1998 ANNUAL REPORT

# NAVAL AVIATION SYSTEMS TEAM

*Acquisition Management*

*Test and Evaluation*

*Repair and Modification*

*In-Service Engineering and Logistics*

*Science and Technology Development*

## 1998 Annual Report

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*Above, Left to Right: RADM W.A. Moffett, USN; aircraft being launched from USN Coal Barge at Pensacola, Florida, circa 1915; on the forward turret platform of the USS Texas (BB-35) circa 1919*

## *A Proud Past.* The history of the Naval Aviation Systems Team parallels that of American aviation. Since the dawn of heavier-than-air flight, visionary men have seen the enormous military potential of combining the Navy's sea power with the advantages of multidimensional space. As technology advanced, it became clear that the Navy needed an organization devoted to the development of naval aviation – the forerunner to the Naval Aviation Systems Team (TEAM). It was through the dedication and courage of a handful of pioneers and dauntless aviators that naval aviation became a reality.

During World War I, the superiority of European military aviation left a lasting impression upon the minds of a new generation of military men who saw firsthand the value of the airplane in battle. In the early years, the traditional seagoing Navy did not readily accept aviation. The American public, however, had become enthralled by romantic notions of flight. Army aviation zealots, such as General Billy Mitchell, threatened to upstage the Navy and monopolize military aviation. Fortunately, the Navy had aviation enthusiasts with the vision and courage to foresee the potential of the airplane in naval warfare.

Bowing to public opinion to exploit military aviation, Congress created the Navy Bureau of Aeronautics on 12 July 1921. One month later, the Navy named Rear Admiral William Moffett its first chief. Moffett, who had earned the Medal of Honor at the Battle of Vera Cruz, had a peripheral interest in naval aviation from its beginning. He had helped plan the first shore-to-ship-to-shore flight in history made by Eugene Ely on 18 January 1911; and at the battle of Vera Cruz, witnessed naval aviators in their first flights against hostile forces. During World War I, Admiral Moffett commanded the Great Lakes Naval Training Station where he established the Aviation Mechanics School. He was instrumental in establishing the Bureau of Aeronautics, and became a shrewd, diplomatic advocate for naval aviation. Moffett drew together aviation offices from across the Navy and fashioned a closely knit and articulate organization. He served as head of the Bureau until his death at sea in the crash of the Navy Airship USS *Akron* on 4 April 1933.

Other champions for naval aviation followed Admiral Moffett. Legendary leaders, such as Admiral John Towers and Fleet Admiral Ernest J. King, kept naval aviation alive until technology caught up with their visions. Innovations, such as a catapult capable of launching an aircraft from a war ship and an arresting device to help it land, led to the advent of the aircraft carrier. The carrier made it possible to integrate naval aviation into the Fleet, where aircraft eventually proved indispensable.

From the time of its creation, the Bureau of Aeronautics concentrated on the technological aspects of developing combat aircraft for the Navy. Technology has always been a driving force in the organization and development of naval aviation. Today the dreams of Admiral Moffett and the early champions of naval aviation have come true. The Naval Aviation Systems Team continues to carry out the high ideals in the spirit of those early pioneers and still depends upon the dedication and pursuit of excellence of all its members.

*Left: Ordnancemen service a Navy scout/bomber aboard the USS Enterprise (CV 6)*

# *Commander's Report.* We achieved great things in 1998.

## Across the board our people excelled in the areas of acquisition management, test and evaluation, repair and modification, in-service engineering, logistics, and

science and technology development – delivering unmatched support to our warfighting customer. The numerous awards and recognition earned by our TEAM members, and the success we have had in executing our programs is indicative of the total TEAM effort.

During 1998, the TEAM delivered 81 aircraft, 2,470 missiles and 308 targets to the Fleet. The depots repaired thousands of components and performed maintenance on more than 400 aircraft and 1,000 aircraft engines. Our product centers were quick to respond in support of Operation DESERT FOX, the U.S. retaliatory strike on Iraq, by fielding weapons systems upgrades to our combat aviators.

A great deal of our attention continues to be focused on ensuring that we are prudent and judicious with the funds entrusted to us by the taxpayer, the Navy, and the Department of Defense. The TEAM received $16.4 billion in 1998. Naval Operations (N-88, Air Warfare Division) is the largest sponsor of the NAVAIR appropriated funds. Other customers include other Navy as well as non-Navy (Air Force, Army, Foreign Military Sales, etc.) organizations. In procuring products and services in support of the Navy and the National Defense Strategy, 80 percent ($13.1 billion) of our funding went to private industry in 1998.

We approached ’98 with a keen recognition of the challenges that lie ahead for our Navy — the Fleet’s need for improved systems and readiness, within the bounds of a budget that looks to remain flat over the next several years. We knew we needed to make significant changes in the way we do business in order for the Navy to afford the technologies and systems it will need to counter future threats.

Having already completed significant downsizing since the early 1990s, via Base Realignment and Closure (BRAC), we embarked on a focused effort to reengineer several of our key processes to dramatically reduce cost and improve cycle time for the Fleet. Our Activity Based Costing (ABC) study vastly improved our understanding of what it costs to produce products and services, and helped identify high return reengineering opportunities. As we closed the year, our Business Process Reengineering (BPR) teams were presenting their redesign recommendations to leadership, and implementation will begin in the spring of ’99. We expect our process improvement efforts to yield significant benefits for our customers.

During 1998, we finished the remaining major closures and realignment actions mandated under the 1995 Base Realignment and Closure Commission. The Naval Air Warfare Center Aircraft Division Center, Trenton, NJ, closed and transferred its functions between facilities at NAS Patuxent River, MD, and the Arnold Engineering Development Center in Tullahoma, TN. Additionally, the Naval Aviation Engineering Service Unit and the Naval Air Technical Services Facility, both in Philadelphia, PA, consolidated and moved to North Island, CA, forming the

*VADM John A. Lockard*
*Commander, NAVAIRSYSCOM*

Naval Air Technical Data and Engineering Service Command (NATEC). The TEAM also turned over station management of Point Mugu, CA, to the Pacific Fleet and began divesting its seven Naval Industrial Reserve Plants.

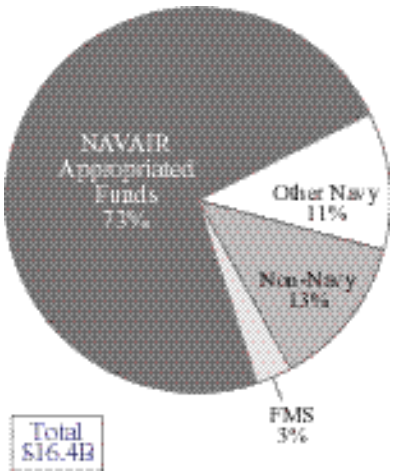
In preparation for the information age in the 21st century, the TEAM has taken the threat of the "millennium bug" seriously. We have been systematically identifying and fixing potentially vulnerable systems. During 1998, all of our activities performed a detailed inventory of their computer/microchip controlled facility systems, industrial plant equipment, information technology equipment, and communications and productivity-enhancing equipment and components in an effort to identify all items that might be susceptible to Year 2000 (Y2K) vulnerabilities. Each of our sites then assessed that entire inventory to determine what items were not Y2K compliant. These areas immediately began working on fixing those systems and components that were not compliant, focusing on mission-essential systems that had the greatest potential risk to disrupt base operations or support for the Research, Development, Test, and Evaluation mission.

Despite the turmoil generated by impending changes, we have seized the advantage to become masters of our own destiny. New challenges lie ahead. Working with industry, the Fleet, and other Navy and Marine Corps Systems Commands, we will take naval aviation into the information age and redefine the warfighter's battlespace. New obstacles must be overcome to fully integrate the spectrum of our information systems. We are preparing now to actively support the integration of aviation systems into the Navy's Network Centric Battle Group. This tight integration of systems will dramatically improve the warfighter's effectiveness and lethality against future threats.

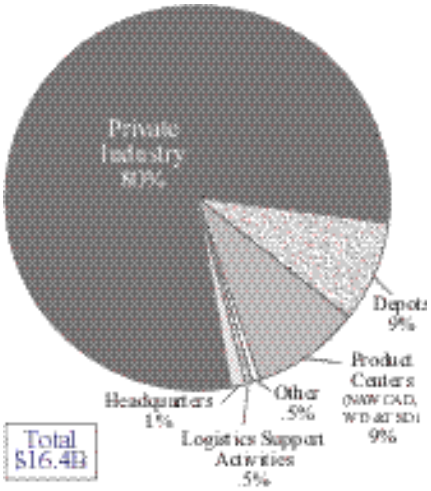
The warriors of the 21st century will rely even more on the TEAM for the myriad of expertise we provide. The increasing complexity of technology and its importance in maintaining military superiority will demand the continued invaluable capabilities, talents, and commitment of our TEAM. Navy, Marine, joint, and coalition warfighters will depend on us to provide effective, affordable aviation systems that are on hand and ready when they need them – every time.

## *1998 Financial Highlights*

*Where the Funding Comes From (Customers)*




*Who Gets the Money (Sources of Products and Services)*




*Major Products Delivered in FY98*

| | |
|---|---|
| Aircraft | 81 |
| Missiles (AUR) | 2,470 |
| Targets | 308 |
| NADEPs | |
| Aircraft SDLM | 355 |
| Engine Repairs | 1,123 |
| Component Repairs | 113,935 |
| NAPRA | |
| Aircraft SDLM | 26 |
| Component Repairs | 1,960 |
| Emergent In-Service Repairs | 462 |
| Contract Actions | 8,075 |

# TEAM PROFILE

*Mission.* The Naval Aviation Systems Team, in partnership with industry, serves the Nation and the Navy by developing, acquiring and supporting naval aeronautical and related technology systems with which the operating forces, in support of the Unified Commanders and our allies, can train, fight, and win.

*Organizational Structure.* The TEAM is comprised of six organizations working as a fully integrated team: Naval Air Systems Command (NAVAIR); Naval Inventory Control Point (NAVICP); Program Executive Office, Air Anti-Submarine Warfare, Assault, and Special Mission Programs PEO(A); Program Executive Office, Cruise Missiles Project and Unmanned Aerial Vehicle Joint Project PEO(CU); Program Executive Office, Tactical Aircraft Programs PEO(T); and Program Executive Office, Joint Strike Fighter PEO(JSF).

*Products and Services.* Working with industry, the TEAM delivers high quality, affordable products and support to the operating forces. Products and services delivered on behalf of the customer include: aircraft, avionics, air-launched weapons, electronic warfare systems, cruise missiles, unmanned aerial vehicles, launch and arresting gear, training equipment and facilities, and all other equipment related to Navy and Marine Corps air power.

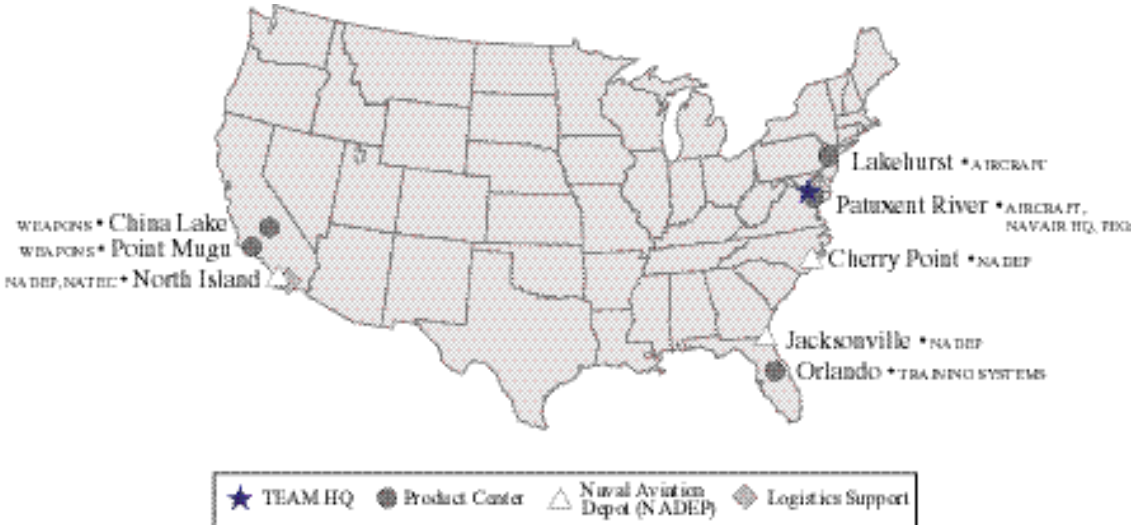
Total life cycle support of all naval aviation weapons systems include: research, design, development, and engineering; acquisition; test and evaluation; training facilities and equipment; repair and modification; and in-service engineering and logistics support.

The Naval Aviation Systems Team is committed to managing the organization as an efficient business. Although geographically dispersed, the organization represents a fully integrated, product-focused team. Ultimately, our goal parallels that of our customers – to reconstitute the Fleet's assets with new and modernized weapons systems, technically and functionally capable of responding to the demands of the 21st century.

*Leadership.*

NAVAIR Commander - VADM J. A. Lockard
NAVAIR Vice Commander - RADM C. E. Steidle
NAVAIR Deputy Commander - Dr. A. R. Somoroff
PEO(A) - RADM L. D. Newsome
PEO(CU) - RADM B. D. Strong
RADM J. Chenevey (as of January 1999)
PEO(T) - RADM J. A. Cook
PEO(JSF) - MG L. F. Kenne (USAF)
NAVICP - RADM R. A. Archer, III

*1998 Naval Aviation Systems Team Major Sites*



*Personnel*. Approximately 31,600 civilian and military within NAVAIR and the four PEOs

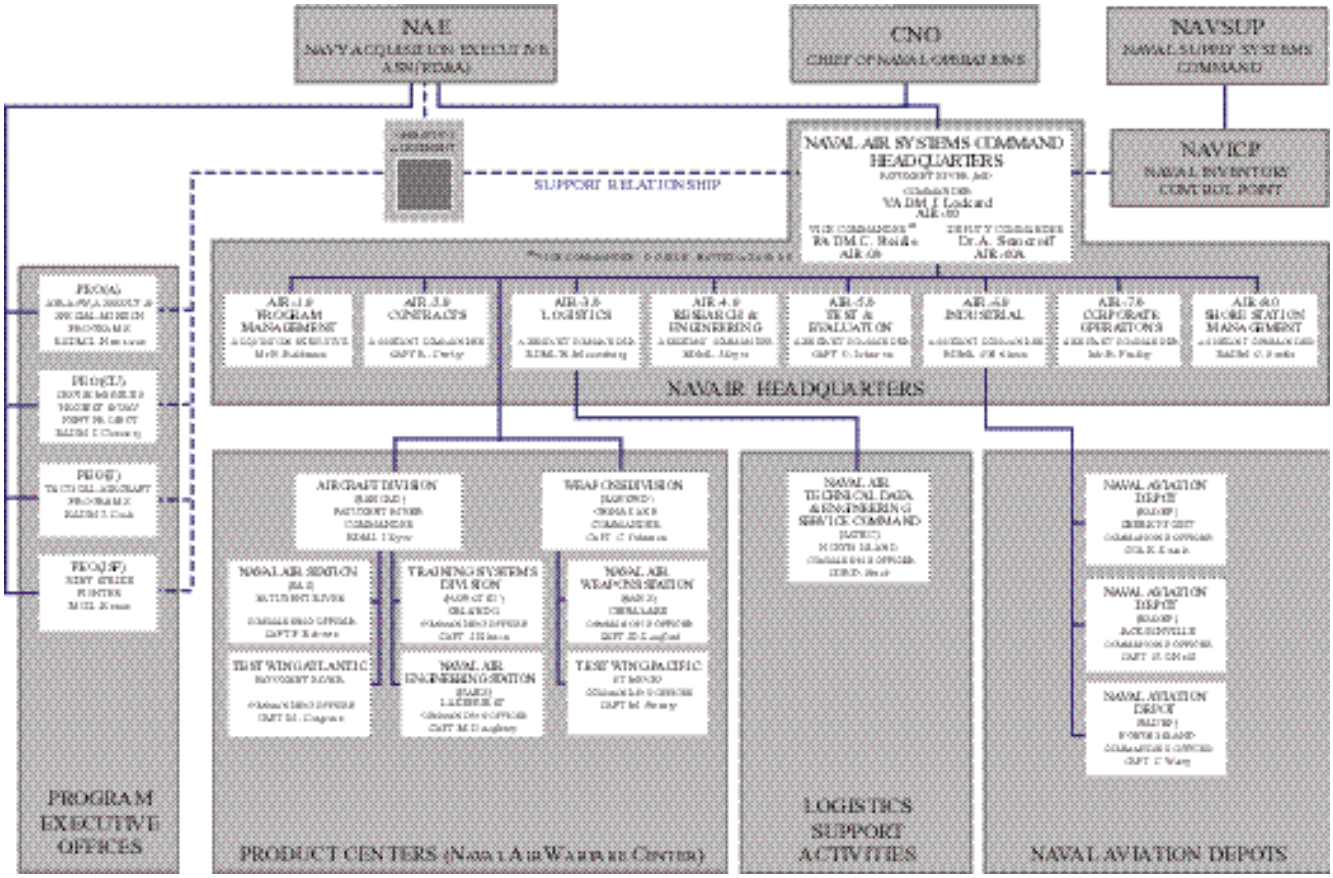
*Facilities*. Currently located at eight major sites throughout the United States

*Programs Managed*. As of 1 October 1998, 148 acquisition programs

*Aircraft Supported*. More than 4,100 active inventory, including 96 individual type/model/series

*Principal Customers*. Operating forces of the Navy and Marine Corps, other activities of the United States Armed Forces and foreign allies

*1998 Naval Aviation Systems Team Major Field Activities / Engineering Centers*




NOTE: Reflects current leadership at publication, March 1999

*Top to Bottom: F-14 on the USS harry S. Truman (CVN 75) flight deck; exercise with Helicopter Anti-Submarine Squadron Eight during the Around-the-World Cruise 1997-1998*

*RDT&E.* Together, the people and facilities of the Naval Air Warfare Center Weapons Division and the Naval Air Warfare Center Aircraft Division make up the finest pool of talent and state-of-the-art equipment in the Research, Development, Test, and Evaluation (RDT&E) business. Their unique capabilities make the Naval Aviation Systems RDT&E Team an irreplaceable national asset, vital to the Nation's defense.

No location can duplicate the Weapons Division's land, sea, airspace, laboratory, and range assets. China Lake's 1,700 square miles of restricted land and airspace – surrounded by 20,000 square miles of military-use airspace – allows unrestricted aircraft operations and experimentation with hazardous and classified materials. Point Mugu's Sea Range covers 36,000 square miles (expandable to 125,000 miles for larger operations) and is overlain by restricted military air space. A Federal Aviation Administration approved flight route connects that airspace with R-2508 to allow large, complex, air-land-sea test and training scenarios. The division uses the 3,200 square mile White Sands Missile Range to test Standard Missile variants and to support National Aeronautics and Space Agency launches and research rockets. The Weapons Division's assets include a 67,500 square foot missile engagement simulation arena, where full size aircraft targets interact with actual missile fuze systems, a weapons survivability laboratory, and an integrated battlespace arena laboratory.

Likewise, the capabilities of the Aircraft Division at NAS Patuxent River, MD, coupled with the aircraft launch and recovery and ground support systems at the Naval Air Engineering Station Lakehurst, NJ, place the division on the cutting edge of aircraft technology. The Aircraft Division's RDT&E assets at NAS Patuxent River include a high performance computing center, cryogenics engineering and overhaul, air combat environment test and evaluation, aircraft modeling and simulation, and propulsion systems capabilities. The Training Systems Division, at the Central Florida Research Park in Orlando, FL, uses the latest modeling and simulation and learning methodology technologies to support aviation, surface, undersea, Marine Corps ground training, and international training programs. As the primary Navy resource for training systems acquisition, the Training Systems Division continues to leverage its wide customer base for the benefit of all, therein reducing costs and time for development and implementation of naval aviation systems.

*Synergy.* The Weapons Division and the Aircraft Division work together to provide smooth integration of RDT&E of weapons and platforms. The F/A-18E/F *Super Hornet*, for example, which had a rigorous flight-test program at Patuxent River, transitioned smoothly to China Lake for developmental and operational testing. A dual High-speed Anti-Radiation Missile (HARM) launch on the land range built on the success of earlier weapon-separation testing at Patuxent River. Both divisions supported flight test operations of the Royal Navy's *Tomahawk* Land Attack Missiles on the NAWC Weapons Division Sea Test Range.

*Above, Left to Right : V-22 Osprey; F/A-18F and F/A-18E take turns refueling from a KC-130 Hercules*

In 1998, the Weapons/Aircraft Division partnership was advanced into the distributed simulation arena. The two divisions joined in a coast-to-coast joint simulation that linked China Lake, Point Mugu, and Patuxent River in the successful execution of a complex suppression-of-enemy-air-defense scenario. To better integrate naval aviation into the larger joint battlespace, the two divisions began development of an overall naval aviation Battlespace Engineering (BSE) Strategy. Members of both divisions gathered at China Lake and Point Mugu for an intensive week-long BSE workshop. Bi-coastal working groups continue to pursue such BSE issues as naval aviation interconnectivity and a new battlefield engineering acquisition process.

*Measuring Our Success.* One way the TEAM can gauge its success rate is by measuring the rate in getting aviation weapons systems to the Fleet on the first try. Over the last six years the TEAM has logged a high rate of success in receiving positive recommendations for systems to enter the Fleet after Operation Evaluation (OPEVAL) or in the final phase of Follow-on Operational Test and Evaluation (FOT&E). The average for the last six years is an 82 percent success rate for OPEVAL of newly developed systems, and 96 percent for FOT&E of modifications to current systems. Such favorable results are attributed to the use of integrated product teams, incorporation of combined developmental and operational test strategies, and application of a rigorous Operational Test Readiness Review process for certifying systems ready for testing. The TEAM strives for 100 percent success, which demands continued improvements in our program management and acquisition processes.

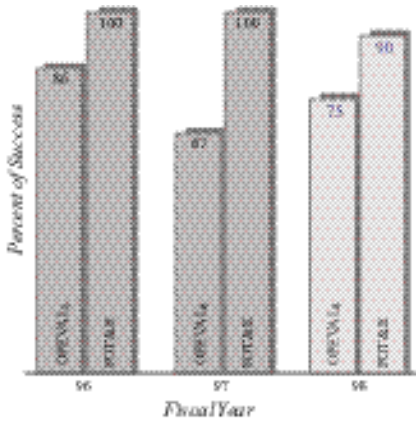
*Aircraft Division.* The Aircraft Division provides a wide array of RDT&E services to the Naval Aviation Systems Team acquisition program managers and the Fleet. During 1998, the division supported the spectrum of Navy and Marine Corps platforms including the F/A-18, F-14, A-6, T-45, P-3, S-3, E-2, C-2, C-130, T-34, V-22, H-60, H-1, H-2, H-3, H-46, H-53, and unmanned aerial vehicle aircraft.

Enormous progress was made this past year in identifying, planning, and readying facility support for hosting the Joint Strike Fighter flight efforts at Patuxent River in the year 2000. This endeavor will encompass two separate contractors and four air vehicles, as well as a mid-field hover area and ski jump. Aircraft system performance requirements were refined throughout the year using the division's air combat environment test and evaluation facility modeling and simulation capabilities, as well as by aircrew and engineering participation in in-flight simulation tests in the United States and England.

