

## AESA – New Technology Revolutionizes Radar Benefits

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Graphic representation of the Active Electronically Scanned Array (AESA) loaded onto an F/A-18 Hornet.

*Nicolette Cormier*

The fleet can expect dramatic changes in radar operation with the introduction of the APG-79 Active Electronically Scanned Array (AESA), a wide band electronically scanned array radar for the F/A-18E/F. While fleet operators are excited about this new technology, many do not appreciate the depth of the differences between the radar in use today, and the AESA the Super Hornet and JSF will utilize.

Cmdr. Dave Dunaway, APG-79 Program Manager, said, "This is a state-of-the-art radar. In my twenty years in the US Navy, this is the first time I have seen a revolutionary leap in capability vice evolutionary. It's not an incremental change. It's probably got at least 10 times more capability than the APG-73 and we are doing it in less time. When compared to historical radar programs, this one is faster, cheaper and provides much more performance."

Dunaway credits the program's success to the inventive acquisition strategy and the compressed timeline put

together by a team of government and industry personnel. He said, "We used an innovative contracting strategy to minimize the delayed start of the program. In the past, a program like this would not have entered Engineering and Manufacturing Development (EMD) for three years from the concept development. Because of this unique funding strategy, AESA hit EMD at full steam in February 2001, a little over a year after new start approval."

AESA's state-of-the-art technology begins with its antenna. Manufactured by the Raytheon Company, it features a tile array vice brick array and uses exceptionally innovative processor architecture. Dunaway explained, "The transmit and receive modules (TR) are very thin, about the size of a quarter. This is the technology of the future. It's basically the same antenna that Boeing and Raytheon had proposed for the JSF, using the flip chip technology."

Testing has shown that the electronically scanned array is far superior to the mechanical scanning

methodology of tracking. With mechanical tracking, the radar tracked while scanning, taking up a fair amount of time and reducing track accuracy. The electronically scanned array uses a "search while track" methodology that significantly improves track quality of multiple targets with little or no degradation of the search capability of the radar.

The new array searches while it tracks the target on a need-to-track basis, giving a much better multiple target track capability. Although it still takes time to go through the volume with electronic scanning, once the target is found within that volume, the radar automatically schedules periodic look backs keeping track of the target at a much higher level of fidelity and frequency than a mechanically scanned antenna.

Furthermore, this AESA has a more powerful radar. Detection ranges will be significantly better than the current APG-73 radar, giving the pilot a tactical

**Cont. on page 2**

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range advantage. This brand new radar shows more targets at a much higher fidelity, which provides the pilot more time to accomplish other tasks, as well as the ability to scan air-to-air and air-to-ground in a near simultaneous fashion.

In the air-to-ground arena, the improved detection range has resulted in higher resolution Synthetic Aperture Resolution (SAR) maps that are at a higher resolution than the current capability. The aircrew can see minute runway details on the map and can identify aircraft. The new AESA provides very high-resolution maps at a range further than possible with the lower resolution APG-73 map.

“This radar will change the way we do business,” said Dunaway. “We are currently limited by the radar’s ability to detect air-to-air targets at range. In other words we have to wait and let the radar catch up before we can shoot the missile. With the AESA we’ll be able to shoot the missile even before the target comes within the missile’s range. The APG-79 radar has been designed to enable the aircrew to detect and process the target, well before it enters the maximum range of the Super Hornet’s air-to-air missiles, allowing missile launch at maximum range.”

The array is situated in the nose of the airplane and each of the TR modules on the array is essentially an individual radar that transmits and receives. Once the information is received by the array, it enters the common integrated sensor processor where it is converted to tactically useful information and displayed to the aircrew. The radar then send commands back to the processor where they are converted to additional tasks for the radar to perform.

From a maintenance standpoint, the antenna is projected to have reliability that’s longer than the life of the airframe. In addition, the processors are no longer replaced at the box level. Repair is easy;

maintenance personnel open the box and pull a card out. This philosophy has eliminated the need to spare good cards within a Weapons Replaceable Assembly (WRA) when only one card is bad.

The Super Hornet has a reduced radar cross section technology (stealth) incorporated into its design. A traditional mechanically scanned array counters that capability and increases the effective radar cross section of the aircraft.

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**Cmdr. Dave Dunaway**

AESA allows the aircrew to enjoy the radar cross-section improvements on the aircraft without adversely impacting weapon system performance. Situated in the nose of the airplane, the AESA communicates through the fibre channel interface of the airplane, transmitting a huge amount of data through the advanced mission computers, into the new displays. All of this information flows freely between the radar, the Advanced Mission Computers (AMCs) and advanced displays via a fibre channel network within the airplane.

