear-powered force in May 2009 with the decommissioning of the last conventionally powered carrier and the delivery of USS *George H. W. Bush* (CVN 77). USS *Enterprise* (CVN 65) will be inactivated in fiscal year 2013 after 51 years of service, resulting in a fleet of all *Nimitz*-class aircraft carriers. The last *Nimitz*-class carrier will serve until 2059.

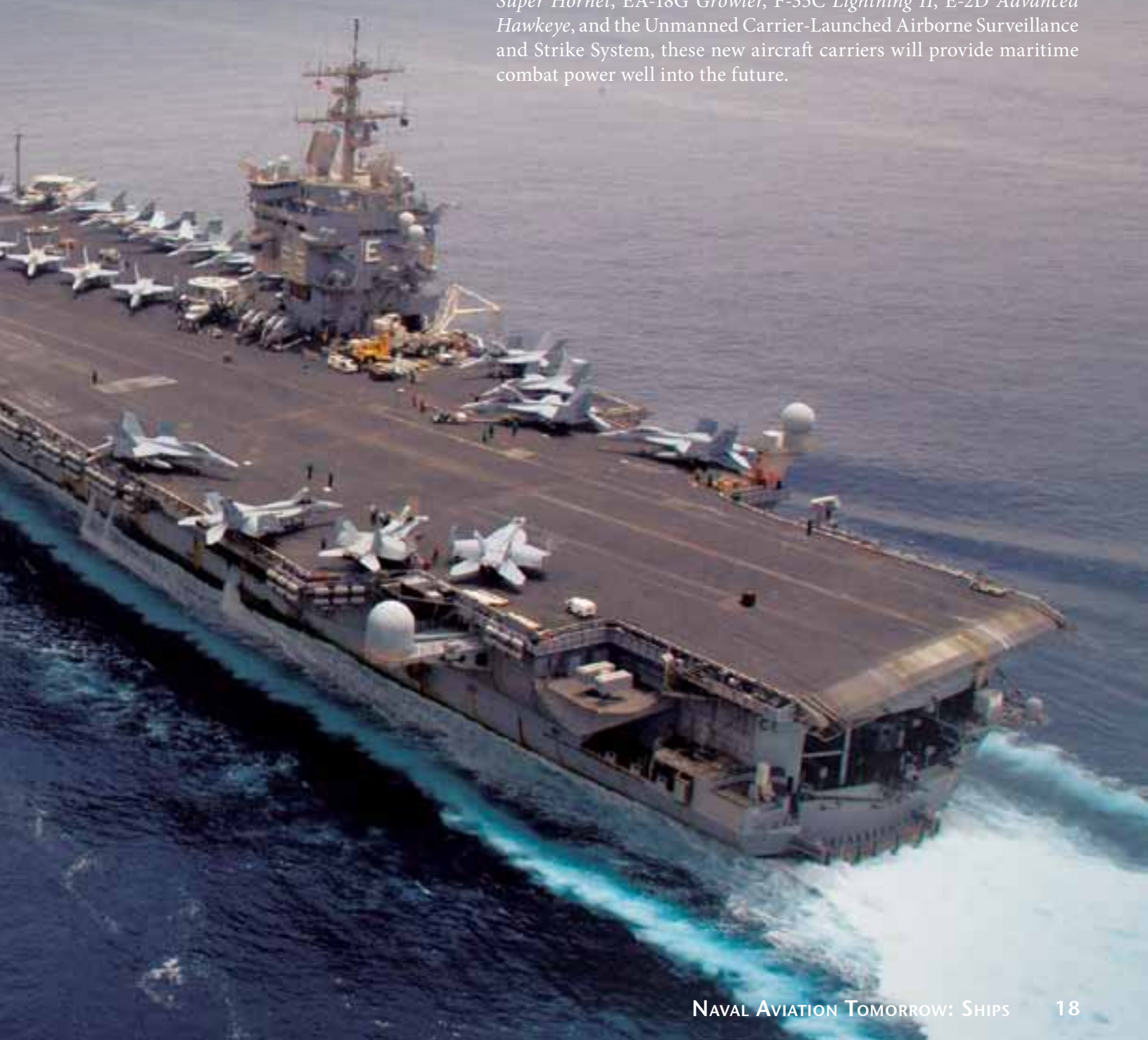
In 2004, a new design was approved to ensure the aircraft carrier's role as the centerpiece of the 21st-century carrier strike group.

Construction of *Gerald R. Ford* (CVN 78), the lead ship of the new class of aircraft carriers, began in 2008. The *Ford* class is the first new aircraft carrier design in more than 40 years. The *Ford* design boasts improved nuclear reactors and converts all auxiliary systems outside the main propulsion plant from steam to electric power. This change will greatly reduce the requirement for costly steam, hydraulic, and pneumatic piping and the repair of those distributed systems. The improved reactor and zoned electrical distribution system will also increase electrical generating capacity by nearly 300 percent. This will enable new technologies such as the Electromagnetic Aircraft Launch System and advanced command-and-control systems. The new ship design, based on the *Nimitz* hull, also includes an advanced arresting gear system, dual-band radar, joint precision approach and landing system, and redesigned flight and hangar decks. The redesigned flight deck allows greater flexibility during aircraft turnaround and launch-and-recovery cycles, leading to a 25-percent increase in daily sortie generation rate capability. The second ship of the *Ford* class, *John F. Kennedy* (CVN 79), began advanced construction phase in December 2010; the first ceremonial steel cutting was conducted in February 2011. *Kennedy* is the planned force-level replacement for USS *Nimitz* (CVN 68).

To meet the demands of 21st-century warfare, *Nimitz*- and *Ford*-class aircraft carriers will deploy long-range manned and unmanned strike aircraft. Advanced weapons and sensors, combined with high-speed sealift platforms, tilt-rotor aircraft, and advanced amphibious assault vehicles, will generate more flexible combat power. Joint concepts of operation, centered on the aircraft carrier, will leverage the military strengths of all the services, bringing cooperative muscle to the fight and a potent synergy across the warfare continuum.



When compared to their *Nimitz*-class counterparts, manpower requirements for *Ford*-class ships and their embarked air wings will be reduced by as many as 1,200 Sailors. These manpower reductions, coupled with improved reliability and reduced maintenance requirements, will enable the Navy to realize total operating cost savings of more than \$5 billion during the life of each ship. The design approach and spiral development of the *Ford* class will reduce risk by introducing new technologies and capabilities at an affordable pace. Armed with advanced aircraft such as the F/A-18 *Super Hornet*, EA-18G *Growler*, F-35C *Lightning II*, E-2D *Advanced Hawkeye*, and the Unmanned Carrier-Launched Airborne Surveillance and Strike System, these new aircraft carriers will provide maritime combat power well into the future.

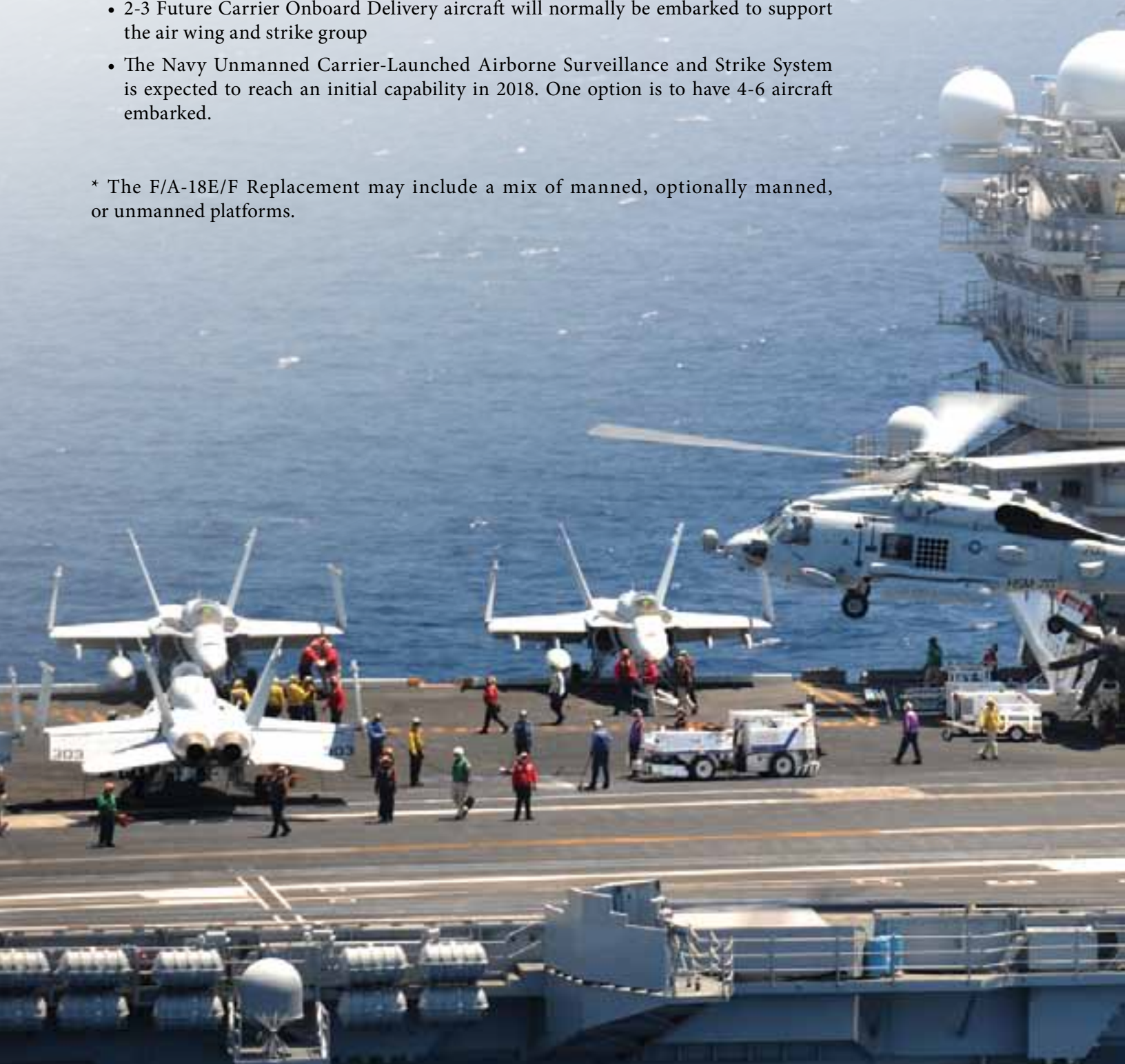


FUTURE CARRIER AIR WING

The carrier air wing of the future will consist of the following aircraft:

- 44 strike fighters (F/A-18E/F, F-35C, F/A-18E/F Replacement*)
- 5 electronic attack aircraft (EA-18G, EA-18G Replacement)
- 5 airborne early warning and command and control aircraft (E-2D)
- 19 helicopters (MH-60R/S or MH-60R/S Replacement). Current projections include deploying 11 helicopters aboard the carrier, with the remaining 8 dispersed to other ships in the strike group
- 2-3 Future Carrier Onboard Delivery aircraft will normally be embarked to support the air wing and strike group
- The Navy Unmanned Carrier-Launched Airborne Surveillance and Strike System is expected to reach an initial capability in 2018. One option is to have 4-6 aircraft embarked.

* The F/A-18E/F Replacement may include a mix of manned, optionally manned, or unmanned platforms.





AMPHIBIOUS ASSAULT SHIPS

The Marine Corps is our nation's amphibious, expeditionary, air-ground team that has the flexibility to conduct military operations from the air, land, and sea. Relevant in conventional as well as irregular warfare, amphibious forces provide highly versatile options for any joint force commander tasked with conducting operations in the littoral regions of the world. Amphibious assault ships are the largest of all amphibious warfare ships, resembling small aircraft carriers. In addition to launching aircraft, they deliver Marine expeditionary forces and their equipment to the beach by way of small watercraft. Perhaps more than any other asset, these ships symbolize the warfighting relationship between the Navy and the Marine Corps, delivering the fight to the enemy in "every clime and place."

Large-deck amphibious assault ships were designed to embark, deploy, and land elements of Marine Corps and special operations forces by tilt-rotor and rotary-wing aircraft, landing craft, and amphibious vehicles while providing organic ground support with fixed-wing aviation. These very capable platforms are routinely deployed as the centerpieces of forward-deployed expeditionary strike groups, which also include *San Antonio*-class, *Whidbey Island*-class, and/or *Harpers Ferry*-class vessels with embarked Marine air-ground task forces. They provide a unique tool capable of supporting the full range of military operations.





LHA: AMPHIBIOUS ASSAULT SHIP – GENERAL PURPOSE

These vessels have been modified to accommodate fixed-wing and tilt-rotor aircraft. Each ship can carry a mix of 31 rotary-wing and fixed-wing vertical/short takeoff and landing and vertical takeoff and landing aircraft with one air-cushioned landing craft or four utility landing craft, and more than 1,700 troops. They can also support sea-based command and control of waterborne and aerial ship-to-shore movements. With a fleet surgical team embarked, an LHA can function as a primary casualty receiving and treatment ship with 17 intensive care unit beds, four operating rooms, 300 hospital beds, a 1,000-unit blood bank, and dental and X-ray facilities. USS *Peleliu* (LHA 5), the remaining *Tarawa*-class LHA, will reach the end of its service life in 2015.





LHD: AMPHIBIOUS ASSAULT SHIP – MULTIPURPOSE

Wasp-class LHDs have an improved flight deck and elevator scheme and can accommodate a mix of 31 rotary-wing and fixed-wing aircraft. LHDs were the first amphibious vessels designed to carry both the AV-8B *Harrier* aircraft and multiple air-cushioned landing craft. Their enhanced well decks are capable of carrying three air-cushion or three utility landing craft, and they can embark more than 1,680 troops. *Wasp*-class LHDs have the same Navy and Marine Corps command-and-control facilities as the *Tarawa* class and also have six operating rooms and 600 hospital beds. All LHDs are being modified to operate the MV-22 *Osprey* and the F-35B *Lightning II*. USS *Makin Island* (LHD 8), the last of the *Wasp*-class LHDs to be commissioned, has a gas-turbine propulsion system and an all-electric auxiliary system.



LHA (R): AMPHIBIOUS ASSAULT SHIP – GENERAL PURPOSE (REPLACEMENT)

The *America*-class LHA (R) will optimize the aviation performance capabilities of the LHD design and will enhance Marine Corps and special operations amphibious assault missions by enabling the deployment of combat forces at longer ranges and greater speeds. The enhanced capabilities of the future aviation combat element—coupled with LHA (R)'s enlarged hangar deck, improved aviation maintenance facilities, increased aviation fuel capacity, and additional aviation storerooms—will add a warfighting dimension not previously available to the joint force. The contract for LHA 6, the first ship of the LHA (R) program, was awarded in June 2007 and delivery is scheduled for the end of fiscal year 2012. Delivery of LHA 7 is tentatively planned for fiscal year 2016.

LH (X): AMPHIBIOUS ASSAULT SHIP – GENERAL/MULTIPURPOSE (NEXT)

The LH (X) will replace all LHD, LHA, and LHA (R) class ships to capitalize on lessons learned with the LHA (R) design. Some of the enhancements for LH (X) will include center-of-gravity/displacement growth margins and a surface interface point aimed at maximizing the combat power of Marine air-ground task forces. From a shipbuilding standpoint, the strategy is to consolidate amphibious ship designs into a single big-deck class and a single small-deck class (based on the LPD 17 hull form). This strategy will support economies across doctrine, organization, training, equipment, and supplies.



FUTURE AVIATION COMBAT ELEMENT

The aviation combat element of the future will consist of the following aircraft:

- 6 short takeoff/vertical landing aircraft (F-35B)
- 12 tilt-rotor aircraft (MV-22)
- 4 heavy-lift helicopters (CH-53K)
- 4 attack helicopters (AH-1Z)
- 3 utility helicopters (UH-1Y)

Aviation combat elements are task organized. The exact composition will vary depending on mission requirements.






MANNED AND UNMANNED AIRCRAFT

UNMANNED SYSTEMS

Unmanned aircraft systems (UASs) have experienced explosive growth in the past decade and have proved to be invaluable assets for joint force commanders. UASs are persistent and highly capable intelligence, surveillance, and reconnaissance platforms. They can be tasked in real time from long distances across the battle space and can often operate beyond line of sight. Whether operating remotely or autonomously, the forward footprint of UASs is minimal, with a small contingent embedded in the operational environment and air vehicle and mission payload operators “flying” missions from the continental United States.





The smaller UAS types usually provide a shorter-duration line-of-sight reconnaissance capability at the unit level. These lightweight, cost-effective UASs have become integral and essential tools for ground and maritime forces and have become ubiquitous throughout the operational environment. All services currently employ a variety of systems, from large to small UASs. In addition to these, several demonstration technologies are under way that are pushing the boundaries of mission possibilities for unmanned systems. The X-47B Unmanned Combat Air System Demonstrator is developing technologies for a carrier-capable, low-observable UAS that will contribute to follow-on acquisition programs such as the Unmanned Carrier-Launched Airborne Surveillance and Strike System and other future carrier air wing aircraft. The X-47B made its first flight in February 2011, and carrier integration activities and surrogate aircraft testing is in progress to validate the various interfaces required to control the aircraft.

The unmanned systems cross-functional team was established in 2011 to identify and address issues associated with the effective development, integration, and fielding of unmanned systems in the Navy and Marines Corps. The team is responsible for unmanned issues in all domains—air, surface, undersea, and ground. It provides an organizational architecture to coordinate sharing of information, enhance collaboration

opportunities, and facilitate the actions of participating organizations. It also makes recommendations to senior leaders, coordinates resolution of identified barriers and issues across all stakeholder organizations, and oversees the efficient fielding of unmanned systems.

The UAS family of systems provides the Navy and Marine Corps with a tiered, joint, interoperable UAS architecture for battle space awareness, maritime domain awareness, force protection, and force application required by supported commanders. UASs are tailored to support specific force levels, from strike groups to individual ships, aircraft, and ground units. Because of their increasing presence, importance, and integration on the maritime and littoral battlefields, the roadmaps for unmanned systems are now included alongside the manned aircraft platforms in the mission categories they serve.

NAVY TACTICAL AIRCRAFT

F-35C Lightning II

The Joint Strike Fighter program is building a tri-service family of next-generation, “day one”-capable, strike-fighter aircraft that is flexible and survivable. With its all-aspect stealth strike design, internal weapon carriage, fully fused mission systems, and unrefueled combat radius of greater than 600 nautical miles, the Navy’s *F-35C Lightning II* will complement the capabilities of the *F/A-18E/F Super Hornet* now serving as the Navy’s premier strike fighter. The *F-35C* will enhance the flexibility, power projection, and strike capabilities of carrier air wings and joint task forces.

F/A-18E/F Super Hornet / F/A-18E/F Replacement

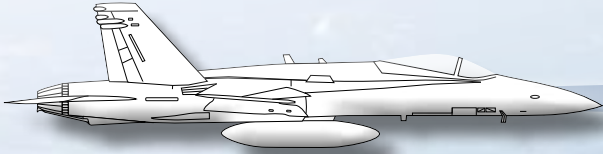
There are a number of enhancements to the *F/A-18E/F Super Hornet* that will sustain its lethality well into the 21st century. Upgrades include critical growth capability, enhanced survivability, and the ability to land on carriers with a greater quantity of unexpended ordnance without exceeding maximum landing weight. Avionics upgrades for the *F/A-18E/F* Block II include the APG-79 Active Electronically Scanned Array Radar System, the Infrared Search and Track System, and advanced sensor integration. Future avionics upgrades will enable network-centric operations, which will enhance situational awareness and the transfer of data to command-and-control nodes. The *Super Hornet* also fills the critical organic tanking mission for carrier air wings, extending the operational reach of the nation’s sea power.

Naval Aviation continues to study the capabilities required when the *F/A-18E/F* reaches the limits of its service life beginning in 2025. The assessment is the initial stage of the requirements and acquisition process; it will evaluate a full range of considerations for addressing future Navy needs and recapitalization issues, including manned, unmanned, and system-of-systems options. The capabilities assessed during the study will be further developed and refined through operational analytical modeling and simulation, potentially leading to an analysis of alternatives and, eventually, a competitive fly-off between various industry proposals for the *F/A-18E/F* Replacement.