Flight testing of the *Super Hornet* continued at a high pace with seven F/A-18E/F test aircraft pushing the total E/F program past 4,000 flight test hours and 2,650 test flights. A government-contractor aeromechanics team solved a potential program-delaying situation when the *Super Hornet* developed an uncommanded wing drop problem that resulted in undesirable flight characteristics. The team was able to solve the problem without a wing redesign, allowing the program to proceed without a schedule impact. The manufacturer delivered the first limited production aircraft to NAS Patuxent River in December for a short series of final tests and successful preoperational evaluation testing. The preliminary evaluations led to a recommendation that the aircraft begin operational testing as planned.

The division conducted significant testing on the F/A-18A/D in support of reconnaissance systems, electronic warfare systems radios, weapons, ground proximity warning system and certification of aircraft carrier precision landing systems, as well as flutter and loads tests for specific aircraft configurations.

*Operational Test and Evaluation Success Rates*



The division's V-22 *Osprey* team provided flight test support for four developmental aircraft encompassing 685 flight hours and 5,512 test conditions. Testing included envelope expansion, night vision goggle evaluation, chaff and flare separation testing, aerial refueling, and hover performance testing. The manned flight simulator was used as a tool for flight control system development, avionics system software, and trade studies for cockpit avionics.

The Aircraft Division oversaw the introduction of the digital flight control system into Navy F-14D aircraft. The division continued development and final assessments on digital flight control system software for the F-14A; demonstrated, in cooperation with Lockheed Martin, the Low Altitude Night Terrain Infrared Navigation (LANTIRN) target systems to support the delivery of global positioning system guided munitions; completed a major reassessment of F-14 fatigue life encompassing new statistical approaches and test data to extend the life of the aircraft, saving the Navy more than $250 million; cleared the GBU-24 weapon for carrier operations, which enhanced aircraft warfighting capability; successfully tested the fast tactical targeting systems, which transmit near-real-time images of onboard sensors to a ground station; and successfully delivered two F-14 2F95A Prototype Trainer Systems to NAS Oceana.

Aircraft Division experts cooperated with fleet users of the T-45 aircraft to ensure that production Cockpit 21 aircraft met training squadron needs and any serious previously identified deficiencies were corrected. The division conducted test and evaluation of T-45 aircraft and aircraft systems, systems safety, logistics, and software; participated in mishap investigation; and contributed to the development, testing, and implementation of aircraft modifications to prevent mishaps in the future.

As part of a TEAM-wide initiative to reduce fleet maintenance costs and extend the life of aircraft, the division introduced a new corrosion prevention program at the Depots and the Fleet. A new type of structural repair, using composite patches on metallic structure was developed, and the division completed a multi-year flight test project evaluating the feasibility of using appliqué materials to replace surface paint on military tactical aircraft.

In support of fleet operations, Aircraft Division engineers developed a method to greatly improve the situational awareness of the warfighter in the field by merging real-time color imagery from an unmanned aerial vehicle (UAV) with national satellite imagery and annotating it with intelligence data. In support of Operation DESERT FOX, the U.S. retaliatory strike against Iraq, the division prepared chemical/biological system buildups. Production installations of H-53D crash attenuating troop seats in fleet aircraft were also started, and division engineers developed a small, lightweight flashlight compatible with night vision goggles.

The Aircraft Division also delivered catapult, recovery, and landing aids to the aircraft carrier USS *Harry S. Truman*, and certified other such systems at 550 ship and shore installations. Division personnel completed a technical

*Top to Bottom: SH-60B; facilities for antenna and RCS measurement at NAWCAD Patuxent River, MD*

evaluation of the aircraft launch and recovery shipboard information system on aircraft carrier USS *Theodore Roosevelt* and supported survivability tests for the next generation destroyer USS *Reid* against the decommissioned cruiser *Richmond K. Turner*. Engineers conducted dockside lightning tests of a MHC Class ship in Corpus Christi, TX, and field-tested and evaluated a mobile aircraft fire training device.

Supporting our sister Services, the division conducted dynamic radar cross-section measurements of the U.S. Air Force F-15; conducted electromagnetic environmental effects testing on U.S. Army OH-58D and AH-64 *Apache Longbow* aircraft and the U.S. Air Force C-17 cargo aircraft; and conducted lightning tests on the U.S. Army *Comanche* helicopter T-801 engine.

The Aircraft Division supported joint and allied operations throughout the year. The division established a joint shipboard helicopter program office to evaluate shipboard and multi-service helicopters to improve the interoperability of rotary wing forces during joint operations. At Patuxent River, the Aircraft Division hosted Air Force KC-135 aircraft and participated in the Carrier Air Wing 3-strike exercise against the air station's infrastructure in preparation for a joint task force exercise. The Aircraft Division assumed chairmanship of the Joint Panel for Aviation Support Equipment, which coordinates support equipment acquisition opportunities among the Services, and contributed to the Joint Software Systems Safety Committee Handbook.

For our allies, the division performed a functional checkout and certification of the aircraft launch and recovery systems on the new French carrier *Charles DeGaulle*; conducted dynamic radar cross section measurements of the Swiss F-18; supported the French E-2C foreign military sales carrier suitability and radar improvement projects; teamed with the British government in providing aircraft launch and recovery systems expertise; and provided services to 31 other allied nations.

*Weapons Division.* The Weapons Division hosted more than 4,000 test events at the sea range, land range, electronic combat range, as well as various test sites, environmental facilities, and Junction Ranch.

The division provided rapid-response support to naval aviation forces in the Persian Gulf, including a major upgrade to the F-14B, file updates for the High-speed Anti-Radiation Missile (HARM) covering the latest threat emitters, and new and safer crew equipment for combat aviators.

Engineers completed the first flight of the AV-8B Open System Core Avionics Capability (OSCAR), which enhances the Marine Corps' ground-attack capabilities and demonstrates the viability of inserting commercial off-the-shelf technology into military avionics. The Weapons Division also contributed to the early deployment of pre-production Joint Standoff Weapon (JSOW) missiles aboard the USS *Eisenhower*, which increases the strength and flexibility of the naval aviation arsenal.

Weapons Division engineers completed warhead design, development, test, and production efforts for the Standoff Land Attack Missile-Expanded Response (SLAM ER) and completed the SLAM ER development test program. The division supported development and testing of Joint Direct Attack Missile, which led to approval for low-rate initial production. The division supported the highly successful first British firings of the *Tomahawk* cruise missile into targets on its land and sea ranges.

*Above: Trident II Vertical Static Firing Test at NAWCWD China Lake, CA*

In support of aircraft programs, the Weapons Division pilots flew more than 200 developmental and operational flight tests of the F/A-18E/F *Super Hornet* including the first live ordnance delivery from the *Super Hornet* and the first dual HARM launch from any F/A-18. A special missions integrated process team was formed as a weapon system support activity for the EP-3E aircraft, which is playing an expanded role in the integrated battlespace. Division experts delivered new operational flight programs and upgrades for the AV-8B, F/A-18, F-14, AH-1W, and EA-6B that integrate additional weapon-system capabilities and expand the operational capabilities of these aircraft. Engineers completed fleet release of Operational Flight Program (OFP) 22 and User Data File (UDF) M5 for the Aircraft Launch and Recovery (ALR-67(V)2) radar warning receiver. Missile developers created new versions of the Rolling Airframe Missile Block 1 Upgrade missile Six-Degree-of-Freedom simulation and detailed seeker simulation that were used in the successful completion of developmental and operational testing.

The Weapons Division also played a significant role in the successful delivery of the first JSOW. The division's JSOW integrated process team oversaw the development and testing of the JSOW and prepared the Fleet for its introduction into operational use. The team, including Raytheon Systems Company members, delivered the first three JSOW missiles to the Navy in May.

The division's electronic warfare systems integrated process team passed a significant milestone transitioning from developmental to operational testing with the ALR-67(V)3 Radar Warning Receiver. The team overcame system deficiencies through an intense team effort accumulating 200 hours of lab and ground testing and over 90 hours of flight-testing.

The Software Engineering Institute gave the F/A-18 software development team a Level 3 Rating, placing the China Lake team in the top 20 percent of software organizations. The team's software inspection process has reduced the development costs of operational flight test programs by finding defects early, cutting waste and rework.

*Training Systems Division.* The Naval Air Warfare Center Training Systems Division (TSD) provides total life cycle support, including research, acquisition and disposal, for naval warfare training systems. In addition to supporting naval aviation, a large part of TSD's customer base is comprised of the Army, Air Force, Marine Corps and other Navy agencies.

Actively advancing deployable training, TSD awarded a contract to Boeing for development of a prototype transportable training system for the F/A-18 aircraft. The division is also leading an integrated process team for the acquisition of a total ship training capability for amphibious transport, destroyer, and the latest CVX class aircraft carrier ships.

The Training Systems Division has been in the forefront of supporting the Navy's transition from a shore-based training infrastructure to a more flexible and economical method of delivering training on demand. The division is involved in a number of research and development projects that use advanced technologies to automate training

*Above, Left to Right: UH-1 search and rescue helicopter, High Sierras; Howitzer tanks, NAWCWD China Lake, CA*

systems, simulate training scenarios, and provide objective and specific assessment of and feedback to trainees. All of these programs are designed to reduce costs and improve readiness by providing just-in-time training, thus reducing training time and costs.

The Automated Electronic Classroom is one of TSD's innovations. It uses a computer-based system that provides students with a multimedia learning environment and a hands-on interactive training experience. This interactive training approach improves student comprehension and offers the potential for reducing course length. The division installed 40 automated classroom systems for the Chief of Education and Training at various locations during 1998.

The Training Systems Division is also using the latest virtual reality technology in developing the virtual environment for submarine ship handling and piloting. Land-based simulator facilities currently exist; however, they do not provide harbor and channel ship-handling training for the officer of the deck. This type of training, under a variety of geographical and environmental conditions, is primarily obtained from on-the-job experience that is extremely limited due to the amount of sailing time available. To meet the Fleet's need for an alternative, the TSD has been developing and evaluating the use of a virtual reality device for harbor and channel piloting and navigation training. This technology has the potential not only to reduce ship-handling errors, thus saving lives and property, but also to enhance the performance of the entire submarine piloting and navigation team. The training device is scheduled for the field in 2000. The division is also exploring the use of virtual environment technology for application in the surface warfare community.

One of TSD's advance technology development projects is designed to improve the teaching of fundamentals in the Navy's basic electricity and electronics course, the first instructional module in the curriculum of 21 Navy Class "A" Schools. Historically, the material has proven difficult for students to learn and has resulted in high rates of both setbacks and attrition. Research efforts have demonstrated that complex content can be learned more efficiently and effectively if presented in the context of real-world situations, tasks, and jobs. Once fully developed, the redesigned basic electricity/electronics course will be computer-simulation-based with intelligent tutoring components to teach problem solving. The course is intended for use in the formal schoolhouse, shipboard training, Naval Reserve units, and computer-based practice at sea, and for self-study.

The Transportable Strike/Assault Rehearsal System (TSARS) is a research and development project at the TSD aimed at solving a training deficiency. Currently there is no simulator with deployable capability for strike/assault aviation aircrews that can integrate mission planning with a realistic, interactive environment. The TSARS project is aimed at creating a transportable physics-based simulator that can mimic weather and other conditions in an infrared and night vision goggle environment to allow aircrews to plan and rehearse missions. Mission rehearsal in a realistic and interactive environment will give our warfighters an edge over any opponent and increase mission success.

The distributed joint special operations task force initiative is designed to give the Special Operations Forces (SOF) community a joint distributed collaborative mission planning system. It involves integrating existing systems of Army, Air Force, and Navy SOF into one single deployable laptop computer to allow collaborative planning. The system uses commercial off-the-shelf software and a secure internet system. The objective is to reduce the time required to plan and coordinate time-critical SOF missions. Deployment of a suite of this equipment during a recent Special Operations Command Central Command exercise validated the concept. The system is already making its way into daily operational use.

Together, the Naval Air Warfare Center Weapons Division, the Naval Air Warfare Center Aircraft Division, and the Training Systems Division conduct the vital mission of research, development, test, and evaluation. Their unique capabilities ensure the continuous technological development of naval aviation, providing our warfighters with the tools they need to train, fight, and win.

## *Fleet Support.* Throughout 1998, the Naval Aviation Depots (NADEPs) continued to provide high quality, responsive, and cost effective services to their fleet customers. The NADEPs completed rework and repair on

219 aircraft, 594 engines, and 113,936 components. Additionally, 70 aircraft and 366 engines were overhauled by interservice activities; 66 aircraft and 163 engines were reworked commercially.

Manufacturing Resource Planning (MRP II), a reengineering tool, interconnects several business process improvement initiatives currently underway. The MRP II drives improvements in scheduling, shop floor control, inventory management, and product delivery. As the initial operating site for MRP II, NADEP Jacksonville is the first of 18 Department of Defense depots to go live with the full system using implementation templates that will serve as the framework for all the other sites.

### *Naval Aviation Depot, Cherry Point, NC.*

The NADEP Cherry Point supports a variety of Rotary Wing and Vertical/Short Take-Off and Landing aircraft and engine rework. In March 1998, the Naval Engine Airfoil Center (NEAC) at NADEP Cherry Point was reevaluated for International Organization for Standardization (ISO) 9000 compliance by the Quality Management Institute (QMI) and passed with zero nonconformances. In March 1997, NEAC became the first Department of Defense activity to receive an ISO 9002 quality system certification. Significant process improvements resulted in 86,588 parts processed with a decrease in average turn around time from 175 to 81 days.

In October 1998, the Calibration Laboratory earned ISO 9000 registration through the QMI. The Calibration Laboratory provides calibration and repair services on electronic and physical measurement test equipment. In preparation for QMI review, the Calibration Laboratory underwent a rigorous ten month effort to streamline work processes, eliminate obsolete work practices, and remove excess shop equipment.

In November 1998, NADEP's Materials Engineering Division and the Regulated Commodities Division both became ISO 9000 registered. The Materials Engineering Division provides materials and process technology services to fleet support and depot industrial teams. The Regulated Commodities Division is involved with tool control, hazardous materials control and management, special support equipment control, and the distribution of these commodities.

### *Naval Aviation Depot, North Island, CA.*

The NADEP North Island has aggressively moved to improve fleet readiness through the expeditious return of fleet aircraft to their units. By initiating self-empowered work teams in all its aircraft programs, the depot dramatically reduced aircraft turn around times. As a result, F/A-18s are down from 287 days in 1994 to 125 days in 1998; E-2s from 500 days in 1994 to 282 days

*Left to Right: Naval Aviation Depot; S-3 rework at Naval Aviation Depot*

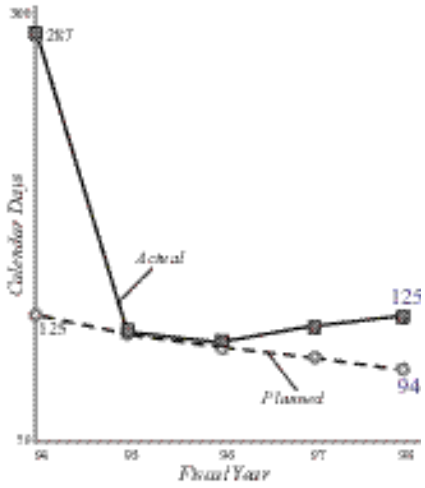
in 1998; S-3s from 423 days in 1996 to 239 days in 1998; and C-2s from 515 days in 1994 to 321 days in 1998. Component parts turn around time dropped from 53 days in 1994 to 29 days in 1998. NADEP North Island's unique aircraft center barrel repair fixture has saved taxpayers more than $430 million in costs to date.

Fleet support teams at NADEP North Island have been instrumental in the design and implementation of an Integrated Maintenance Concept (IMC) for the F/A-18, E-2C, and S-3 aircraft. Since the inception of this program, the Depot inducted ten E-2C aircraft: by December 1998, five aircraft had completed rework; two were in flight acceptance; and three aircraft were in process. IMC implementation is resulting in significant reductions in turn around time and out-of-service time. Extensive procedures for the configuration management of the super-modules used for the E-2C aircraft under IMC have been instituted, enabling the tracking and assessment of material condition and service life of the super-modules using reliability centered maintenance principles. The Depot plans to extend IMC to the C-2A aircraft rework line in FY99. The planning and development process involves a return on investment analysis; complete review and update of the rework specification; and all maintenance tasks at organizational, intermediate, and depot levels. Additionally, all Integrated Logistics Support (ILS) elements are being reviewed for both the E-2C and C-2A aircraft as part of this continuing process.

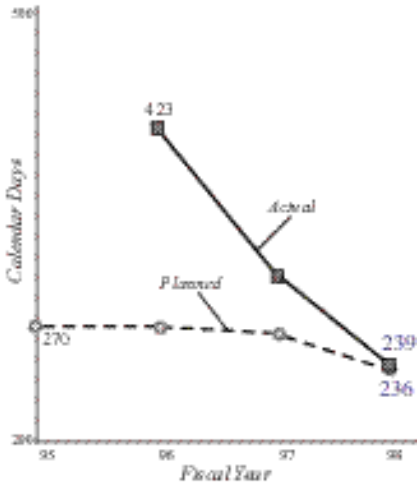
## *Naval Aviation Depot, Jacksonville, FL.*

In 1998, NADEP Jacksonville began disassembly of the first F414-GE-400 engine, which powers the F/A-18E/F *Super Hornet*. Utilizing existing tools, knowledge, and experience in the F404 engine program, the prototype is progressing smoothly. As the program matures, unique F414 engine tooling will be identified and purchased. This engine tear down prototype represents a major step in making the depot a qualified repair activity for the F414-GE-400. In addition, personnel from various TEAM competencies and the F/A-18 program developed an innovative Government/Industry Logistics Support (GILS)

*F/A-18 Standard Depot Level Maintenance Performance Turn Around Time*




*S-3 Standard Depot Level Maintenance Performance Turn Around Time*




Plan. The GILS Plan is a teaming arrangement capitalizing on the inherent strengths of both government and commercial logistics providers and significantly reducing the life cycle cost of the F414-GE-400 engine. In support of the upcoming operation evaluation program for the F/A-18E/F *Super Hornet*, plans are being made to start the component pilot rework and repair program earlier than originally anticipated.

The Naval Aviation Depots made a commitment in the early 1990s to adopt modern business practices and this commitment continues today. The necessity of reducing cycle time and cost has driven ongoing business process

reengineering efforts, incorporating new and improved business methodologies to maximize depot production with limited resources.

*Naval Air Pacific Repair Activity, Atsugi, Japan.* The Naval Air Pacific Repair Activity (NAPRA) provided depot services to forward-deployed forces, including rework of 26 aircraft at contractor facilities in Japan, Korea, Singapore, and Italy. In addition, NAPRA managed the repair of 1,980 components and completed 462 emergent in-service depot repairs on more than 20 different type/model/series aircraft located ashore and in remote locations from Guam to the east Atlantic, and on 23 forward-deployed air capable ships.

*Naval Inventory Control Point, Philadelphia, PA.* Throughout 1998, the Naval Inventory Control Point (NAVICP) remained committed to meeting the TEAM's readiness objectives and affordability challenges through effective inventory reduction and judicious acquisition programs. In 1998, NAVICP invested more than $98 million to increase weapon reliability through aviation logistic engineering change proposals. These investments funded 17 proposals supporting 11 weapon platforms. The proposals varied from the development of new systems, such as the H-46 attitude heading reference system, to modifications, such as the F/A-18 airframe mounted accessory drive.

In June, NAVICP launched a Broad Agency Announcement for organic industrial enterprise logistics support and supply chain management in partnership with NAVAIR and the NADEPs. This effort will leverage best business practices and seek nontraditional, commercial logistics solutions and adoption of notional concepts to long-standing industrial material support issues.

Premium Transportation is a NAVICP cost savings initiative designed to improve Order and Ship Time and reduce material handling costs for selected national stock numbers using rapid commercial transportation for delivery. Through a contract with Federal Express, wholesale items are centrally stored and delivered within 24 hours in the continental U.S. and 48 hours overseas. This results in expedited delivery for requisitions and overall savings for the Navy with no decrease in readiness.

Another way NAVICP is working to improve readiness is by improving management of retrograde depot level repairables. A team of NAVICP, Naval Supply Systems Command, and Fleet Maintenance Support Office subject matter experts is developing improved practices that include identifying areas in which the Fleet would benefit from expedited transportation, streamlined depot receipt, and repair induction of retrograde material. Expected benefits include significant improvement in overall retrograde/repair turn around time and improved material availability to the Fleet.

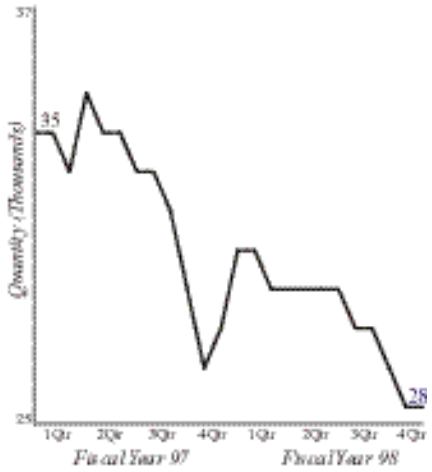
*Top to Bottom: E-2C rework at Naval Aviation Depot; Naval Aviation Depot*

The NAVICP's success is evident in the increased average availability of parts and supplies and the drop in outstanding requisition back orders for repairables. During FY98, the average availability of parts rose two points higher than FY97 levels, the highest yearly material availability rate of the decade. Outstanding back orders reached the lowest point in three years. Back orders dropped six percent from FY97 and 25 percent over the last three years.

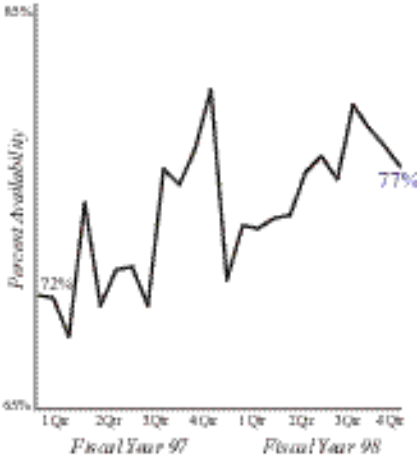
Another measure of success is the responsiveness of the retail and wholesale inventory. In 1998, eighty-nine percent of all plane-side material requirements were filled with assets available in the allowance inventory or by expeditious repair at the local Aviation Intermediate Maintenance Department (AIMD). For those requirements not available, 82 percent were filled with material available in the wholesale supply system. The Integrated Logistic Support (ILS) readiness system fills 98 percent of material requirements without a material backorder.

The Response-To-Failure (RTF) metric is changing the focus from traditional measures monitored by individual logistics elements to a metric that captures the whole process. Inventory managers use metrics such as material availability, back order count, and age and logistics response times. Maintenance managers review production, backlog, and repair turn around time as measures of effectiveness. While each metric provides managers with an effective tool to gauge the effectiveness of their activity, none provides a measure of the coordinated support that all integrated logistics elements provide the warfighter. RTF is the first attempt to link individual ILS element metrics to the overall quality of logistics support provided to the warfigher. The RTF metric represents the time that maintenance personnel wait for material, capturing material receipts from three sources: local supply activity, repair in the AIMD, and wholesale supply activities.