This is the first state-of-the-art fibre channel bus to be installed in a Navy

tactical fighter and it represents another leap in capability and growth potential. This new architecture paves the way for tremendous AESA growth capabilities in Electronic Warfare and makes an AESA equipped Super Hornet a prime candidate for the Advanced Electronic Attack (AEA) aircraft.

In addition to all of the modifications directly associated with the radar, there have been extensive modifications to the aircraft to support the AESA. Because of the tremendous power generated and the multitude of processors required, two new heat exchangers were added to the aft end of the airplane. These new heat exchangers have enhanced the liquid cooling capacity of the aircraft significantly, and have provided the radar the essential cooling required.

Dunaway summed up the timeline. “We started the program with a year of contractor development in the primary development phase under a unique advanced agreement that got us through a Preliminary Design Review (PDR). In February of 2001, we kicked off EMD and conducted a Critical Design Review (CDR) by December of 2001. It is very unusual for a program this complex to progress so quickly. Since CDR, the program has been focusing on producing EMD hardware that is being delivered to the laboratories for hardware development, software development and weapon system integration.

Following the laboratory development phase, an extensive flight test program with the AESA radar installed in the Super Hornet will be conducted to ensure that the total system performance meets or exceeds the performance required in the projected threat environment.

The AESA radar is a revolution, not an evolution for the Super Hornet and will make this airplane one of the most capable and desired aircraft on the battlefield.”



## Half Turn on Suspension Lug Makes Life Easier for VFA-115



F/A-18 with external tank on board prepares to for a carrier landing.

*Nicolette Cormier*

During a January 2002 detachment on board the USS *Abraham Lincoln* (CVN-72), VFA-115, the first operational F/A-18E squadron, experienced recurrent external fuel tank transfer problem, which subsequently led to aircraft being diverted to Naval Air Station Lemoore, Calif. Although the technical investigation that followed the squadron's return to home base identified several factors related to the aircraft's external tank transfer issue, a half turn on a tank suspension lug started the ball rolling towards a successful issue resolution.

This simple, but extremely important maintenance practice would ultimately lead the F/A-18 External Tank Tiger Team toward improvement of the tank's loading procedures and discovery of a software anomaly in the aircraft's Signal Data Computer (SDC).

NAVAIR External Tank Tiger Team Lead, Kim Frowein, Fuel Systems Engineer for the F/A-18, explained, "External fuel tanks are vital to this aircraft's mission. The purpose of the tank is to supplement the aircraft's internal fuel. The tanks significantly increase the time the aircraft can stay in the air and the distance it flies. The object, once the aircraft is airborne, is to begin to transfer fuel from the external tanks into the internal tanks as the fuel is consumed from the main tanks. If the aircraft is not capable of transferring the fuel from the external tanks you cannot "trap" aboard the carrier, the only other options are to fly to a land-based airport or jettison the tank or tanks. Jettisoning is a costly measure.

Given the recent frequency of both failure to transfer, and slow to transfer discrepancies, the squadron determined this issue should be addressed prior to the next detachment."

In March, the External Tank Tiger Team, comprised of North Island Fleet (FST) System Team members, Boeing, and NAVAIR Fuel Systems Team engineers, met at NAS Lemoore with VFA-115 maintenance personnel to review the events further, and investigate the root cause of the discrepancy.

Frowein said, "VFA-115 had been tracking the problem and putting together the maintenance data. We had to look at the entire picture because it could have been any number of things

that could cause failure to transfer the fuel. That's one of the things that made a resolution difficult. It's hard to solve a problem if you don't have a broken aircraft to troubleshoot."

The squadron's cooperation allowed the team to look at the issue despite the fact that they were doing workups for the next carrier detachment.

Frowein continued, "It wasn't easy to troubleshoot as the squadron had its job to do and we were out there on a 'not to interfere' basis. Fortunately, this turned out to be a good opportunity for us as they were flying quite a few missions using external tanks. We were lucky enough that on the first day one of the aircraft was experiencing some transfer problems."

The team inspected the specific aircraft and fuel tank hardware involved in the events, reviewed technical publication and squadron maintenance procedures for loading and unloading 480 external fuel tanks, and discussed theory of operation of the aircraft fuel systems, which could have contributed to the events. During this time it became obvious that the suspension lug adjustment on the tank didn't correspond with the intent of the tech manual maintenance instructions.

The team soon realized interpretation of the maintenance instructions became subjective when the manual used the term "flush" to describe adjustment of the lugs. A rim around the lug well brought into question what the lug should be flush with.

The tank has two probes that need to be properly engaged with the F/A-18E/F to transfer the fuel. One is a fuel probe; the other is an air probe. Air pressurization is used to get fuel out of the 480-gallon tank. Correct insertion of the probes is essential for fuel transfer.