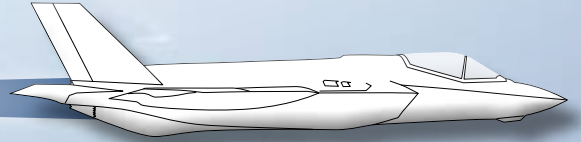


2012

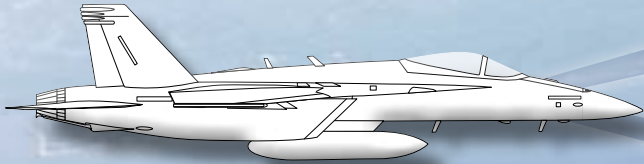
2032



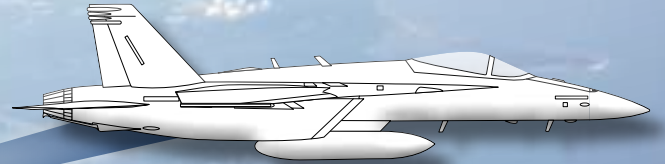
F/A-18A/B/C/D



F-35C



F/A-18E/F BL I/II



F/A-18E/F BL II

F/A-18E/F
REPLACEMENT



EA-18G Growler / EA-18G Replacement

The EA-6B *Prowler* has long served as the nation's foremost tactical airborne electronic attack platform. In December 2001, the Navy completed an analysis of alternatives for electronic attack, laying the foundation for the replacement of the *Prowler* with the EA-18G *Growler*. The *Growler* leveraged the investments made in the ALQ-218 receiver system, which is the heart of the EA-6B Improved Capability III program. The next step is to replace the ALQ-99 Tactical Jamming System with the Next Generation Jammer (NGJ), with an initial operational capability anticipated in 2020. Development of NGJ is critical to the Navy's vision for the future of airborne electronic attack and is a vital component of the Defense Department's plan to build a joint system-of-systems electronic attack capability. The EA-18G is already in service, and saw its first combat sorties in Libya. Full operational capability is scheduled for 2015. By 2032, the EA-18G Replacement aircraft will have begun replacing the EA-18G *Growler*.

E-2C Hawkeye / E-2D Advanced Hawkeye

The E-2C *Hawkeye* provides all-weather airborne early warning, airborne battle management, and command-and-control functions for strike group and joint force commanders. An integral component of carrier air wings, the E-2C uses its radar, identification friend or foe, electronic surveillance sensors, and offboard data sources to provide early warning threat analysis against potentially hostile air, surface, and ground targets. E-2C/D usage of Link-11, Link-16, Cooperative Engagement Capability, and a communication suite connects carrier air wings and strike groups at the tactical level to the operational level of warfare. The E-2D *Advanced Hawkeye* will replace the current E-2C aircraft beginning in 2014, with the final squadron transition scheduled for 2022. The E-2D's electronically scanned array radar will provide enhanced capabilities in the overland and littoral environments, while significantly improving performance against clutter and small targets and providing integrated air and missile defense capabilities. The E-2D is currently undergoing flight testing and has been approved for all four years of low-rate initial production. Initial operational capability for the aircraft will be October 2014.

Unmanned Carrier-Launched Airborne Surveillance and Strike System

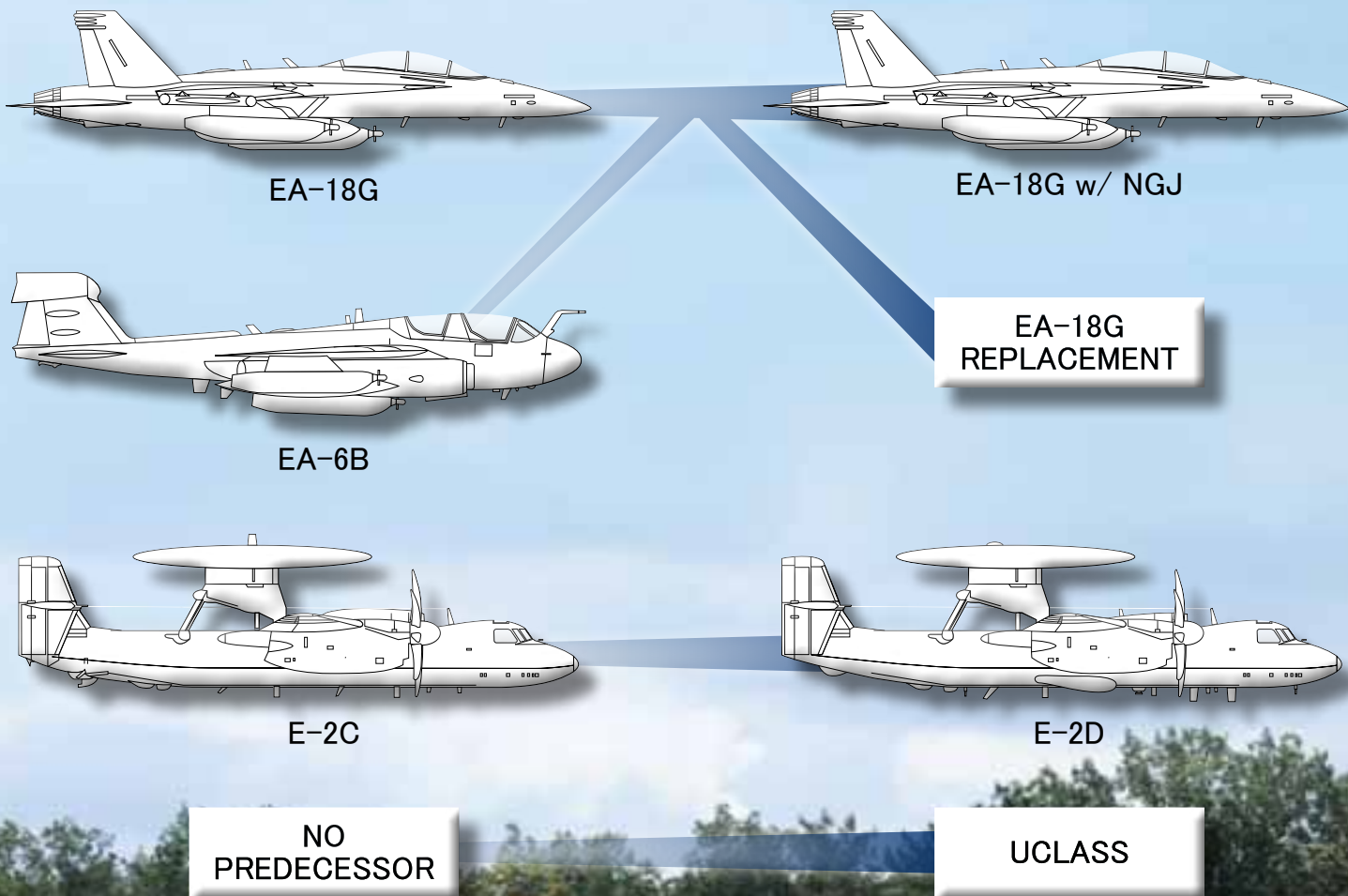
The Unmanned Carrier-Launched Airborne Surveillance and Strike System (UCLASS) will provide a persistent, aircraft carrier-based reconnaissance and strike capability to support carrier air wing operations beginning in the 2018 timeframe. The system will maximize use of existing technology to launch and control the air vehicle, transfer data in support of precision strike, and conduct persistent surveillance operations. It will consist of an air vehicle, a



remote vehicle control-and-connectivity segment, a carrier segment, and connectivity to existing Defense Department tasking, processing, exploitation, and dissemination systems. The system will be integrated into carrier-controlled airspace operations and it will be maintained in accordance with standard fleet processes as tailored for unmanned application. It will contain balanced survivability attributes that will be effective in specified tactical situations. Formal acquisition and contracting strategies are in development.

2012

2032



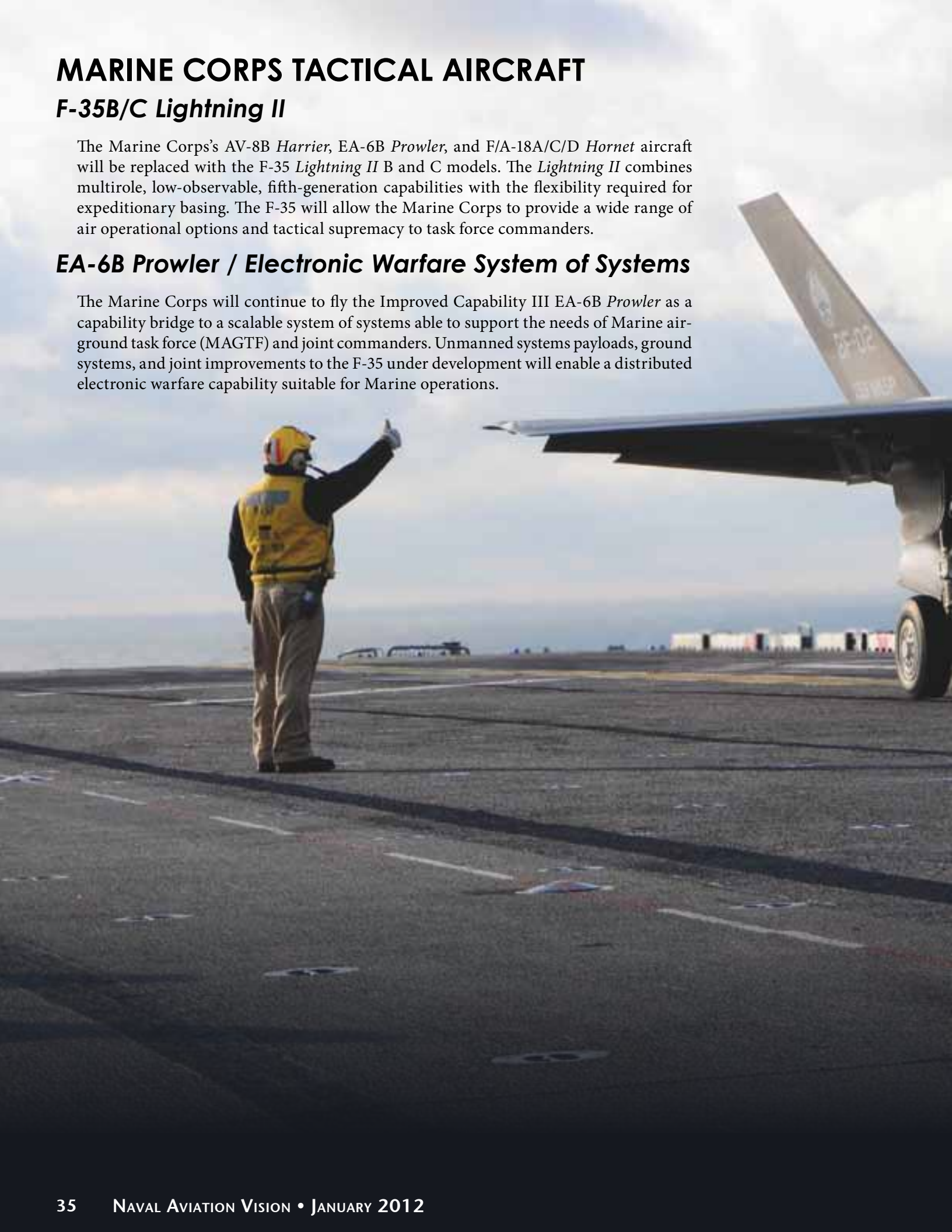
MARINE CORPS TACTICAL AIRCRAFT

F-35B/C Lightning II

The Marine Corps's AV-8B *Harrier*, EA-6B *Prowler*, and F/A-18A/C/D *Hornet* aircraft will be replaced with the F-35 *Lightning II* B and C models. The *Lightning II* combines multirole, low-observable, fifth-generation capabilities with the flexibility required for expeditionary basing. The F-35 will allow the Marine Corps to provide a wide range of air operational options and tactical supremacy to task force commanders.

EA-6B Prowler / Electronic Warfare System of Systems

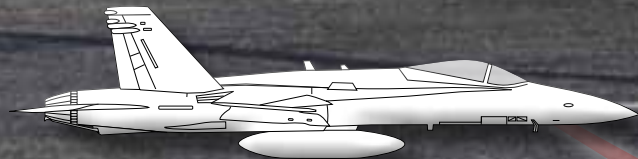
The Marine Corps will continue to fly the Improved Capability III EA-6B *Prowler* as a capability bridge to a scalable system of systems able to support the needs of Marine air-ground task force (MAGTF) and joint commanders. Unmanned systems payloads, ground systems, and joint improvements to the F-35 under development will enable a distributed electronic warfare capability suitable for Marine operations.



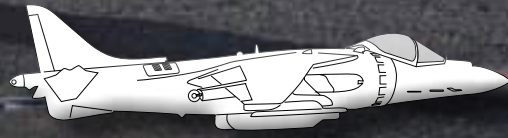


2012

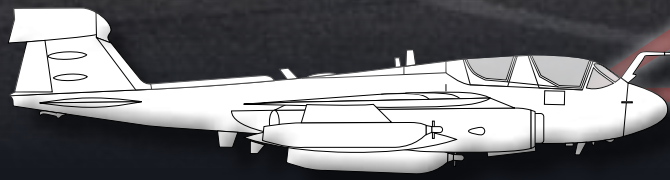
2032



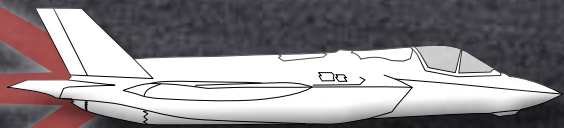
F/A-18A/C/D



AV-8B



EA-6B



F-35B/C
w/ ELECTRONIC ATTACK
PAYLOADS

**MAGTF EW
SYSTEM OF SYSTEMS**

NAVY HELICOPTERS

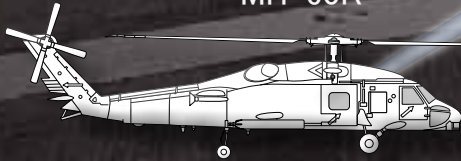


2012

2032



MH-60R



SH-60B/F

MH-60R
REPLACEMENT

MH-60R/S Seahawk

The MH-60R and MH-60S multimission combat helicopters are the pillars of the naval helicopter concept of operations for the 21st century. These two variants share 85 percent commonality to facilitate maintenance and logistics support. For the first time, they were deployed as carrier air group squadrons embarked on aircraft carriers and strike group escort ships under the leadership of carrier air wing commanders. The expeditionary squadrons deploy as detachments embarked on LHAs/LHDs, surface combatants, and logistics vessels. The MH-60R/S aircraft are integral components of littoral combat ship mission modules, with the MH-60R supporting anti-submarine and surface modules and the MH-60S supporting surface warfare and mine countermeasures modules.

The MH-60R/S Replacement is envisioned for the 2032 time frame when the *Seahawks* reach the end of their planned service lives.

MH-60R / MH-60R REPLACEMENT

The MH-60R provides surface and subsurface warfare support with its airborne low-frequency sonar, inverse synthetic aperture radar with automatic periscope detection and discrimination modes, electronic support measures, an advanced forward-looking infrared system, precision air-to-ground missiles, machine guns, and lightweight torpedoes. The MH-60R is the only organic airborne anti-submarine warfare asset within strike groups and is critical to ensuring maritime dominance.



MH-60S / MH-60S REPLACEMENT

The MH-60S multimission helicopter is currently conducting search-and-rescue, combat search-and-rescue, special operations forces support, air ambulance, anti-piracy, combat support, and fleet logistics operations. (Through the 2020s, the HH-60H will also provide special operations forces support in addition to the MH-60S.) Its utility has been critical to successful humanitarian assistance and disaster relief efforts since the devastating 2004 Indian Ocean tsunami. Using the forward-looking infrared sensor, Link-16, and an array of current and programmed air-to-ground weaponry as well as crew-served weapons, the MH-60S operates independently or as part of a “hunter/killer” team with the MH-60R for anti-surface warfare missions. In addition, the platform provides critical airborne mine countermeasures as part of the littoral combat ship mine countermeasures mission package. Using one of four advanced sensor and weapon packages to provide detection, localization, and neutralization of anti-access mine threats, these systems enable naval forces to operate and maneuver in littoral and blue-water environments.

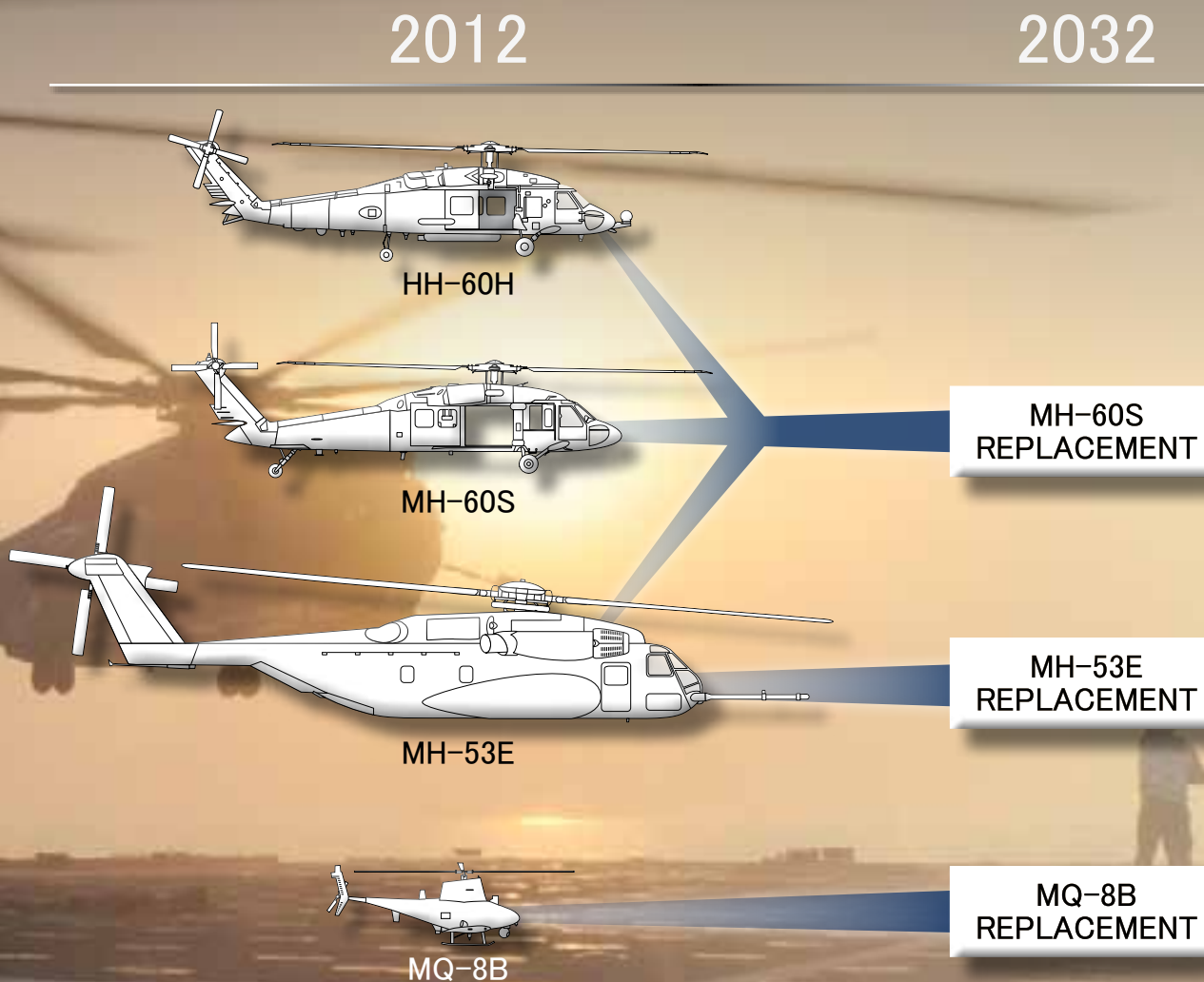


MH-53E Replacement

The MH-53E *Sea Dragon* continues to conduct dedicated airborne mine countermeasures and vertical on-board-delivery, heavy-lift missions in the fleet. Future plans include transitioning the mine countermeasures capability from the *Sea Dragon* to the MH-60S and identifying an MH-53E Replacement for the Navy's future heavy-lift capability. Initial operational capability will be required in the 2026 time frame.

MQ-8B Fire Scout

The MQ-8B *Fire Scout* vertical takeoff and landing unmanned aerial vehicle is designed to operate from all air-capable ships with the Tactical Control System. Initial operational capability is planned for fiscal year 2013. With the current electro-optical/infrared payload and other modular mission payloads, *Fire Scout* has a range of 125 nautical miles and can remain on station for up to five-and-a-half hours. *Fire Scout* is operated and maintained by members of a composite MQ-8/MH-60R/S aviation detachment. *Fire Scout* conducted a military utility assessment aboard USS *Halyburton* (FFG 40) to develop fleet concepts for operation of the system and to support data collection and intelligence, surveillance, and reconnaissance for counterpiracy operations in the Gulf of Aden and NATO operations off the coast of Libya. In addition, a *Fire Scout* expeditionary detachment is currently supporting full-motion video intelligence, surveillance, and reconnaissance requirements in Afghanistan.





MARINE CORPS ASSAULT SUPPORT AIRCRAFT

AH-1Z Viper and UH-1Y Venom

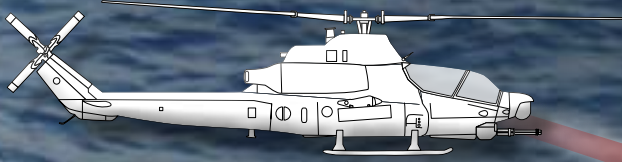
Having achieved full-rate production and initial operational capability for both the UH-1Y and the AH-1Z, focus for the H-1 upgrade program has shifted toward fielding and sustaining these capable airframes. H-1 upgrade aircraft are equipped with a four-bladed rotor system, 10,000-hour airframes, integrated avionics, glass cockpits, significantly improved sensors, and helmet-mounted displays, and have vastly increased payload, range, and time-on-station. The UH-1Y has supported combat operations in Operation *Enduring Freedom* since October 2009, and the AH-1Z deployed for the first time in November 2011 alongside the UH-1Y as part of an “all upgrades” Marine expeditionary unit. The AH-1Z/UH-1Y combined deployment showcased the advantages of sharing 84 percent of components, significantly increasing maintainability while reducing the logistics footprint and associated training requirements.