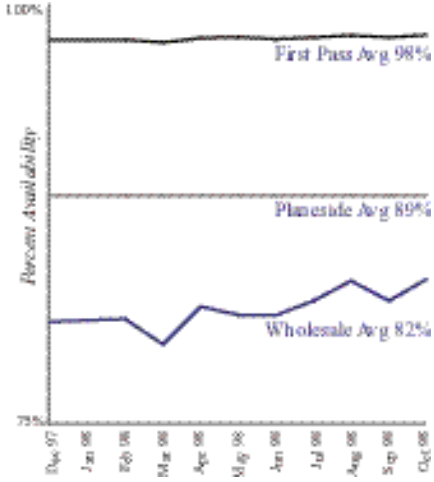
*Aviation Back Orders*



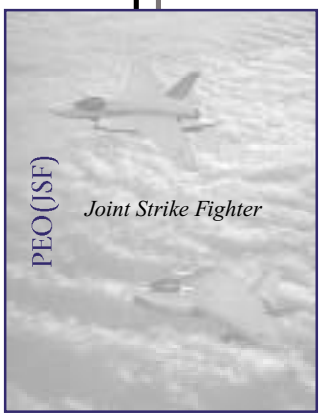

*Aviation Supply Material Availability*




*Customer's Perspective First Pass Effectiveness*
*Responsiveness of the Retail and Wholesale Inventory*



**ASN (RD&A)**
**ASSISTANT SECRETARY OF THE NAVY**
*(Research, Development & Acquisition)*




**TACTICAL AIRCRAFT AND RELATED SYSTEMS**

PEO(T)

| | |
|---|---|
| PMA201 | *Conventional Strike Weapons* |
| | *Joint Air-to-Surface Standoff Weapon* |
| | *Joint Direct Attack Munition* |
| | *Joint Standoff Weapon* |
| | *Cartridge Activated Devices/Propulsion Activated Devices* |
| | *In-Service Weapons Team* |
| PMA231 | *C-2A Greyhound* |
| | *E-2C Hawkeye* |
| PMA233 | *Mission Planning Systems* |
| | *Joint Mission Planning Systems* |
| | *Tactical Automated Mission Planning System* |
| PMA234 | *EA-6B Prowler* |
| PMA241 | *F-14 Tomcat* |
| PMA242 | *Defense Suppression Systems* |
| | *Advanced Anti-Radiation Ground Missile* |
| | *High-Speed Anti-Radiation Missile* |
| | *Joint Advanced Weapons Systems* |
| PMA259 | *Air-to-Air Missile Systems* |
| | *AIM-9X Sidewinder* |
| PMA265 | *F/A-18 Hornet* |
| PMA268 | *Advanced Medium Range Air-to-Air Missiles* |
| | *AIM-120C Advanced Medium Range Air-to-Air Missiles* |
| PMA272 | *Advanced Tactical Aircraft Protection* |
| | *ALE-50 Counter Measure Decoy Dispenser System* |
| | *ALR(V)2 Advanced Special Receiver* |
| | *ALR(V)3 Advanced Special Receiver* |
| | *AAR-47 Missile Warning System* |
| | *Integrated Defense Electronic Countermeasures* |

## *Acquisition Programs.*

The TEAM's Program Executive Officers (PEOs) are responsible for all aspects of life cycle management for their assigned programs, providing direct oversight of cost, schedule, and performance. The PEOs report directly to the Chief of Naval Operations (CNO) for matters pertaining to in-service support and to the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN (RD&A)) on acquisition matters. The Joint Strike Fighter Program is a joint program with no lead service, staffed by Air Force, Navy, and Marine Corps personnel. The Program Director position alternates between the Departments of Navy and Air Force, and reports to the Service Acquisition Executive (SAE) of the other Service. The Program Director is currently an Air Force Major General. The Deputy Program Director is a Marine Corps Brigadier General.

The Commander, Naval Air Systems Command (NAVAIR) has three primary roles: managing programs other than those assigned to the PEOs; providing for in-service support; and providing functional support, e.g., logistics, engineering, contracting, test and evaluation, to assist the PEOs in program execution. The commander reports to ASN (RD&A) for all research, development and acquisition issues and to the CNO on the support of operational forces.

Each program manager has the authority, accountability and resources necessary to manage all aspects of their program from concept to disposal. Multi-disciplined Integrated Program Teams (IPTs) support TEAM program managers in accordance with program cost, schedule, and performance guidelines. The IPT structure provides a responsive, single line of accountability and authority to the customer.

## CNO
## CHIEF OF NAVAL OPERATIONS

### PEO(A)
### AIR ANTI-SUBMARINE WARFARE, ASSAULT, AND SPECIAL MISSIONS

| | |
|---|---|
| PMA257 | *A/V Weapons Systems* |
| | *AV-8B Harrier* |
| PMA261 | *H-53 Helicopters* |
| | *CH/MH-53E Super Stallion* |
| | *Executive Transport Helicopters* |
| PMA264 | *Air ASW Systems* |
| | *Sonobuoys and Sensor Systems* |
| PMA271 | *Airborne Strategic Comms* |
| | *E-6B Mercury* |
| PMA273 | *Undergraduate Jet Flight Training* |
| | *JPATS* |
| | *T-45 Goshawk Training System* |
| PMA275 | *V-22 Osprey* |
| PMA276 | *AH-1W Super Cobra* |
| | *UH-1N Huey* |
| | *USMC H-1 Upgrades (AH-1Z, UH-1Y)* |
| PMA290 | *Maritime Patrol Aircraft* |
| | *EP-3E Aries II* |
| | *ES-3A Shadow* |
| | *P-3C Orion* |
| | *S-3B Viking* |
| PMA299 | *CH-60* |
| | *HH-60H* |
| | *SH-60B Seahawk* |
| | *SH-60R* |

### NAVAIR PROGRAMS
### COMMANDER, NAVAIRSYSCOM

| | |
|---|---|
| PMA187 | *Global Positioning System* |
| PMA202 | *Aircrew Systems* |
| PMA205 | *Aviation Training Systems* |
| PMA207 | *Support/Commercial Derivatives* |
| PMA209 | *Air Combat Electronics* |
| PMA213 | *Air Traffic Control/Landing* |
| PMA221 | *Program Mgmt Air, North Island, CA* |
| PMA222 | *Program Mgmt Air, Jacksonville, FL* |
| PMA225 | *Program Mgmt Air, Pensacola, FL* |
| | *H-3 Sea King* |
| | *T-2 Buckeye* |
| PMA226 | *Program Mgmt Air, Cherry Point, NC* |
| | *H-46 Sea Knight* |
| PMA248 | *Tactical Training Ranges* |
| PMA251 | *Launch & Recovery Equipment* |
| PMA260 | *Aviation Support Equipment* |

### PEO(CU)
### CRUISE MISSILES AND UAVs

| | |
|---|---|
| PMA208 | *Aerial Targets and Decoys* |
| PMA258 | *Standoff Missile Systems* |
| | *Standoff Land Attack Missile-Expanded Response* |
| PMA263 | *Navy Unmanned Aerial Vehicles* |
| | *Pioneer* |
| | *Tactical Control Systems* |
| | *Vertical Take-Off and Landing* |
| PMA280 | *Tomahawk All-Up-Round* |
| | *Tactical Tomahawk* |
| PMA281 | *Cruise Missiles Command & Control* |
| PMA282 | *Cruise Missile Weapons System* |
| | *Advanced Tomahawk Weapons Control Systems* |
| PM-TS | *Tactical Systems* |

Fleet Support
Program Management
Coordination on Requirements and Resources

*Left to Right: Artist's conception of the Lockheed Martin Joint Strike Fighter, artist's conception of the Boeing Joint Strike Fighter; E-2C Hawkeye; P-3 Orion; CH-46 Sea King; Tomahawk cruise missile*

FLY 2
28

# Recapitalization

*Left: MV-22 Osprey*

# RECAPITALIZATION

*F/A-18 Hornet.* In 1998, the F/A-18 program continued to pursue innovative naval aviation acquisition efforts. The *Super Hornet*, a multi-mission strike fighter for the 21st century, completed a thorough and successful operational test phase (OT-IIB). Other F/A-18E/F program milestones included the first night flight and first live ordnance drop at Naval Air Warfare Center Weapons Division (NAWCWD), China Lake, CA. After three years of testing at the Naval Air Warfare Center, Aircraft Division (NAWCAD), Patuxent River, MD, more than 90 percent of engineering and manufacturing development was successfully completed. Full-scale Fatigue Test Airframe (FT-50) completed its first lifetime testing, 6,000 spectrum fatigue hours in August. The year closed with delivery of the first F/A-18E/F *Super Hornet* production aircraft. The F/A-18E/F *Super Hornet* program continues on schedule, on cost, and more than 350 pounds below its weight specification. The Navy plans to procure a minimum of 548 *Super Hornets*. Twenty aircraft are fully funded for FY98, thirty in FY99. Delivery at a maximum rate of 48 per year is expected by FY02. The F/A-18E/F *Super Hornet* is expected to attain initial operational capability in FY01.

The F/A-18 Foreign Military Sales (FMS) Integrated Program Team (IPT) sponsored the buy back and conversion of Thailand's eight F/A-18s, saving the Navy approximately $340 million. The *Hornets* were procured by the Marine Corps, extending the F/A-18C/D production line to FY00.

The F/A-18 Production and Systems Development (P&SD) IPT accomplished much during the year. The Advanced Targeting Forward-Looking Infrared Radar (ATFLIR) IPT received the Navy Acquisition Reform Certificate of Excellence for saving $50 million in the near term and a total cost avoidance of more than $130 million. The P&SD team developed a post production support management plan, a contractual vehicle, and a contingency plan for shutting down the F/A-18C/D production line. Other IPT accomplishments include completing engineering and manufacturing development of the radar upgrade Phase II program, more than $8.8 million under budget; and the tactical reconnaissance engineering manufacturing development element three contract, $800 thousand under budget. Plans were finalized to stand-up the Integrated Maintenance Concept (IMC) process in 1999. This program is one of the key factors in maintaining the *Hornet* past the year 2018.

*Joint Strike Fighter.* The Joint Strike Fighter (JSF) Program will develop and field an affordable, highly common family of next-generation strike aircraft for the United States Navy, Marine Corps, Air Force, and allies. The carrier suitable variant of the JSF will provide the Navy a multi-role, stealthy strike fighter to complement the F/A-18E/F. The Short Take-Off and Vertical Landing (STOVL) variant will be a multi-role strike fighter to replace the AV-8B and F/A-18A/C/D for the Marine Corps, and replace the *Sea Harrier* for the United Kingdom Royal Navy. The Air Force variant will be a multi-role fighter, primary-air-to-ground, to replace the F-16 and A-10 and complement the F-22.

The cornerstone of the JSF Program is affordability — reducing the development cost, production cost, and cost of ownership of the JSF family of aircraft. The program was structured from the beginning to be a model of acquisition reform, with an emphasis on jointness, technology maturation and concept demonstrations, and early cost and performance trades integral to the weapon system requirements definition process.

*Above: F/A-18*

In FY1998, JSF continued its $2.2 billion competitive Concept Demonstration effort. The program's competing prime contractors successfully completed key reviews, began fabrication and assembly of the Concept Demonstrator Aircraft, and commenced engine testing preparatory to flight testing in 2000. The program, in conjunction with Service warfighters, completed the third iteration of cost and performance trades in support of the continuing requirements definition process. Critical technology demonstrations to lower risk and life cycle cost also continued. Canada joined the program and Italy initiated action to join.

The JSF Program placed great emphasis on acquisition reform from its inception. JSF's "common family" of aircraft variants approach is estimated to save nearly $18 billion ($FY95) in development. The Services are evolving aircraft capability requirements incrementally, based on cost and operational performance trades in conjunction with extensive modeling and simulation. Warfighters and industry participate in this unique approach to establishing system requirements with an emphasis on affordability.

Technology maturation demonstrations focus on reducing total ownership cost and lowering the risk of leading edge technologies across the technical spectrum, i.e., in the areas of airframe, flight systems, manufacturing and producibility, propulsion, supportability, and mission systems. Examples of specific technology maturation initiatives include the following: developing a system-of-systems strategy to maximize effectiveness and integration with other combat information systems; open systems architecture; promoting innovative design and manufacturing approaches; improved tooling concepts and other process improvements; paintless aircraft; and improved diagnostics and failure predictions to reduce the need for scheduled inspections and premature replacement of parts.

Streamlining in acquisition processes is also central to the program. The program is making great strides toward a paperless office environment including the following: electronic contracting (solicitations, source selection, and award); contractor performance monitoring via direct government on-line access to real-time contractor data; and data deliverables and presentations submitted electronically. The Engineering and Manufacturing Development contract will include performance-based specifications instead of the traditional MILSPECS. The bottom line is that government will tell the contractor what performance is expected, not how to achieve it.

*V-22 Osprey.* The V-22 *Osprey* was designed as an assault transport with the inherent capability to meet a wide range of mission requirements. The *Osprey* will replace the Marine Corps CH-46E and CH53D, and give the Marines improved amphibious/vertical assault capability. In addition, the *Osprey* will replace the MH-53J helicopter flown by Air Force special operations forces. The V-22, with its ability to self-deploy worldwide; perform in any adverse weather, day or night; and operate in a high-threat environment; is a high reliability, low maintenance aircraft with a small logistics foot print, making it an ideal vehicle for the insertion and extraction of Marine and special operations forces. When compared with the Marine Corps H-46, the V-22 is twice as fast and can carry much greater payloads across greater range. A versatile dual-use aircraft that can convert from helicopter

to airplane mode, the V-22's tiltrotor technology has enormous potential, making the *Osprey* a prime candidate for foreign military sales and civil applications. State-of-the-art design and manufacturing tools, such as computer-aided three dimensional interactive software, integrated wiring system, and advanced production technology, have resulted in reduced aircraft weight and cost.

During 1998, four MV-22 engineering and manufacturing development aircraft were in flight test at NAS Patuxent River, MD; Marine Corps Air Station New River, NC; Eglin AFB, FL; and Fort Huachuca, AZ. Mission related test activities included: formation flying, austere and mountain area landings, carrying external loads up to 10,000 lbs., simulated carrier landing, aerial refueling (dry plugs), expendable deployment, fast roping, Special Patrol Insertion and Extraction (SPIE) rig work, and soft duck (boat and swimmers off ramp into water). A dedicated operational test period was conducted September-October 1998. Engineers completed a Critical Design Review for the CV-22 variant in December; and advance acquisition funding for MV-22 low rate initial production lot three was initiated.

The V-22 program has also implemented several acquisition reform initiatives to reduce total ownership costs, including using commercial off-the-shelf technology and contractor support contracts. The commercial engine procurement and support contract awarded to the Allison Engine Company has a potential savings of more than $500 million in life cycle support costs. Additional cost saving initiatives and manufacturing process improvements targeted for Bell-Boeing, the airframe contractor, could show additional $500 million life cycle cost reductions, if implemented. Multi-year procurement is another planned initiative that will reduce costs by almost $300 million.

*Joint Standoff Weapon.* The Joint Standoff Weapon (JSOW) is a joint Navy and Air Force program designed to increase standoff distance of the launching aircraft, reducing the possibility of risk from enemy forces. The JSOW consolidates weapon types by incorporating multiple type warheads into one weapon family.

Delivery of the baseline Air-to-Ground Missile-154A (AGM-154A) was formally commemorated in July 1998. The JSOW BLU-108 variant AGM-154B successfully completed development testing, exceeding required lethality by 100 percent. Following these successes, JSOW baseline, AGM-154A, received Milestone III (full rate production) approval and low rate initial production for the BLU-109 JSOW variant, AGM-154B.

The JSOW unitary variant AGM-154C applied Cost as an Independent Variable (CAIV) to achieve a revised configuration, capable against 95 percent of the required target set at 60 percent of the pre-CAIV unit cost.

*Joint Direct Attack Munitions.* The Joint Direct Attack Munition (JDAM), a joint Navy and Air Force program, provides low cost inertial navigation/global position systems guidance kits for 1,000 and 2,000-pound conventional bombs. The kits enhance accuracy on a variety of aircraft. During 1998, the program successfully completed operational test readiness review and entered operational evaluation on the F/A-18 and B-52. First production delivery occurred in June 1998.

*Left to Right: Artist's conception of Boeing Joint Strike Fighter; artist's conception of Lockheed Martin Joint Strike Fighter; F/A-18 with JDAM*

## *Joint Air-to-Surface Standoff Missile.*

The Joint Air-To-Air Surface Standoff Missile (JASSM) provides a standoff missile for high value fixed and re-locatable targets. The program definition risk reduction phase was completed in October 1998. The JASSM program successfully completed carrier operability with a flight test matrix of 15 arrested landings and six catapult launches on the F/A-18C at Patuxent River, MD. The JASSM recently completed Milestone II and began a 40-month engineering and manufacturing development program in November 1998.

## *Joint Primary Aircraft Training System.*

The Joint Primary Aircraft Training System (JPATS) consists of the T-6A *Texan II* aircraft, simulators, and computer aided academics. This joint Navy/Air Force program, with the Air Force acting as the executive service, is developing a common training system to replace the Navy T-34C and the Air Force T-37B systems. The program uses commercial off-the-shelf subsystems to the maximum extent possible. The *Texan* is a derivative of the Swiss *Pilatus* aircraft with a PT-6 engine and ejection seat.

During 1998, the contractor delivered six aircraft under engineering and manufacturing development agreement, and the aircraft entered developmental flight-testing. Joint Navy and Air Force operational test and evaluation of the T-6A will begin in FY99. To reduce total ownership cost, the aircraft and its ground-based training system will be completely supported and maintained by commercial vendors. In addition, the use of commercial avionics will further reduce costs. The manufacturer will provide depot level maintenance with intermediate maintenance provided for selected systems at the operating site. This will result in the minimum total ownership cost for the system. When fully fielded, the JPATS will be operational at 12 pilot training bases. The Air Force expects to have Initial Operational Capability (IOC) in 2001, and the Navy in 2003.

## *AIM-9X Sidewinder.*

The AIM-9X *Sidewinder* weapon system is a joint Navy/Air Force development program that will provide the warfighter with the premier "dogfight" air-to-air missile for the 21st century. The AIM-9X weapon system is designed to replace the AIM-9M and will be fielded on the Navy's F/A-18C/D *Hornet* and F/A-18E/F *Super Hornet*, and on the Air Force's F-15C/D *Eagle*, F-16C/D *Fighting Falcon*, and F-22 *Raptor*. Capabilities include full day-night capability, resistance to countermeasures, off-boresight acquisition, maneuverability, and target acquisition superior to any AIM-9 predecessor. When combined with the Joint Helmet Mounted Cueing System, the AIM-9X will prove to be a highly integrated, formidable weapon.

Raytheon Missile Systems and the government are partners in an industry-led integrated process and product development team responsible for developing an effective and affordable weapon system. In 1998, the AIM-9X Sidewinder team completed the second of a five-year engineering and manufacturing development program designed to achieve an Initial Operational Capability in 2002. Significant milestones have been accomplished during design, simulation, laboratory, ground, and flight-testing. The Sidewinder team completed critical design review in early spring and guidance section captive carry evaluations during the summer. The first separation control test vehicle captive flights were accomplished in preparation for the first launches scheduled for 1999.

The AIM-9X is a Cost as an Independent Variable (CAIV) flagship program. The program team has continued to be successful in reducing the cost of the first production missile through an aggressive program using CAIV principles.

*Above: Aviation ordnancemen load an AIM-9 Sidewinder air-to-air missile onto one of their squadron's F-14B Tomcat aircraft*

*Top to Bottom: AIM-9R Sidewinder; MV-22 Osprey; Sidewinder*

# Modernization

*Left: T-45 Goshawk*

# TACTICAL AIRCRAFT AND RELATED SYSTEMS

*F-14 Tomcat.* The F-14 *Tomcat* is the Navy's long-range strike fighter aircraft. Modernization programs and technical and performance improvements ensure the *Tomcat* remains a viable threat to the enemy. The *Tomcat's* critical role in maintaining air superiority and its ability to launch extensive precision guided ordnance at long range make it vital to the Fleet.

*Tomcat* improvements include digital avionics, a major computer upgrade, and structural and survivability enhancements. A major reliability enhancement to the aircraft is the Virtual Device Interface group/heads up display replacement. This improvement increases maintenance flying hours between failure from 16.7 to 750.0 hours and is scheduled for installation in 1999. Eleven upgraded aircraft entered service in 1998, bringing the total to 39. Currently, there are five F-14 squadrons deploying F-14 upgrade aircraft.

The *Tomcat* is equipped with the Low Altitude Navigation and Targeting Infrared and Night (LANTIRN) targeting system. LANTIRN provides accurate autonomous designation and targeting capability for the delivery of laser guided bombs. Tomcat Tactical Targeting (T3) provides the ability to generate global positioning system quality coordinates and transmission of LANTIRN targeting system imagery. The T3 software upgrade is scheduled for release in April 1999. Fourteen LANTIRN systems were delivered in 1998, bringing the Fleet total to 35. Twelve squadrons are currently deployed with LANTIRN capable aircraft.

The *Tomcat* is the Navy's only manned tactical reconnaissance capability until the introduction of the next generation of reconnaissance aircraft. The Tactical Aerial Reconnaissance POD System (TARPS) Digital Imaging (DI) system provides near real-time imagery for detection and identification of tactical targets, as well as immediate threat and bomb damage assessment. In 1998, TARPS DI was deployed with all battle groups.

A further enhancement to the *Tomcat's* warfighting capability is the introduction of Fast Tactical Imaging (FTI). The FTI can transmit, receive, and record LANTIRN generated imagery, assisting battle group strike planning and execution. System testing was completed in 1998, and the first FTI capable F-14Bs/Ds are scheduled for delivery in December 1998. Two FTI-equipped squadrons are scheduled to deploy in March 1999.

The incorporation of a digital flight control system is a major safety enhancement to the F-14. This system replaces the analog flight control system, and prevents departures from controlled flight and spins. Engineers completed developmental testing in 1998; operational testing will continue into 1999. Fleet installations began in 1998 in four *Tomcat* squadrons that will deploy during 1999. In 1998, 97 aircraft were modified at non-depot sites. The modifications were consolidated under the integrated modification program and included the digital flight control system, ALR-67, BOL CHAFF, GPS, LANTIRN, and structural modifications. The consolidation produced cost savings and reduced maintenance down time.

*EA-6B Prowler.* The Navy's electronic warfare aircraft, the EA-6B *Prowler* exemplifies modernization of existing systems. This year the EA-6B assumed full responsibility for Department of Defense radar jamming missions. *Prowlers* now forward deploy to three land-based sites and all carrier battle groups. The final new squadron deployed; and a Navy intermediate maintenance van complex was established at Prince Sultan Air Base, Saudi Arabia.

The EA-6B *Prowler* leadership team refined their vision for the *Prowler* program and identified the team's role in global *Prowler* presence – increasing available aircraft inventory, improving reliability and capability of aircraft systems, and improving jamming equipment.

*Above: F-14 Tomcat*

The Fleet saw significant progress toward increasing flyable aircraft inventory. Consolidating replacement of center wing sections, block upgrade, and scheduled depot level maintenance lines have reduced aircraft out-of-service time. In December 1998, the first aircraft to benefit from this consolidation were delivered. In 1998, 25 EA-6Bs were inducted into the depot and five more wings were procured. Team efforts brought 12 EA-6Bs out of storage, allowing fleet inventory to rise to required levels in 1999.

The team completed technical evaluation of the ARC-210 radios, embedded INS/GPS, improved AYK-14 mission computer, and upgraded flight instrument displays. The team delivered four of these Block 89A configuration aircraft to the Fleet. Another nine Block 89A kits were placed on contract with Northrop Grumman.

The Improved Capability (ICAP III) Program, integrating a new receiver group, color displays and overhead connectivity, entered the engineering and manufacturing development phase in March 1998. A consortium headed by Northrop Grumman won the competitive contract and is working toward initial operational capability in January 2004.