Frowein said, "Due to the suspension lug not being flush, the air probe was not achieving adequate insertion into the pylon disconnect valve. We were getting either intermittent or no fuel transfer. Once this discovery was made and the maintenance personnel were briefed on the loading procedures, the External Tank Tiger Team completed its mission within three days."

The squadron has reported significantly improved performance of the fuel system during their latest workup detachment aboard the *Lincoln*. Final closure of this effort is to release and implement the necessary instruction changes in the Integrated Electronic Technical Manual System (IETMS) and related technical publications.

The F/A-18E/F Air Vehicle IPT is now working with Core Avionics IPT to investigate SDC and SDCR software changes to correct the fuel system software anomaly. Greg Drohat, NAVAIR F/A-18E/F Air Vehicle Team Lead, said, "From my perspective, it was a great example of how the fleet, NAVAIR, FST and Boeing can work as a team to bring to bear the resources necessary to solve fleet operational problems and improve the availability of the Super Hornets for the courageous men and women who fly and maintain them in defense of our country."



# F/A-18 MIDS-LVT FLIES HIGH

F/A-18 Public Affairs Office

In an era where real time information exchange provides a critical edge in the battlefield, the Multifunctional Information Distribution System - Low Volume Terminal (MIDS-LVT) is on track to deliver the goods. The system is expected to bring the F/A-18, surface ships and allied air and sea platforms a new level of interconnectivity, providing operations with real time information exchange.

The program recently completed the first part of their Technical Evaluation (TECHEVAL) test phase with flights aboard an F/A-18 during the Joint Combat Identification Evaluation Team (JCIET) exercise at Eglin Air Force Base, Florida.

MIDS, an advanced, high capacity, jam resistant, digital communication link, is used for the exchange of near real-time secure voice and data information among air, ground and sea elements engaged in tactical operations. As the next generation, Link-16 compliant, Command, Control, Communications and Intelligence (C3I) system, MIDS is designed to facilitate the exchange of target information between a variety of platforms through the use of Surveillance, Air Control, and Fighter-to-Fighter networking capabilities. The system is compact and contained in a black box for easy flight-line maintenance.

Gary Kessler, F/A-18 Deputy Program Manager for Systems Development, explained, "MIDS is going to change the way the Hornet fights in battle. The pilot has complete situational awareness of the whole battlefield - all the time, without getting pieces of information from other data. MIDS pulls information together from other platforms and cuts down both the pilot's workload and decision time. The program is one of the most complex integration efforts ever attempted."

The MIDS-LVT, as installed in the



F/A-18s equipped with the MIDS system are ready to take to the skies.

F/A-18, demonstrated a capability to considerably increase aircrew situational awareness throughout all phases of the mission with a potential to revolutionize the way the aircraft is employed. VX-31 MIDS Project Officer, Maj. Brian Kelly (USMC) commented on the overall success of the exercise saying, "All around situational awareness was spectacular during the JCIET. Aircrews now realize how important Link-16 will be in future combat missions."

In addition to performing C3I functions, MIDS serves as a navigational aid by providing relative navigation position keeping functions through the use of Precise Participant Location and Identification (PPLI) Link-16 messages. MIDS also incorporates TACAN functionality, replacing the AN/ARN-118 TACAN system.

JCIET is a large-scale tactical evaluation that employs equipment and personnel from all armed services to evaluate, investigate, and assess various concepts of Combat ID on the battlefield. A combined detachment, five F/A-18 aircraft from Air Test and Evaluation Squadrons, VX-23 from Patuxent River and VX-31 from China Lake were deployed to Eglin Air Force Base, Florida. It involved aircrew, engineers and maintenance personnel from Patuxent River, China Lake and

Boeing who work together to achieve common test objectives. Operational test aircrew from VX-9 also participated as part of an ongoing evaluation and continued involvement in the test program.

Fifty-five flights were flown from Eglin as part of the JCIET 2002 large-scale evaluation. These sorties were flown during both day and night operations. Portions of each flight were allocated for participation in both opposing force (OPFOR) and friendly force (BLUEFOR) Link-16 networks

Kessler said, "JCIET was an exercise that showed how MIDS would work in a real life battlefield situation. The system performed wonderfully. This gives us confidence and highlights critical areas to address as we finish up TECHEVAL and go into OPEVAL (Operational Evaluation) this fall, for training for deployment as part of the Nimitz Battle Group in early 2003."

MIDS will be carried both shipboard and airborne on a variety of platforms; the F/A-18 is the lead aircraft platform. Within the Navy, the Program Executive Office, Tactical Aircraft Programs (PEO-T) Tactical Datalinks Office (PMW-101/159) manages the MIDS program and the F/A-18 Program Office (PMA265) manages F/A-18 MIDS integration and testing.