MV-22B Osprey

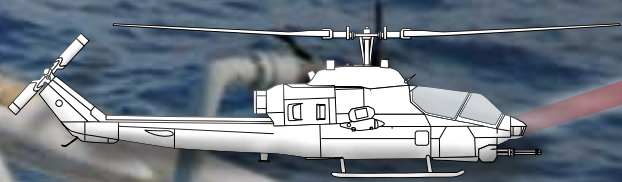
The MV-22B *Osprey* is a tiltrotor vertical/short takeoff and landing aircraft designed as the medium-lift replacement for the Vietnam-era CH-46E *Sea Knight* assault support helicopter. The *Osprey* can operate as a helicopter or as a turboprop aircraft and incorporates advances in composite materials, airfoil design, fly-by-wire controls, and digital avionics. It has twice the speed, six times the range, and three times the payload of the aircraft it replaces. In February 2011 the V-22 program surpassed 100,000 flight hours and has successfully deployed multiple times to Iraq and Afghanistan and aboard U.S. naval shipping. It currently supports combat operations in the Central Command area of responsibility.

2012

2032



AH-1Z



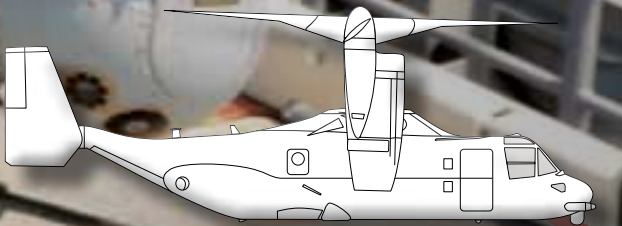
AH-1W



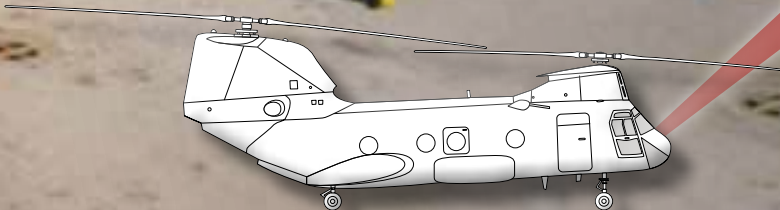
UH-1Y



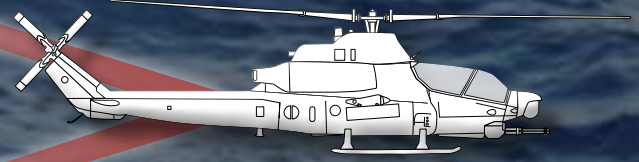
UH-1N



MV-22B



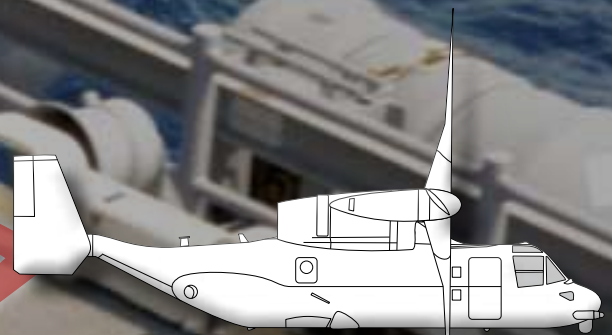
CH-46E



AH-1Z



UH-1Y



MV-22B

KC-130J Super Hercules

The KC-130J *Super Hercules* is a multimission tactical tanker and assault support aircraft well suited to the mission needs of forward-deployed Marine air-ground task forces. As the replacement for active-component KC-130T model aircraft, the KC-130J provides increased speed, range, and survivability; an improved refueling system; and a digital cockpit with heads-up display. The KC-130J will replace reserve KC-130T aircraft beginning in 2015, bringing commonality and interoperability to active and reserve Marine Corps components. With the addition of the Harvest HAWK mission kit, the KC-130J can be rapidly reconfigured into a platform capable of persistent targeting and precision fires.

CH-53K Heavy-Lift Helicopter

The CH-53D is reaching the end of its service life and will be retired by the fall of 2012. Approaching 30 years of service, the CH-53E is undergoing required sustainment efforts to maintain its heavy-lift capability until delivery of the CH-53K. Expeditionary heavy-lift requirements are expanding and will continue to be critical to successful land- and sea-based operations. The new CH-53K will have heavy-lift capabilities not possessed by any of today's platforms, and will contribute directly to the increased agility, lethality, and persistence of Marine and joint task forces. The CH-53K will transport 27,000 pounds of external cargo to a range of 110 nautical miles, nearly tripling the CH-53E's lift capability under similar environmental conditions, while fitting within the same shipboard footprint. The CH-53K also will provide lift capability under high-altitude and hot-weather conditions. Maintainability and reliability enhancements of the CH-53K will significantly decrease recurring operating costs, and will greatly improve aircraft efficiency and operational effectiveness. In addition, survivability and force protection enhancements will dramatically increase protection for both air crew members and passengers, thereby broadening the depth and breadth of heavy-lift operational support to Marine and joint commanders.

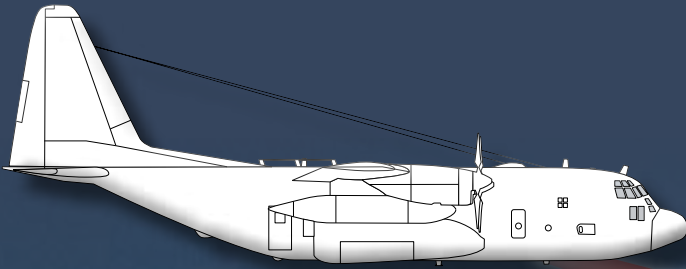
Cargo Resupply Unmanned Aerial System

The Cargo Resupply Unmanned Aerial System (CRUAS) effort supports the Marine Corps's requirements captured in a joint urgent operational needs statement to "get trucks off the roads" in combat zones and minimize the threat of improvised explosive devices to logistics convoys. The system will provide a low-risk, persistent capability for dispersed forces on the battlefield that will mitigate the requirement for manned ground vehicles to resupply forces in remote locations. CRUAS will also augment manned aviation assault support assets and airdrop methods when weather, terrain, and enemy threats elevate the levels of risk. A ground control station at a main operating base and a remote terminal at the drop-off zone will deliver cargo by air between main logistical hubs and remote "spokes." This initiative began as a military user assessment in November 2011 that will inform a follow-on program of record.

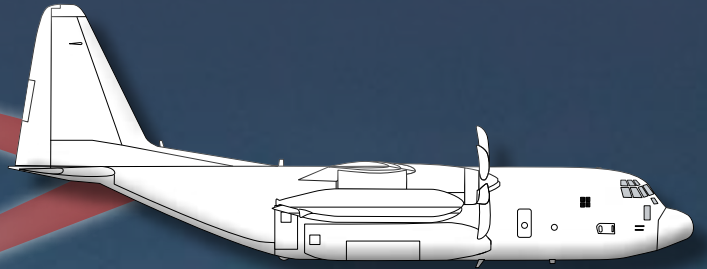


2012

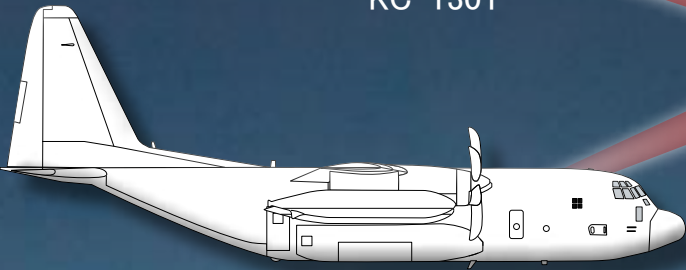
2032



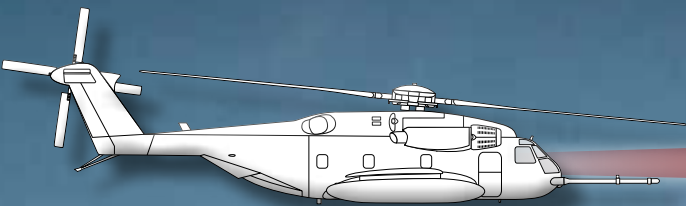
KC-130T



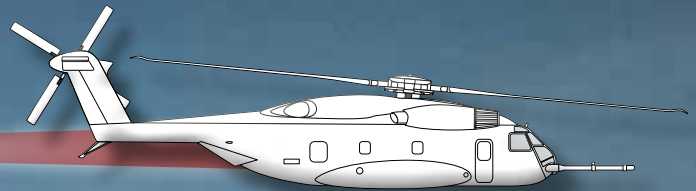
KC-130J



KC-130J



CH-53E



CH-53K

NO
PREDECESSOR

CRUAS



MARINE CORPS UNMANNED TACTICAL SUPPORT SYSTEMS

RQ-7B Shadow

Shadow is an expeditionary, multimission tactical unmanned system that provides dedicated reconnaissance, surveillance, target acquisition and designation, and communications relay to regimental-sized and larger Marine Corps units. Since 2007, *Shadow* systems have deployed to Iraq, Afghanistan, and elsewhere, where they have flown more than 20,000 combat hours in support of Marine Corps, joint, and allied operations. Four Marine unmanned aerial vehicle squadrons now operate 13 *Shadow* systems.

RQ-21A Integrator

The RQ-21A *Integrator* Small Tactical Unmanned Aircraft System will provide a tactical intelligence, surveillance, and reconnaissance capability for Navy special warfare operators, amphibious assault ships, and Marine Corps battalion- and company-sized units. The *Integrator* is a 135-pound unmanned aerial vehicle (fully loaded) with a 37-pound payload consisting of an electro-optical/infrared sensor ball and communications relay package. The *Integrator* completed its first operational test phase in January 2011 at the Yuma Proving Ground in Arizona. The Marine Corps procured two early operational capability systems in 2011. The Navy will begin procurement in fiscal year 2012 with the purchase of two early operational capability systems.

Scan Eagle

Scan Eagle is a 40-pound vehicle with a cruising speed of 50 knots and a ceiling of 15,000 feet. Designed to fly missions of 15 hours or more, it is used for both land- and ship-based operations. The *Scan Eagle* system includes the Sky Wedge hydraulic launcher, the Sky Hook retrieving system, and a mobile ground-control element. The vehicle is equipped with a nose-mounted inertial-stabilized camera turret that carries either a digital camera or infrared sensor. The *Scan Eagle* system is being used to fill a capability gap on an interim basis; intelligence, surveillance, and reconnaissance services will be partially replaced by the RQ-21A beginning in fiscal year 2013.

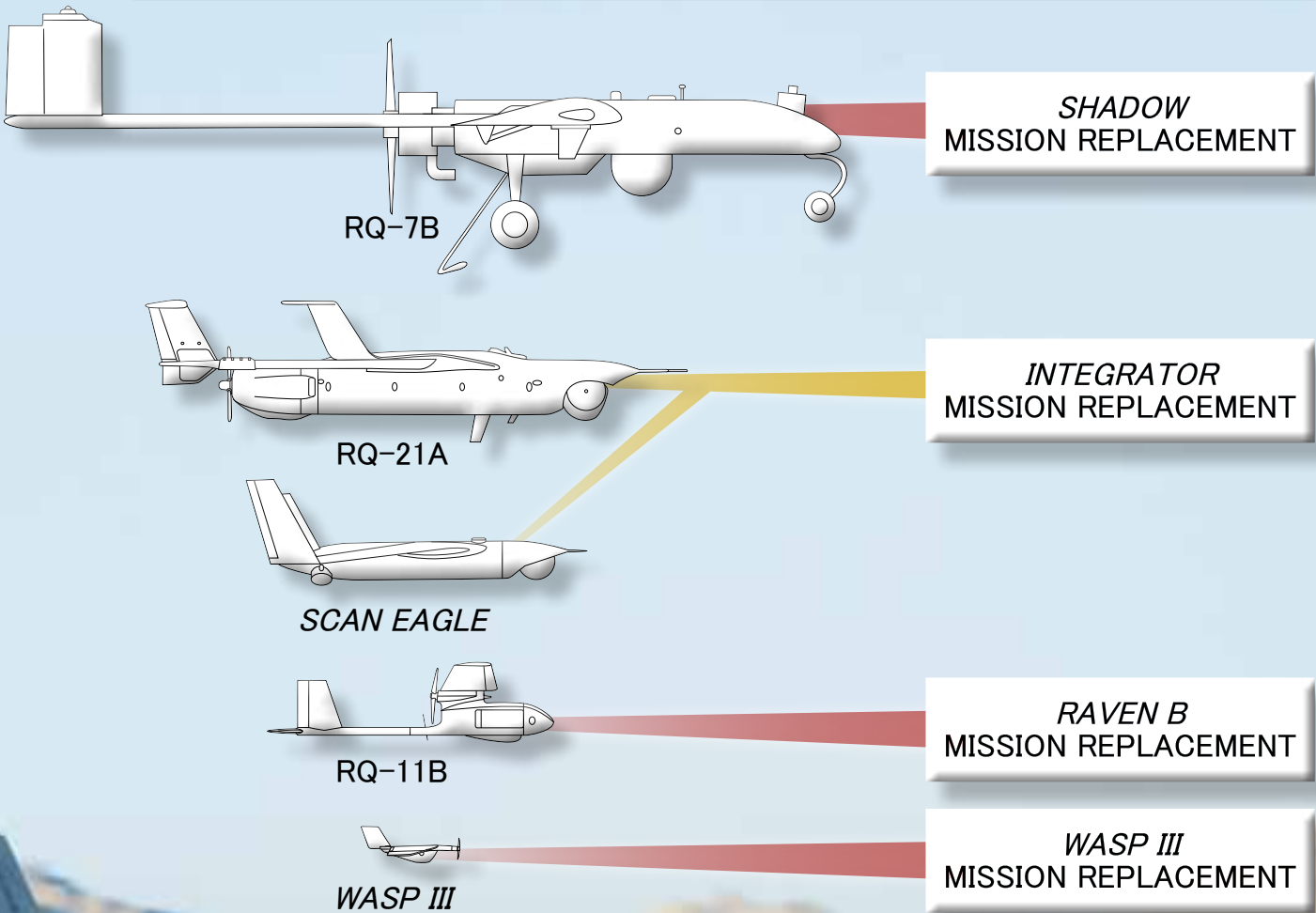


RQ-11B Raven B

The *Raven B* provides small Marine Corps units with near-real-time reconnaissance and surveillance information. The system consists of a ground control station, three air vehicles, and a field support kit. The system has an endurance of up to two hours with a range of 10 kilometers. It provides day/night live video feedback to users by way of a laptop-based ground control station with color electro-optical, black-and-white low-light, and infrared payloads. *Raven B* systems are currently being upgraded to a digital data link.

2012

2032



Wasp III

The *Wasp III* is a micro aerial vehicle that weighs approximately one pound and has an endurance of 45 minutes and a five-kilometer range. It shares a common ground control station with the RQ-11B *Raven B*. The Marine Corps is fielding 135 *Wasp III* systems to answer an urgent operational need for additional man-portable unmanned aircraft systems. A program of record decision is expected in fiscal year 2012 following fleet evaluation.

NAVY MARITIME PATROL AND RECONNAISSANCE AIRCRAFT

P-8A Poseidon

The P-8A *Poseidon* will replace the P-3C *Orion*, which has reached the end of its service life. The *Poseidon* will provide broad area maritime and littoral anti-submarine and anti-surface warfare as well as armed intelligence, surveillance, and reconnaissance capabilities to joint warfighters. To keep pace with emerging threats, the P-8A features a sensor and communications suite built within an open architecture to facilitate the insertion of state-of-the-art anti-submarine warfare sensors, net-ready technologies, and the latest joint weapons throughout its service life. The procurement plan for the *Poseidon* provides for a force with the lethality and capacity needed to support strike groups and the joint battle force in any maritime environment. Initial operational capability for the P-8A *Poseidon* is 2013.

EP-3E Aries / Future Family of Airborne ISR, Targeting, and Information Operations System

The EP-3E *Aries* is the Navy's premier manned airborne intelligence, surveillance, reconnaissance (ISR), targeting, and information operations platform. Upgrades to the aircraft have created significant multi-intelligence, data-fusion, and cue-to-kill targeting capabilities essential to support current overseas contingency operations. Though optimized for the anti-surface warfare targeting mission in the maritime and littoral environments, recent capability upgrades have improved EP-3E mission effectiveness in supporting warfighters in all environments around the globe. Multi-intelligence sensors, data links, and a flexible and dependable P-3 airframe ensure effective support to conventional and nonconventional warfare operations. With the end of the EP-X program, Naval Aviation is developing a family-of-systems construct to be in place by the end of the decade to recapitalize the airborne capabilities currently provided by the *Aries* aircraft. Those systems include the MQ-4C, the Unmanned Carrier-Launched Airborne Surveillance and Strike System and the MQ-8B. Until then, investment in the EP-3E Joint Common Configuration program will ensure *Aries* mission systems keep pace with current and emerging threats.

MQ-4C Broad Area Maritime Surveillance System

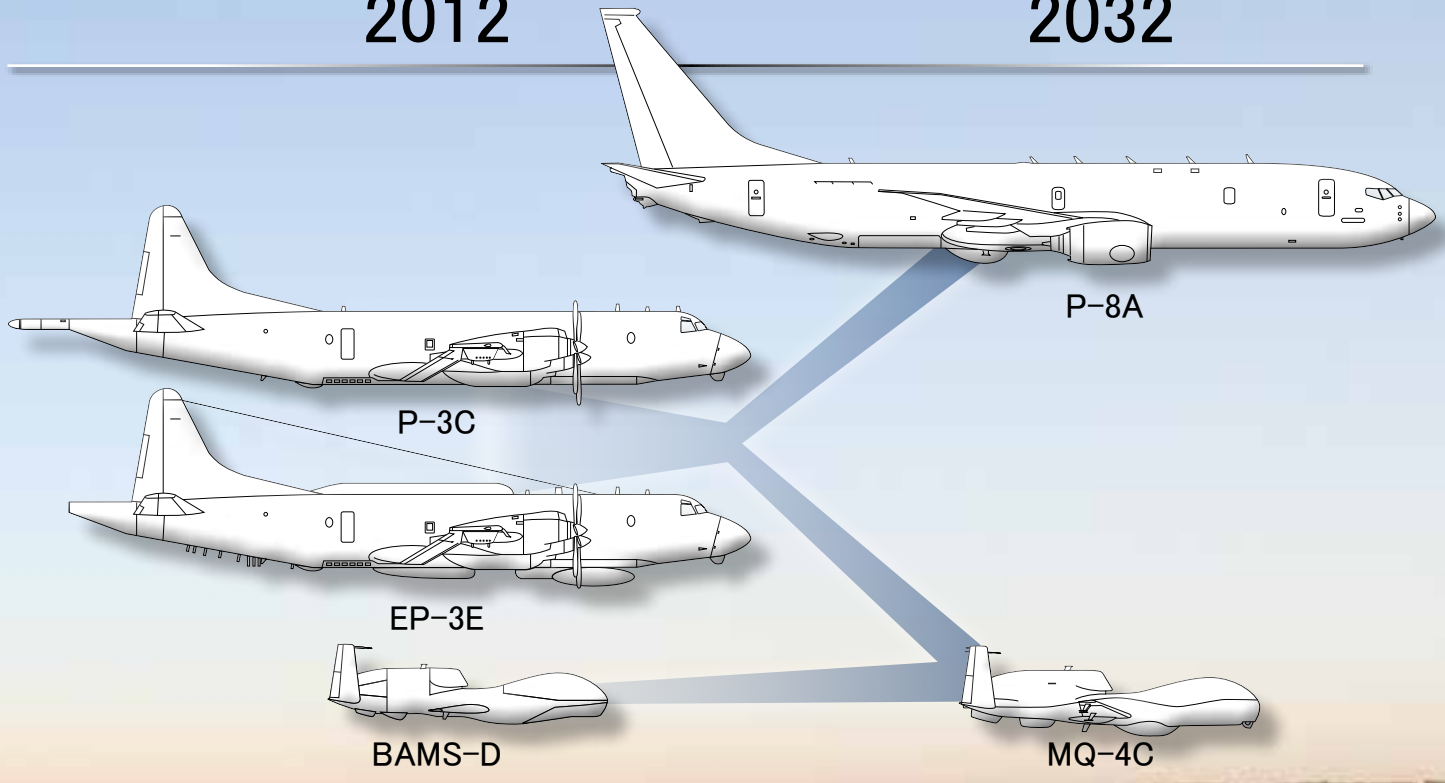
The MQ-4C Broad Area Maritime Surveillance (BAMS) System is an adjunct to the P-8A multimission aircraft. The MQ-4C will be forward-deployed, operating under the cognizance of the maritime patrol and reconnaissance force to leverage manpower, infrastructure, and expertise. This land-based system will provide persistent maritime reconnaissance and basic communications relay capabilities from five operational sites (orbits) worldwide in support of fleet commanders and coalition and joint forces. The MQ-4C's persistence, combined with networked sensor data, will enable the unmanned aircraft family of systems to meet requirements more effectively.