## *E-2C Hawkeye.*

As the "eyes of the fleet," the *Hawkeye* airborne early warning system aircraft guards the battle group against high-speed aircraft and guided missile attack by vectoring fighter aircraft to the enemy.

In FY98, the Navy received three new production E-2C aircraft and the French Navy received two. Congress funded a five-year procurement plan for 21 aircraft, resulting in savings of approximately 14 percent or $204 million. The *Hawkeye* 2000 will be equipped with commercial off-the-shelf based mission computer and displays; an improved, environmentally friendly vapor cycle; satellite communications; and cooperative engagement capability. This new suite of equipment increases the Navy's airborne early warning capability in the near-land, overland, communication, and display environments.

The *Hawkeye* 2000 prototype aircraft, delivered in FY98, successfully participated in cooperative engagement capability test events at Patuxent River, MD, and with surface units in the waters off Puerto Rico. The tests demonstrated a dramatic increase in target information available from the cooperative engagement capability airborne element to surface and shore based units.

Program managers kicked off the radar modernization program, an advanced technology demonstration that initiates the application of new radar technologies common to both land and sea based airborne early warning aircraft. The goal of this modernization program is to provide a definitive littoral theater air missile defense capability. The test bed for radar modernization is a C-130 transferred from the Air Force and configured with the E-2C APS-145 radar suite.

## *C-2A Greyhound.*

The *Greyhound* continues to provide carrier-on-board delivery of critical personnel and parts for the Navy's deployed aircraft battle groups. Current plans require the C-2A to perform its mission supporting battle group operational readiness through 2015. Sustaining worldwide *Greyhound* operations and readiness is possible through a combination of fleet fatigue life management and an ongoing managed service life extension program that includes weapon system modifications. As part of the aircraft's service life management, the *Greyhound* completed 23,000 equivalent flight hours of full scale fatigue testing and 2,858 equivalent flight hours of outer wing panel thermal testing. These fatigue tests will allow the *Greyhound* to remain in service well beyond 2015.

Program managers oversaw installation of crash survivable flight incident recorders and global positioning systems into the C-2A fleet, as mandated by the Department of Defense. Verification testing of the structural data recorder set was completed. Also during the year, development of the C-2A operational flight trainer began.

## *Naval Mission Planning System.*

The Naval Mission Planning Systems (NavMPS) program evolved its current suite of mission planning products to a system-of-applications. The Fleet can now perform unit level flight/fuel planning on the Navy Portable Flight Planning System, weapon planning and data loading on TAMPS, and Strike Force level planning on the beta version of the Tactical Strike Coordination Manager. The system-of-applications concept is being introduced to the Fleet with the TAMPS 6.2K product.

TAMPS 6.2 is completing operational testing. A favorable interim test report has supported fleet introduction of TAMPS 6.2K – the Y2K compliant version of TAMPS 6.2. This software release provides: (1) Mission Planning Local Area Networking between the Carrier Intelligence Center and squadron ready rooms; (2) intelligence connectivity with Modernized Integrated Database 2.0 through Global Command Control System-Maritime; (3) imagery from Joint Service Image Processing System-Navy; and (4) faster, more reliable hardware for F/A-18 squadrons and associated precision guided munitions.

TAMPS 6.1.1F, the first Foreign Military Sales (FMS) version of TAMPS, was successfully developed and delivered to France in support of the E-2C procurement.

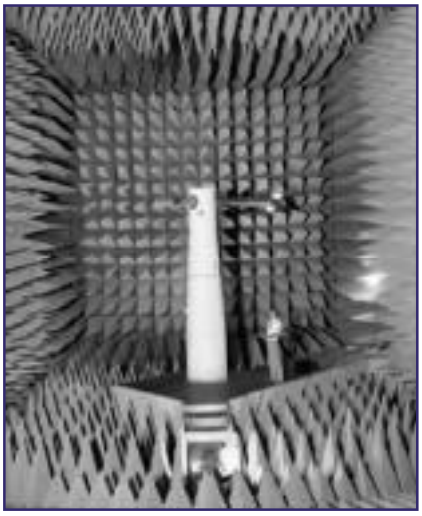
The Navy Portable Flight Planning System released versions 3.0 and 3.01 to 262 Navy and Marine Corps squadrons. Three Naval Aviation Training and Operating Procedures Standardization certified flight performance modules have been released for the F/A-18 400 and 402 engines, as well as the C-2 aircraft.

The Joint Mission Planning System (JMPS), a co-development effort between the Navy and Air Force, awarded a Phase I study to two contractors. The JMPS Requirements Process and the Joint Requirements Board (JRB) have been established, facilitating collaborative identification of common and Service-unique requirements. The JRB provides funding and budget coordination among the Services. A milestone decision is expected this summer to proceed with the development of the JMPS framework and common components to provide Navy-portable flight planning system-like functionality in a Windows NT-based, scalable, extensible, Defense Information Infrastructure Common Operating Environment/Joint Technical compliant environment.

The F/A-18 A/B/C/D Automated Tactical Manual Supplement (ATACS) version 1.2 was delivered to Fleet commands. ATACS version 2.0 completed development test. This version will satisfy the Fleet request for Windows compatibility and incorporation of the Joint Standoff Weapon.

The Navy Stores Planning and Weaponeering product began development and will provide a certified weaponeering tactical decision aid for unit level mission planning. This product is being designed using object-oriented programming and is destined for incorporation into the JMPS architecture.

*Left to Right: C-2 Greyhound; EA-6B Prowler; E-2C Hawkeye 2000*



*AIM-120 AMRAAM.* The AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM) achieved fleet Initial Operational Capability in 1993, providing F/A-18 pilots with increased lethality and survivability. Since then, the Air-to-Air Joint Systems Program Office (JSPO) and prime contractor Raytheon Missile Systems Company have continually improved the AMRAAM, delivering more than 6,000 missiles to the Air Force and Navy. In FY98, Raytheon delivered 115 AIM-120C tactical missiles to the Navy, incorporating the latest active radar guidance updates and electronic protection measures developed in the Pre-Planned Product Improvement (P3I) Phase II program. Several hundred AIM-120B missiles received a similar software upgrade via reprogramming in the field. The P3I Phase II program continued this year with the successful test firings of the AIM-120C-4/5 variants that will introduce the improved lethality warhead and +5" rocket motor upgrades to the Fleet in FY99/00.

The AMRAAM program is a leader in Department of Defense acquisition reform. The Air-to-Air JSPO negotiated a new FY98 sole-source contract with Raytheon incorporating performance specifications, contractor configuration control, total system performance responsibility, lifecycle depot maintenance, contractor performance of many previously government support/test functions, and a long term pricing agreement. In the Navy alone, these and other infrastructure reforms generated approximately $93 million projected in FY00-05 program savings.

Performance of the AIM-120 in the Fleet continues to exceed performance, reliability, and availability thresholds by significant margins. Affordable readiness initiatives approved this year will continue to improve AMRAAM's operational effectiveness and suitability. These include installation of power outlets for tactical software reprogramming aboard aircraft carriers, random inventory surveillance versus scheduled maintenance, and a direct ship to contractor depot repair plan.

The AMRAAM program continues to provide fleet warfighters with the most lethal and easy to maintain air-to-air weapon ever built. With strong planning and budget support in place, the AMRAAM will continually evolve, countering emerging threats for many years to come.

*AGM-88 HARM.* The High-speed Anti-Radiation Missile (HARM) Block IIIA/V software upgrades provide greater effectiveness and home-on-jam capability. Combined developmental/operational testing was conducted during 1998, and the developmental testing was successfully completed. This included a total of three Block IIIA firings and five Block V firings from F-16s, F/A-18s and EA-6Bs. Software upgrades to both United States and Foreign Military Sales HARM missiles will bring welcome enhancements to the HARM weapon. Upgrades include the ability to counter high-powered jammers in Block V. Both Block IIIA and V improve anti-fratricide capability to minimize collateral damage, provide greater aircraft protection against improved radar threats, and minimize mechanical wear in the Guidance Section.

*Top to Bottom: AIM-120 AMRAAM; HARM missile in the anechoic chamber*

In 1998, the Navy and Air Force implemented a joint service stockpile reliability program, the result of which will be significant cost avoidance. The goal of this initiative is to develop a common reliability baseline to support the Navy and Air Force missile inventory populations by sharing logistical data efficiently between Services. Eliminating expensive and unnecessary maintenance, the program will be able to confidently predict what the yearly and out-year inventory reliability will be, including the rate of degradation. Cost savings of approximately $10 million are projected.

The International High-Speed Anti-Radiation Missile (HARM) Upgrade Program team (IHUPT) is a tri-national cooperative project to develop an upgrade kit for retrofit into existing missiles in the inventory of the German Air Force and Navy, the United States Navy, and the Italian Air Force. The Federal Ministry of Defense of the Federal Republic of Germany, the Ministry of Defense of the Republic of Italy, and the Department of Defense signed the HARM International upgrade Memorandum of Understanding on 7 March 1998. The upgrade will bring improved capability to engage evolving and advanced threats. It will also greatly reduce the risk of fratricide and allow the missile to be employed with restrictive rules of engagement, as well as add high-speed, point-to-point precision munitions capability.

*Top to Bottom: Ordnancemen load HARMs onto an F/A-18C Hornet; AIM-120 AMRAAM; ordnance crews attaching HARMs to a Hornet*

## *Advanced Anti-Radiation Ground Missile.*

The Advanced Anti-Radiation Guided Missile (AARGM) technology program is demonstrating a guidance system capable of engaging enemy air defenses even if these systems shut down radar frequency emissions or employ other countermeasures. During the summer of 1998, the Defense Suppression Systems Program Office and industry initiated the Navy's largest Cooperative Research Development Agreement (CRADA) for the AARGM program at NAWCWD, China Lake, with Science and Applied Technology, Inc. (SAT) for approximately $10.3 million. The Weapons Division is SAT's largest subcontractor responsible for field testing and integration of the AARGM demonstration seeker. The technical objective of the CRADA is to model and test a multimode seeker (anti-radiation homing/millimeter wave) on a HARM testbed.

The first RFCM system was integrated at the Weapons Division, Pt. Mugu, CA, marking the start of government developmental DT-IIB testing. In April, the Naval Research Lab successfully demonstrated deploy/retrieve operation of two fiber optics towed decoy pods mounted under each wing of a contractor operated lear jet. This capability was demonstrated with both the ALE-50 and ALE-55 mass model assemblies.

The Common Missile Warning System, a program led by the Army, provides missile warning capability for F/A-18E/F and AV-8B aircraft. The program is still in engineering and manufacturing development. The F/A-18E/F program is currently undertaking a sensor repackage study to optimize sensor and algorithms for tactical air roles.

The Advanced Strategic and Tactical Infrared Expendable (ASTE), a joint program led by the Air Force, is developing three advanced expendables for tactical and strategic aircraft use against modern and projected surface-to-air missile and air-to-air threats. The three flares include a kinetic decoy rocket (MJU-47/B), a two-part expendable decoy (MJU-48/B), and a covert decoy (MJU-51/B). The program is currently conducting qualification testing on the MJU-47/B and MJU-48/B. The MJU-51/B has already passed qualification tests. All three flares are expected to enter developmental test and evaluation in March 1999.

## *Joint Advanced Weapons Systems.*

The Advanced Prototype Experimentation (APEX) lab at Redstone Arsenal, AL, in partnership with the Defense Suppression Systems Program Office, demonstrated the latest Joint Advanced Weapons System (JAWS) technologies for use in close air support and urban missions. The APEX lab provides modeling and simulation support for all Services. Future goals of the APEX lab are to incorporate dual mode *Hellfire* seeker technology and fixed wing capability for the *Hellfire* missile into its high fidelity battlefield environment weapon system simulator.

## *Integrated Defense Electronic Countermeasures.*

Hardware component deliveries of Radio Frequency Countermeasures (RFCM) for testing commenced with instrumented mass model decoys and the RFCM technique generator system.

## *ALE-50 Advanced Airborne Expendable Decoy.*

The ALE-50 is part of a joint program led by the Navy. The system consists of a Multi-platform Launch Controller (MPLC) and Advanced Airborne Expendable Decoy (ALE-50 AAED). In paving the way for Integrated Defensive Electronic Counter Measures (IDECM) decoy development, the ALE-50 team is working with the manufacturer, Raytheon, to modify and improve the controller for use with fiber optic towed decoys and IDECM hardware/software. To date, two engineering and manufacturing development units have been delivered to Sanders-Lockheed Martin for integration into the IDECM radio frequency countermeasures system. The ALE-50 program has been successful in its integration tests with enhanced towlines, which are less susceptible to F/A-18E/F abrasion and engine plume heat stresses.

*Top to Bottom: F-14 TACAIR Pod; Tactical Air Reconnaissance Pod System (TARPS)*

## *ALR-67(V)3 Advanced Special Receiver.*

The ALR-67(V)3 successfully passed an operational assessment in January and began operational evaluation in June 1998; testing will conclude by January 1999. In May 1998, the Assistant Secretary of the Navy for Research, Development, and Acquisition approved the low-rate initial production contract, which provides for delivery of 20 systems plus spares in July 2000. The Navy awarded an additional contract to Raytheon Systems Company in March 1998, for integration and software development on the F/A-18E/F.

## *ALR-67(V)2 Advanced Special Receiver.*

The ALR-67(V)2 upgrade program improves the sensitivity and performance of the basic (V)2 by providing enhanced antennas, wavelet processors, and software algorithms. Major platform beneficiaries of this program are AV-8Bs and F-14s. An interim release user data file (M5) with updated surface-to-air missile theater threats was delivered to deploying fleet squadrons conducting operations in the Bosnia and Middle East theaters in February 1998.

## *AAR-47 Missile Warning System.*

The AAR-47 Missile Warning System (MWS) provides passive missile approach warning for the Navy, Marine Corps, Air Force, Army, and allied helicopter and low/slow fixed wing aircraft (2,500 systems worldwide). The program completed a computer processor upgrade, modernizing the processor and restoring processor reserves to make way for a sensor upgrade. The sensor upgrade program increases detection capability and incorporates laser warning functions to correct operational deficiencies, thus modernizing this legacy MWS and reducing total ownership costs.

The microprocessor upgrade program replaces current hardware with faster, more efficient hardware and software to enhance threat declaration and better control false alarms. The AAR-47 testing progressed well throughout 1998. The system successfully completed combined developmental/operational testing at Patuxent River, MD, in May 1998; completed live fire testing in July 1998 exceeding all test and evaluation master plan thresholds; and then entered follow on test and evaluation (FOT&E) in August 1998. The program completed FOT&E in November 1998. The Commander, Operational Test and Evaluation Force "quicklook" message indicated the system passed with grades of "operationally effective" and "operationally suitable" – the highest possible rating.

The Navy awarded Alliant Tech Systems the sensor upgrade contract in November 1998, following a competitive request for proposal. The sensor upgrade promises to improve high temperature performance, increase service life and detection sensitivity, reduce saturation effects in the optical sensor converter recovery time, and improve suppression of some false alarms. The addition of the integrated laser warning capability will meet or exceed those of AVR-2A+ and provide savings to the user in installation and life cycle costs.

## *In-Service Weapons Team.*

The In-Service Weapons team completed a no-cost restructure of the GBU-24 contract to a performance-based specification. This change allowed for the development and procurement of an enhanced version of the GBU-24 that incorporates global positioning satellite and inertial navigational system technologies. The laser guided weapon programs will be the beneficiaries of the two Navy and Air Force contracts awarded for fuzes. Alliant Tech was awarded the contract for the detecting device unit (DSU-33) proximity sensor; and Dayron will be developing and manufacturing the joint programmable fuze. The Fleet has taken the first deliveries of laser guided training rounds from the contract awarded to Lockheed Martin. Test, evaluation, and qualification of Cast Ductile Iron (CDI) for the 500-pound bomb body have been completed. The CDI is a material and manufacturing process change for MK 80 series bombs that has the potential to expand the industrial base and decrease unit cost.

## Cartridge Activated Devices/Propulsion Activated Devices.

In 1998, the CAD/PAD program delivered approximately 175,000 items to the Fleet for aircraft installs and operations involving stores release. CAD/PAD Supply Support Process Reengineering entered the Prototype Phase with seven shore sites. The sites reported a decrease in average lead-time from 120 days to six days. Internet technology was introduced and is being used to provide the Fleet direct access to CAD/PAD data.

# AIR ANTI-SUBMARINE WARFARE, ASSAULT, AND SPECIAL MISSIONS

**AV-8B Harrier.** The Marine Corps AV-8B *Harrier* vertical short takeoff and landing aircraft remanufacture program continues to update earlier day attack AV-8B aircraft into the latest night/radar version equipped with the APG-65 radar. The APG-65 radar, already operational in more than 1,100 aircraft worldwide, enhances the *Harrier's* close air support mission in day, night and all-weather operations. This variant of the *Harrier*, carrying up to 13,200 pounds of ordnance, including air-to-air and air-to-ground missiles, gives the Marine Corps and the Italian and Spanish Navies the capability they need to meet the demands of the early 21st century. Italy and Spain received 24 radar equipped AV-8B *Harrier* II Plus aircraft. During FY98, Boeing delivered 10 AV-8B remanufactured aircraft to the Marine Corps. One of the major accomplishments of the AV-8B cooperative program is the Open System Core Avionics Requirements (OSCAR). The OSCAR will support product team development, integration, testing, production, and delivery of commercial off-the-shelf computers and rewritten software, using higher order language, to replace current AV-8B aircraft systems. The OSCAR will reduce life cycle costs of future system upgrades to the *Harrier* fleet, allowing affordable improvements to the warfighting capabilities of the Marine Corps and the Italian and Spanish Navies.

**E-6B Mercury.** The E-6A Take-Charge-and-Move-Out (TACAMO) mission provides survivable, reliable, worldwide communications between the National Command Authority (NCA) and the United States strategic and nonstrategic forces.

In 1993, the Secretary of Defense directed the transfer of the strategic Airborne Command Post (ABNCP) mission from the Air Force's EC-135 aircraft to the Navy's E-6A aircraft, resulting in an E-6B designation. With the consolidation of the TACAMO/ABNCP functions, the Commander in Chief, Strategic Command, can execute direct command and control of strategic forces with a single airborne platform. In addition to the TACAMO and ABNCP missions, the E-6B also serves as the backup for the National Airborne Operations Center mission. On 1 October 1998, the EC-135 aircraft officially retired, and the Airborne Command Post mission transferred to the E-6B aircraft. Of the 16 E-6 aircraft in production through 2003, seven have been delivered to the Fleet.

The Airborne Strategic Command, Control and Communications program office is pursuing several other modification programs for the E-6. The Modified Miniature Receiver Terminal (MMRT) program is a joint service initiative which will replace obsolete VLF/LF receiver processor systems in the E-4 and E-6 aircraft. In 1998, design reviews for MMRT were conducted and approved. An E-6 aircraft will have a prototype MMRT installed in January 1999, with the first production unit to be installed in September 2001. The Multifunction Display System (MDS) modification installs the 737-700 cockpit into the E-6 fleet at significant cost savings through the use of commercial off-the-shelf technology. Milestone III for the MDS is planned for FY99, with program completion in FY04. These current and future modifications will provide building blocks for the E-6 airframe to navigate globally and perform its missions successfully through 2010 and beyond.

***P-3C Orion.*** The *Orion* provides the Fleet with anti-surface warfare, command communication, battle group support, littoral surveillance and aerial mining. In 1998, the P-3 team delivered the first Sustained Readiness Program (SRP) P-3C. The SRP is an extensive modification program to combat shortened service life due to material degradation. The first anti-surface warfare improvement program production aircraft were introduced to the operational community in 1998. These aircraft

*Above: AV-8B Harrier*

significantly improve fleet capabilities in anti-submarine and anti-surface warfare; command, control, communications, and intelligence; and over the horizon targeting. Of the nine production aircraft delivered in 1998, three were assigned to a squadron on deployment to the Persian Gulf region. Battle group commanders were so impressed by the performance of the improved aircraft that the three aircraft flew over 65 percent of the squadron's missions. The pre-production advanced imaging multi-spectral sensor, an advanced electro-optical sensor, and the new AN/USQ78A acoustic processor were introduced late in 1998. The advanced concurrent processing and the new color displays of the USQ-78A implement overdue acoustic gains into the platform. In 1998, the block modification upgrade program awarded the Phase II contract which will convert 25 Update II and II.5 aircraft with Update "m" avionics. The upgrade program will address Update III avionics parts obsolescence including new color displays and will increase the Fleet's total Update "m" inventory to 165 aircraft. The Global Positioning System (GPS) was installed on 78 P-3s in 1998. To date, approximately 70 percent of fleet P-3s have GPS.

*S-3B Viking.* The Navy is conducting an S-3B/ES-3A service life assessment program that will be followed by a fully funded full scale fatigue test through a contract awarded to Lockheed Martin Aeronautical Systems Company on 2 October 1998. These efforts will define the requirements for a service life extension program needed to extend the airframe life of these aircraft beyond 2008.

A Critical Avionics program is underway to replace obsolete and unsupportable UHF/VHF radios; carrier aligned inertial navigation systems, armament control systems and tactical mission display systems.

Developmental and operational testing for the communications improvement program started during late FY98 and will be completed by the second quarter of FY99. Global positioning and USH-42 video recorder systems were installed in approximately one-half of fleet S-3Bs during FY98. Additionally, a tactical mission computer replacement (AYK-23) will enter the operational test and evaluation phase during December 1998; fleet installations are scheduled to start in July 1999.

Following delivery of a validated technical data package during late FY98, NAVAIR granted approval to proceed with the S-3B prototype Integrated Maintenance Concept effort. This program, which promises to improve aircraft material condition, improve aircraft availability, and reduce aircraft out of service time, is comprised of six phase inspections conducted at 301-day intervals by organizational level personnel. Three depot level phase inspections will be performed at 602-day intervals concurrently with the organizational level 301-day inspection. The prototype program is scheduled to commence during the second quarter of FY99.

Planned technology capability demonstrations for FY99 include an advanced APS-137B (V)5 synthetic aperture radar and high resolution Electro-Optical/Infrared system. The S-3B community has developed the framework for an advanced Carrier Battle Group precision targeting aircraft and will demonstrate that capability during FY99.

The Chief of Naval Operations directed that the Anti-Surface Warfare (ASW) and mining missions for all S-3 platforms be deleted by the second quarter of FY99. The S-3B continues to fulfill its primary mission of Anti-Surface Warfare and Communications, Command and

Control, as well as the secondary mission of refueling. It is anticipated that ASW specific equipment will be removed and 48 S-3B aircraft will be modified as KS-3 tankers. With the significant delay in fielding the common support aircraft, the S-3B remains vital to Carrier Battle Group operations until at least 2015.

*ES-3A Shadow.* A modification of the S-3 *Viking* airframe, the ES-3A *Shadow* provides the Fleet real-time tactical reporting of threats. In 1998, the ES-3A completed delivery of Fleet Issue 4 and common improvement program, which added the AN/ARC-187 radio and replaced the AN/USH-26 recorders. A quick reaction capability prototype was also installed to demonstrate Delta Wing, an advanced signal processor. In addition, the ES-3A completed system design review for the Joint Airborne Signal Intelligence Compliance Program.

*EP-3E Aries.* The EP-3E *Aries* provides vital enhancement of the Fleet's electronic warfare capability by reporting real-time threat activity and intentions beyond the battle group's horizon. In 1998, the *Aries* began developmental testing on sensor system improvement program and common improvement program. These modifications will increase EP-3 tactical communications connectivity and signal processing capability. Following closely is the Joint Airborne Signal Intelligence (SIGINT) Family (JSAF) Modification (JMOD) program, which will update the EP-3E with the Joint Airborne SIGINT Architecture (JASA) compliant Low Band Sub-System (LBSS). LBSS completed preliminary design review in July, and JMOD completed system design review in December. A prototype JASA and new high band sensor technology demonstration model deployed in 1998.