The MQ-4C completed its critical design review in February 2011. Its initial operational capability is scheduled for fiscal year 2016 (one orbit); full operational capability is scheduled for fiscal year 2020 (five orbits).

Since 2009, a BAMS Demonstrator has served operationally with 5th Fleet, providing near-real-time, high-resolution tactical imagery in support of combat operations. In addition, the demonstrator facilitates the tactical integration of unmanned aircraft systems into fleet operations by: validating concepts of operation; developing tactics, techniques, and procedures; and executing training and proficiency flights. Lessons learned are being used in the development of maritime patrol and reconnaissance capabilities.

2012

2032



NAVY AND MARINE CORPS TRAINING, LOGISTICS, AND OPERATIONAL SUPPORT AIRCRAFT

Training Aircraft

T-6B TEXAN II JOINT PRIMARY TRAINER

Navy and Marine Corps primary pilot training is transitioning to the T-6B *Texan II* as the T-34C *TurboMentor* is retired after more than 30 years of service. The T-6A will continue to be used for naval flight officer and Air Force combat systems officer training.

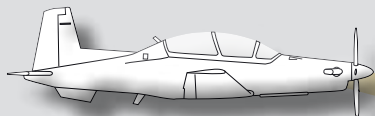
T-45C

The T-45C *Goshawk* will be the single advanced strike trainer for tailhook pilots and naval flight officers as the T-39G/N *Sabreliner* is retired and the T-45A aircraft is retrofitted to the T-45C configuration. All T-45A cockpits will be digitized through the required avionics modernization program, which consists of a glass cockpit upgrade with two multifunction displays, mission display processor, recorder, and cockpit controls. The virtual mission training system program will integrate a virtual multimode radar capability into the T-45C to enable basic tactical skills training that will prepare students for the advanced tactical jet aircraft of the future. By 2020, work will have begun to identify a replacement for the T-45C as this aircraft reaches the end of its service life.

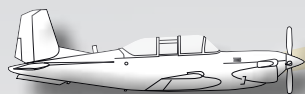


2012

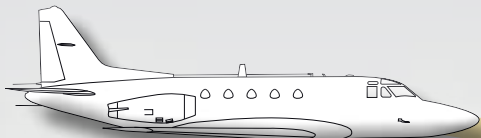
2032



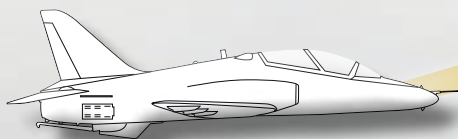
T-6A/B



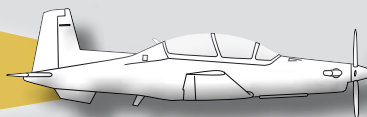
T-34C



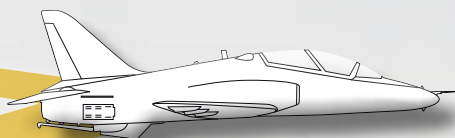
T-39G/N



T-45A/C



T-6A/B



T-45C



T-44 REPLACEMENT AIRCRAFT

The T-44A *Pegasus* and the TC-12B *Huron* are both pressurized, twin-engine, fixed-wing aircraft used to conduct multiengine aircraft training for Navy, Marine Corps, Air Force, and Coast Guard pilots. The T-44C, which upgrades the T-44A with a digital cockpit, will become the single multiengine training platform for Naval Aviation. The T-44 Replacement will be in place by 2032. Training in the TC-12B will be discontinued in 2012.

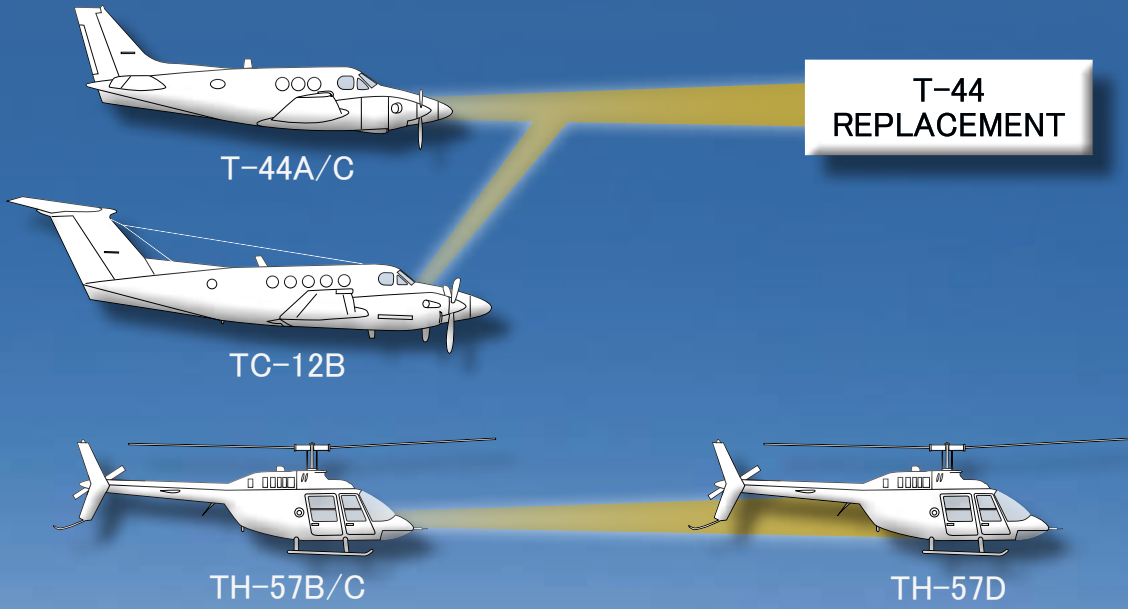
TH-57D SEA RANGER ROTARY AND TILTROTOR TRAINER

The TH-57D *Sea Ranger* will replace the TH-57B/C as Naval Aviation's single rotary-wing and tilt-rotor aircraft training platform. Future upgrades will include a digital cockpit and passenger protection to enhance training and safety and to match more closely the capabilities of Navy and Marine Corps fleet rotary-wing platforms.



2012

2032



Navy-Unique, Fleet-Essential Airlift

Navy-unique, fleet-essential airlift provides combatant commanders with short-notice, fast-response, intratheater logistics support when and where it is needed. This family of aircraft platforms delivers medium- and heavy-lift capabilities in support of the fleet. Designed primarily to provide a reliable and highly flexible airborne logistics capability for the wartime movement of personnel and heavy cargo, these aircraft respond to immediate demands for the movement of essential fleet personnel and cargo to mobile sea-based forces worldwide.

The Marine Corps considers the C-9B to be an operational support airlift asset. Marine Aviation is pursuing the C-40A as the C-9B Replacement Aircraft to meet its medium-lift requirements.

C-40A CLIPPER

The C-40A *Clipper* is a Boeing 737-700 next-generation aircraft equipped with an oversized cargo door that offers multiple passenger and cargo configurations. The *Clipper* is replacing the aging C-9 *Skytrain* and C-20G *Gulfstream* fleet. The venerable C-9 has served the fleet exceptionally well for years, but with an average aircraft age of more than 36 years maintenance costs are steadily rising. The C-40A has increased range, capacity, and fuel efficiencies to support sea-based logistics.

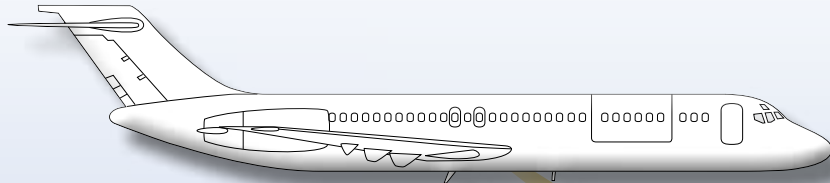
KC-130J HERCULES

The KC-130J will replace the C-130T. With increased performance, fuel efficiency, and maintenance reliability, the KC-130J is fully compliant with the Communications Navigation Surveillance/Air Traffic Management System and comes equipped with an electronic flight deck. Scheduled for delivery in fiscal year 2017 this aircraft can transport up to 35,000 pounds of cargo (or 75 passengers) 1,800 nautical miles at 350 knots.

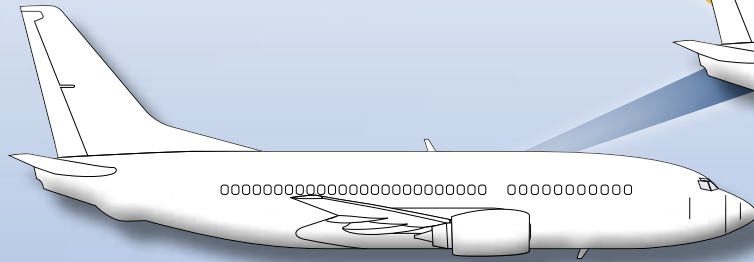


2012

2032



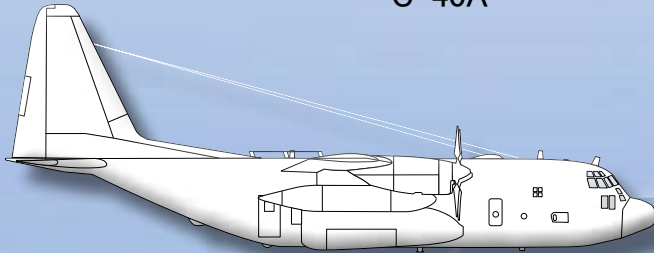
C-9B



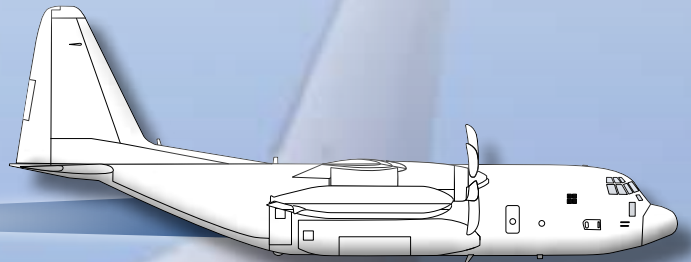
C-40A



C-40A



C-130T



KC-130J



Operational Support Aircraft

Operational support aircraft are used to transport high-priority passengers and cargo when requirements are time-, place-, or mission-sensitive. They are stationed worldwide and perform critical airlift missions for the geographic combatant commanders to and from remote locations where commercial sources are not available or viable.

UC-12W HURON

The Marine Corps is replacing UC-12B/F aircraft with the UC-12W *Huron*, which will provide light-lift capability through 2032. With a crew of three and a maximum range of 1,900 nautical miles, the *Huron* can transport up to eight passengers while flying at a speed of 279 knots at an altitude of 35,000 feet. The UC-12W is a deployable light-lift aircraft equipped with aircraft survivability equipment and has the radios necessary to operate in the Marine Corps Aviation Command and Control System.

UC-35 EXTENDED-RANGE REPLACEMENT

The UC-35C/D aircraft provides high-speed transport for forward-deployed Marine forces that have time-sensitive passenger and cargo requirements. Operating forces require a jet transport with increased range and improved passenger and cargo capabilities. The UC-35 Extended-Range Replacement aircraft will meet these needs.



2012

2032



UC-12B/F



UC-12W



UC-35C/D



UC-12W



UC-35ER



C-20G

**C-20
REPLACEMENT**

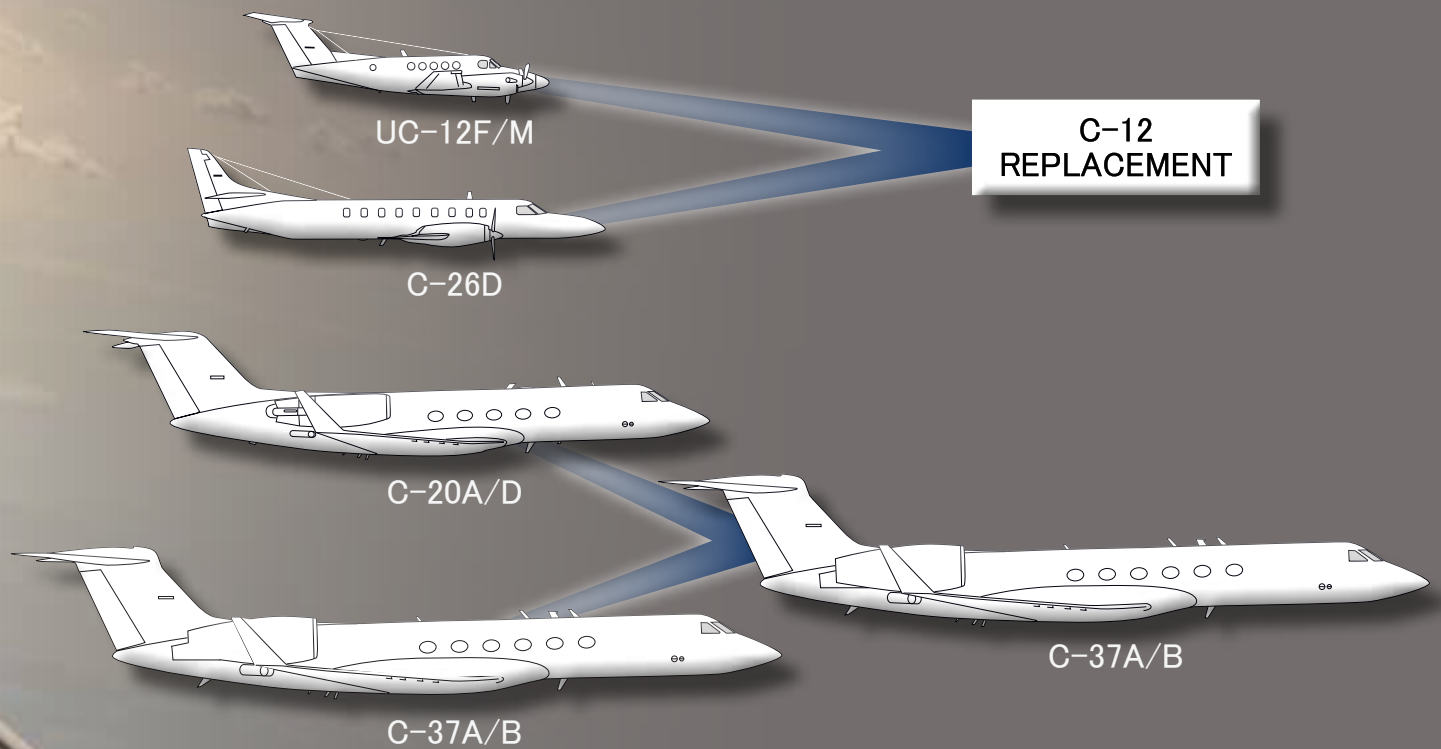
C-20G REPLACEMENT

Marine Corps Aviation has identified a need to replace the C-20G to support Marines. Range, payload, and performance characteristics similar to those of the C-20G will be required.



2012

2032



C-12 Replacement

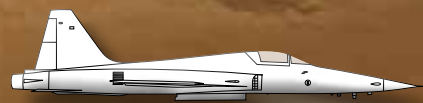
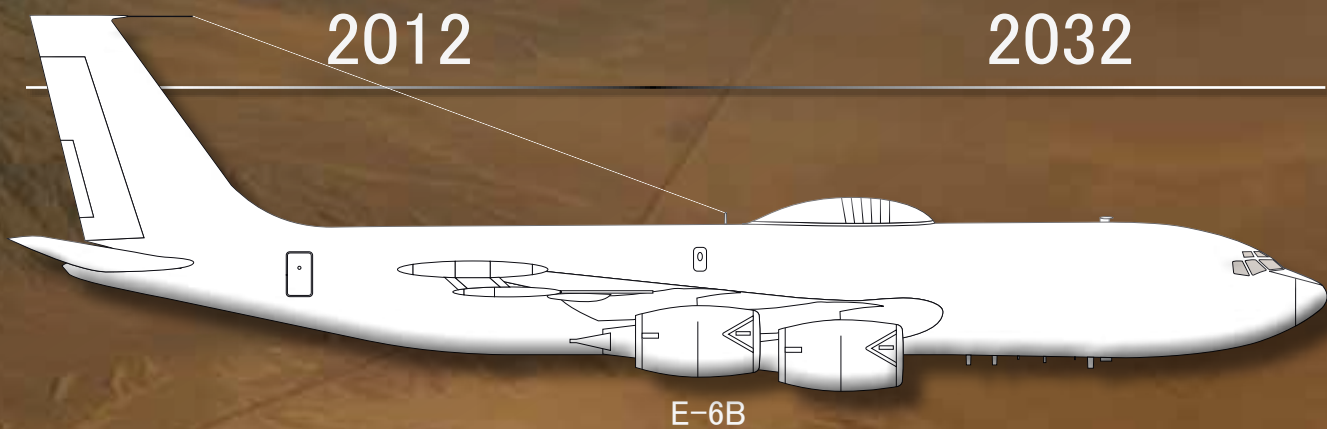
A C-12 Replacement aircraft will be identified to replace the Navy's current fleet of UC-12F/M *Huron* and C-26D *Metroliner* aircraft to provide light-lift capability through 2032.

C-37A/B Gulfstream G550

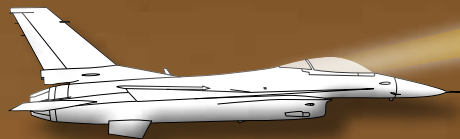
The C-37A/B *Gulfstream* executive transport aircraft replaces the aging C-20A/D to provide senior Navy Department personnel with high-speed, long-range transportation with a secure communications capability. Flying at speeds up to 585 knots, the G550 can travel 6,750 nautical miles at 45,000 feet and transport 12 or 14 passengers depending on how it is configured.

SPECIALIZED NAVAL AIRCRAFT





F-5N/F



F-16A/B

ADVERSARY
REPLACEMENT

E-6B Mercury

Derived from Boeing's 707 aircraft, the E-6B supports U.S. Strategic Command with command, control, and communications capabilities to direct and employ strategic forces. Designed to support a flexible nuclear deterrent posture, the E-6B uses very-low-frequency emergency communications for U.S. Strategic Command airborne command post missions and airborne launch control of ground-based intercontinental ballistic missiles. The Block I program (initial operational capability in 2013) is designed to improve the mission communication systems of the aircraft and increase efficiencies between airborne command post and Navy communications personnel. The internet protocol/bandwidth expansion program (2013) and the Block II program (2015) both provide increases in line-of-sight and satellite-based data links to allow for greater data throughput supporting high-capacity communications. The service life extension program (2011) ensures continued airframe viability well into the 21st century.

F-5N/F Tiger II and F-16A/B Fighting Falcon

Navy and Marine Corps adversary squadrons provide advanced training support to active-duty squadrons. The Navy and Marine Reserve squadrons dedicated to this mission employ the F-5N and F-5F *Tiger II* as well as F/A-18A+ *Hornets*. The Naval Strike Air Warfare Center in Fallon, Nev., maintains a fleet of 14 F-16A/B *Fighting Falcons* that provide dissimilar, fourth-generation threat replication. Adversary squadrons provide opposing forces for large force exercises, unit-level training, and fleet replacement squadron training, and are a key component for advanced tactical fleet training. A replacement platform is envisioned in the 2025 timeframe for the F-5 and F-16.

C-2A Greyhound / Future Carrier Onboard Delivery Aircraft

The C-2A *Greyhound* is the Navy's medium-lift/long-range logistics support aircraft, transporting high-priority cargo, mail, and passengers between carrier strike groups and forward logistics sites. It can deliver a combined payload of 10,000 pounds a distance of 1,000 nautical miles, and the interior cabin can be easily rearranged to accommodate passengers, litter patients, or time-critical cargo. The large cargo ramp at the rear of the aircraft allows rear loading and unloading for fast turnaround and can be operated in flight to air drop supplies and personnel. Equipped with an auxiliary power unit for unassisted engine starts, the versatile *Greyhound* can operate independently from remote locations. The aircraft is undergoing several modifications and a service life extension program, which include structural enhancements, improvements to the avionics system, rewiring, and a new propeller system. These modifications will extend the *Greyhound's* service life until a Future Carrier Onboard Delivery Aircraft can be fielded. Initial operational capability will be required by 2026.

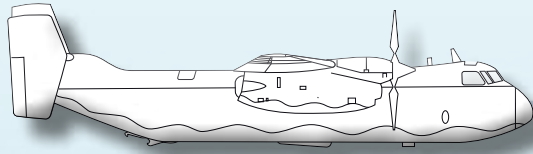
VXX Replacement Presidential Helicopter

A replacement is under development for the 35-year-old VH-3D and the 25-year old VH-60N helicopters, currently providing transportation for the President of the United States, foreign heads of states, and other dignitaries as directed by the White House Military Office. The Replacement Presidential Helicopter (VXX) will provide a hardened, mobile command-and-control transportation capability and a system of integrated systems necessary to meet current and future presidential transport mission requirements.



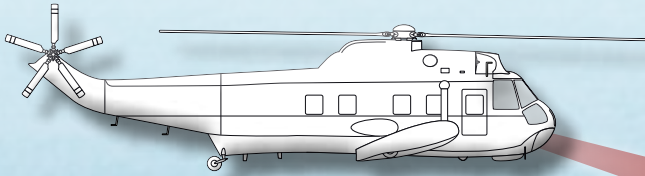
2012

2032

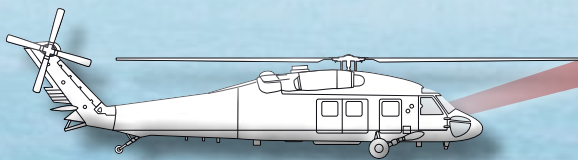


C-2A

FUTURE CARRIER
ONBOARD DELIVERY
AIRCRAFT



VH-3D



VH-60N

REPLACEMENT
PRESIDENTIAL
HELICOPTER



WEAPONS

LONG-RANGE STANDOFF WEAPONS

AGM-84H/K Standoff Land-Attack Missile – Expanded Response

The Standoff Land Attack Missile–Expanded Response (SLAM-ER) is a long-range, highly precise, air-launched strike missile capable of attacking fixed and mobile land targets as well as surface ships. Terminal control of the weapon is achieved when the pilot designates the impact point on the imaging infrared scene transmitted by the weapon to the cockpit display. Man-in-the-loop commands are sent to the SLAM-ER by way of a data-link pod carried by the launching (or secondary control) aircraft. An analysis of alternatives is defining a follow-on weapon solution to meet the maritime standoff strike mission currently filled by SLAM-ER and *Harpoon* Block 1C.

AGM/RGM-84D Harpoon Block 1C

The *Harpoon* Block 1C is an air- or surface-launched, anti-ship, all-weather cruise missile that employs an autonomous active radar seeker to attack a wide variety of surface ship targets from standoff ranges. The *Harpoon*, which entered service in 1977, is currently carried by F/A-18 and P-3C aircraft as well as a portion of the Navy's DDG-51 and CG-47 surface ship classes. Numerous air, surface, and submarine platforms currently deploy *Harpoon* for 27 international customers. An analysis of alternatives is being conducted to scope and define a follow-on weapon solution to meet the maritime standoff strike mission currently addressed by SLAM-ER and *Harpoon* Block 1C.

Tomahawk Land-Attack Missile

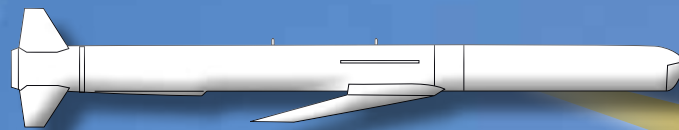
The *Tomahawk* Land Attack Missile is a long-range, subsonic cruise missile used for deep land attack warfare that is launched from U.S. Navy surface ships and U.S. Navy and United Kingdom Royal Navy submarines. There are currently three main versions: the Block II nuclear variant, which contains the W80 warhead; the Block III conventional variant, which can carry either a 1,000-pound unitary warhead or a submunition-dispensing warhead; and the Block IV, or Tactical *Tomahawk*, which is network-enabled and capable of changing targets while in flight. *Tomahawk* provides on-scene commanders with the flexibility to attack long-range fixed targets or to support special operations forces with a lethal, responsive, precise weapon system. Potential future capabilities for the *Tomahawk* Block IV include improvements to the warhead (the Joint Multiple Effects Warhead System) and a maritime interdiction multimission capability (Multimission *Tomahawk*). The former system will demonstrate the



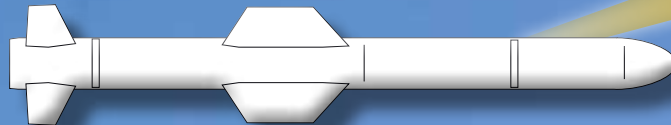
military utility of a programmable warhead with increased effects of penetration and blast against the full range of targets, from area to hardened targets. Multimission *Tomahawk* adds a moving target seeker and upgraded data link to the existing Tactical *Tomahawk* missile. The *Tomahawk* program office is currently investigating industry seeker technologies for maritime interdiction that could potentially be integrated into the existing Block IV weapon system. Additional studies have been initiated to develop a next-generation supersonic cruise missile capability for *Tomahawk* that will increase responsiveness against time-critical targets.

2012

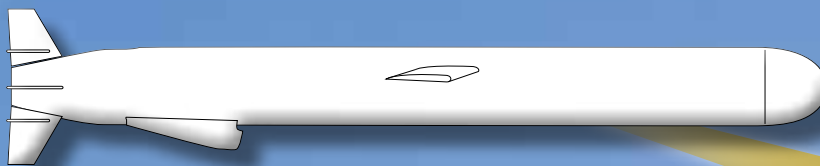
2032



SLAM-ER



HARPOON



TOMAHAWK BL II/III



TOMAHAWK BL IV

FOLLOW-ON
STANDOFF
WEAPON

FOLLOW-ON
TOMAHAWK
BLOCK UPGRADE

MID-RANGE STANDOFF WEAPONS

AGM-88E Advanced Anti-Radiation Guided Missile

The Advanced Anti-Radiation Guided Missile (AARGM) upgrade program transforms a portion of the existing AGM-88 HARM inventory into lethal strike weapons with enhanced time-critical strike and precision attack capabilities. The AARGM upgrade includes: an advanced digital anti-radiation homing receiver for greater sensitivity and enhanced air defense system capabilities; an active millimeter wave terminal radar to increase lethality against modern air defense units, such as surface-to-air missile radars that use radar shutdown and countermeasures designed to defeat anti-radiation missiles; inertial navigation/global positioning systems; a weapon impact assessment transmitter to aid and cue the battle damage assessment process; and an integrated broadcast service receiver for network-centric connectivity reception of off-board targeting information. AARGM correlates multiple sensors and geo-specific capabilities to locate and attack both stationary and fixed targets with precision while countering enemy tactics designed to defeat anti-radiation missiles. Initial operational capability for AARGM is fiscal year 2012.

AGM-154 Joint Standoff Weapon

The Joint Standoff Weapon (JSOW) is a joint family of armaments that permits Navy and Air Force aircraft to attack targets at increased standoff distances. The weapon uses inertial navigation/global positioning systems for guidance. JSOW provides low- and high-altitude launch capabilities to enable launch platforms to remain outside the range of defenses, enhancing aircraft survivability. All JSOW variants share a common body but can be configured for use against area targets or bunker penetration. The JSOW-C unitary variant adds an imaging infrared seeker and an autonomous target acquisition capability to attack targets with precision accuracy. The JSOW-C-1 will incorporate new target tracking algorithms into the seeker and a strike common weapon data link, giving joint force commanders an affordable, air-delivered, standoff weapon effective against moving maritime targets as well as fixed land targets. The system will maintain JSOW-C functionality to be effective against targets in or through adverse weather conditions, in both day and night. Used in conjunction with accurate targeting information and anti-radiation weapons, JSOW-C-1 will defeat enemy air defenses.

Small-Diameter Bomb Increment II

The Small-Diameter Bomb Increment II (SDB II) is a joint program that will provide warfighters with the capability to attack mobile targets at standoff ranges in all types of weather. This 250-pound-class weapon addresses the following additional requirements: multiple ordnance carriage; precision munitions capability; reduced munitions footprint; increased weapon effectiveness; minimized potential for collateral damage; reduced susceptibility of munitions to countermeasures; and an incremental development path to a network-centric operations capability. SDB II integration is planned for the F-35B/C *Lightning II*.



2012

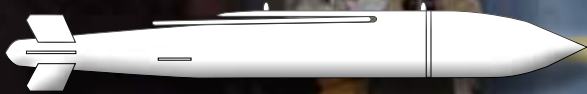
2032



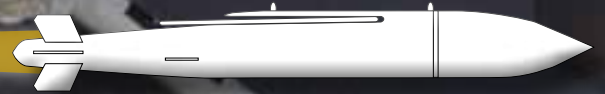
HARM BL V



HARM BL V / AARGM



JSOW-A/C



JSOW-A/C-1

NO PREDECESSOR



SDB II

DIRECT-ATTACK WEAPONS

General Purpose Bombs

Mark 80/BLU series General Purpose 500-, 1,000-, and 2,000-pound bombs provide blast and fragmentation effects against a variety of non-hardened targets and are used extensively for direct attack, close air support, and suppression missions. The thermally protected warhead is used for Joint Direct Attack Munitions (JDAMs), Laser JDAMs, Dual Mode Laser-Guided Bombs (DMLGBs), and Low Collateral Damage Bombs (LCDBs). General Purpose bombs are expected to remain in the inventory through 2032.

Laser Joint Direct-Attack Munition

The Laser JDAM is a retrofit weapon that converts laser-guided bombs currently in the inventory to a dual mode configuration using common components. The retrofit replaces the existing computer control group with inertial navigation/global positioning systems that provides fire-and-forget, all-weather terminal guidance. The retrofit strategy streamlines qualification timelines, putting a new weapon in the hands of warfighters that much faster. The Direct-Attack Moving Target Capability (DAMTC) is intended to provide naval and joint warfighters with a lethal, interoperable, and cost-effective precision strike weapon system that can engage moving, semi-mobile, and stationary targets. DAMTC will be retrofitted to the JDAM weapon and reach initial operational capability in 2012.

Low Collateral Damage Bomb

The LCDB is ideal for modern urban warfare where target discrimination between friendly, noncombatants, and enemy forces requires exceptional blast control. LCDB provides a reduced blast that yields lower collateral damage and adheres to the rules of engagement currently dictated by U.S. Central Command. A precision strike weapon, LCDB can be used with the same guidance kits as those used for laser-guided bombs, DMLGBs, JDAMs, and Laser JDAMs. LCDB is the result of a modification of an existing weapon system, which reduced its design, production, and sustainment costs.



2012

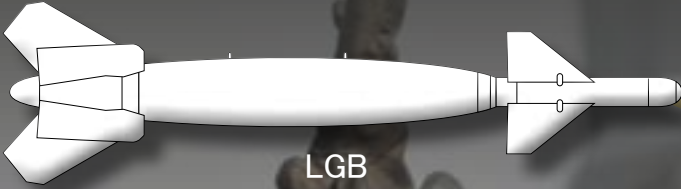
2032



GP BOMBS



GP BOMBS



LGB

LJDAM (DAMTC)



JDAM



LCDB



LCDB

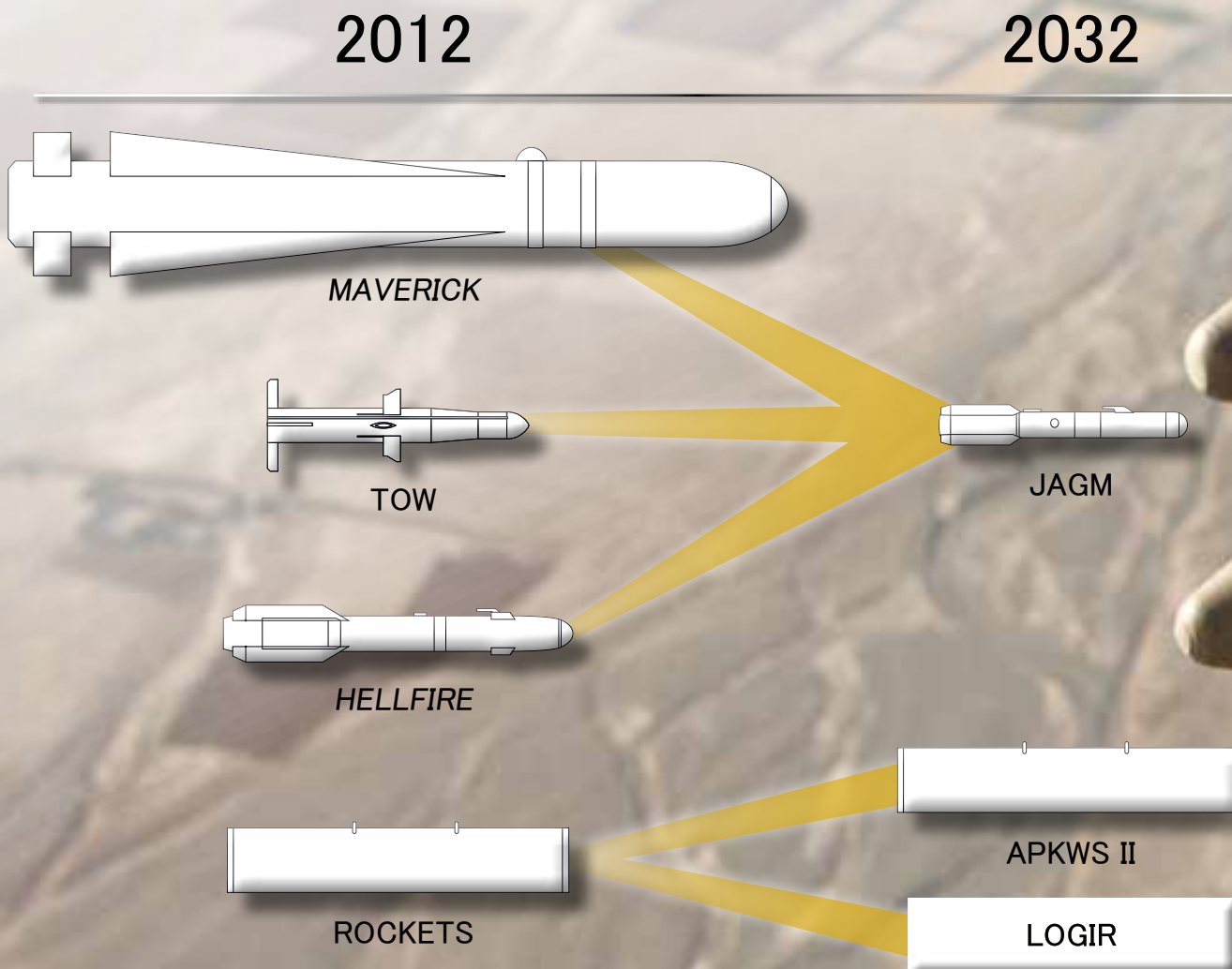


Joint Air-to-Ground Missile

The Joint Air-to-Ground Missile (JAGM) is a joint Army-Navy initiative, with the Army designated as the lead service. It is an all-weather, direct-attack, 100-pound-class weapon system that will use a tri-mode seeker (semi-active laser, millimeter wave radar, and imaging infrared), multipurpose warhead, and single configuration rocket motor to destroy high-value hardened and non-armored stationary and moving targets. JAGM as a direct-attack capability is envisioned as the eventual replacement for the AGM-114 *Hellfire*, AGM-65 *Maverick*, and tube-launched, optically tracked, wire-guided missile systems. Threshold platforms include the AH-1Z, the MH-60R, and other joint service manned and unmanned aircraft. It is expected to reach initial operational capability in fiscal year 2016 for the AH-1Z and fiscal year 2017 for the MH-60R.

Advanced Precision Kill Weapon System II

The Advanced Precision Kill Weapon System II (APKWS II) provides precision guidance to the existing *Hydra 70*, 2.75-inch rocket system by placing a laser-guided seeker on existing rocket motors and warheads. APKWS II provides an excellent low-cost, mid-range weapon that is well suited to urban environments. Accurate to within two meters of the aim point, the weapon will destroy target sets consisting of personnel, unarmored vehicles, lightly armored vehicles, armored personnel carriers, structures, and man-portable air defense systems at ranges from one and a half to five kilometers. Initial operational capability is expected in fiscal year 2012.



Low-Cost Guided Imaging Rocket

The Low-Cost Guided Imaging Rocket (LOGIR) is a 2.75-inch rocket with a front-end imaging/infrared guidance kit. In 2012, the LOGIR team from the weapons division of the Naval Air Warfare Center will complete the final deployment testing. Preliminary results exhibit excellent functionality. In addition, researchers have made significant theoretical advances that will lead to the elimination of nearly all image processing thresholds—technologies that are now being incorporated into LOGIR.



TORPEDOES

MK-54

By 2032, the MK-54 will have replaced the current inventory of MK-46 and MK-50 lightweight torpedoes. The MK-54 was created by combining the homing section of the MK-50 with the propulsion unit and warhead of the MK-46 (improved for better performance in shallow water), and adding commercial off-the-shelf technology. The MK-54 has both analog and digital fire control capabilities in addition to a software upgrade capability. Aircraft capable of employing the MK-54 are the SH-60F, MH-60R, P-3C, and P-8A (in 2013). Still in the design phase, a special variant of the MK-54—the High-Altitude Anti-Submarine Warfare Weapon—is an air-launch accessory that allows fixed-wing aircraft to employ the MK-54 torpedo outside the current air-launch envelope. Beginning in 2016 this variant will provide the P-8A *Poseidon* with the ability to engage undersea targets with precision at high altitude and long range without the need for dedicated attack runs. Future developments may include a data link allowing in-flight control and mid-course guidance by 2019.

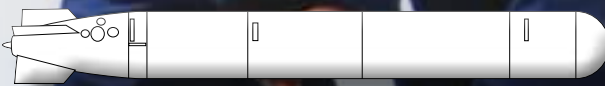


2012

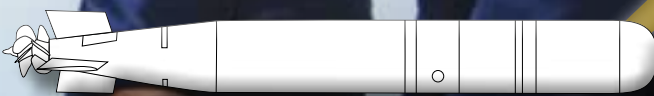
2032



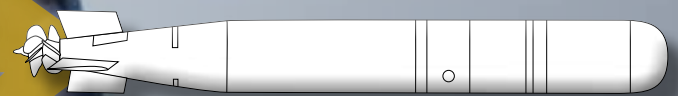
MK-46



MK-50



MK-54



MK-54



AIR-TO-AIR WEAPONS

AIM-9X Block II/P³I Sidewinder

The AIM-9X *Sidewinder* is a major upgrade to the AIM-9M short-range air-to-air missile that provides U.S. fighters with the ability to defeat tomorrow's advanced threats. The AIM-9X system contains a focal-plane-array guidance-control section, a highly maneuverable airframe, and signal processors that enhance kinematics and infrared countermeasure capabilities. The AIM-9X Block II/Pre-Planned Product Improvement (P³I) program will provide warfighters with increased lethality, high off-boresight capability, and a data link to take full advantage of increased kinematics and range. When combined with the Joint Helmet-Mounted Cueing System, AIM-9X provides a "first-look, first-shoot" weapon option. *Sidewinder* was originally a "within visual-range missile"; with modernization, it has become a "beyond visual-range missile."

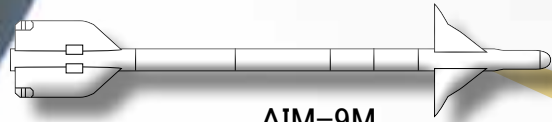
AIM-120D/P³I Advanced Medium-Range Air-to-Air Missile

The Advanced Medium-Range Air-to-Air Missile (AMRAAM) is fielded on the F/A-18A/B/C/D *Hornet*, F/A-18E/F *Super Hornet*, EA-18G *Growler*, and AV-8B *Harrier*. AMRAAM will also be utilized by the F-35. The AIM-120D program modernizes prior versions of this missile to maintain a beyond-visual-range engagement capability. This modernization plan includes an enhanced data link, a GPS system, improved high off-boresight capability, enhanced kinematics, and improved electronic counter-countermeasures capabilities through software upgrades. Initial acceptance of the AIM-120Ds began in 2009.



2012

2032



AIM-9M



AIM-9X



AIM-7



AIM-120A/B/C



AIM-9X BL II/P3I



AIM-120D/P3I





NON-KINETIC WEAPONS

AN/ALQ-99 Tactical Jamming System

The AN/ALQ-99 is the primary electronic attack capability carried on Navy and Marine Corps EA-6Bs and Navy EA-18Gs. Introduced during the Vietnam War, it consists of up to five externally mounted transmitter pods and an onboard system. The system jams high-power surveillance, acquisition, and tracking radars. The onboard system intercepts and automatically processes radar signals to jam diverse radar threats with very high radiated power. The modular architecture of the jammer system, which facilitates optimizing transmitters and antennas for a given frequency range, also facilitates tailored mission configurations. The EA-6B and EA-18G can carry up to five ALQ-99 tactical jammer pods—two under each wing and one under the fuselage.

Next Generation Jammer

The Next Generation Jammer (NGJ) will replace and improve the capability currently enabled by the AN/ALQ-99 system, providing a significant enhancement to the EA-18G's capabilities at reduced operations and sustainment costs. NGJ mitigates growing ALQ-99 obsolescence and inventory issues and provides higher availability and capability. It will be a vital component of the joint airborne electronic attack system of systems. The EA-18G, and eventually the F-35, will employ NGJ as the electronic attack payload. The NGJ will allow the Department of Defense to conduct electronic warfare on a broader and more integrated basis than is currently possible. It will be a stand-alone asset, capable of performing a variety of functions over a wide section of the electromagnetic spectrum. Like the ALQ-99 Tactical Jamming System it will replace, NGJ is designed to be a wide-spectrum jammer that can be used in a variety of different missions and scenarios. It is scheduled for initial operational capability in 2020.