*T-45 Goshawk.* The T-45 Training System integrates flight and ground training for intermediate and advanced student naval aviators in the strike and E-2/C-2 training program. The system includes the T-45 *Goshawk* aircraft, simulators, and computer aided instructional subsystems. Operating from Naval Air Station (NAS) Kingsville, TX, and at NAS Meridian, MS, the T-45 integrated training system produces carrier qualified naval aviators more quickly and for less cost than previous naval jet trainer aircraft.

The T-45C entered service in 1998 at NAS Meridian. Seventeen of these aircraft, configured with state-of-the-art "glass" cockpits, are presently in service. This capability greatly improves the training experience of student aviators and improves their transition to fleet aircraft.

To improve Integrated Program Team (IPT) coordination, the T-45 team implemented an operational electronic data interchange system using World Wide Web technology. Nicknamed the "Gosnet," the system connects all Navy sites and contractors using an Extranet approach. This system greatly improves communication throughout the program allowing prompt dissemination of technical information and required contract deliverables.

To keep program costs down, program managers instituted commercial maintenance support for the *Goshawk*. Contractors at NAS Kingsville perform depot airframe maintenance for the T-45. Additionally, the installation of the Flashjet® paint removal system, pioneered by Boeing Company and installed at NAS Kingsville, helps further reduce total ownership costs. The Flashjet® system removes paint from aircraft quickly, with fewer environmental pollutants, and less expensively than conventional methods.

*Left to Right: T-45 Goshawk; S-3 Viking firing a Maverick Missile; P-3 Orion*

## *AH-1Z Super Cobra and UH-1Y Huey.*

The AH-1Z and UH-1Y will provide the most potent and cost effective alternative for the Marine Corps' light/attack helicopter requirements into the 21st century. The H-1 Upgrades program was established as a mid-life revitalization for the AH-1W *Super Cobra* and the UH-1N *Huey*. With 85 percent commonality of major drive, propulsion, and rotor systems, the modifications reduce maintenance costs. The new target sight system, integrated avionics, and glass cockpit significantly enhance lethality, speed, maneuverability, and payload, while decreasing pilot workload and increasing situational awareness, making the aircraft safer and more combat effective.

The H-1 upgrades development completed several key milestones in 1998, on the way to first flight and low rate initial production for both aircraft. In July 1998, Bell Helicopter competitively selected Lockheed Martin for development of the AH-1Z Target Sight System (TSS). The TSS provides advanced third generation thermal image processing, eye-safe laser range finding, target designation, and full fire control integration. In August 1998, four AH-1Ws and three UH-1Ns were delivered to Bell Helicopter for conversion into AH-1Z and UH-1Y test aircraft. In September 1998, engineers completed a highly successful critical design review of the airframe, which featured a state-of-the-art, computer generated electronic mock-up to convey design details. The design review paved the way for manufacturing development.

Until the AH-1Z and UH-1Y arrive in the Fleet, the AH-1W *Super Cobra* and UH-1N *Huey* will continue their stellar performance for the Marine Corps. The AH-1W, operating from ship and land, provides close air support, armed escort, fire support coordination, and reconnaissance. In 1998, the program delivered seven AH-1Ws to the Marine Corps, bringing the current aircraft inventory to 201. The UH-1N, operating from ship and land, provides command and control support, search and rescue, assault support, and medical evacuation capabilities. Incorporation of the navigation thermal imaging system into the UH-1N was completed in 1998. This system significantly enhances the *Huey's* ability to navigate in reduced visibility. Additionally, several other improvements for both the AH-1W (night targeting system and communications/navigation) and UH-1N (safety enhancements and communications/navigation) continued.

## *H-60 Seahawk.*

In December 1996, the H-60 program was selected as the Anti-Submarine Warfare/ Assault and Special Mission helicopter prototype for implementing an Integrated Maintenance Concept (IMC). IMC is a total life cycle preventive maintenance program based on Reliability Centered Maintenance (RCM) principles and has goals of improving readiness, maintenance training, and aircraft material condition, while reducing unnecessary inspections and operating and support costs. It is estimated that IMC will save $200 million over the next 15 years and improve aircraft availability by 18 aircraft per year.

*Top to Bottom: EP-3E Aries; S-3 Viking*

*Clockwise: Attack helicopters AH-1T Super Cobra and AH-1J Cobra; SH-60; AH-1 helicopter gunship; SH-60H Seahawk*

Under the Navy Helicopter Master Plan, the SH-60B and SH-60F aircraft will be remanufactured to a common SH-60R configuration. The IMC team will take advantage of the remanufacture program by implementing a Service Tour Extension Process (STEP). This program will restore SH-60B/F aircraft to a suitable material condition that will keep them operating safely until they are inducted into the remanufacture process. Implementing a STEP prior to remanufacture will provide significant cost savings.

Program managers are developing a plan for Chief of Naval Operations (CNO) approval to implement the H-60 IMC program Fleet wide. In 1998, eight baseline prototypes were completed in the field with an integrated team of organic depot artisans, original equipment manufacture contractors, and organizational level maintenance support. In November, the CNO granted one-year approval of the STEP program for FY99, based on the success of the prototypes.

## *SH-60B / HH-60H Armed Helicopter.*

The armed helicopter team has enjoyed another successful year that culminated with the completion of the Combat Search and Rescue HH-60H armed helicopter operational test program. Aircraft carriers with full complements of HH-60H armed helicopters are scheduled for operational deployments in spring 1999.

The currently deployed rapid deployment kits on the SH-60B Light Airborne Multi-Purpose System (LAMPS) have enjoyed 16 successful *Hellfire* missile shots, as well as unprecedented reliability with the Forward Looking Infra-Red (FLIR)/Laser designator, AN/AAS-44(V). In addition, Naval Rotary Wing Test Squadron has already begun developmental testing on the fully integrated SH-60B armed helicopter. This developmental iteration will directly benefit from the lessons learned from the award-winning acquisition reform Rapid Deployment Kit Program. Installation of the kits is scheduled for the summer of 1999.

*SH-60R.* The SH-60B Light Airborne Multi-Purpose System (LAMPS) MK III Block II/multi-mission helicopter upgrade will provide the Navy with a multi-mission platform capable of conducting undersea and surface warfare for the next 20-25 years. A critical part of the Navy Helicopter Master Plan, SH-60B/F aircraft will be remanufactured to a new configuration designated SH-60R. The primary requirement for the SH-60R is to support warfare in the littoral regions including: undersea warfare; anti-surface warfare; area surveillance and combat identification; naval surface fire support; search and rescue; and traditional rotary wing support roles.

In addition to the capability upgrade, the remanufacturing process includes concurrent standard depot level maintenance, a Service Life Extension Program (SLEP), and incorporation of engineering change proposals to reduce lifecycle costs. The SLEP will increase the life of the airframe from 10,000 hours to 20,000 hours and increase its structural weight capability from the current limit of 21,884 lbs. to 23,500 lbs. Also during 1998, steps

*Top to Bottom: SH-60 Seahawk; MH-53 Super Stallion*

were taken to reduce lifecycle costs by emphasizing the use of common avionics between SH-60R and CH-60S by initiating "common cockpit" development including a commercial off-the-shelf mission processor.

*CH-60S.* The Navy CH-60S is essentially a modification of the Army's *Blackhawk* helicopter. The Navy will be entering into a joint venture with the Army initially using the Army's multi-year contract to procure CH-60S during FY99-01, followed by a Navy multi-year contract for the balance of CH-60 procurement. The CH-60S mission is to maintain forward deployed fleet sustainability through airborne delivery of materials and personnel by supporting amphibious operations and through search and rescue coverage. The Navy approved Milestone II/low rate initial production during 1998 and awarded the nonrecurring development contract. The program is currently involved in negotiating the Army's multi-year contract to accommodate the Navy's engineering change proposal.

*CH/MH-53E Super Stallion.* The *Super Stallion*, an indispensable workhorse, is vital to the Fleet's assault and heavy-lift capability and airborne mine countermeasures mission. The *Super Stallion* continues to undergo improvements that increase operational readiness and safety. Modifications, such as a night vision system, heads up display, global positioning system, UHF/VHF jam-resistant radios, crashworthy seats, and number two engine fire detectors, enhance the aircraft's survivability and capability. During 1998, the Fleet received three new production CH-53Es.

*Clockwise: CH-53E; SH-60F; HH-60H*

In June 1998, engineers successfully completed a critical design review for an H-53 and H-60 Integrated Mechanical Diagnostics (IMD) Health and Usage Monitoring System (HUMS) that will integrate, test, and procure a commercial/military "dual use" mechanical diagnostic system. The IMD HUMS kits will be installed into H-53Es and H-60s for developmental and operational testing in 1999.

*H-52 / H-60 IMD HUMS.* The H-52/H-60 team made substantial progress in 1998 toward fielding an Integrated Mechanical Diagnostic (IMD) Health and Usage Monitoring System (HUMS) for Navy and Marine Corps helicopter operators. This key affordable readiness program will integrate, test, and procure a commercial/military "dual use" HUMS from BFGoodrich Aerospace for the H-53E and H-60 helicopter. This system will reduce operations and support costs, improve operational readiness, and increase flight safety through the early identification and correction of degraded components in the engine, drive train, and rotor systems of the helicopter.

In May 1997, the Defense Advanced Research Projects Agency selected the program as a Commercial Operations and Support Savings Initiative (COSSI). The COSSI award, which facilitates extensive streamlining of the acquisition process, allowed a two-year acceleration of IMD HUMS.

With completion of the Critical Design Review (CDR) milestone in June 1998, IMD HUMS started its transition from engineering design to integration and demonstration of prototype systems. The CDR milestone was achieved only 49 weeks after signature of the agreement. In May 1998, the Assistant Secretary of the Navy for Research, Development and Acquisition recognized the IMD program for outstanding innovation in implementing the tenets of acquisition reform. Installation of CH-53E and SH-60B prototype IMD HUMS units at Patuxent River, MD, will begin in January 1999, followed by operational testing in 10 fleet aircraft later in the year.

*VH-3D / VH-60N Executive Transport Helicopters.* Executive transport helicopters provide helicopter transportation for the President and Vice President of the United States, members of the President's cabinet, and foreign dignitaries. Installation of crash survivable flight incident recorders, which will enhance safety and survivability, began during 1998. Additionally, program managers fielded two ground support equipment initiatives that not only enhance the mission effectiveness of executive transport helicopters, but also have potential for other Navy aircraft. The Versatile Huffer Unit (VHU) replaces the GTC-85 "bullet huffer" and the MA-1A "air start unit" and incorporates both start air and electrical power for the VH-60N. The versatile hydraulic cart (VHC) is a replacement for the UH-60 *Blackhawk* air

*Top to Bottom: HH-60H; SH-60B*

transportability cart and is used during Air Force C-5 and C-17 on-load/off-load operations. These initiatives provide cost benefits to the Navy by using commercial off-the-shelf technology and common aircraft inventory parts.

*Sonobuoys and Sensors.* Since World War II, development of air-launched sonobuoys and sensors has been a priority in Air Anti-Submarine Warfare (ASW). Exploiting technology to achieve superiority for the warfighter has been the goal of the research and development effort. As the nature of ASW continues to change, development of improved equipment is essential to ensure that the Fleet has the sonobuoys and sensors necessary to meet any potential threat. During 1998, the TEAM delivered 74,079 sonobuoys to the Fleet for operational use.

Sonobuoys include three basic types: passive sonobuoys that detect noises from submarines; active sonobuoys that detect acoustic pulses bounced off submarine hulls; and special purpose sonobuoys that measure the ocean water temperature profile or communicate with submarines. To reduce production and logistics support costs for sonobuoys, the program managers developed a plan to merge the functionality of three separate types into one multifunction unit. Another cost saving measure involves using C-12 utility aircraft for sonobuoy acceptance testing instead of fleet aircraft. This not only reduces cost, but also relieves the Fleet from having to provide aircraft for testing. This initiative was one of the first to receive approval for funding under NAVAIR's Affordable Readiness Program.

One of the latest developments in sonobuoys is the air deployed active receiver. This sonobuoy can detect acoustic pulses bounced off submarines as part of the improved extended echo ranging program that dramatically improves littoral Air ASW capabilities. In September 1998, the program successfully concluded technical evaluation on its way to a Milestone III decision in March 1999.

Another notable achievement involved the advanced radar periscope detection and discrimination system. This advanced sensor, which provides automatic detection and classification capabilities, for the first time underwent successful testing aboard the USS *Stump* and received high praise from the crew.

Realistic training is an important edge our warfighters need to maintain sea superiority. The Generic Acoustic Stimulation System (GASS) research and development program is designed to provide the highest quality in acoustic fidelity and environmental realism for acoustic ASW simulations – especially for littoral and shallow water training scenarios. The GASS uses an extensive database of acoustic signatures approved by the Office of Naval Intelligence; environmental modeling validated by the Oceanographer of the Navy; and the characteristics/specifications of the various ASW sensors. Using GASS, Air ASW aircrews can train for any spot in the world, against any possible target, using whatever sensor they choose. The GASS program, exportable to each Air ASW weapon system trainer, minimizes the cost of developing software for individual weapon system trainers and ensures standardized training throughout the Fleet. The GASS engineering and manufacturing development effort continued through 1998.

*Above: VH-3D Executive Transport Helicopter*

# CRUISE MISSILES AND UAVS

*Tomahawk.* As the "weapon of choice", *Tomahawk* continues to demonstrate unparalleled performance in striking high value targets deep within hostile territory. The Navy and Congress continued the commitment to unmanned deep strike capability by approving and reprogramming funds for the tactical *Tomahawk* engineering and manufacturing development program. By approving *Tactical Tomahawk*, the Navy will increase its inventory of deep strike cruise missiles and field the capability to communicate with and retarget *Tomahawk* missiles in flight. This increased capability will be fielded in FY03, at a significantly reduced unit price.

The *Tomahawk* program continued to reduce logistics infrastructure costs by completing the consolidation of nuclear weapons activities with the *Trident* missile program avoiding approximately $4 million annually. Additionally, 215 new production *Tomahawk* missiles were delivered to the United States Navy with an additional 22 delivered to the United Kingdom's Royal Navy. This year was highlighted by three Royal Navy flight tests, which demonstrated the Royal Navy's *Tomahawk* capability and culminated in a spectacularly successful live warhead test on San Clemente Island, CA.

*Advanced Tomahawk Weapon Control System.* The cruise missiles project achieved Milestone III approval and fleet introduction for the Advanced *Tomahawk* Weapon Control System (ATWCS) Track Control Group (TCG) in September 1998. The ATWCS replaces obsolete technology currently deployed on surface ships. This new system takes advantage of commercial off-the-shelf computer technology to initiate and support launch preparation of *Tomahawk* land attack missiles on surface combatants and fast attack submarines. The ATWCS TCG is presently installed on two Navy nuclear submarines, 15 guided missile cruisers/destroyer/guided missile destroyer class ships, and one Royal Navy submarine. Planned installations will eventually place the new system on more than 150 platforms.

The ATWCS employment on surface ships and submarines, as well as Foreign Military Sales to the United Kingdom, posed a formidable challenge due to the unique interfaces and launch dynamics associated with various host platforms. The program office adopted a product line approach and developed multiple integrated software programs sharing a common set of core functionality. Because more than 70 percent of the software is reused, the program office has been able to support aggressive parallel development efforts using common computer software configuration items. The product line approach for ATWCS development will continue to provide significant future cost reductions during life cycle maintenance.

Phased development of the ATWCS continues with the addition of the Launch Control Group (LCG) planned for fleet introduction next year. The LCG completes ATWCS computer technology for mission critical functionality by providing real time processing and missile launch sequence control.

*Tactical Tomahawk Weapon Control System.* The Navy initiated the *Tactical Tomahawk* Weapons Control System (TTWCS) following a program decision meeting in December 1997. The TTWCS acquisition strategy consolidates all aspects of the system's engineering, development, integration and fielding under one prime contractor to be awarded through a competitive procurement. The tenants of acquisition reform were tailored to the acquisition. Specific initiatives included: use of a statement of objectives to articulate "what" the

*Above: Tomahawk cruise missile*

government wanted and not "how"; use of a performance specification to specify system performance; Total Ownership Cost as a valuable attribute for "best value" evaluation; use of an open architecture compliant with the joint technical architecture to permit system growth beyond the TTWCS; responsibility and accountability resting with the prime contractor in the execution of development; maximum use of commercial standards and specifications; and data management left to the discretion of the prime contractor.

## *Cruise Missiles Command And Control.*

Despite the difficulties imposed by the relocation to the Washington Navy Yard in 1998, work in progress continued unabated in support of the operational users of the *Tomahawk* mission planning and distribution systems and the Joint Services Imagery Processing System - Navy.

The cruise missiles program installed a consolidated configuration digital imagery workstation at Cruise Missile Support Activities (CMSAs) at both United States Atlantic Command and Pacific Command. This allows the CMSAs a faster throughput in processing imagery for planning missions.

The Washington Navy Yard/Washington Planning Center (WPC) was selected as the site for the Naval Strike Warfare Planning Center (NSWPC) Prototype Integration Facility. This facility will be used for verification and validation testing of the systems that will reside in the aircraft carrier suitable CV Intelligence Center (CVIC). This location will provide synergy with the WPC and allow sharing of assets and personnel.

The cruise missiles program achieved significant success with the systems installation, training, and evaluation of personnel for the new CMSA United Kingdom (UK). The CMSA UK achieved initial operational capability on 29 June 1998. CMSA UK mission rehearsal resulted in two inert and one live warhead flight tests successfully completed in November 1998. Major United Kingdom television and United States national networks covered the live test.

Year 2000 (Y2K) compliance testing was completed successfully to verify that the Tomahawk mission planning system is fully Y2K compliant and ready for systems installation ashore and shipboard around the globe during 1999.

## *AGM-84H SLAM-ER.*

The Standoff Land Attack Missile-Expanded Response (SLAM-ER), a revolutionary upgrade to the baseline SLAM missile, is an air-launched, long range weapon designed to attack fixed, high value targets ashore. SLAM-ER incorporates an improved Anti-Surface Warfare (ASuW) mode to attack ship targets in the littoral. The missile combines the *Maverick* Infrared Seeker, an advanced ring laser gyro inertial navigation system, with integrated multi-channel global positioning system and man-in-the-loop control to allow precise terminal aimpoint selection by the pilot. The new SLAM-ER configuration incorporates folding planar wings, a reactive case titanium warhead, and an advanced mission computer with new operational flight software providing significant missile performance and pilot interface enhancements. In combination, these improvements allow precision strikes to be conducted by F/A-18 aircraft at ranges greater than 150 nautical miles with increased accuracy, lethality, and survivability.

Additionally, the automated SLAM-ER mission planning module in the Tactical Automated Mission Planning System (TAMPS) is easy to use and allows SLAM-ER missions to be planned in 30 minutes or less.

SLAM-ER operational evaluation commenced in August 1998, after completion of developmental testing and combined developmental/operational testing flight program. Approval for full-rate production of SLAM-ER is expected in spring 1999; and the first F/A-18 squadron weapon deployments are planned for summer. Additionally, the system has completed Year 2000 computer compatibility testing and will not be affected by the "millennium bug." SLAM-ER received the Navy Acquisition Reform Certificate of Excellence from Assistant Secretary of the Navy for Research, Development and Acquisition for acquisition streamlining and reform initiatives. Development of an automatic target acquisition capability for SLAM-ER (SLAM-ER+) is in full swing with flight testing planned in 1999. SLAM-ER+ will provide aircrews with improved target acquisition and counter-countermeasure performance for attack of targets in highly cluttered scenes and in environmentally degraded conditions. Fleet release of SLAM-ER+ is expected in 2000.

*Aerial Targets and Decoys.* The Naval Aviation Systems Team procures and fields a wide range of target systems for the Navy, including subsonic sub-scale targets, missile targets, and full-scale targets to simulate and replicate enemy threat systems for testing of weapon systems and fleet training. In 1998, NAVAIR initiated efforts to develop two new target systems, designated Target 21 and the Supersonic Sea Skimming Target (SSST) "Threat C", to replicate the next generation of missile threats. Target 21 will replicate the most advanced and stressing subsonic cruise missile threat. The SSST will replicate a supersonic sea skimming anti-ship threat with a speed of Mach 2.5 at cruising altitudes down to 15 feet.

The TEAM also procures air-launched decoy systems for the Navy that provide realistic decoys of strike aircraft to deceive and saturate enemy integrated air defenses. First article tests of the Improved Tactical Air Launched Decoy (ITALD) system were completed in 1998. The system will be fielded in 1999.

*VTOL UAV.* The Navy selected three contractors to demonstrate Vertical Take-Off and Landing (VTOL) Technology during summer 1998. The purpose of this demonstration was to evaluate the maturity of VTOL Unmanned Aerial Vehicle (UAV) technology, evaluate air vehicle performance, and identify any risks associated with a future procurement of a VTOL UAV. The contractors participating in the demonstration were Bell Helicopter Textron Incorporated with the *Eagle Eye* air vehicle; Bombardier Services Corporation with the CL-327 air vehicle; and Science Applications International Corporation with the *Vigilante* air vehicle. More than 120 flight test hours were accumulated during the three-month demonstration. The demonstration will continue through FY99 and will culminate in an at-sea demonstration. The Joint Requirements Oversight Council validated a Navy tactical unmanned aerial vehicle operational requirements document in December 1998. Acquisition efforts are under way for a FY00 contract award to begin engineering and manufacturing development phase with an initial operating capability in FY03/04.

*Left to Right: Tomahawk cruise missile; SLAM-ER; SH-60 with decoy flares*

## *Pioneer UAV.*

The *Pioneer* has been in fleet service for more than 12 years and has flown more than 18,000 total flight hours, 1,900 of which occurred during the last 12 months. *Pioneer* first deployed in 1986 and operated extensively during DESERT SHIELD/DESERT STORM. The *Pioneer* continues to serve the Navy with day/night surveillance, target acquisition, and battlefield management.

The Navy modified its fifth ship, the USS *Ponce* (LPD-15) to support *Pioneer* operations. In 1998, *Pioneer* accumulated more than 300 at-sea flight hours and was continuously deployed with cruises on the USS *Shreveport*; USS *Denver*; USS *Austin*; and USS *Cleveland*.

Key events include 15 Air Vehicle buy; Modular Integrated Avionics Group integration; and Tactical Control System integration. These efforts will ensure the viability of *Pioneer* until its replacement is fielded early in the next decade.

## *UAV Tactical Control Systems.*

During 1998, the Unmanned Aerial Vehicle (UAV) tactical control system made significant progress, providing the joint warfighter with a UAV ground control system capable of operating different air vehicles and payloads, as well as the capability to disseminate data electronically to a wide variety of service targeting and intelligence management systems.

During the year, the program completed preliminary design review and accomplished the third and fourth of five initial configuration software builds. In addition, engineers completed associated flight tests with the *Predator* medium altitude endurance UAV. Prototype TCS configurations were accomplished to support both land and sea-based UAV operations, and control of a simulated remote mine hunting surface craft was completed. Program managers delivered a TCS and multiple UAV simulation environment system to Canada; and the Navy signed an agreement with the United Kingdom to procure two TCS systems. Britain also agreed to participate in the United States Vertical Take-Off and Landing Phase II demonstration. In addition, the program gained acceptance from the North Atlantic Treaty Organization for use of TCS architecture. The program demonstrated an active antenna array – using a single antenna aperture – capable of communicating simultaneously with multiple UAVs that are spatially separated. The program office also completed a Joint Service TCS concept of operations document.