MAKING OUR VISION REAL





The Challenges of Transitions



Transitions are complex and must be planned, coordinated, and executed very carefully. Many entities are involved: the program office responsible for the transitioning platform or system; personnel from Naval Air System Command (NAVAIR) who provide the program office with the technical expertise necessary to enact the transition; Director, Air Warfare (N88), which connects warfighting requirements to resources and funding; the staff of the type wing commander, responsible for both the incumbent and transitioning type/model/series aircraft; fleet introduction teams that represent the concerns of the squadrons that actually fly, operate, and maintain new aircraft and systems; and the fleet itself, on whose shoulders rests the responsibility to maintain specific warfighting capabilities with old platforms while learning to fly and tactically employ new ones.

The squadron is where much of the heavy lifting occurs. Pilots and naval flight officers already qualified in one type/model/series aircraft must be cycled back through the fleet replacement squadron to learn how to fly and operate new platforms and systems. Aircrews transitioning from the SH-60B/F helicopter to the MH-60R/S, for example, change to a “glass” cockpit where information on airspeed, attitude, altitude, heading, engine performance, and more is presented on a video display instead of analog gauges. SH-60 maintenance crews must be trained on how to fix and sustain the MH-60 while remaining qualified to preserve the SH-60 until it is completely gone from the squadron.

Integrating air and ship systems, such as the Electromagnetic Aircraft Launch System (EMALS), pose additional design, test, and installation challenges. EMALS is a completely new launch system designed for a new carrier class that required simultaneous system and ship design, as well as the design and construction of a test facility at Lakehurst. Since the test facility had to be completed first, it accelerated many design decisions for the overall system and the

ship, such as the configuration of the EMALS trough. While launch energies and other key performance parameters were already known, EMALS hardware had to be designed and tested to meet many other shipboard requirements, such as shock, vibration, deck loads, electromagnetic effects, and the impact of the harsh flight deck environment on the launch motors located in the trough (salt spray, heat, cold, humidity, fire extinguishing agents, etc.).

Another challenging transition is integrating unmanned systems into the air wing of the future. The Unmanned Combat Aircraft System Demonstrator program will help manage this risk through the phased testing of shipboard digital messaging and a control architecture using manned surrogates and the X-47B unmanned aircraft for operations on and around the carrier, including launch and recovery. The program will ensure that the technologies and operational procedures are available to support Unmanned Carrier-Launched Airborne Surveillance and Strike System development.

The Aviation/Ship Integration team is the executive agent for upgrading legacy ships to meet new aviation requirements. NAVAIR teams support Naval Sea Systems Command at the Program Executive Office (PEO) for Carriers, the PEO for Littoral Combat Ships, and the PEO for Ships to meet the aviation requirements of new vessels such as *Ford*-class carriers, *Freedom/Independence*-class littoral combat ships, *Zumwalt*-class destroyers, *Spearhead*-class joint high speed vessels, and LHA (R). The Aviation/Ship Integration team leverages mid-life availabilities of carriers and amphibious assault ships to incorporate major aviation facility upgrades. An example of this is the joint effort between NAVAIR, Naval Sea Systems Command, and the F-35 Joint Program Office to manage the integration of F-35Bs with LHDs and F-35Cs with CVNs.

The sum of all transitions across the Naval Aviation Enterprise is subject to the realities of current and future defense fiscal environments. This fact, coupled with the increasing complexity of new products and the rising costs to maintain current inventory, presents significant challenges in terms of affordability. Even as we test and deliver new platforms and systems, we must also upgrade and maintain those currently in the fleet, and do so throughout their complete life cycles—which can be 30 years or more.

The following section outlines several initiatives and concepts that are helping Naval Aviation fight better, organize its resources more effectively, and meet the many challenges of transition in the coming decades. Here also are descriptions of the vital tools and capabilities at Naval Aviation's disposal that are implementing the vision.

Initiatives and Concepts

AIR-SEA BATTLE

The Air-Sea Battle concept leverages current and future military and technological capabilities that reflect unprecedented Navy, Marine Corps, and Air Force collaboration, cooperation, and resource investments. The capabilities needed to conduct operations described in Air-Sea Battle will inform Department of the Air Force and Department of the Navy investment planning and drive institutional change in both departments. The Air-Sea Battle concept is both a natural and deliberate evolution of U.S. power projection and a key supporting component of U.S. national security strategy for the 21st century. Air-Sea Battle is a limited operational concept that focuses the development of integrated air and naval forces to address evolving anti-access and area denial threats—i.e., the ability of an adversary to deny entry of U.S. forces into a theater of operations (anti-access) or to prevent the maneuver of U.S. forces within an area (area denial). This concept exploits and improves on the advantage U.S. forces have in operating across domains. This advantage is essential to defeat increasingly sophisticated weapon systems such as homing ballistic missiles and supersonic cruise missiles.

The Air-Sea Battle operational design employs a networked and integrated attack in depth to disrupt, destroy, and defeat anti-access and area denial threats. Networked actions are tightly coordinated in real time across domains by mission-organized physical and human networks able to command and control air and naval forces in a contested environment.



The forces they direct are organized to conduct integrated operations across all domains: attacking in depth to disrupt the ability of adversaries to use command and control to employ anti-access and area denial weapon systems; destroying or neutralizing weapon systems within effective range of U.S. forces; and defeating an adversary's weapons to preserve essential joint forces to sustain offensive and defensive operations.

Aging hardware, the accelerating anti-access and area denial threats to global stability, and U.S. national interests demand the adoption of a smarter, more collaborative approach to addressing this challenge. Air-Sea Battle provides a framework to deter, defend against, and defeat aggression by adversaries employing anti-access and area-denial strategies and capabilities. It will also advance the longstanding U.S. role as a trusted partner to maintain the safety and openness of the global commons.



NETWORKING AND INFORMATION DOMINANCE

Warfighters consistently face the challenge of understanding the battlefield, exploiting information, and applying that knowledge to achieve victory. The concept of “information dominance” opens new horizons for Naval Aviation to use information against adversaries to achieve effective kinetic and non-kinetic results. The benefits of mastering information as a main battery of U.S. naval warfighting capability include compressed kill chains, enhanced lethality, increased survivability, synchronized effects, and reduced fratricide and collateral damage.

Naval Aviation will leverage the information dominance revolution by improving the core networking capabilities of tactical data links such as Link 16, common data links such as Hawk Link, and critical enabling networks such as the Cooperative Engagement Capability and future capabilities as they mature. Naval Aviation assets will increasingly tap into the global information grid through redundant and flexible pathways to enable command and control, coordination, and enhanced mission execution. In the future, platforms, weapons, systems, and operators must cognitively collaborate within the battle space to assemble information and knowledge that allow U.S. forces to maintain a decisive advantage over their adversaries. We will pursue these game-changing capabilities through the employment of advanced networking technologies.

The information dominance guiding principle of “every platform a sensor; every sensor networked,” is driving a closer relationship between the Naval Aviation Enterprise (NAE) and the Naval Information Dominance Enterprise



(NIDE). In a time of decreasing resources, substantial investments in platforms and systems must be leveraged and their capabilities integrated across all missions and domains through flexible, adaptive networks. Creating a networked family of systems will generate effects greater than the sum of individual components.

To achieve alignment, the NAE and NIDE are laying the foundation for compatible processes to deliver integrated capability. The primary tools are the Naval Aviation integrated capabilities packages and the information dominance roadmaps such as intelligence, surveillance, and reconnaissance and integrated targeting and fire control. Requirements, resourcing, acquisition, validation, and science and technology efforts will be synchronized among the enterprises. Solutions such as common waveforms, radios, and network management approaches, and modular computing environments will culminate in machine-to-machine collaboration at the mission software application level.

This collaboration of platforms and systems will first aim to deliver sufficient targeting for future weapons, enabling more flexibility with less complexity. The right technology solutions will also enable better fire control, electronic warfare battle management, sensor fusion, and unmanned systems. Follow-on increments will lead to a collaborative family of systems where platforms, weapons, and unmanned systems are capable of joining an integrated, survivable, and flexible network and discovering other nodes of information. These assets will rapidly assemble actionable knowledge in an ad hoc manner and work together across domains, providing dynamic mission execution as never before.







INTEGRATION AND INTEROPERABILITY

Today's exceedingly complex and interdependent weapon systems cannot be viewed individually—they require a system-of-systems approach in developing warfighting capability. To be successful, they must be resourced, developed, tested, and fielded as integrated and interoperable systems.

The development, integration, and testing of weapon systems to deliver air, surface, and subsurface mission capabilities is an inherently governmental function. The expertise and tools necessary to improve the delivery of integrated capabilities reside within the Navy; government system engineers in the systems commands and warfare centers are focused on essential mission engineering. The government's role is leveraged to provide technical authority across program boundaries to ensure the integrity of mission requirements is maintained as systems are integrated. Improvements are underway to translate operational capability at the mission level more effectively into system requirements at the program level. Warfighting gaps are being identified and resolved while systems are in development, before they are fielded. The development and test capabilities of the systems commands' and warfare centers' laboratory and range infrastructures are being linked together to create a realistic operational environment to horizontally integrate systems as well as to validate warfighting capabilities across all domains prior to system deployment. In addition, mission-level processes and tools that focus on developing, integrating, testing, and delivering warfighting effects at best value are being implemented and institutionalized. These tools are the enablers to support data-driven decision-making on warfighting capability.

REDUCING TOTAL OWNERSHIP COSTS

A big part of acquisition strategy is program cost and performance improvement, which begins with a solid understanding of requirements, a clear description of what is being procured, and a systematic understanding of when capabilities and costs are out of synch. During execution, we must balance marginal increases in capability gains versus disproportionate increases in cost to attain the optimum affordable solution. By evaluating how various baseline assumptions influence a program's cost and schedule requirements, we determine technical and programmatic risk and uncertainty.

The V-22 program is an example of total ownership cost reduction at work. The V-22 cost-per-flight-hour budget estimates were developed several years before the aircraft was fielded using comparisons with existing rotary- and fixed-wing aircraft. The estimate incorporated reliability predictions and repair capability assumptions that were below the actual cost per flight hour once the aircraft became operational. The V-22 team implemented a plan to reduce costs as well as improve readiness through a variety of initiatives, including reliability and maintainability improvements, maintenance concept changes, additional repair capabilities, improved repair turnaround times, repair price reductions, and changes to contract strategy. By June 2011, these efforts resulted in the V-22's cost per flight hour decreasing by nearly 30 percent over the previous two fiscal years.

Complete transparency of performance data is a vital requirement for the successful management and execution of acquisition programs. We have made great strides in the past few years transforming program data into graphic formats that facilitate understanding and analysis, effectively transforming data into actionable information. The "command information center" (CIC) concept in particular has helped organize critical program planning and performance data for integrated analysis, issue identification, action planning, prioritization, decision making, and corrective action follow through. The CIC has been deployed at both the program and command levels.

Six focus initiatives are helping to provide the insight, tools, and business processes targeted to enable "should-cost management" and achieve better buying power, reduced acquisition cycle times, and lower total ownership costs within the Naval Aviation portfolio:

- The total ownership cost transparency initiative identifies the drivers of total life-cycle costs for both legacy and new acquisition programs. A portfolio analysis capability will also facilitate cross platform/program analyses and strategic affordability assessments. Understanding of programmatic, technical, and cost-related issues provides the basis for cost reduction, cost avoidance, and informed should-cost management opportunities.
- The contractor cost structure and rates initiative is targeted to develop an understanding of contractors' cost and rate structures and the business pressures and decisions that drive cost and rate growth in our programs. The objective is to engage Naval Air Systems Command (NAVAIR), the Defense Contract Management Agency (DCMA), and industry to target greater efficiency and affordability.



- The supplier network initiative’s objective is to work with DCMA and other Defense Department services to develop a comprehensive understanding of who is supporting Naval Aviation Enterprise programs and to identify program and portfolio risks and opportunities for risk mitigation and cost improvements.
- The production management initiative recognizes that NAVAIR’s current portfolio of programs is shifting from a research-and-development-centric to a production-centric mode, and we must have insights into production planning and performance, as well as into the processes, tools, training, and business disciplines to manage product quality, delivery, and cost performance.
- The business collaboration initiative engages industry in a three-tiered strategy focused on obtaining greater efficiency and productivity. The Joint Management Council (JMC) is an important part of NAVAIR’s overarching business collaboration strategy with industry and directly supports better buying power initiatives. The JMC looks at critical common processes such as supplier management, production/manufacturing/cost-of-poor-quality rates, proposal quality/cycle time, and alignment with government science and technology to illuminate affordability and cycle-time reduction opportunities. The JMC examines these issues within a portfolio of programs and is considered the middle level of NAVAIR’s tiered engagement strategy. In contrast, the program management review is a lower-tier process focused on program-specific issues and the business collaborative exchange is the upper-tier process looking at enterprise-wide issues and NAVAIR strategic initiatives.
- The enculturation (or “changing the culture”) initiative helps build the professional work force for total ownership cost improvements through effective should-cost management. Enculturation includes the dissemination of skills and knowledge through focused training and development, assisting program offices with planning and management through project consulting, and managing knowledge.

We are making progress on our transition challenges using Naval Aviation Enterprise principles and by collaborating with industry, DCMA, and other Defense Department services on specific areas of improvement. The goal is to develop and incorporate acquisition strategies and business efficiencies that enable effective should-cost management and reduce the total ownership costs of our platforms and systems.







AIRSpeed

AIRSpeed is the name of the Naval Aviation Enterprise's continuous process improvement effort. This term encompasses all improvement tools and methodologies that produce readiness, improve quality of life for Sailors, Marines, and civilians, and assist with meeting cost constraints. The industry-proven tools used under the *AIRSpeed* effort include Theory of Constraints, Lean, Six Sigma, barrier removal teams, and Kaizen initiatives. Their application to the processes associated with Naval Aviation maintenance, supply, and administration is driving the development of improved operating practices that deliver greater readiness with greater efficiency. Because of its scope and flexibility, *AIRSpeed* can be tailored to the needs of multiple areas within the Naval Aviation Enterprise. *AIRSpeed* enables readiness production by increasing the speed, reliability, and predictability of the processes associated with integrated maintenance and supply replenishment. It has contributed to reductions in the cycle time of aircraft, engine, and component repair and overhaul, leading to fewer items in the repair pipeline and more of them available for fleet use. Within the systems commands, *AIRSpeed* and similar continuous process improvement tool sets reduce the response times and costs of processes employed in the course of acquiring, testing, and sustaining new aircraft, weapons, and their related systems.

MARINE CORPS COMMAND AND CONTROL TRANSFORMATION

One of Marine Corps Aviation's highest priorities is to ensure that the Marine Air Command-and-Control System (MACCS) is prepared for emerging operational environments while it continues to support current operations. This system enhances capability by improving deployability, flexibility, adaptability, Marine air-ground task force (MAGTF) integration, data fusion, and training.

All future enhancements to MACCS will focus on the "command" aspect of aviation command and control. By leveraging technological advancements and innovation to increase capability, MACCS will ensure that tactical air commanders can execute their battle command and management functions in support of MAGTF commanders.

MARINE CORPS LOGISTICS TRANSFORMATION

Marine Corps Aviation logistics continues to transform its business practices and processes through End-to-End Alignment (EEA). As a centerpiece of the Marine Corps's aviation transformation strategy, EEA affects the underlying processes that support current readiness goals and objectives in all environments. EEA provides squadron commanders with a system-of-systems approach to planning, scheduling, and executing the sortie-based training program to achieve greater core competency and increased combat power. A focused continuous process improvement program, EEA harnesses best practices from Theory of Constraints, Lean, and Six Sigma to institutionalize demand-pull logistics across the entire aviation logistics chain. A focus on the production and replenishment of "ready mission sets" by aviation logistics squadrons, organic depots, and original equipment manufacturers establishes conditions for successful migrations toward the Marine Aviation Logistics Support Program II (MALSP II). By linking EEA and MALSP II, Marine Corps Aviation supports legacy, transition, and future platforms.

MALSP II is transforming a logistics capability from a historical data-based "push" system to a modern demand-driven "pull" system. In 2011, MALSP II focused on completing a demand-pull nodal logistics proof of concept in the Horn of Africa, sustaining critical information technology known as the "Expeditionary Pack-Up Kit" for detached and deployed operations. The project office is also working with the Naval Aviation Enterprise retail policy group on the future of logistics inventory allowance processes and procedures in support of MALSP II's initial operational capability goal at the end of fiscal year 2014.

The aviation and ground logistics communities have embarked on similar logistics transformation efforts in response to current operational demands and in preparation for an uncertain future. Marine Corps Aviation's MALSP II and the ground element's logistics modernization present opportunities for alignment, interoperability, and integration to improve the overall performance of MAGTFs. MAGTF logistics integration seeks to identify and exploit these opportunities in ways that will positively impact logistic support to naval forces, and provides a forum for constant and dynamic engagement between the two logistics communities.





Capabilities

FLEET READINESS CENTERS

Naval Aviation's maintenance and repair organization developed a new way of doing business in 2005, when the Base Realignment and Closure Act mandated a consolidation of depots and intermediate maintenance detachments into the eight fleet readiness centers (FRCs) that exist today. FRCs provide Naval Aviation with maintenance, repair, and overhaul products and services that enable the fleet to project power around the globe. The FRCs' mission is to produce quality airframes, engines, components, and support equipment, and provide services that meet the Naval Aviation Enterprise's aircraft ready for tasking goals with improved effectiveness and efficiency.

Every year, the FRCs produce more than 500 aircraft, more than 5,000 engines and engine modules, and more than 600,000 aircraft components for naval aircraft at every fleet concentration area in the continental United States. The FRCs have a combined workforce of approximately 18,000 personnel in locations around the world. With three FRCs on the East Coast, three on the West Coast, Support Equipment Facilities in Solomons Island, Md., and FRC Western Pacific in Atsugi, Japan, the FRCs are geographically dispersed and positioned to provide maximum aircraft maintenance and repair support at the lowest cost and highest efficiency. This streamlined enterprise enables the Navy to move industrial maintenance capability closer to warfighters when needed for greater efficiency, agility, and speed. In 2010, for example, this included conducting 219 depot-level repairs on aircraft at sea.

The past decade of worldwide combat operations has generated significant wear and tear on Naval Aviation equipment and personnel. One of the challenges of keeping aging aircraft operational is the premature failure of parts and their replacement when the original equipment manufacturer is out of business or no longer manufactures them. One of the FRCs' innovative solutions to this problem is the direct digital manufacturing of metallic components and other tools. Another is the use of aluminum and magnesium cold-spray technologies to re-deposit metal for repair of H-60 and H-1 helicopter transmission gearbox casings, which will result in significant material savings. Digital manufacturing and similar technologies provide Level III maintenance activities with the capability to restore formerly unserviceable cases to ready-for-issue condition.

Commander, Fleet Readiness Centers, is also procuring and developing back-scatter X-ray technology that will result in significant man-hour reductions in the time required to inspect wing fittings, hinge points, and hard mounting flanges for the F/A-18 and other systems. This technology will eliminate the need to remove the wing from the aircraft for nondestructive inspections. Other technological solutions include advanced composite manufacturing, rapid manufacturing technology, and three-dimensional manufacturing processes. To mitigate environmental and durability issues with paint processes, FRCs are investigating the use of robotic paint stripping to reduce workers' exposure to hazardous materials and new advanced coating technologies such as powder coating and nonchromate paints to provide more durable surface finishes.

Naval Aviation faces major challenges in the future with the transition of legacy systems to new platforms. The FRCs ensure new systems have the right support when they are fielded and legacy platforms are safely flown until the last one is retired. They are preparing facilities and capabilities to support transitions such as replacing the P-3 with the P-8A. While preparing for this transition, maintenance and sustainment of the aging P-3 will present additional challenges that must be managed, such as corrosion caused by age, re-winging, and periodic repairs. With the F-35, the FRCs are building new capability to support the Joint Strike Fighter's new engines and to provide maintenance for an aircraft that will operate in demanding physical environments. The EA-18G, MV-22, AH-1Z, UH-1Y, CH-53K, E-2D, MQ-4C, MQ-8B, and Naval Aviation's other new platforms will similarly all demand new maintenance and support technologies and facilities.



RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

NAVAL AIR WARFARE CENTER WEAPONS DIVISION

Designated the Department of the Navy's weapons and armament center of excellence, the Naval Air Warfare Center Weapons Division (NAWCWD) is the NAE's principal center for naval weapons, weapons energetics, electronic warfare, threat/target systems, manned/unmanned integrated warfare systems, system-of-systems integration, and science and technology applied research. NAWCWD consists of three primary sites in California: China Lake, Point Mugu, and San Nicolas Island.

China Lake is NAWCWD's headquarters, managing more than one million acres that represent nearly 40 percent of the Navy's worldwide land holdings. Overlaying this fully instrumented land range is the R2508 airspace complex which includes an additional 1,700 square miles of restricted airspace. The range complex is ideally suited for air-to-air and air-to-surface weapons and weapon system testing and evaluation as well as fleet training and tactics development. NAWCWD bridges the gap between laboratory and open-air testing with its electronic combat range, used for testing and evaluation of airborne electronic combat systems. The range provides a realistic electronic combat environment and offers a wide variety of threat simulations, surrogates, and actual systems, providing an operationally-realistic environment. Current efforts using these land test environments include the AIM-9X, AIM-120D, AGM-65, AGM-164, AGM-88E, Laser Direct-Attack Munition, Advanced Precision Kill Weapon System II, numerous unmanned aerial systems, and mission system suites for F/A-18, EA-18G, AV-8B, AH-1, and UH-1 aircraft.

The NAWCWD sea range at Point Mugu encompasses 36,000 square miles of instrumented, controlled sea and airspace. The range supports the testing and evaluation of a wide variety of weapons, sensors, ships, aircraft, and specialized



systems for a range of military, government, allied, and private-sector programs. The sea range hosts numerous exercises (joint task force, composite training unit, combat systems ship qualification test, etc.) that verify tactics, techniques, and procedures of various weapon systems such as *Harpoon*, the Standard Missile family, AGM-84H/K, Rolling Airframe Missile, *Tomahawk*, and Joint Standoff Weapon C-1.

San Nicolas Island is located 60 miles south of Point Mugu within the NAWCWD sea range. This 14,500-acre island provides a 10,000-foot runway, hangar, and logistic support in a controlled maritime test environment. Test facilities include missile and target launch facilities, littoral target impact areas, radar tracking and instrumentation, electro-optical/laser targeting, telemetry, and communication equipment.

Located within these three sites are more than 40 laboratories and nearly 2,000 facilities suited for developing and testing weapon systems up to fifth generation. NAWCWD is home to the largest applied research center outside the Naval Research Laboratory, with more than 100 research scientists, physicists, chemists, and mathematicians generating more than 100 innovative patent actions annually. NAWCWD's leading research chemist recently discovered a unique way to convert biomass-based alcohol (butanol) into gasoline, diesel, and jet fuel using a sustainable green process, helping Naval Aviation and the Navy advance the goal of fielding the "Great Green Fleet."

NAWCWD has charge over NAVAIR's Test Wing Pacific Echelon IV command composed of Air Test and Evaluation Squadron (VX) 30 and VX-31. The wing has an inventory of 53 manned/unmanned aircraft of 21 types/models/series, providing operationally experienced test pilots, naval flight officers, and engineers executing ground and airborne testing evaluation of the NAE's weapon and warfare systems.

NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION

Located at Patuxent River, Md., Lakehurst, N.J., and Orlando, Fla., the Naval Air Warfare Center Aircraft Division's (NAWCAD) facilities support research, development, test, evaluation, engineering, and fleet support of Navy and Marine Corps air vehicle systems and trainers. NAWCAD is steward of the ranges, test facilities, laboratories, and aircraft necessary to support the fleet's acquisition requirements. One of two product centers within Naval Air Systems Command, NAWCAD provides a variety of services to the Department of Defense, other federal agencies, and nongovernment customers.

NAWCAD operates Naval Test Wing Atlantic, composed of the U.S. Naval Test Pilot School, Air Test and Evaluation Squadron (VX) 23, VX-20, and HX-21. Together these organizations maintain 140 aircraft of 40 types/models/series.

The Integrated Battlespace Simulation and Test Department operates, maintains, and manages the testing and evaluation of Navy and Marine Corps aircraft. From launch to recovery, every aspect of a mission is simulated to enable engineers to assess the performance, mission effectiveness, and interoperability of avionics and weapon systems. The department is a collection of diverse laboratories and facilities, each with its own mission and identity. These labs provide a full-range testing capability that makes use of modeling and simulation, distributed testing, and ground testing.

The fully instrumented and integrated Atlantic Test Range supports cradle-to-grave testing of aircraft and aircraft systems and training for aircrews. Test range engineers design, develop, integrate, install, maintain, and operate all test range instrumentation, communications, and digital data gathering and handling equipment at Patuxent River, including acquisition, surveillance and tracking radar, special-purpose electronic combat emitters, videographic and photographic instrumentation, and laser and optical tracking systems.

In 2010, the test range completed 1,924 test events, including 102 remote operations. These test flight customers included the Program Executive Office Joint Strike Fighter, PMA-265 (F/A-18 and EA-18G program office), PMA-231 (E-2C, E-2D, and C-2A program office), PMA-275 (V-22 joint program office), U.S. Coast Guard, U.S. Air Force, and Naval Sea Systems Command. On a typical



day, tests were conducted on the F-35B, V-22, E-2D, P-8A, F/A-18, MH-60, VH-3, and CH-53. The workload will continue to increase with the F-35B and C.

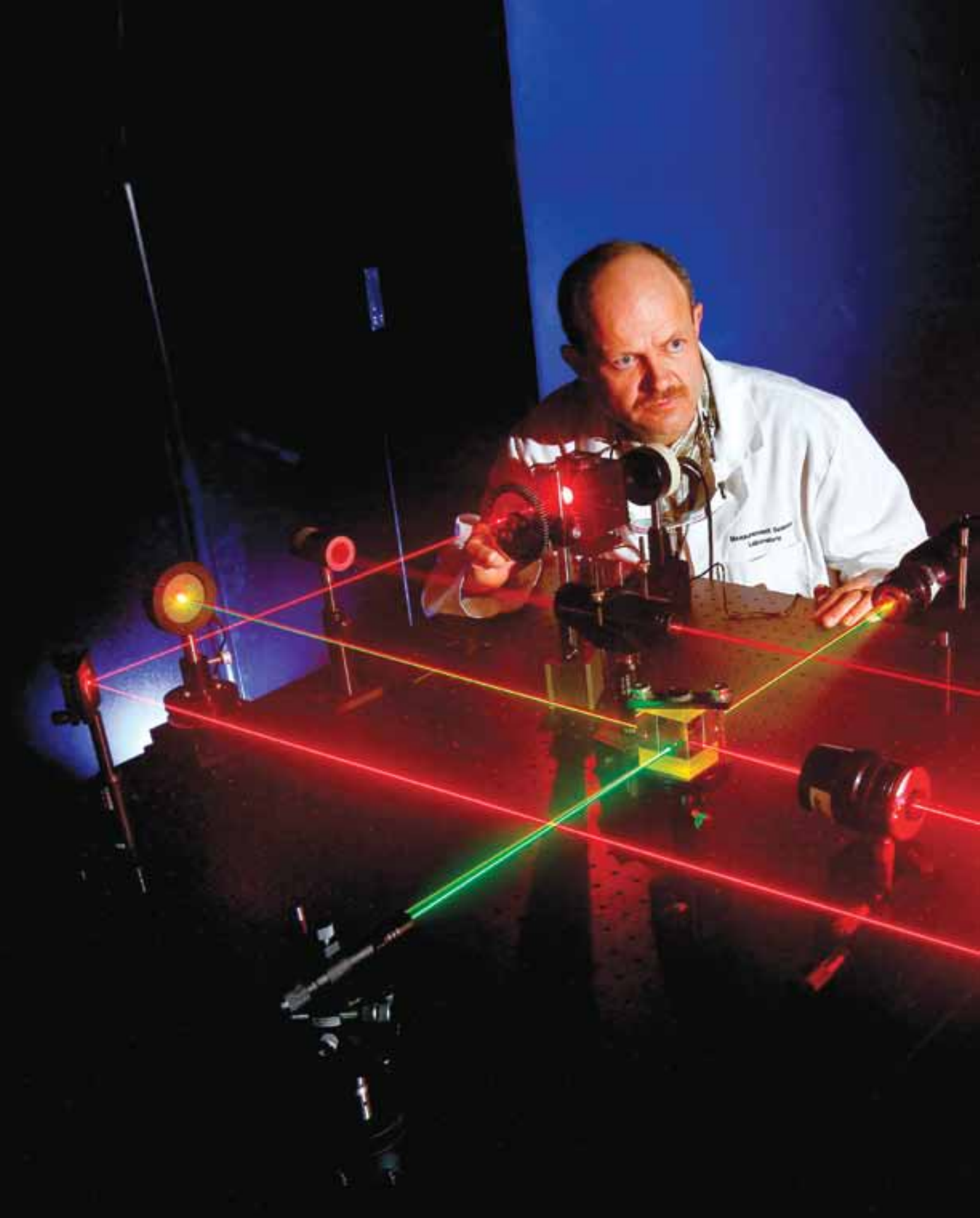
NAWCAD also operates numerous engineering laboratories at Patuxent River specializing in systems engineering, cost, air vehicle engineering, propulsion and power, human systems, weapons, energetics, warfare analysis, avionics, research, and intelligence.

Patent holders representing 33 inventions developed in the NAWCAD labs were honored in the past year for their work. Many of these inventions directly support warfighters. Working with the Navy and Marine Corps multimission tactical unmanned air systems program office, NAWCAD recently integrated and tested two ground control stations for the RQ-8B *Fire Scout*. NAWCAD efforts included: procurement, fabrication, integration, and installation of internal communications cabinets; integration of air vehicle operator, mission payload operator, and exterior communications cabinets; and fabrication of antenna mounts and interconnecting cables. In April 2011, these *Fire Scout* systems deployed to Central Command to provide intelligence, surveillance, and reconnaissance services in northern Afghanistan.

The Naval Air Engineering Station Lakehurst is the critical link between Naval Aviation and carrier strike groups worldwide. Lakehurst is the Navy's lead engineering support activity for existing aircraft launch and recovery equipment and support equipment, as well as for the development and test of new systems such as the Electromagnetic Aircraft Launch System (EMALS) and Advanced Arresting Gear. In 2011, the C-2, T-45, E-2D, and F/A-18E/F aircraft completed successful test launches from EMALS.

The NAWC Training Systems Division in Orlando, Fla., is responsible for research, development, test, evaluation, acquisition, and product support of training systems. Simulation and training are key to ensuring military preparedness and to adapting to new and changing roles and missions. The research, development, and acquisition teams of Training Systems Division, in concert with their military and private industry partners, deliver aviation training systems that enhance capabilities, reduce risk, and lower costs. In 2010 and 2011, the division developed tactical operational flight trainers for the MH-60R and EA-18G with full mission and weapon system simulations, an avionics maintenance trainer for the MH-60R, and an air crew tactical team trainer for the P-3C designed to be easily adapted for P-8A *Poseidon* crews when that aircraft joins the fleet.





SCIENCE AND TECHNOLOGY

To meet current and emerging warfighter needs and to deliver future force capabilities, the Naval Research Enterprise invests in research in a wide variety of areas to provide the best technology solutions to warfighting problems. The science and technology portfolio is balanced to ensure near-term warfighting needs are addressed without sacrificing the pursuit of long-term revolutionary capabilities. To do this, innovative solutions must be developed through investments that span all time frames: near-term (0-5 years) efforts that demonstrate mature technology in operational environments and facilitate transition of technology to acquisition; mid-term (6-15 years) efforts that translate research into militarily useful technology applications; and far-term (15+ years) research that creates new understandings of technologies that offer paradigm-shifting capabilities. The distribution and balance among these efforts is critical to ensure that science and technology investments are healthy and relevant.

Naval Aviation Enterprise leaders have collectively identified science and technology objectives that guide alignment of investments with requirements. These objectives represent the goals of the Naval Aviation Enterprise, and are used as the baseline for identifying, prioritizing, aligning, and synchronizing investment efforts throughout the enterprise.

They represent a broad strategy that provides focused direction for the future, while retaining sufficient flexibility to allow the science and technology community to meet emerging challenges.



Naval Aviation Enterprise Science and Technology Objectives

The evolution of autonomous technologies and their use in the battle space poses many technical challenges for the Naval Research Enterprise (NAE). The Autonomous Aerial Cargo/Utility System program is addressing these issues by developing and demonstrating intelligent autonomous capability for a future aerial cargo/utility system that can provide timely, affordable, reliable, and shipboard-compatible supply logistics and casualty evacuation.

New aircraft will need to carry a diverse suite of both offensive and defensive systems, including high-power directed-energy weapons and networked sensors and electronics. Sustained investment in programs such as Variable-Cycle Advanced Technology will deliver propulsion technology for the next-generation carrier-based tactical aircraft and intelligence, surveillance, reconnaissance systems resulting in dramatic improvements in range, cruise speed, endurance, thermal management, power generation, and signatures. Early research investment in areas such as dynamic interfaces, aeromechanics, and structures will address naval-unique technology challenges associated with future vertical lift platforms.

The NAE strives to reduce tactical petroleum consumption by investing in more efficient engines, decreased aircraft drag, power and thermal management integration, optimized mission planning, and increased simulator usage. Small business investment in areas such as converting biomass into renewable jet fuels and other green energy projects will provide the NAE with viable alternatives to traditional fossil fuels.

The NAE science and technology program will develop technologies to reduce the cost of all naval systems, including air platforms, weapons, support equipment, training systems, and aircraft carriers. Projects such as the Integrated Hybrid Structural Management System Future Naval Capability will provide low-impact solutions to reduce maintenance costs and increase readiness through real-time health monitoring and prognostics capability.

Increasing mission and technological complexity demands new education and training technologies to maximize the transfer of knowledge from the classroom and trainer to the operational environment. Development of improved training technologies, such as the Live, Virtual, and Constructive Training Fidelity Future Naval Capability, will allow aviators to train in dynamic, customized, and low-cost environments, resulting in improved aviator proficiency and readiness.

Naval Aviation and Green Energy

Naval Aviation is headed toward a future powered by green energy. Biofuels for powering aircraft—the largest consumers of the 100,000 barrels of oil the Navy uses every day—are high on the agenda to reach that future. A successful series of biofuel aircraft test flights completed in 2011 by Naval Air Systems Command began in 2008 when the Navy Fuels Team began to test small quantities of biofuels at its Patuxent River laboratory.

Based on this evaluation, a procurement specification for the jet propulsion 5 (JP-5) biofuel was developed and the team initiated testing with the F/A-18, also known as the “Green Hornet.” Secretary of the Navy Ray Mabus’s announcement of the Navy and Marine Corps’s energy goals, designed to lessen the services’ dependence on foreign oil, helped accelerate the team’s efforts in October 2009. These goals include: incorporating lifetime system energy costs in Navy and Marine Corps contracts; by 2012, creating a “Green Strike Group” composed of nuclear vessels and ships powered by biofuels and deploying that fleet by 2016; by 2015, reducing petroleum use in the Navy Department’s 50,000 commercial vehicle fleet by 50 percent; producing at least half of shore-based energy requirements from renewable sources; and, by 2020, ensuring at least 40 percent of the Navy’s total energy consumption comes from alternative sources.

To date, the most promising fuel has come from *Camelina sativa* (a type of mustard plant). The oils that come from crushing the camelina seed are structurally more similar to petroleum than other bio-based products. Used by the ancient Romans as lamp oil, camelina oil was produced in Europe and Asia throughout the 19th century for a variety of mostly industrial applications.



After World War II, however, the crop fell out of favor and is now largely regarded as a minor non-food crop in Europe and a weed in North America.

Camelina moved to the forefront of the renewable fuels scene only in 2009. It is best grown in rotation with dryland wheat during the part of the cycle when the land would otherwise lie fallow. As a result, camelina does not compete with food crops, and requires little irrigation. It has even been shown to enhance the yield of subsequent crops by up to 15 percent. In addition, the oil it produces is more cold-tolerant than other biofuel feedstocks.

On 22 April 2010 (Earth Day), what appeared to be a routine flight of the Green Hornet attracted hundreds of onlookers. For the first time, the jet was powered with a 50/50 blend of camelina-based biofuel and petroleum-based fuel. The flight, one of a series of test flights held in 2010 and 2011 at Patuxent River, marked the first time an aircraft has flown faster than the speed of sound on a biomass-derived fuel.

Since that first flight, Naval Air Systems Command has also tested other versions of the F/A-18 *Hornet*, the EA-6B *Prowler*, T-45A *Goshawk*, and AV-8B *Harrier* fixed-wing aircraft using a 50/50 blend of camelina-based fuel and JP-5. Rotary-wing aircraft biofuel tests were also conducted on the MV-22 *Osprey* and the MH-60S *Seahawk*. The MH-60S was tested on both camelina- and algae-based biofuels. In September, 2011, the Blue Angels even flew an entire air show on the biofuel blend. The final scheduled test included the MQ-8B *Fire Scout* vertical takeoff and landing unmanned aerial vehicle. The first military unmanned aircraft to operate with biofuel flew for an hour checking performance and handling. All aircraft tested showed no perceivable differences in flying characteristics or power levels, proving that biofuel-blended fuels can be used to operate combat aircraft and add to the nation's energy security.



People



The Naval Aviation Enterprise (NAE) total force strategy reflects the belief that Naval Aviation's competitive advantage is, and always will be, its dedicated and highly talented people. The primary goal of this strategy is to enrich, shape, and deliver a proficient, diverse, and cost-effective total force comprising Sailors and Marines, government civilians, and contract support personnel. Their job is to perform all of the functions required for Naval Aviation to fight and win in combat. The total force strategy relies on readiness and capability demand signals from the fleet to define work requirements clearly, shape the workforce correctly, and affect budgeting and programming decisions positively. It is a living management tool—one that is continually assessed, improved, and refined to maintain relevance and effectiveness.

To accomplish this goal, the NAE will continue to work across the total force supply chain to overcome systemic barriers and constraints adversely impacting our ability to deliver the right force with the right readiness, at the right time. The NAE will apply the tools of continuous process improvement to attack those barriers so we build capability efficiently and transition to new platforms successfully.



The NAE has implemented metrics to evaluate the effectiveness of recruiting, training, and assigning personnel. These metrics are already helping to assess readiness and the performance of the end-to-end total force supply chain.

The NAE will focus on improving the capability and capacity of the total force so that it is better prepared to meet the challenges of the future. To accomplish this, the NAE will work to improve the force's technical skill sets through better training and an emphasis on continuous learning.

In the years ahead, new type/model/series aircraft, unmanned systems, and a new class of aircraft carrier will enter the fleet, providing new capabilities to warfighters and changing manpower requirements. The NAE will assess the personnel support requirements of these transitioning platforms, use that information to drive training strategies, and grow the total force required to support the future of Naval Aviation.

THE FACES OF NAVAL AVIATION

Included here are profiles of some of the people who make Naval Aviation what it is today, and who are making the force of tomorrow a reality.



**Naval Aircrewman (Operator) 1st Class (AW)
Anthony M. McKenna**

Title: Tactical Auxiliary Ground Station Sensor Operator

Unit: Commander, Patrol and Reconnaissance Wing 2,
Broad Area Maritime Surveillance (BAMS)
Demonstrator Detachment

I work with naval and civilian counterparts on the latest, cutting-edge unmanned platform in Naval Aviation known as the BAMS Demonstrator. As a key team member in the development of tactics, techniques, and procedures in the Navy-designed tactical auxiliary ground station, I use the data from the demonstrator's integrated sensor suite to provide near-real-time intelligence in support of real-world contingency operations. Our job is to provide the fleet with what they need to complete the mission, as well as lessons learned for the introduction of BAMS. As an adjunct to the P-8A *Poseidon*, BAMS is integral to the Navy's maritime patrol and reconnaissance force family of systems.



**Aviation Boatswain's Mate (Fuels) Airman (AW)
Erika D. Williams**

Title: Pump Room/Fuels Filter Operator

Unit: USS *Bonhomme Richard* (LHD 6)

My contribution to Naval Aviation includes providing clean and bright fuel and lubricating oil to embarked aircraft, support equipment, and amphibious assault vehicles. My job is multifaceted, as I participate on teams that enforce safety precautions and maintain fuel quality. My job also involves participating in training exercises with fire-fighting crews and damage control parties. My crewmates and I are responsible for major roles in launching and recovering naval aircraft quickly and safely aboard ship. We frequently work in a fast-paced and often potentially hazardous environment: the flight deck, in all climatic conditions. Our most important task is maintaining the safety of our fellow U.S. personnel. Naval Aviation has given me the opportunity to play a key role in executing our mission: helping naval aircraft support and transport Marines and equipment, afloat and ashore.



Lieutenant Robert Stochel

Title: E-2C *Hawkeye* Instructor Pilot/E-2D *Advanced Hawkeye* Initial Operational Test and Evaluation Team

Unit: Airborne Early Warning Squadron (VAW) 120

As an E-2 instructor pilot, you directly affect the next generation of naval aviators in the *Hawkeye* community. At the beginning of 2012, I and 11 other instructors will lead the operational testing of the E-2D *Advanced Hawkeye* over the course of eight months. After this evaluation, VAW-120 will begin accepting E-2Ds into our inventory to begin training more instructors prior to the aircraft joining the fleet in 2013. My love for Naval Aviation began when I was five, looking through a book called *American Warplanes*. I excitedly flipped through the pages, coming across warplanes that naval aviators know by name alone: *Corsair*, *Hellcat*, *Avenger*, *Skyraider*, *Phantom*, *Intruder*, *Hawkeye*, and *Tomcat*. From flying off the last conventional aircraft carrier, USS *Kitty Hawk* (CV 63), to taking part in Yellow Sea operations with the Republic of Korea, to signing for my first aircraft at “the Boat,” to walking the beaches of Iwo Jima prior to field carrier landing practices—these are just some of the awesome memories I cherish as a naval aviator. As I continue my journey through Naval Aviation, I’m thrilled to know that the *Hawkeye* community’s future is secure and healthy and will be taking “cats” and “traps” for many years to come.