In addition, the TCS program awarded a system design, test, and integration multi-year cost plus award fee contract to an industry team lead by Raytheon Systems Company as part of its strategy to transition TCS system design and production responsibility to industry. Finally, the TCS program team conducted its first acquisition executive program review, gaining approval to continue system development in preparation for eventual incorporation into the Air Force *Predator* and Army, Navy, and Marine Corps

*Top to Bottom: VTOL UAV; EXDRONE UAV mission, Ground Control Station (GCS) crew tracking and controlling the air vehicle*

tactical UAV ground control stations. The TCS program ended 1998 well positioned for a FY99 critical design review, Milestone II review, and entry into the engineering manufacturing development phase, associated initial developmental test and evaluation, and initial operational test and evaluation events.

*Tactical UAV Systems.* The UAV systems group had a very successful year. The UAV Common Automatic Recovery System (UCARS) is in full production.

Deliveries of Lot I are complete; and Lot II is nearing completion. The system will become operational in 1999 as an integral part of the *Pioneer* UAV system. Modular Integrated Avionics Group (MIAG) completed qualifications and is being incorporated into the next buy of *Pioneer* air vehicles. MIAG will extend the capability and life of the only tactical UAV in inventory today. We successfully demonstrated a number of payload developments, including chemical sensors, small synthetic aperture radar, communications relays, mine reconnaissance payloads, and miniature infrared cameras. The small UAV initiative is off the ground and a solid requirement for this capability is being discussed. The international interest in UAVs continues to build; and we have been able to coordinate this activity to the best interests of the DOD and United States industry.

*Above: Pioneer UAV*

# NAVAIR PROGRAMS

*H-46 Sea Knight.* The H-46 *Sea Knight* medium lift helicopter is a vital element of Navy and Marine Corps operations. Modifications to improve the *Sea Knight* continued during 1998. The installation of a new rotor head and upgraded transmission has improved flight and rotor controls, and eliminated current rotor head inspections. Sixty percent of the H-46 fleet has already been modified. The program will complete fleet installations in FY00.

Two additional upgrades to the H-46 include installation of the ARC-210 radio and night vision goggle heads up display, concurrently being installed with the integrated communication navigation control system modification. The communication navigation control system installations are currently 60 percent incorporated into fleet aircraft. These modification programs are on schedule for completion by the end of FY00. Additionally, program managers oversaw a blade-balancing modification to the H-46 during 1998. This modification reduced aircraft vibrations and increased reliability of the airframe and rotating subsystem components.

*Air Combat Electronics.* The Air Combat Electronics Program's major initiatives range from the development of state-of-the-art, open-architecture systems, to the installation of mandated safety critical aircraft systems. During 1998, the program delivered 5,700 production items with a 98 percent on-time delivery.

The program office oversaw the installation of a crash survivable flight incident recording system in all passenger-carrying aircraft in 1998. The installations, mandated by the Secretary of Defense, were completed within two years on the C-2, C-130T, C-12, and CT-39 aircraft. Installation of this system in tactical aircraft began with the F/A-18 and A/V-8 as the lead platforms.

The Chief of Naval Operations' mandate to install Traffic and Alert Collision Avoidance Systems (TCAS) was met by standing up a team one year prior to the originally scheduled program initiation. TCAS provides time-critical sound and visual warnings to the aircrew to prevent midair collisions. Current planned installations include C-2, C-130T, KC-130, and VP-3 aircraft.

The Ground Proximity Warning System (GPWS), a safety warning system, alerts pilots to impending Controlled Flight into Terrain in time to take corrective action. Validation/verification installs of this system were completed in the C-130, H-53, and H-46 aircraft. Work was also initiated during 1998 to integrate, test, and deploy the upgraded version of embedded GPWS into the F/A-18 10A+ and 11C+ Operational Flight Programs.

Upgrades to the ARC 210 (RT-1794) were completed, which provide a complete range of communications (electronic protection, satellite communication, demand assigned multiple access, crypto-digital communication, and digital burst) throughout the Fleet and electronic battlefield environments, thereby providing required connectivity and multi-service interoperability.

Embedded GPS in Inertial Navigation System (EGI) for F/A-18A/B, EA-6B, AH-1W, F-14, and S-3B achieved 100 percent on time deliveries for FY98. The EGI developmental test flights on the F/A-18 commenced at China Lake and Patuxent River. Developmental testing also was conducted on the F-14B, EA-6B, and S-3B.

The Navy designated the Advanced Mission Computer and Display as the standard mission computer and display system for naval aviation with the F/A-18 as the lead platform. The system successfully achieved a Milestone I/II decision, was redesignated as an Acquisition Category II program, and was expanded to include A/V-8B aircraft.

*Above: CH-46E Sea Knight*

Tactical Aircraft Moving Map Capability, designated as the standard moving map for naval aviation, will provide critical elements of the digital battlefield utilizing commercial technology and National Imagery and Mapping Agency standard data products. Engineering and manufacturing development units of this new map system were delivered for F/A-18 developmental testing.

*H-3 Sea King.* The versatile H-3 *Sea King* continues to provide cost effective and reliable search and rescue, utility, and executive transport to the Fleet. Raytheon Corporation received the first UH-3H to be modified for the executive transport configuration upgrade during 1998. Three others will be upgraded in the next few years, replacing the aging VH-3A aircraft.

The UH-3H fleet is receiving the global positioning system receiver integrated through the tactical navigation computer. The system provides visual displays and steering information to navigate anywhere in the world. The UH-3H also received AN/ARC-182 radios to improve communications reliability and interoperability.

*T-2 Buckeye.* The T-2 continues its long tradition of training naval aviators. Recent improvements in aircraft flight control and ejection seating have improved the aircraft's handling and safety. The aircraft had a history of uncommanded pitch events, which became chronic in the last few years. Extensive research identified the causes. Changes to the elevator boost actuator have been implemented to correct the problem. In addition, a redesign to correct a long-standing deficiency in the ejection seat pan has been developed and successfully tested. Modifications are to begin in early 1999.

## *Support / Commercial Derivatives.*

The Support/Commercial Derivative Aircraft Program Office is a leader in DOD efforts to maximize the use of commercial off-the-shelf equipment that allows the team to use proven commercial systems resulting in cost effective solutions to meet mandated safety requirements for passenger carrying aircraft.

During 1998, the Support/Commercial Derivative Aircraft program managed the mandated avionics upgrade of the C-9B/DC-9. The C-9 is being modified in two phases. Phase I included the installation of dual Global Positioning System (GPS)-based flight management system and traffic collision avoidance system, new frequency separation radios, and the replacement of older, obsolete, and less reliable equipment. Phase I was completed in January 1999. Phase II installations will begin in mid 1999.

In 1998, the Navy procured a third high performance C-40A aircraft. The aircraft's state-of-the-art flight deck avionics meet FAA safety mandates and its engines will be Stage III noise compliant with over-water operation. Depot maintenance will be provided by commercial outsourcing. Delivery of the first C-40A is expected in 2001.

The next generation *Hercules* tanker, the KC-130J, incorporates state-of-the-art technology. The advanced features of the KC-130J will yield significant performance enhancements, improving range by 40 percent, cruise ceiling by 40 percent, and maximum speed by 21 percent. To date, five KC-130J aircraft have been placed on contract and deliveries will begin in 2000.

The Undergraduate Flight Officers (UNFO) training system program provides 17 Navy-owned T-39N aircraft,

air-to-air and air-to-ground based training systems, and contractor training support services at NAS Pensacola, FL. In 1999, as many as eight additional Navy owned CT-39 aircraft will be added to the UNFO program.

In 1998, the Program Office procured two UC-35 aircraft to replace the CT-39 Operational Support Airlift assets. The two UC-35s, *Cessna* Citation Ultra twin engine jet aircraft, will be delivered in 1999.

*Tactical Training Ranges.* The Navy led joint services team completed development of the KGV-23 advanced message oriented data security module. At the conclusion of the development phase, the Naval Research Lab accredited the KGV-23, through a stringent design verification process. The National Security Agency then certified the encryption device for classified operation on training ranges. A contract was awarded for Lot I Production Option for more than 500 production units.

The Joint Tactical Combat Training System had a successful infrastructure design review in February 1998; followed by a successful prototype datalink transceiver flight test in May. Joint tactical combat training system datalink transceiver electromagnetic compatibility testing and pod static load testing were completed in June 1998. Critical design review for infrastructure software was held in September 1998.

The Pacific Missile Training Facility Shallow Water Training Range has been installed and integrated. This is the first shallow water training range for the Navy.

The Large Area Tracking Range is a Global Positioning System based cooperative tracking system currently installed and used at four ranges: the Southern California Offshore Range, the Littoral Warfare Training Complex in the Virginia Capes, the Pacific Missile Training Facility, and the Atlantic Underwater Test and Evaluation Center. A portable large area tracking range tracking system was designed, produced and accepted at the Atlantic Underwater Test and Evaluation Center range in May 1998. A large area tracking range air combat maneuvering capability, using tactical aircrew combat training system weapon simulations, is currently being designed and developed for the Pacific Missile Training Facility range. A successful production design review and critical design review were conducted in 1998 with a projected IOC for the air combat maneuvering capability at Pacific Missile Training Facility in May 1999.

Weapons Impact Scoring Systems were installed at AFWTF, Cherry Point, NC, Fallon, NV, and El Centro, CA. In addition, the Air Force selected the Weapons Impact Scoring System to upgrade their existing weapons scoring systems. The first of these installations has occurred at the Utah Test and Training Range.

The Tactical Aircrew Combat Training System program accomplished several significant advances in 1998. Production of the AN/ASM-694 (V)2 Pod Test Set manufactured by Raytheon Technical Services was completed with the Navy's final units being delivered in December. The test set incorporates state-of-the-art technology and provides the added capability of testing additional airborne hardware such as the Countermeasures Employment Detection Subsystem (CEDS) and the tactical interface module. CEDS successfully completed

*Left to Right: SH-3G, SH-3D, VH-3; T-2C Buckeye; C-9*

government acceptance testing on F-14 aircraft in May and F/A-18 aircraft in June. These tests were conducted at the Naval Air Station Oceana Tactical Aircrew Combat Training System range by a NAWCAD Patuxent River test team. CEDS met all requirements for both aircraft. The advanced display and debriefing subsystem received a number of enhancements/improvements with the dissemination of advanced display and debriefing subsystems software versions 3.1 and 4.0. Tactical aircrew combat training system software version 5.1 was released, which incorporates several enhancements including a limited Advanced Medium Range Air-to-Air Missile capability.

*Aviation Training Systems.* The Aviation Training Systems Program provides life cycle acquisition management of naval aviation training systems. In 1998, the program provided the Fleet training capabilities enabling them to operate the wide variety of Navy weapon systems accurately and effectively. Deployed aircrews were able to refresh and enhance their skills through the delivery of 193 desktop computers equipped with CD-ROMs containing electronic warfare/acoustic courseware. This delivery is a continuation of the aviation multipurpose training system. The Fleet further benefited in 1998 with two interactive multi-sensor analysis trainer systems.

During 1998, F/A-18 Weapons Tactics Trainers were enhanced with Operations Flight Program 13C (Joint Standoff Weapon, Joint Direct Attack Munitions, Standoff Land Attack Missile Expanded Response, Global Positioning System). Two F-14 operational flight trainers were delivered after completion of service life extension and new technology visual systems implementation. Existing F-14 trainers received capability for digital flight control system, low altitude navigation targeting infrared for night, embedded global positioning system/internal navigation system and global positioning system. The T-45 operational flight trainers and instrument flight trainers were delivered to Naval Air Station Meridian in Cockpit 21 configuration.

Additionally, an E-2C Integrated System Maintenance Trainer reconfigured to Group II was delivered to Naval Aviation Maintenance Training Group Detachment 1026 Norfolk. The day and night visual system of the E-2C operational flight trainer was upgraded. Two AH-1W aircrew procedure trainers received the night targeting system capability. The visual, motion, and tactical environment simulation systems for CH-53 weapon system trainers were upgraded during 1998.

Sixteen TOPSCENE mission rehearsal systems units and two TOPSCENE database units were delivered to Department of Defense activities. TOPSCENE is the prewar mission rehearsal training that aircrews receive prior to operational deployment/combat. TOPSCENE gives aircrews increased confidence to conduct their missions successfully, significantly improving their target acquisition capability – elements essential for aircrews to maintain their combat edge.

*Global Positioning System.* Naval aviation greatly benefits from the satellite-based navigation system, Global Positioning System (GPS). Along with improving flight operations, GPSs enhance performance to the platform's combat direction system, weapons system, situation awareness, and combat search and rescue capability. The system provides the precise time as required in many C4I applications. Ultimately, after installation into the Fleet, the warfighter's mission planning time will be reduced and tactical accuracy improved, while meeting capabilities for future navigation and mission requirements.

*Above: F-14 landing on the USS John C. Stennis (CVN 74)*

In February 1998, a contract was awarded for the design of a higher capacity tactical and mission planning Programmable Data Transfer Module. A contract was awarded to Raytheon for the first next generation GPS airborne receiver, the MAGR 2000. An initial quantity of 254 will be delivered to the Navy, Marine Corps, and Coast Guard with a total delivery of 4000 available. A Space Based Infra-Red Phase II contract for a new robust antenna, known as the Low Elevation Antenna Nuller (LEAN) antenna, was awarded with demonstration testing to be completed in 1999.

A GPS Interference Precision Locator prototype, a congressionally directed demonstration program, was fabricated, and anechoic chamber testing has been completed. Follow-on testing will be coordinated into fleet exercises and other demonstrations. Testing of the Situation Awareness Beacon with Reply (SABER) prototypes continued in Fleet Exercise Delta. Production quantities are scheduled for award in early 1999.

The Non-Precision Approach Demonstration program made great strides toward the impending Flight Test. The non-precision approach software was flown in the manned flight simulator by a team of test pilots from various communities with encouraging results.

Upon formal integration test completion, installations were commenced on F-14D, D/C-9B, UC-12B, T-44, and TH-57 aircraft. Testing continues on the E-2C, EA-6B, F-14B, T-34, C-20D, RC-12F/M, CT-39G, P-3C, F-18A/B aircraft. The Secretary of Defense ASAP program completed 100 percent of the planned integration for passenger carrying aircraft. This included the C-9B/DC-9, UC-12B/F/M, C-20D/G, C-130T, VH-3D, VH-60N, CT-39G, C-2, VP/UP-3 for a total of 178 aircraft. NAVAIR delivered 571 fully integrated GPS installations in Navy/Marine Corps and Coast Guard aircraft.

*Air Traffic Control.* Air Traffic Control and Landing Systems support control and landing applications at sea, as well as at Navy and Marine Corps air stations worldwide. The program continually pursues upgrades to enhance precision approach and air traffic control services for fleet operations. The Marine Air Traffic Control and Landing Systems support Marine Corps expeditionary requirements. During the past year, the program advanced many new systems that will have initial operational capabilities well beyond the year 2000. These capabilities include the Navy's hardware for participating in the National Airspace System Modernization, joint precision approach and landing systems, and Marine Corps systems. The team is also advancing new sensors and systems for battle group RADAR and combat identification, which are closely interactive with air traffic control.

*Top to Bottom: Sailors stand watch in the Carrier Control Area Air Traffic Control (CCAATC); Global Positioning Satellite technology being tested at the Manned Flight Simulator facility*

*Aircraft Launch and Recovery Equipment.* The Aircraft Launch and Recovery Equipment program supports the launch and recovery equipment needs of the Fleet. The program is responsible for the definition, development, test and evaluation, acquisition, life cycle support, and readiness improvements of aircraft launch and recovery equipment systems. These include all Navy and Marine Corps systems and equipment for launch and recovery of fixed and rotary wing aircraft, visual landing aids, wind measuring systems, aviation marking and lighting installed in ships, and recovery systems and visual landing aids installed ashore. Significant activities for 1998 include: accepting delivery of the P-25 shipboard fire truck; conducting technical evaluation and fire fighting training with the mobile aircraft fire training device; completing operational evaluation on aviation data management and control system/integrated shipboard information system and carrier long range line up system; and performing numerous aircraft launch and recovery equipment and aviation facilities certifications.

The mobile aircraft fire fighting training device has allowed more than 1,500 federal, military, and civilian fire fighters to participate in aircraft fire fighting training exercises. This includes crash crews, at-sea fire parties, and repair lockers from aircraft carriers. The mobile trainer consists of a tow/control vehicle and a trailer. Mounted atop the trailer is a simulated aircraft shape with all external configurations. The computerized control system is capable of simulating engine, wheel, structural, and internal compartment fires. The device brings fire fighting training to afloat and ashore units, and allows fire fighting crews to attack it just as they would attack a real aircraft crash. The mobile training device provides realistic situations for crash crews to battle and significantly reduces fire fighting training costs.

The P-25 shipboard fire truck is a self-propelled vehicle that quickly transports and applies fire fighting agents to CV/CVN/LHA/LHD flight deck fires, extinguishing or limiting the severity of a fire until other systems can be activated. In 1998, performance improvements included a factor increase of four times the AFFF flow rate, a factor of two times greater AFFF onboard volume and a factor of ten improvement rate in reliability.

*Aircrew Systems.* The Aircrew Systems Program provides life cycle acquisition management for aviation life support systems. These systems are developed to protect aircrews from current known and future threats including: directed energy weapons, chemical/biological/radiological agents and fallout, ballistic projectiles, temperature extremes, heat and fire, low concentration oxygen environments, emergency egress high dynamic, and high “g” forces. Through the use of acquisition initiatives, the Aircrew Systems Program has expedited the

*Top to Bottom: Joint Helmet Mounted Cueing System ejection seat test; Members of crash/salvage effecting risk rescue aboard the USS Harry S. Truman (CVN 75)*

*Clockwise: Ejection seat test at NAWCWD China Lake, CA; F/A-18 Hornet flight simulator; live fire fighting training aboard the USS John F. Kennedy (CVN 67); night training evolutions aboard the USS John C. Stennis (CVN 74)*

introduction of life support systems into the Navy and the Marine Corps' fixed and rotary wing aircraft, reduced costs, and promoted interservice commonality. These initiatives include nondevelopment items, joint and tri-service developments, and NATO/Allied cooperative ventures. Through a combination of logistics engineering change proposals, value engineering change proposals, small business innovation research initiatives, and industry partnering, program managers identified savings of $605 million in 1998. Funding for 20 different Affordable Readiness Initiatives were secured resulting in an $85 million cost avoidance for the Navy. In particular, the Navy Aircrew Common Ejection Seat program was used as a pilot to demonstrate how total ownership cost analysis can reduce the overall cost of a weapon system. Total ownership cost initiatives for the Navy aircrew common ejection seat will save the Navy $14.1 million over the next decade.

The Navy Aircrew Common Ejection Seat pre-Planned Product Improvement Program has completed Engineering Proofing Article and Field Maintainability Article testing, and Critical Design Review, and has begun Design Verification Testing. The Joint Helmet Mounted Cueing System program has passed Critical Design Review and achieved first flights for both the Air Force and the Navy.

During 1998, Aircrew Systems awarded a contract for the procurement of a state-of-the-art noncombat survival radio to replace the aging PRC-90. The new radio will incorporate COSPAS / SARSAT (Search and Rescue Satellite Aided Tracking), permitting worldwide location of downed aircrew within a radius of 100 meters. COSPAS is a Russian space system used for the search of a vessel in distress. A development contract was awarded for the design, development, test, and evaluation of a Common Crash Resistant Troop Seat System for the H-3 and H-46 helicopters.

*Support Equipment.* The Consolidated Automated Support System (CASS) provides the Fleet with the capability to test and repair electronic equipment both ashore and afloat. During 1998, NAVAIR purchased 70 CASS stations and installed 58 at various fleet, Navy working capital fund, and foreign military sales sites. There are now 91 CASS aboard the 12 CV ships. More than 320 CASS stations (approaching 50 percent of the inventory objective) have been fielded in total. The antiquated versatile avionics shop tester has now been removed from all the CV ships. The CASS electro-optics support system successfully completed operational evaluation this year, and the first two units have been delivered to the Fleet. New CASS test program sets delivered to the Fleet totaled 242.

The CASS software support activity reached a major milestone when it was certified as meeting the software engineering institute's capability maturity model level 2 standards. Affordable readiness initiatives implemented by the support equipment program in 1998 will save the Fleet

*Top to Bottom: Consolidated Automated Support System; ejection seat test*

more than $3 million. The initiatives cover improvements for several items of common support equipment including the PON-6 pre-oiler, the jet engine corrosion control cart, aircraft tow bars, and the tire inflation kit, as well as several models of tow tractors.

During 1998, NAVAIR delivered more than 3,600 new items of common support equipment to the Fleet, including 2,275 items of pollution prevention equipment. The USS *Truman* was outfitted with 7,500 end items of support equipment and LHD-6 was outfitted with 2,000 support equipment items.

*Above: Tow tractor and tow bar being used to pull an F-18*

## *Foreign Military Sales.*

The Foreign Military Sales (FMS) program office is located in Jacksonville, FL, and works exclusively with security assistance cases to foreign military units and foreign governments. The office acts as program managers for the A-6E *Intruder*, the A-7 *Corsair* II, the S-2 *Tracker*, the AN/AAQ-22C pod-mounted forward looking infrared system, and a military variant of the *Cessna* 337 in-line twin known as the O-2. The FMS office currently manages and supports over 60 FMS cases in over a dozen countries. The FMS program offers affordable, supportable, and capable combat aircraft alternatives to those countries that might not otherwise afford premier tactical aircraft.

During 1998, the TEAM's FMS program office successfully commenced in-country Integrated Weapons Training for the Royal Thai Navy's A-7 program, and successfully completed day and night aerial refueling training for the Hellenic (Greek) Air Force's A-7 programs. Program managers also calibrated, tested, and made operational the A/E37T-14 Engine Test Cell for testing TF-41 engines in Araxos, Greece. A test cell for the base in Souda Bay, Crete, will be delivered and installed soon.

New business development included preparing pricing and availability for the Government of France to procure 12 A-6E aircraft and all related A-6E training, spares, and support for the French Navy. Further, the TEAM took on new FMS cases with New Zealand in support of A-4 ejection seats and with Australia in support of the TF-30 engine used in the F-111. The FMS program office also accepted 10 French E-6A cases from another program office. Seven of the ten were candidates for closure. Before the end of 1998, we were able to initiate closure certification for four of those seven; we have reprogrammed case funding to resolve problems in the remaining active cases.

Management of aircraft no longer in the U.S. inventory requires considerable logistics planning. Program managers have consolidated, inventoried, and retained spares and support equipment to ensure viability of future A-6E FMS cases. Last year, the FMS program management sold enough A-7 materiel from our Orange Park, FL, warehouse to fully fund that warehouse and the warehouses in Granite City, IL; Beaufort, SC; China Lake, CA; and Point Mugu, CA, which are used by other TEAM program offices directly supporting the U.S. Fleet.

Finally, the FMS program office took aggressive action in 1998 to upgrade the avionics and weapons systems in the existing customer base, including managing cases that will replace or eliminate expensive/high failure rate equipment and fix an impending Year 2000 computer problem in an engine monitoring and test station.