Corporal Carrie R. Carlson

Title: AV-8B *Harrier* Avionics Technician

Unit: Marine Attack Squadron (VMA) 214

My contribution to Naval Aviation is my duty as a collateral duty inspector. My responsibility is to inspect the work of my fellow Marines and ensure the job is complete and the aircraft is functional. I assist the maintenance effort by providing on-the-job training to junior Marines. Our task is to troubleshoot the discrepancies down to faulty wire bundles or electronic components and repair the wiring or replace the components so the aircraft can be returned to mission-ready status. The most important aspect of my job is ensuring my fellow technicians take the time to do each job effectively and efficiently. I strive to complete repairs correctly the first time so Marines do not have to repeat the repair again after minimum flight time. I want my Marines to know that they do not need to rush; they should be confident in their abilities to do the job properly. I ensure they have the ability to ask any questions while working on the aircraft. My job is to train my future replacements because their knowledge is the key to successful future missions.





Lieutenant Commander Geoff Hughes

Title: Naval Aviator Production Process and Adversary Officer

Unit: Commander, Naval Air Forces

For the naval aviator production process, I oversee fleet replacement squadron activities. I ensure their syllabi match fleet requirements and that Commander, Naval Air Forces (CNAF), provides them with the requisite amount of aircraft, flight time, equipment, and instructors to meet their missions. I also oversee the operational portion of the Navy's adversary program and provide the CNAF perspective on future adversary requirements. I make sure the fleet replacement squadrons have everything they need to succeed, and ensure that fleet squadrons have the correct amount of adversary support to keep them sharp at the tip of the spear. Becoming a Navy pilot was my childhood dream. Whether I'm flying a *Hornet*, an F-5, or a big particle board desk, I'm just happy to be here.



Sergeant Jesus J. Castro

Title: KC-130J *Super Hercules* Aircraft Communications/Navigation Systems Technician Collateral Duty Inspector

Unit: Marine Aerial Refueler Transport Squadron (VMGR) 152

I am responsible for the safe and successful operation of all avionics systems on the KC-130J. My contribution to Naval Aviation is to ensure our avionics systems are fully operational and able to meet the speedy deployments of VMGR-152 in the Pacific Theater to support humanitarian missions, training exercises, and combat deployments to Afghanistan. Being technically proficient, helping to make missions safe, and training Marines to be successful technicians are my most important contributions to Naval Aviation. Naval Aviation means to me that America has greater presence in the world, not only by having the most powerful Navy but also having the capability to arrive anywhere on Earth to engage enemies, put troops on the ground, or provide humanitarian relief at a moment's notice. It means that by combining an expeditionary force like the Marine Corps with self-contained air support you give the naval services an advantage over other armed forces.



Chief Aviation Boatswain's Mate (Aircraft Handling) (AW/SW) Anthony A. Thomas Sr.

Title: Crash and Salvage Leading Chief Petty Officer

Unit: USS *Enterprise* (CVN 65)

Most of my professional career of more than 20 years has been immersed in Naval Aviation. I have served on the decks of USS *Dwight D. Eisenhower* (CVN 69), USS *Harry S. Truman* (CVN 75), USS *George Washington* (CVN 73), and *Enterprise*. In addition, I've trained corpsmen on the helicopter flight deck of the hospital ship USNS *Comfort* (T-AH 20). Launching and recovering aircraft on *Enterprise* is a unique and very rewarding task. There are many complex and ongoing challenges aboard a 50-year-old aircraft carrier that, through persistence and dedication to duty, make my job gratifying. Ensuring my Sailors are safe, trained, and understand their positions is my top priority. It is my responsibility to train more than 1,000 Sailors of our ship and air wing in aircraft firefighting safety, and I know we are ready to respond when needed. As we get ready for the ship's 22nd and final deployment, I could not be more proud of my team on the flight deck and their contributions to Naval Aviation.



Sergeant Nicholas A. Inca

Title: CH-46E *Sea Knight* Avionics Technician/Aerial Observer/Aerial Gunner

Unit: Marine Medium Helicopter Squadron (HMM) 265 (Reinforced), 31st Marine Expeditionary Unit

I have contributed to Naval Aviation by becoming an avionics collateral duty inspector, which means I inspect maintenance actions and make sure they're done properly and safely. I work on multiple systems, including the automatic flight control system, communications and navigation, electronic countermeasures, power plants, and everything that has an electrical wire attached. As an aerial observer I get to crew the aircraft during missions, including troop and cargo transport, casualty evacuation, and humanitarian aid. The most important part of my job is ensuring that all the aircraft maintenance is done properly and safely, which will keep our squadron's combat readiness at its highest potential and ensure both the aircrew and the aircraft are safe for flight. When I joined the Marine Corps I wanted to be part of a Marine air wing. I sincerely believe Naval Aviation is the best of all the branches of service. Naval air power dominates the skies during combat, delivers ground combat elements to the fight on the ground, and provides humanitarian assistance when called on to do so.

Naval Aviation Enterprise

The Naval Aviation Enterprise (NAE) is a partnership among Naval Aviation leaders and stakeholders that supports the readiness requirements of Naval Aviation by enhancing communication, fostering organizational alignment, encouraging interservice integration, stimulating a culture of continuous process improvement, and facilitating change when needed. The NAE remains keenly aware of the single fleet-driven metric—Naval Aviation forces efficiently delivered for tasking—yet more broadly seeks to advance and sustain Naval Aviation warfighting capabilities at an affordable cost.

The NAE provides Naval Aviation leadership with relevant and in-depth information, focused processes, and a culture of transparency and collaboration to balance the interests of, and requirements placed on Naval Aviation. As a result of the NAE, leaders are able to make informed decisions that benefit all of Naval Aviation, improve warfighting readiness and effectiveness, and generate the greatest possible efficiencies in a transparent and seamless manner.

The NAE is spearheaded by Commander, Naval Air Forces, the Marine Corps Deputy Commandant for Aviation, and Commander, Naval Air Systems Command. Together with every major Naval Aviation stakeholder, they align efforts to ensure that Naval Aviation is best served to address challenges and affordability in current readiness, future readiness, and total force. The NAE is now executing its third two-year strategic plan and has conducted a major update to its organizational structure and governance document. These updates ensure that the Enterprise remains relevant to, and focused on, the deliverables expected from Naval Aviation.



The NAE has a set of principles that form the basis of behavior and action. These principles encourage leaders to share information and participate in dialogue that result in informed decision-making, and places the welfare of Naval Aviation ahead of individual organizational interests. This is the bedrock of the enterprise culture, and it is inextricably linked to the following principles:

- Consistently apply cross-functional process thinking
- Establish and maintain process discipline
- Use consistent, integrated, and hierarchical metrics
- Ensure full and consistent transparency of data, information, and activities
- Establish and maintain accountability for actions and results
- Apply an integrated governance structure
- Maintain a total ownership cost perspective
- Tie efforts to a single fleet-driven metric: Naval Aviation forces efficiently delivered for tasking.



CROSS-FUNCTIONAL TEAMS

CURRENT READINESS

The Current Readiness Cross-Function Team brings operators and providers together to produce “ready for tasking” Naval Aviation assets at a cost the nation can afford. The team accomplishes this by working together with leadership teams and the other Naval Aviation Enterprise (NAE) teams to identify and resolve barriers in producing the right readiness at the right time at the right cost. These leadership teams are composed of Navy wing and Marine Corps group commanders, program managers, resource sponsors, and leaders from provider commands representing 20 different type/model/series aircraft groupings, an Air-Launched Weapons Team, a Carrier Readiness Team, and the Naval Aviation Production Team, as well as the 30-plus staffs that make up the NAE. The Current Readiness Cross-Functional Team is also the NAE single-process owner for training readiness.

The Maintenance and Supply Chain Management Team, a sub-team within Current Readiness, oversees maintenance and supply processes to ensure the production of prescribed levels of equipment “ready for tasking” at reduced product line costs. This team focuses on the efficiency and effectiveness of all integrated logistics support processes, including material requirements forecasting, scheduling, contracting, purchasing, buying management, inventory management, distribution, repair induction, planning, scheduling, diagnostics, repair, quality assurance, and analysis.

TOTAL FORCE

The Total Force Cross-Functional Team delivers the technically superior, diverse, and cost-effective total force required to fight and win in combat. The team enriches the skills of Sailors, Marines, and civilians by adding technical skill sets and programmatic improvements to Naval Aviation training. It uses innovations like the People-Master Aviation Plan tool, manpower war games, and other workforce planning initiatives, and conducts manpower and manning risk



assessments for transitioning air systems. It also optimizes the delivery of Sailors and Marines by examining current processes, identifying systemic barriers and constraints, and assigning resources to tackle them through continuous process improvement.

FUTURE READINESS

The Future Readiness Cross-Functional Team improves the reliability, maintainability, and availability of Naval Aviation systems at optimized costs. During the fiscal year 2012 and 2013 budget cycles, 12 future readiness/total ownership cost initiatives were advanced for funding with an investment of more than \$300 million and a calculated return on investment of \$2.4 billion. The team increases awareness of requirements and acquisition processes as well as systems engineering technical reviews and independent logistics assessments for new programs. In addition, the team leverages science and technology projects for future systems and facilitates the transition to programs of record.

INTEGRATED RESOURCE MANAGEMENT

The Integrated Resource Management Team maintains a future-year focus and manages a balanced risk approach to Naval Aviation resource and investment decision making. The team concentrates on providing, planning, programming, budgeting, and execution support to resource sponsors developing budgets in the Office of the Chief of Naval Operations. It provides an integrated view of the Naval Aviation portfolio to the leadership of the Naval Aviation Enterprise, and offers financial analysis and recommendations to create a balanced portfolio. It also identifies those who need to participate in solving issues and works to resolve financial conflicts between resource sponsors.



CONTRIBUTIONS TO READINESS

A person wearing a green flight suit and a helmet with goggles is focused on working on the engine of an aircraft. The engine is a large, complex piece of machinery with various components and pipes. The person is wearing a green helmet with a white visor and a green flight suit with a white patch on the chest. The background is slightly blurred, showing other people in green flight suits working on the aircraft.

The Naval Aviation Enterprise (NAE) is a partnership as well as a way of doing business. It relies on its members to take action under their command and control responsibilities, to commit the necessary resources (e.g., time, people, funding) and to lend their personal resolve so the best interests of Naval Aviation are served in a collaborative manner. The cultural changes, improvements in aircraft and personnel readiness, cost avoidance, and outright savings that have resulted from the NAE are helping to ensure the right readiness continues to be produced more efficiently. Quality data and a culture of collaboration have provided Naval Aviation's leaders with the insight and information that assists them in managing the transitions and readiness that are required, and gauging the potential impact of efficiency initiatives before they are implemented.

Qualitative contributions attributable to NAE actions and processes include: the establishment of metrics and processes that link readiness to resource requirements, resulting in better budgeting and execution; increased transparency and the elimination of "stovepiped" decisions; the development of a culture of continuous process improvement; and the top-down implementation of best behavior by leadership.

Quantitative contributions include a dramatic flattening in the cost growth of flying naval aircraft for the past six years, avoiding as much as \$4 billion in increased costs if the growth had gone unchecked. NAE future readiness initiatives now in the fiscal year 2012 budget will result in a \$1.5-billion return on investment over the remaining life of those systems. Proposed fiscal year 2013 initiatives could return as much as \$900 million. Fleet readiness centers originated by the NAE significantly changed how Naval Aviation maintenance is performed, and they have implemented process changes that surpassed a \$1-billion goal of reduced costs, ahead of Base Realignment and Closure Commission timelines.

We remain a warfighting organization first and foremost, but we must do it in a cost-effective way. Across the NAE, it's clear that the Navy and Marine Corps team "gets it," whether it is \$192,000 saved annually at Marine Aviation Logistics Squadron 24 at Kaneohe, Hawaii, which implemented a new cross-service repair process for the P-3 intercommunications system, or process improvements employed at Fleet Readiness Center Northwest's paint shop that reduced unanticipated maintenance delays. (This process improvement prevented significant undocumented rework removing rust that accumulated on parts during handoffs. Designated parts were immediately sent for nondestructive inspection and rust prevention, resulting in saving more than \$1.2 million.) Many more such examples can be found across Naval Aviation as this culture continues to grow.



SUMMARY



Naval Aviation is a warfighting force that is integral to the ability of the Navy, Marine Corps, and joint forces to deter or win regional conflicts and major power wars. Our aircraft carriers, amphibious assault ships, carrier air wings, aviation combat elements, and maritime patrol and reconnaissance forces maintain a combat-ready posture that is deployed forward as an instrument of our nation's will. We understand the importance of cooperative multinational relationships because no one nation has the resources required to guarantee the complete safety of the world's oceans and the air space above them. As a key component of a global force for good, Naval Aviation provides not only sea-based combat power to resolve conflict and protect national and international interests, but also sea-based peace power to provide disaster relief and humanitarian assistance.

Naval Aviation is a warfighting enterprise that will continue to develop, deliver, and sustain the aircraft, weapons, and systems our Sailors and Marines need to serve America in defense of freedom. We embrace the privilege of this awesome responsibility with pride, determination, and enthusiasm.



IMAGE CREDITS

- Cover design by Jennifer Faunce
- i-ii U.S. Navy photo by Mass Communication Specialist 3rd Class Deven B. King
- iii-iv Photo by Erik Hildebrandt
- 1-2 U.S. Navy photo by Mass Communication Specialist 2nd Class James R. Evans
- 3-4 Composite of U.S. Navy and Marine Corps photos by Ken Collins
- 5-6 Photo by Erik Hildebrandt
- 7-8 U.S. Navy photo by Mass Communication Specialist 2nd Class Gary Granger Jr.
- 9-10 U.S. Marine Corps photo by Corporal Samantha H. Arrington
- 11-12 U.S. Navy photo by Mass Communication Specialist 3rd Class Dylan McCord
- 13-14 Lockheed Martin Photo by Phaedra Loftis
- 15-16 U.S. Navy photo by Mass Communication Specialist 2nd Class Julio Rivera
- 17-18 U.S. Navy photo by Mass Communication Specialist 2nd Class Brooks B. Patton Jr.
- 19-20 U.S. Navy photo by Mass Communication Specialist 2nd Class Tony D. Curtis
- 21-22 U.S. Navy photo by Mass Communication Specialist 2nd Class Joseph M. Buliavac
- 23-24 U.S. Navy photo by Chief Mass Communication Specialist John Lill
- 25-26 U.S. Navy photo by Mass Communication Specialist 2nd Class Julio Rivera
- 27-28 U.S. Navy photo by Mass Communication Specialist 1st Class Steve Smith
- 29-30 U.S. Marine Corps photo by Corporal Reece E. Lodder
- 31-32 U.S. Navy photo by Liz Goettee
- 33-34 U.S. Navy photo by Kelly Schindler
- 35-36 U.S. Navy photo By Mass Communication Specialist Seaman Andrew Rivard
- 37-38 U.S. Navy photo by Mass Communication Specialist 3rd Class Sebastian McCormack
- 39-40 U.S. Navy photo by Mass Communication Specialist 3rd Class Bryan Blair
- 41-42 U.S. Navy photo by Mass Communication Specialist 1st Class Rebekah Adler
- 43-44 U.S. Marine Corps photo by Staff Sergeant James R. Richardson
- 45-46 U.S. Marine Corps photo by Corporal Richard A. Tetreau
- 47-48 U.S. Navy photo by Chief Mass Communication Specialist William Lovelady
- 49-50 U.S. Navy photo by Mass Communication Specialist 3rd Class Nathan Parde
- 51-52 U.S. Navy photo by Richard Stewart
- 53-54 U.S. Navy photo by Mass Communication Specialist 2nd Class Nardel Gervacio
- 55-56 Photo by Ted Carlson
- 57-58 Photo by Erik Hildebrandt
- 59-60 Photo by Erik Hildebrandt
- 61-62 U.S. Navy photo by Mass Communication Specialist Seaman Rosa A. Arzola
- 63-64 U.S. Navy photo by Mass Communication Specialist 3rd Class Jonathan Sunderman

65-66 U.S. Navy photo by Mass Communication Specialist 2nd Class Orrin Batiste

67-68 U.S. Navy photo by Mass Communication Specialist Seaman Apprentice Michael Feddersen

69-70 U.S. Marine Corps photo by Staff Sergeant James R. Richardson

71-72 U.S. Navy photo by Mass Communication Specialist 3rd Class Betsy Lynn Knapper

73-74 U.S. Navy photo by Mass Communication Specialist 3rd Class Timothy A. Hazel

75-76 U.S. Navy photo by Mass Communication Specialist 3rd Class Shawn J. Stewart

77-78 U.S. Navy photo by Mass Communication Specialist 2nd Class Walter M. Wayman

79-80 Photo by Andy Wolfe, courtesy Lockheed Martin

81-82 U.S. Navy photo by Lieutenant Marques Jackson

83-84 Photo by Ted Carlson

85-86 U.S. Navy photo by Mass Communication Specialist Seaman Apprentice Brian Read Castillo

87-88 U.S. Navy photo by Mass Communication Specialist 2nd Class Josue L. Escobosa

89-90 U.S. Marine Corps photo by Private First Class Kevin A. Crist

91-92 U.S. Marine Corps photo by Gunnery Sergeant Scott Dunn

93-94 U.S. Navy photo provided by FRC East

95-96 U.S. Navy photo provided by NAWCWD

97-98 U.S. Navy photo

99-100 U.S. Navy photo by Greg Vojtko

101-102 Photo by Christian Turner, AFFTC Aerial Photographer

103-104 US Navy Photo by MC1 Rachel McMarr

105-106 U.S. Navy photo by Mass Communication Specialist 2nd Class Walter M. Wayman

107-108 U.S. Navy photo by Mass Communication Specialist 3rd Class Travis J. Kuykendall

107 (l) Photo by Tara Collis, courtesy SAIC

107 (r) U.S. Navy photo by Mass Communications Specialist 3rd Class Ryan McLearnon

107 (l) U.S. Navy photo by Mass Communications Specialist 3rd Class Katherine K. Barkley

108 (r) U.S. Marine Corps photo courtesy of VMA-214

109-110 U.S. Navy photo by Mass Communication Specialist Seaman Jesse L. Gonzalez

109 (l) U.S. Navy photo by Lieutenant Aaron Kakiel

109 (r) U.S. Marine Corps photo courtesy of VMGR-152

110 (l) U.S. Navy photo by Senior Chief Mass Communications Specialist Dave Nagle

110 (r) U.S. Marine Corps photo courtesy of HMM-265

111-112 Composite of U.S. Navy photos by Ken Collins

113-114 U.S. Navy photo by Mass Communication Specialist 3rd Class Benjamin Crossley

115-116 U.S. Navy photo by Mass Communication Specialist 3rd Class Benjamin Crossley

117-118 U.S. Navy photo by Liz Wolter

119-120 U.S. Navy photo by Mass Communication Specialist 3rd Class Alexander Tidd

121-122 U.S. Navy photo by Mass Communication Specialist 3rd Class Travis K. Mendoza

ACKNOWLEDGMENTS

Naval Aviation Vision • January 2012

Project Sponsor

RDML Paul Grosklags, USN
Vice Commander, Naval Air Systems Command

Project Director

Gary E. Shrout
Naval Aviation Enterprise Strategic Communication Coordinator

Project Manager

Suzy Lang

Managing Editor

Colin E. Babb

Art Director

Ken Collins

Design and Layout

Dave Bradford

Research and Editing Team

John Pierce
Mimi Kotner

NAE Publication Distribution

Arlene Guy

Subject Area Representatives

Mike Warriner Commander, Naval Air Forces Deputy Director for the Naval Aviation Enterprise	RDML Jeffrey Penfield, USN Naval Air Systems Command, Integration and Interoperability
Robert Ghisolfi Naval Air Systems Command, Strategic Leadership Support	Rebecca Ahne Naval Air Systems Command, Science and Technology
Brett Matthews Headquarters, USMC Aviation Logistics Branch	Kevin Davis Information Dominance (OPNAV N2/N6)
Gregg Sears Air Warfare (OPNAV N88), Policy, Plans, and Operations	Doug Abbotts Naval Air Warfare Center Aircraft Division
Rick Meana Air Warfare (OPNAV N88), Operations Research Advisor	Desiree Jones Naval Air Warfare Center Weapons Division
Micheal Kitchens Naval Air Systems Command, Reducing Total Ownership Cost	David Walton NAE Total Force Cross-Functional Team
	Kim Mozingo Commander, Fleet Readiness Centers Senior Executive Advisor

Thanks to the many others in Naval Aviation who contributed to the creation of this document.

Special thanks to the members of the strategic planning and communications team from Omnitec Solutions, Inc. for their expertise in writing, editing, and designing this document.