# IMPROVING READINESS

*Affordable Responsiveness.* Faced with declining resources, aging aircraft inventory, and rapidly escalating operating costs, the TEAM has pursued an active role in reducing the cost of doing business for the Navy. Cost reduction is imperative to achieve a more efficient, affordable military strategy. Today's challenge is significant – to sustain our superior warfighting capabilities, improve fleet readiness, and ensure we maintain our technological superiority well into the future. The Navy is examining every avenue to reduce costs while improving readiness and preserving quality. To answer this challenge, the TEAM is reengineering processes and investing in initiatives that will yield high returns in the future. NAVAIR's Affordable Readiness Program and the Chief of Naval Operations' Aviation Maintenance and Supply Readiness Study Group are two key initiatives driving credible solutions for maintaining operational capability, reducing operating support costs, and improving our responsiveness to the Fleet.

*Aviation Maintenance and Supply Readiness.* Balancing today's operational requirements while ensuring that we are properly poised and ready to meet the threats of the future is becoming increasingly difficult. While deployed readiness remains adequate, nondeployed readiness has declined. Illustrating this tenuous balance requires an understanding of the Navy's deployment cycle.

Following a deployment, units enter the Inter Deployment Training Cycle (IDTC). During early stages of the IDTC, readiness degradation is expected as ships and aircraft undergo maintenance and crews turnover. As units progress through the IDTC, readiness should steadily improve as maintenance is completed and training opportunities increase. In the latter stages of the IDTC, units hone their warfighting skills by participating in exercises designed to ensure full combat readiness prior to deployment.

Nondeployed readiness is currently funded at levels that leave little margin for flexibility. When funding shortfalls occur, the Navy focuses first on ensuring the full readiness of deployed forces. Consequently, nondeployed readiness suffers as units in earlier stages of the IDTC defer the ordering of parts, maintenance, and training so that additional funds can be made available for deployed units. While this allows us to maintain a satisfactory deployed readiness posture, it has an undesirable effect on nondeployed forces. As a result, the nondeployed airwing readiness curve, or "bathtub," normally associated with units in the IDTC has become increasingly deep and recovery to full combat readiness has become much more taxing, occurring later in the IDTC. The "bathtub" chart illustrates the increasing difficulty our nondeployed forces are experiencing as they pass through the IDTC.

The Navy became increasingly concerned with some key readiness indicators and the degree to which it had been unable to take necessary corrective actions. In response to these rising concerns, in March 1998, the Chief of Naval Operations (CNO) directed the formation of an Aviation Maintenance and Supply Readiness (AMSR) Study Group. Representatives from the Fleet and the TEAM were tasked with identifying specific actions that would reduce overall aviation maintenance and supply costs, increase readiness, and provide systemic improvements to support naval aviation in the 21st century. The study group focused on problems contributing to the deterioration of naval aviation.

As the study group identified issues and formulated recommendations, five primary focus areas emerged: Metrics; Integrated Logistics Support (ILS); Maintenance and Supply; Personnel; and Funding and Cost Management. Within these five areas, the study group identified eighteen separate issues. NAVAIR has taken the lead in nine of these issues. These are: customer focused metrics; ILS metrics reporting improvements; ILS moving away from plane-side; ILS health maintenance; NAVAIR/ Naval Aviation Depot core depot workload; aviation configuration management; aircraft and engine shortfalls; cannibalization; and Aviation Depot Level Repairable (AVDLR) costs and reliability.

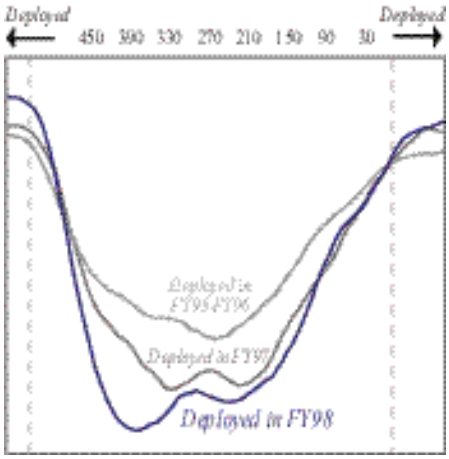
The AMSR Study Group briefed Navy and Marine Corps leadership and gathered feedback throughout the Fleet from the executive and deckplate level. From their discussions and fleet visits, the study group recognized the urgency for immediate action to stop further degradation and the long-term nature of implementing fundamental process changes. The group recommended both short and long term solutions to address the issues. While most initiatives will take time before sizable gains can be measured, some of the AMSR study group's recommendations are already having a positive impact on improving responsiveness to the customer. The corrections will be made in the context of "best value" for the Navy as a whole, providing balanced solutions that meet both short and long-term needs. The NAVAIR logistics team has taken an active role in this effort by working with all levels of Navy including the Systems Commands, the Type Commands, Commanders in Chief, and the operational Navy to coordinate and facilitate the accomplishment of the AMSR study group objectives.

## *Affordable Readiness.*

NAVAIR's Affordable Readiness Program is a concept of operations whereby platform/equipment/competency managers are required to continuously seek and implement opportunities to reduce life cycle support (operating/support/infrastructure) costs, while sustaining the fleet readiness and safety of applicable aircraft and equipment. The intention is that the savings from such reductions are to be reinvested in naval aviation modernization and recapitalization. The Navy is looking across every avenue to find ways to reduce costs while also improving readiness. We are changing our processes and investing in initiatives that will yield high returns in the future.

NAVAIR has established set aside funding that has been made available to all Program Teams and Competency Teams who have "good ideas" that require a fixed investment, and that will provide a quantifiable return on that investment over the next ten years. In FY98, NAVAIR invested $38.3 million in 40 of these cost-reducing initiatives and expects a Return On Investment (ROI) of $265.5 million by FY07. In FY99, NAVAIR plans to fund another 138 initiatives, requiring $101.2 million. These initiatives should reduce requirements another $913.1 million over the next ten years, with most of the reductions being in depot level repairables.

*Nondeployed Air Wing Readiness "Bathtub Chart"*
*(Days Prior to Deployment)*




*Aircraft and Systems Age*

## *Total Ownership Cost.*

Faced with declining resources, aging aircraft inventory and rapidly escalating operating costs, the TEAM has taken an active role in reducing the cost of doing business for the Navy. This is no longer simply a matter of eliminating wasteful spending; that point has long passed. The challenge today is to sustain our superior warfighting capabilities, improve Fleet readiness, and ensure that we maintain our technological superiority well into the future.

Since NAVAIR began implementing Affordable Readiness, additional guidance and direction from both the Department of the Navy (DON) and Department of Defense (DOD) on Total Ownership Cost reduction have

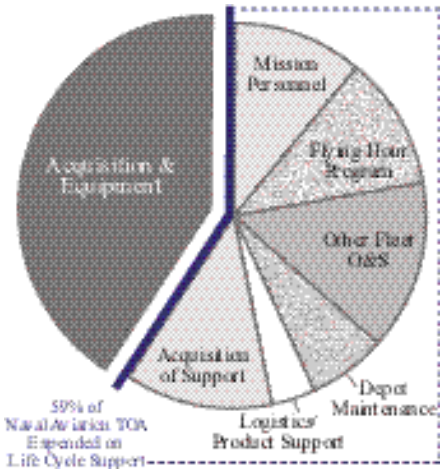
been released. Total Ownership Cost (TOC), as defined for the ASN (RD&A) Strategic Plan, includes all costs associated with the research, development, procurement, operation, logistical support, and disposal of an individual weapon system including the total supporting infrastructure that plans, manages, and executes that weapon system program over its full life.

TOC reduction is not a Navy only effort, it is a DOD-wide issue – the Air Force for example, has a formally established Total Ownership Cost Program Office. But both ASN (RD&A)'s TOC directive and the DOD thrust have been based upon the NAVAIR's Affordable Readiness. A simplistic view is that TOC reduction is the overall umbrella and Affordable Readiness is the process for implementation of Life Cycle Support/In-service programs – while the application of Cost As an Independent Variable (CAIV) is the process for managing cost during R&D/preproduction programs.

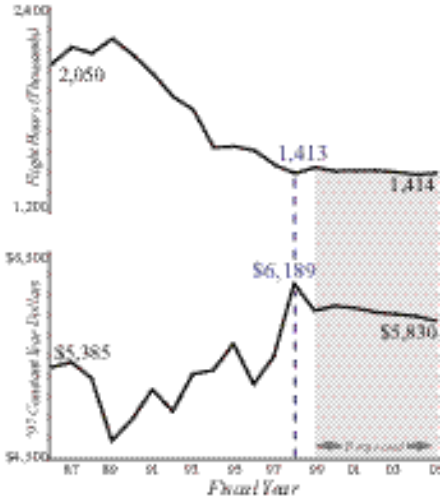
## *Integrated Maintenance Concept.*

NAVAIR's Integrated Maintenance Concept (IMC) is one method of achieving Affordable Readiness goals. The IMC uses Reliability Centered Maintenance (RCM) – a proactive process to establish and adjust preventive maintenance requirements for all levels of maintenance. RCM bases preventative maintenance measures on the failure characteristics of equipment. It increases system performance when applied across the life cycle and allows equipment to realize its inherent reliability at the lowest cost. RCM enables managers to better plan and schedule aircraft maintenance among depots, intermediate and organizational level maintenance activities, as well as to utilize private industry. Implementing IMC throughout naval aviation will take a combined Fleet and TEAM-wide effort. Together, the Fleet and the Naval Aviation Systems Team can use IMC to reduce both aircraft out-of-service time and operating support costs. IMC has reduced spending for the AV-8B *Harrier* from $9.8 million per year to $1.2 million. Additionally, T-45 aircraft costs have declined from approximately $325 thousand to $65 thousand per unit.

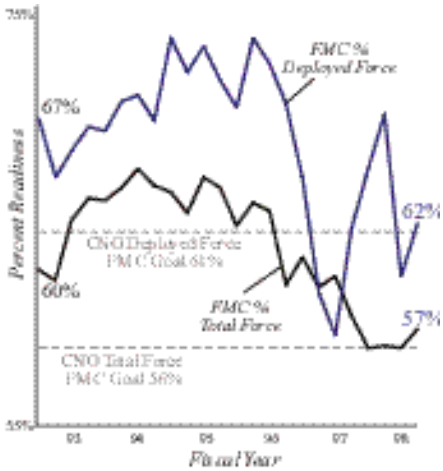
*Life Cycle Support*




*Life Cycle Support Cost (Per Flight Hour)*




*Readiness Trend (Fully Mission Capable)*



# REDUCING COST

## *Activity Based Costing / Business Process Reengineering.*

Throughout the past decade, the Navy's fundamental challenge has been to maintain its warfighting edge in an era of increasingly limited resources. The Naval Aviation Systems Team has undergone tremendous change in order to respond effectively to the Navy's needs. Since the early 1990s, the TEAM has closed sites, consolidated, resized the work force, realigned the organization, and strengthened relationships with the private sector.

TEAM leadership recognized the need to go beyond reductions in people and infrastructure to achieve significant savings in cost and cycle time. In 1998, the focus shifted to improving efficiency through process reengineering. An Activity Based Costing (ABC) study was initiated to determine the costs of our internal processes and activities. The ABC study identified significant cost drivers, which allowed the TEAM process owners to identify candidates for reengineering from within the TEAM's six core processes: Acquisition Management, Test and Evaluation, Repair and Modification, In-Service Engineering and Logistics, Technology Development and Organic Development, and Support Services. After reviewing recommendations and weighing strategic implications, leadership selected 14 processes to reengineer that would have the most immediate impact on the Fleet and would achieve significant improvements in cost and cycle time.

By the end of 1998, the first eight teams had completed their redesigns and identified recommendations to increase process efficiency. Implementation of these processes will take place in 1999. The eight initial process teams were: Acquisition Management, Test and Evaluation (T&E) Network Centric Warfare Capabilities, T&E Infrastructure Consolidation, T&E Processes; Material Management, Naval Aviation Depot Planning and Scheduling, Component Repair, and Engineering Investigations.

The remaining teams are in various stages of their projects. The Government Software Development and Financial Management teams are currently in the redesign phase, examining ways to facilitate reengineering and implement standardized business practices. In-Service Engineering and Logistics, Science and Technology Strategy, Information Technology, and Asset and Property Management will begin redesigning processes in 1999.

NAVAIR is continuing to take steps to be a process-oriented organization. Our challenge is to find new ways of doing things better and continue to design different approaches to providing solutions. We are committed to meeting that challenge. Periodic cost studies will be conducted, and new processes will be selected for redesign as the environment indicates. The business process reengineering efforts enable us to transform processes to deliver savings the Navy needs. These funds can be used to improve combat capabilities and to invest in modernization, recapitalization and information technology that 21st century warfighting will require.

## *Commercial Activities / Outsourcing.*

As the TEAM pursues ways to ensure the best business outcome for the Navy, we continue an ongoing search for the most efficient and cost effective way to perform our functions. Commercial Activity cost studies (directed by Office of Management and Budget Circular A-76) are a proven methodology used throughout the government to build leaner, more efficient organizations. Activity efficiency-based competition helps determine the most cost effective and efficient ways to complete work. In essence, the government competes against contractor bids to determine who can perform the work more efficiently. Historically, commercial activity studies have result in an average of 30 percent savings whether the government or private sector wins. The government wins about 50 percent of the commercial activity studies. Savings generated throughout the TEAM will be used for critically needed modernization and recapitalization.

Through September 1998, 1,572 civilian positions were designated for competitive sourcing. Each site identifies commercial activity study teams to develop comprehensive performance work statements describing the work to be performed. Independent auditors review performance and cost estimates to ensure equity in comparing government and industry bids. The work statements are then used as the basis for the solicitation. The best value contractor proposal is selected and compared against the government's most efficient organization. If the contractor bid is at least ten percent less than the government bid, a tentative outsource decision is made.

The TEAM underwent 14 studies during 1997 and 16 during 1998. The TEAM identified positions in the areas of test and evaluation (Atlantic ranges and facilities, aircraft maintenance, test article preparation); shore station management (supply and vehicle services, material management, and facilities maintenance); and automated data processing and administrative support services, for commercial activities cost comparison. All eight TEAM sites were included for study. In 1998, studies at Patuxent River's Aircraft Intermediate Maintenance, Lakehurst's Material Management and China Lake's Propulsion, Warheads and Environment Test Site were completed. In all three cases, the government's most efficient organization bid proved to be more cost effective. Currently, the TEAM is involved in 24 ongoing studies. The average study process time, from start to award, is 18 to 27 months.

*Privatization.* In addition to outsourcing, privatization of certain functions is another avenue the Navy and the TEAM is using to reduce infrastructure costs. We initiated utility privatization studies at four of the sites we own: Patuxent River, MD; Lakehurst, NJ; Orlando, FL; and China Lake, CA. We will continue working with the Naval Facilities Command and local utility companies in support of the Department of Defense's (DOD's) goal to privatize all DOD owned/operated utility systems.

In 1998, we continued to pursue divestiture of the seven Naval Weapons Industrial Reserve Plants that NAVAIR owns and aviation contractors operate. This year, we turned over more than 3,000 acres of land and facilities at Calverton, NY, to the local community, and more than 230 acres of land in McGregor, TX. In each case, the local communities are pursuing redevelopment plans, and envision many new economic gains from these plants that are no longer in use by the Navy. Of the seven plants, two are closed and are in the process of being deeded over to local communities (Calverton and McGregor), another two are planned to be turned over to local communities, and the remaining three will be sold to either the current operators or other entities.

*Partnerships.* In the early 1990s, the United States military focused on partnering with each other and creating efficiencies through jointness. Since then, we have broadened our views to a more businesslike approach that includes pursuing partnerships with other government agencies, industry, and the academic world. By doing so, we can take advantage of cost efficiencies. Even more importantly, we can share ideas and innovations, expanding not only our military capabilities, but also developing new technologies for the benefit of society. The V-22 *Osprey* program is one example of how a joint military program in partnership with aerospace industry is developing new technologies with enormous potential for both military and private sector applications.

*Left to Right: V-22 Osprey; flight deck ordnancemen "de-arm" an F/A-18C Hornet*

In order to take advantage of these opportunities, we are actively seeking innovative agreements with industry and academia, as well as state, local, and international governments. The Naval Aviation Systems Team can offer unique facilities and world-class expertise in program management, test and evaluation, modeling, simulation, and engineering. Through partnerships we reduce duplication and increase access to leading edge commercial technologies. Partnerships provide a bridge to move technology out of our labs and into the commercial marketplace – allowing us to influence product designs that may address future military requirements. Everyone wins, including the Fleet.

Government and industry partnerships in supporting systems have enabled us to provide efficient, "just-in-time" delivery of parts. Through the F-14 component Virtual Prime Vendor program, Naval Aviation Depot, Jacksonville, is repairing components, and the vendor is responsible for manufacturing, configuration, engineering, technical support, and supplying the Fleet at a specified readiness level. We save cost and improve readiness to the Fleet through a vendor-managed inventory, based on usage and reliability.

Both commercial and military customers are using our ranges, facilities and expertise to conduct complex air, land, and sea testing and training. While it is economically smart for our customers, we are provided additional sources of funding to offset our operating expenses, lowering costs for our principal customers. Test and evaluation is being conducted concurrently, saving time and money. On the F/A-18E/F and V-22 programs, test teams are co-led by government and contract personnel who share equal responsibility and accountability.

The Weapons Team Engagement Trainer (WTET) developed at our Training Systems Division was the result of crossing commercial investment with technology. The WTET provides realistic tactical engagements for military Special Forces and civilian law enforcement personnel. This collaboration resulted in a versatile product, costing one third less than originally planned. This opened the door to an interagency agreement with the Department of Justice. In addition, TSD Orlando worked closely with the University of Central Florida and state and congressional delegations to develop a partnership that offered Navy land for UCF to build on, in exchange for needed floor space in the new building for TSD. This partnership not only saved Navy military construction dollars that would have been spent to build the facility space that TSD needed, but also creates an ongoing relationship with UCF and TSD to develop and share new training technologies within the same facility.

We are well on our way to successful partnerships. During 1998, the TEAM successfully kicked off the Naval Aviation Community Partnership initiative between local community and business leaders, and our activities, fostering improved relationships and mutually beneficial development opportunities.

*Acquisition Reform Initiatives.* The Naval Aviation Systems Team continues to aggressively pursue Acquisition Reform Initiatives and to work with acquisition managers and contractors to reduce costs and procurement times. Initiatives have yielded tangible savings, and acquisition reform has become an integral part of the program planning process. During 1998, we conducted an Acquisition Reform Road Show to introduce goals, processes and reform tools to some of our major and second-tier contractors. Throughout Acquisition Reform Awareness Week, we provided extensive training, materials and feedback to our acquisition team.

NAVAIR initiated efforts in support of the Paperless Acquisition effort mandated by the Office of the Secretary of Defense. In 1998, the TEAM made significant progress in the electronic transmission and processing of contract solicitations and awards. More than 70 percent of solicitations and awards are now processed electronically. NAVAIR has developed a comprehensive plan utilizing a "system of systems" approach. Capitalizing on existing systems at Headquarters, the Aircraft Division, the Naval Sea Systems Command, and in conjunction with DOD initiatives, NAVAIR has designed a low-cost approach to meet the requirements for paperless acquisition.

The Standard Procurement System (SPS) is a DOD mandated initiative for contractual document preparation designed to meet paperless acquisition requirements. The

NAVAIR TEAM attained Initial Operational Capability (IOC) status and was the first major SYSCOM in the Navy to achieve IOC utilizing a single server supporting 1,400 users throughout the TEAM. In addition, NAWCWD in China Lake was one of the first sites in the Navy to attain Full Operational Capability status. Intended as the single procurement system to be used throughout DOD, the SPS is expected to replace other NAVAIR systems providing expedient connectivity throughout the organization.

Specifications and Standards Reform has decreased reliance on detailed product and process descriptions, and increased emphasis on the use of performance-based descriptions and commercial specifications. Working with industry and professional associations, we have achieved a 48 percent reduction of military specifications and standards through cancellations, using commercial equivalents, and rewriting performance specifications.

Alpha Acquisition Contracting, a joint government/industry process, has replaced many traditional, sequential contracting processes. Alpha Acquisition contracts are concurrently negotiated, prepared, and reviewed, resulting in a 66 percent reduction in time to award. The F/A-18E/F LRIP II/III contract was completed using Alpha Contracting, resulting in a $500 million savings on a $3.7 billion contract. The process saved more than four months, yet it was significantly more complex and larger in scope. Alpha Contracting was instrumental in the timely award of follow on test and evaluation contracting efforts for the F414 engine.

Government/Contractor Integrated Test Teams, comprised of government and industry personnel spanning all activities, have increased availability of data for all participants, established a single set of project facts, and enabled the understanding of distinct and complementary roles. Both government and industry team members review test results concurrently, reducing flight and test requirements.

Earned Value Management (EVM), an industry best practice endorsed by the General Accounting Office and Office of Management and Budget, is used to redesign the management processes at TEAM sites. EVM identifies problems not previously known, has the capability to trace problems to source, improves forecasts of at-completion costs, and improves customer confidence in management systems. All work is planned, budgeted, and scheduled in time-phased “planned value” increments. EVM is a valuable tool for identifying both performance trends and variances from the management plan.

The Single Process Initiative (SPI), a key component of DOD acquisition reform, has enabled us to use performance based specifications and best commercial practices. To date, we have reviewed 619 proposals, and 427 contracts have been modified to incorporate SPI initiatives. The goal of SPI is to eliminate multiple processes, both manufacturing and business, thereby reducing cost and government oversight. Thus, DOD gets the most for its dollars spent.

The automated Contract Performance Assessment Reporting System (CPARS) completed testing during 1998 and is now operational. CPARS is a source of contractor performance information that is current and available for use in conducting source selections. The CPARS process motivates contractors to improve their performance. As of March 1998, DOD and Navy guidance has expanded the scope of CPARS to cover Services, Operations Support, and Information Technology. The primary purpose of the CPARS is to provide a database

*Left to Right: AV-8B Harrier; CH-46 Sea Knight transports ammunition to the carrier USS Enterprise (CVN 65)*

of contractor performance information that is current and available for use in source selections.

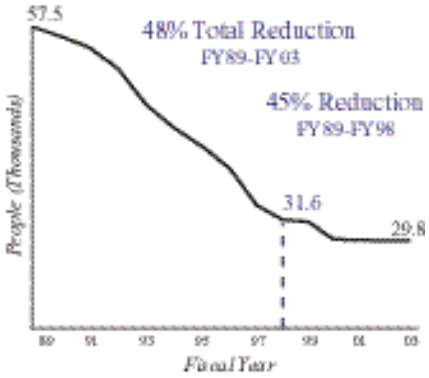
The Naval Aviation System Team will continue to pursue savings in all areas of acquisition processes, while maintaining its outstanding reputation for providing customers with the finest, most affordable products and services available.

## *Base Realignment and Closure.*

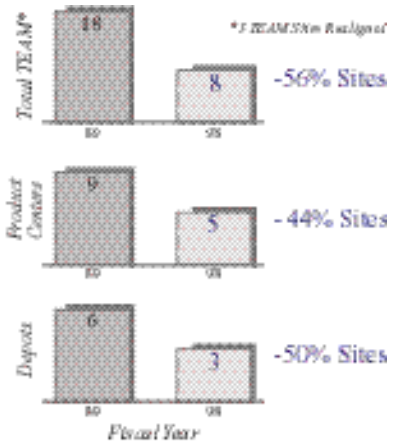
This year, the TEAM completed several realignments that represent the end of the 1995 BRAC commission actions. The Naval Air Warfare Center Aircraft Division, Trenton, NJ, transferred its functions, effective 1 October 1998, between facilities at NAS Patuxent River and the Arnold Engineering Development Center in Tullahoma, TN. Eighty-four test and evaluation personnel relocated to NAS Patuxent River. Additionally, the Naval Aviation Engineering Service Unit (NAESU) and the Naval Air Technical Services Facility (NATSF), both located in Philadelphia, PA, consolidated and transferred their functions to the Naval Air Station at North Island, CA, effective 1 October 1998. The consolidated functions at North Island were collectively renamed the Naval Air Technical Data and Engineering Service Command (NATEC). In another BRAC-related move, NAVAIR turned over station management of Point Mugu to the Pacific Fleet on 1 October 1998.

The Philadelphia sites were the last major NAVAIR sites closed under the 1995 BRAC. During the past decade, NAVAIR underwent the closure of three of six Naval Aviation Depots (NADEPs Alameda, CA; Pensacola, FL; and Norfolk, VA); and seven other site closures or realignments throughout the United States. Overall, NAVAIR has experienced a 45 percent reduction in personnel and has reduced from eighteen sites to eight. After undergoing the painful but necessary closure process, the TEAM's Depots emerged as a testament to process reform. Although operating with only 70 percent of the manpower they had before the BRAC closures, process improvements have allowed the three remaining Depots to perform 100 to 150 percent of the former workload previously done by six locations.

*FY89-FY03 People (Military / Civilian)*




*Total TEAM Sites, Depots, and Product Centers Site Reductions*

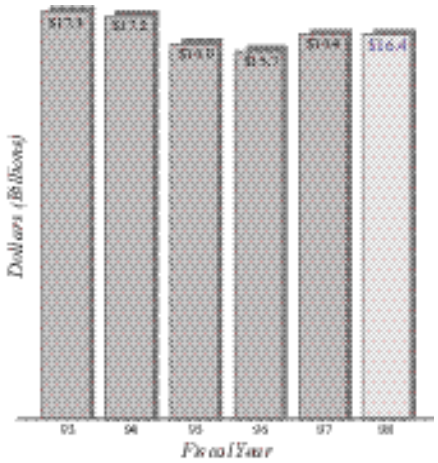


# FINANCIAL OVERVIEW

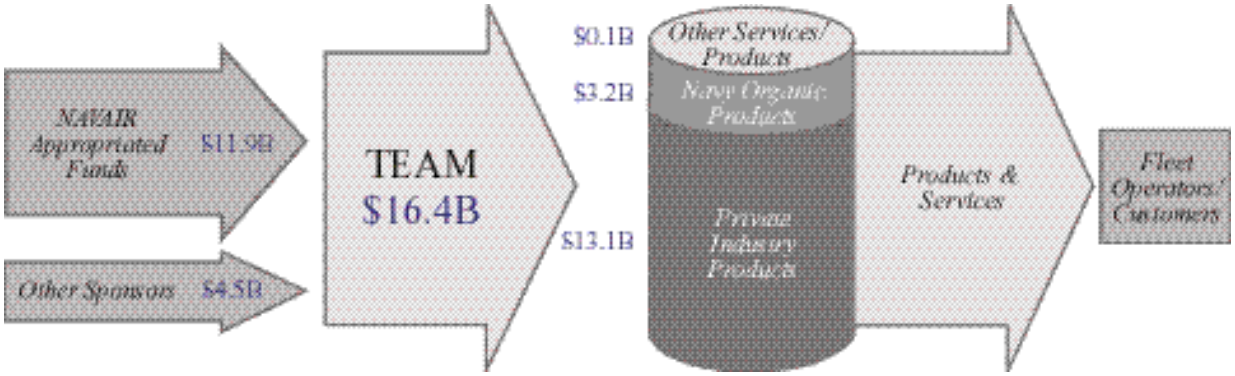
*Macro Funding Flow.* The TEAM recognizes its critical role as steward of the funds entrusted to it and continually seeks opportunities to improve its business processes and spending effectiveness to ensure the best value for the Navy. In 1998, TEAM leadership recognized the need to look beyond reductions in work force and infrastructure to achieve savings in cost and cycle time and took significant steps toward understanding the costs associated with its products and services. An Activity Based Costing (ABC) study was conducted using financial and manpower data. The results of the study helped leadership understand how resources are distributed relative to the products and services they provide and identified processes for Business Process Reengineering (BPR). Currently, a command wide Business Process Reengineering effort is in progress to ensure that the most efficient and cost effective business practices are in place. This effort focuses on reducing the $3.2 billion the TEAM spent internally on products and services in 1998.

The TEAM's total funding in 1998 was $16.4 billion; $11.9 billion were NAVAIR appropriated funds *(figure 1)*. The Deputy Chief of Naval Operations for Air Warfare (N-88) is the largest sponsor of this direct funding, providing 91 percent of the total appropriated funds. The remaining $4.5 billion comes from other Navy (NAVSEA, etc.), as well as non-Navy organizations (Air Force, Army, Foreign Military Sales, etc.). In support of naval aviation, the Naval Inventory Control Point contributed $0.7 billion for component and manufacturing at the depots. Although total funding has remained the same as in 1997, NAVAIR appropriated funding decreased by 3 percent, while funding from other Navy and non-Navy customers increased *(figure 2)*.

*TEAM Funding (All Sources)*
*(figure 2)*




*Funding Flow*
*(figure 1)*



The majority of the TEAM's funds, 80 percent ($13.1 billion), is awarded to private industry. The proportional share of funds going to private industry has increased over the past five years from 69 percent in 1993 to 80 percent in 1998 *(figure 3)*. This trend demonstrates the TEAM's commitment to the goals of the National Performance Review.

The TEAM spent $3.2 billion internally (organic) on products and services. The TEAM operates in a partnership with other services on a variety of joint programs. The remaining $0.1 billion of the $16.4 billion was allocated to other services, agencies, and SYSCOMs.

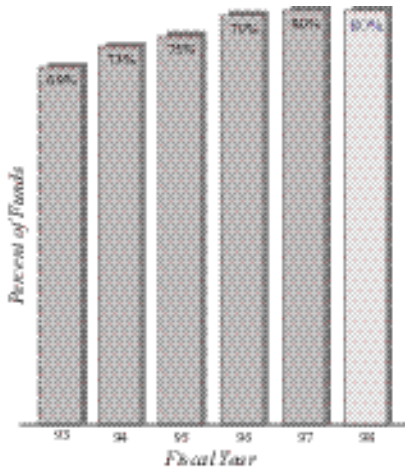
NAVAIR appropriated funds were $11.9 billion *(figure 4)* in FY98. These funds consist of the following types: Aircraft Procurement (APN), Weapons Procurement (WPN), Research Development Test and Evaluation (RDT&E,N), Operations and Maintenance (OMN), Other Procurement (OPN), and Other (PAN&MC & BRAC) *(figure 5)*.

Overall, the TEAM has experienced a 41 percent reduction in appropriated funds since 1989 *(figure 6)*. Procurement of several of the TEAM's recapitalization programs are driving the future increase in funding throughout the Five-Year Defense Plan (FYDP). Fiscal year quantity increases are planned for both the F/A-E/F and V-22. Twenty F/A-18E/Fs were procured in 1998; compared to twelve in 1997. Procurement of the V-22 and the F/A-18E/F represent 32 percent of the total budget in FY03.

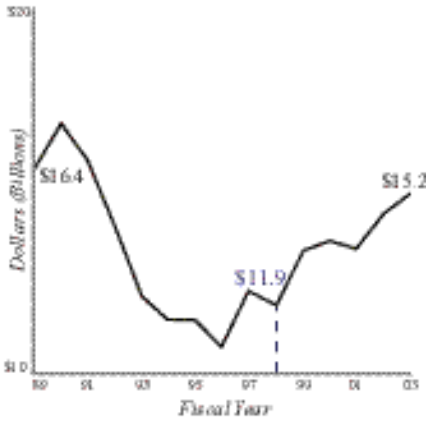
## OPERATING EFFICIENCY

*Net Operating Results.* The TEAM operates the Naval Aviation Depot and Product Center Working Capital Fund at net-zero level. Workload fluctuations are expected to result in minor surpluses or losses from year to year. To compensate for this, the TEAM adjusts rates for services accordingly and recoups for sufficient reimbursements to bring the fund back to a net-zero state. During FY98, both the Product Centers and the Depots operated within 1 percent of planned activity levels.

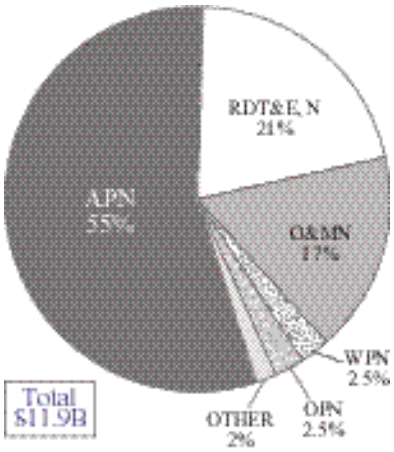
*Percent of Funds to Private Industry*
*(figure 3)*




*NAVAIR Appropriated Funds (Trends)*
*(figure 4)*




*FY98 NAVAIR Appropriated Funds*
*(figure 5)*



*Overhead.* Throughout the past eight years, there have been significant reductions in overhead at the Depots and Product Centers, primarily due to the closing and consolidation of sites as part of the Base Realignment and Closure (BRAC) commission. In 1998, there were some fluctuations in the overhead as the TEAM reached a stable period following the completion of major BRAC actions *(figure 7)*. We have determined our minimum essential capabilities and our current work force is near optimum size based on our TEAM's mission.

The TEAM continually evaluates opportunities to reduce the cost of operations without jeopardizing critical capabilities, thus retaining a mission essential work force and technological superiority. Through Commercial Activities Studies and BPR efforts currently underway, the TEAM will look for opportunities to further streamline costs. The TEAM wants to ensure full utilization of its facilities through increased use by other customers to reduce the cost of infrastructure to our naval aviation customers.

*Measuring Unit Cost.* One way financial results are measured is through unit cost. The Standard Depot Level Maintenance unit cost for the S-3 aircraft has seen a 34 percent reduction since FY95 *(figure 8)*. These results are due primarily to the implementation of the Program Depot Maintenance Schedule System (PDMSS) has proven to be a very successful tool in saving time and money.

*Workload / Work Force Trends.* The DOD shift in strategy following the end of the Cold War led to a substantial reduction in the work force and a decrease in military spending. This trend is now beginning to stabilize as we reach the end of the BRAC consolidations and strive to maintain a work force capable of performing core critical capabilities for the TEAM. This reduction in work force has occurred more rapidly than the reduction in workload for both the Product Centers *(figure 9)* and

*FY89-FY98 Appropriated Funds (Percent Reductions)*
*(figure 6)*

*Overhead Cost Trends*
*(figure 7)*

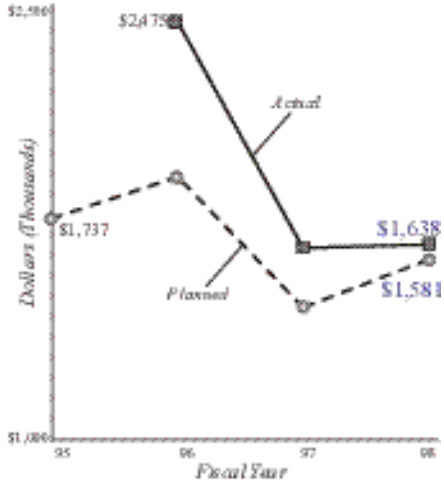
| PRODUCT CENTERS | FY91 | FY97 | FY98 |
|---|---|---|---|
| Overhead Cost | $934 | $652 | $621 |
| Ratio of Overhead to Total Cost | 33% | 27% | 30% |

FY91-98 Overhead Cost Reduction 34%

| NAVAL AVIATION DEPOTS | | | |
|---|---|---|---|
| Overhead Cost | $896 | $532 | $542 |
| Ratio of Overhead to Total Cost | 37% | 34% | 35% |

FY91-98 Overhead Cost Reduction 40%

*S-3 Standard Depot Level Maintenance Performance Unit Cost*
*(figure 8)*



Depots *(figure 10)*. Therefore, fewer people must perform the duties and responsibilities necessary to maintain and support a ready force, able to meet future demands.

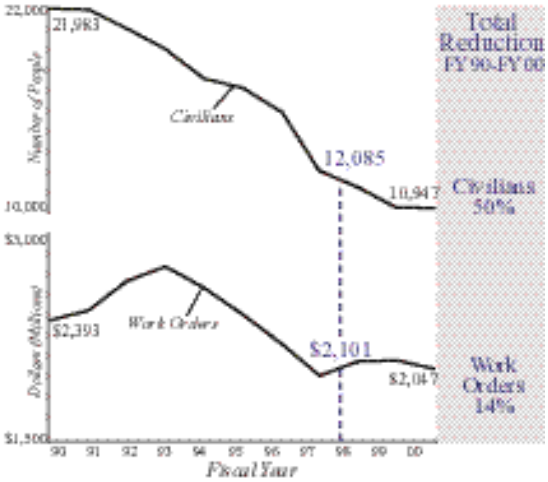
## *Our Financial Future.*

As we reach the final stages of a tremendous downsizing effort, we must find innovative ways to bring added value to the customer. One of the primary methods to accomplish this undertaking within the coming years will be to embed Total Ownership Cost (TOC) reduction as an integral part of our business. By understanding all costs associated with a weapons system, including the total supporting infrastructure that plans, manages and executes the program, we can explore new ways to reduce those costs.

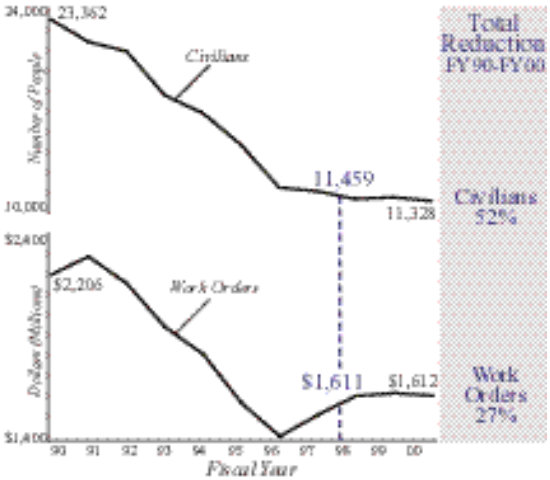
Other means to achieve cost reductions include the CNO's Aviation Maintenance and Supply Readiness (AMSR) study group, Business Process Reengineering (BPR), and the utilization of Enterprise Resource Planning (ERP) systems to enable the organization to make better "corporate" decisions. Our five-year strategic plan calls for improved performance measurement, increased operating efficiency, improved return on investments, and reduction of costs in internal processes. Additionally, we are seeking partnership opportunities that allow outside customers to utilize our infrastructure resources. This results in better asset utilization and increased savings for our primary customers.

As we approach the 21st century, delivering quality products and services at an affordable price to the customer remains our top priority.

*Product Centers Customer Orders and Work Force (figure 9)*




*Naval Aviation Depots Customer Orders and Work Force (figure 10)*



## *Team Awards.* Like any winning team, the success of the Naval Aviation Systems Team rests squarely on its members. Dedication, integrity and commitment to excellence are the hallmark of the people who comprise our TEAM.

The entire TEAM earned the aviation industry's admiration when Aviation Week & Space Technology magazine selected the Naval Air Systems Command (NAVAIR) as the first Aviation Week Quality Center. The award recognizes superior quality management at both civil and military organizations and facilities, as well as the geographic regions that support their operations. NAVAIR was chosen for its demonstrated success in developing and implementing customer-focused quality initiatives that have dramatically improved productivity and life cycle support while reducing the cost of acquiring and sustaining Navy and Marine Corps warfighting capability.

On 7 December 1998, at a formal presentation at the Pentagon, members of the Naval Air Systems Command's Industrial Operations Team were presented the prestigious Hammer Award. The Hammer Award is Vice President Al Gore's special recognition to teams of federal employees who have made significant contributions in support of the President's National Performance Review (NPR) principles. The team was selected by the Office of the Under Secretary of Defense (Comptroller) for its success in executing Base Realignment and Closure 1993 NADEP infrastructure reductions and workload consolidations.

The Training Systems Division Research and Engineering Department's In-Service Engineering Division Received Vice President's Hammer Award for In-Service Training Engineering Cost Reduction Efforts. The department's Quick Response Modification (QRM) Process streamlined the Standard Modification Process (response and action procedure) for evaluating and implementing proposed design and engineering changes to existing warfare trainer/training systems. The QRM process realized a significant cost avoidance of more than $33.2 million (FY94-98) by reducing maintenance costs, cycle time and improving readiness. The QRM process also reduced trainer down time due to time saved during modification upgrade.

The Naval Inventory Control Point (NAVICP) earned two prestigious National Performance Review Hammer Awards. The first, for pioneering the use of processes used to determine the number of spare parts positioned at Navy and Marine Corps activities to support aircraft maintenance and flight operations. Improvements realized savings of $202 million. The second Hammer Award highlighted NAVICP's efforts in assisting a Hardware Systems Command team in eliminating non value-added steps, streamlining product delivery, and reducing infrastructure costs. The NAVICP accomplished this by accepting management responsibilities for 4,500 end items.

Acquisition reform is an area that TEAM members have worked hard toward achieving. Reducing ownership costs and improving our responsiveness to the Fleet and other customers is our never-ending concern. TEAM program managers recognized a need within the Fleet for general purpose transportable automatic test equipment to support electronic systems on board ships and at shore sites. Concerns with the proliferation of peculiar support equipment and lack of commonality among test equipment prompted the development of the Consolidated Automated Support System (CASS). The CASS is designed to increase material readiness, reduce weapon system life cycle costs, and improve tester sustainability. The CASS will provide a Navy-wide testing capability for existing and future electronic requirements. With their innovative solution, the consolidated automated support system logistics team earned the Admiral Stan Arthur Award for Logistics Excellence in recognition of achieving a cost

avoidance of more than $240 million. The Naval Inventory Control Point (NAVICP) shared the Admiral Stan Arthur Award with NAVAIR.

In June 1998, Naval Aviation Depot (NADEP) Cherry Point received a DOD Value Engineering Achievement Award for reducing aircraft repair and facility operating costs. The NADEP's winning proposal was two-pronged and involved modifying, rather than purchasing, a CH-53D overhead door fixture to accommodate the "E" model during repair, and installing a pneumatic air receiver to reduce compressor run time and increase production test capability. These two efforts netted savings of $101,244 and $160,000, respectively, for reduced material procurement and reduced electric utility costs.

The DOD recognized the T45TS naval undergraduate flight training system team's success through the receipt of the Defense Acquisition Executive Award for Excellence in Acquisition. The DOD also awarded the Service Acquisition Executive Certificate of Achievement to the F-14 earned value management implementation team, the F-14 integrated process team, and the MA-31 foreign comparative test team.

Stewardship of the environment is a responsibility TEAM members take very seriously, as evidenced by the number of awards and hard-earned recognition received during 1997 and 1998. NADEP North Island, CA, received the Secretary of Defense's Environmental Award for Industrial Installations in 1997. To be eligible for the Secretary of Defense award, NADEP North Island first had to compete for and win both the Chief of Naval Operations (CNO) and the Secretary of the Navy environmental awards. The Depot's environmental team adopted the motto "Beyond Compliance"; they have clearly succeeded as they went a fifth consecutive year without a notice of violation from the San Diego Air Pollution Control District. The NADEP North Island also received the CNO's Pollution Prevention Award for an Industrial Installation in 1998.

In October 1998, the NADEP Cherry Point received the North Carolina Governor's Award for Excellence in Waste Reduction in the Federal Government Category (Significant Level) for 1997, and the CNO's environmental award for reducing disposal costs by using waste as a sellable resource. Specifically, the NADEP's plastic media blasting recycling program reduced hazardous waste by more than 4.8 million pounds. In addition, the depot reduced other hazardous waste by 624,000 pounds, recycled 236 tons of office paper, and 175 tons of cardboard. The office paper recycling effort alone yielded savings and revenue of approximately $45,000, while other recycling revenues and cost avoidance exceeded $1.1 million. Naval Air Station Patuxent River received the FY98 CNO Cultural Resources Management Award for the care and management of the numerous historical sites on the station. The Patuxent River team later earned the Secretary of the Navy Cultural Resources Management Award. Naval Aviation Depot Cherry Point earned the CNO's Environmental Quality Award in the Industrial Installation category. Naval Air Engineering Station Lakehurst also earned the CNO's Environmental Quality Award for a Non-Industrial Installation, as well as the Chief's Recycling Award and the Installation Environmental Cleanup Award. Our T-45 Training System team earned its CNO Environmental Quality Award in the Weapon System Acquisition Team category.

*Above: The Naval Aviation Depot, Cherry Point, NC, earned the CNO's Environmental Excellence Award for its plastic media blasting. The award was one of many earned by TEAM members during 1998.*

*Strategic Vision.* The 1998 Annual Report reflects our long-standing commitment to Fleet support. The Naval Aviation Systems Team remains focused on sustaining the warfighter's edge through technological superiority, while ensuring readiness and supporting the spectrum of operational requirements. We have been actively involved in revolutionizing our processes, and remain committed to delivering effective, affordable, and interoperable products and services that meet the high expectations of our customers, at or below cost, and on schedule.

As the 21st century approaches, achieving savings for modernization and recapitalization is even more imperative. As technology advances at an ever more rapid pace, keeping our technological edge will become more costly. It is essential that we continue to develop and cultivate partnerships with industry and other agencies to take advantage of the efficiencies of synergies. We must also remain attuned to the needs of the Fleet and our other customers. The cornerstone of our comprehensive strategy is to manage our organization as an effective business – partnering with our suppliers, evaluating technological solutions, learning from the success of other organizations, and continuing to implement initiatives that are cost effective.

To shape the future direction of the command, Navy leadership has developed a five-year corporate strategic plan to improve future business operations. Our objectives emphasize warfighter needs, taking care of our people, getting the most for the warfighter for every dollar we spend, and improving the way we do business. Implementing these strategies will require the cooperation of all elements of our organization to ensure we make steady progress on our long-term goals.

*Warfighter.* We must ensure that the next generation of aircraft and weapons systems proceed while meeting established costs, schedules, and performance targets. We will continue to provide systematic improvements to support 21st century naval aviation, enabling our naval forces to shape the battlespace of the future. Interoperability among our sister Services and allies will become even more important. Connectivity among the Navy's Systems Commands and the Fleet will be essential to ensure all network centric elements are integrated and interoperable.

*People.* Our people represent the vital link between our strength and our achievements. The men and women of our Navy and Marine Corps, along with our civilian employees, have exemplified commitment. To encourage initiative and further support them, we must provide professional development and rewarding career opportunities. Our objective is to modernize training policies and knowledge resources to ensure our people are ready to meet the challenges of tomorrow.

*Affordability.* We will continue to develop measurement systems to capture cost, savings, and return on investment, while finding the right fiscal balance to maintain operational primacy. This strategy includes implementing financial management improvements and decision-making processes that enable the TEAM to establish and execute cost reduction plans. This will provide the necessary focus on reducing those costs to allow naval aviation to continue to fulfill its mission requirements, while providing the resources necessary for recapitalization and modernization.

*Business Processes.* Business process reengineering teams are redesigning processes to revolutionize the way we do business. Integrated technological solutions, which will further integrate, consolidate, and standardize key processes across the TEAM, are being evaluated. This is an unprecedented opportunity to seek new ways of doing business. These tools will give us a common set of business practices that will tie the entire organization together in a way that will help us understand, measure, and gain maximum benefits in support of continued process improvement.

We are committed to being *One TEAM . . . Delivering 21st Century Aviation Solutions Enabling Dominance From the Sea.*

# ONE TEAM . . .

Delivering 21st Century Aviation Solutions
Enabling Dominance
From The Sea

Naval Aviation Systems Team Vision

# 1998 ANNUAL REPORT