## F/A-18 PROGRAM CELEBRATES GREAT ATFLIR DAY

### F/A-18 Public Affairs Office

The NAVAIR ATFLIR team celebrated more good news on June 11 as the Naval Air Warfare Center Weapons Division, China Lake, was the site for the first GBU-24B/B delivery guided by an ATFLIR on an F/A-18D Hornet. While the range of the shot remains classified, the performance (i.e. direct hit) wowed the evaluators.

Said Lt. Cmdr. Dave "Scoop" Swenson, ATFLIR Project Officer, F/A-18 Advanced Weapons Lab, VX-31, "Bomb impact was exactly on the aim point, exactly on the spot, exactly on the

target, with high order detonation. All in all, a very smooth evolution."

Scoop went on to comment, "The weapon and pilot were provided by VX-9 and the aircraft, the ATFLIR, the range and the WSO were provided by VX-31. This is a great way to do business, as both organizations were able to be involved in the planning, execution, and analysis."

Piloting the F/A-18D Hornet was Lt. Mike "Siep" Siepert from VX-9 and in the backseat was Weapon System Officer Lt. Cmdr. Swenson.

ATFLIR will provide Early

Operational Capability (EOC) with VFA-115, an F/A-18E squadron when they cruise later this year, utilizing engineering development model assets. ATFLIR will IOC in May 03.

### Editor's note:

*The Navy has awarded the Boeing Company a contract for the second low-rate initial production of ATFLIR systems and spares. The contract will include production of 24 ATFLIR pods for the F/A-18E/F and four ATFLIR pods and two pod adapters for the F/A-18C/D.*



## VFA-115 CHANGE OF COMMAND



VFA-115 pilots in front of Talon 200 wearing the patches of Engine 54.

### Lt. J.g. Stephen Dean, VFA-115 PAO

On a sunny day in Lemoore, Calif. Strike Fighter Squadron VFA 115 took a break from their busy pre-deployment schedule to hold a Change of Command ceremony as the "Eagles" joined friends, family, and distinguished guests to bid farewell to former Cmdr. Eric deVita as Cmdr. Jeff Penfield took the reins.

As skipper, deVita commanded the Eagles during the first fleet transition to the F/A-18E Super Hornet. During

his remarks, he reflected on the successes the squadron has enjoyed during the transition. Under his command, the Eagles conducted a detachment to New Orleans, La. to fly the Super Hornet against the U.S. Air Force. The detachment enjoyed a 99 percent sortie completion rate. At the start of the Interdeployment Training Cycle, VFA 115 completed the Strike Fighter Advanced Readiness Program graded the best squadron in the last three years. Finally, during recent exercises with the US *Abraham Lincoln* (CVN-72)

Battle Group, the squadron flew an unprecedented 42 sorties and over 80 flight hours in a single day. "I can stand here all day touting the accomplishments of this squadron," said deVita. "The pilots, the maintenance personnel and support staff are a group of amazing individuals."

Taking over for deVita, Penfield said the Eagles are ready for the upcoming deployment. "As this squadron enters the world stage on the fight against terrorism, the time for talk has ended. It is now time to speak with our actions, to take the fight wherever it is required ... and we will be triumphant."

Adding to the significance of the deployment, the squadron has "adopted" Engine 54, Ladder Four of the New York City Fire Department. Aircraft 200 and 201 were unveiled during the Change of Command bearing the Engine's logo and names of four firefighters they lost on September 11. Engine 54, Ladder Four, located in the Theater District of Manhattan. Engine 54, was one of the first units on scene following the attacks on the World Trade Center. They lost everyone who worked that day — 15 firefighters in all. Penfield has dedicated the upcoming deployment to the memory of all those who lost their lives on September 11.



# Out and About With The Fleet



Members of the catapult crew aboard *USS Nimitz* (CVN 68) give the o.k. to launch one of the new F/A-18F *Super Hornets* of the "Black Aces" of Strike Fighter Squadron Four One (VFA -41) from the ship's flight deck. VFA-41 started the transition from the F-14 *Tomcat* to the F/A-18F *Super Hornet* in November 2001. The squadron, originally established June 1, 1945 flying the Chance-Vought F4U *Corsair*, is based at Naval Air Station Lemoore, Calif.

U.S. Navy photo by Photographer's Mate Airman Kristi Earl.

Aviation Ordnanceman 3rd Class Allen Crow prepares to move a 2000 lb. Joint Direct Attack Munition (JDAM) GBU-32 for transport to the flight deck of the *USS John F. Kennedy* (CV 67). The *Kennedy* and her embarked Carrier Air Wing Seven (CVW-7) are conducting combat missions in support of Operation Enduring Freedom.



An F/A-18 Hornet assigned to the "Golden Dragons" of Fighter Attack Squadron One Nine Two (VFA-192) takes to the air after launching from the flight deck of the *USS Kitty Hawk* (CV 63) The carrier is providing a forward presence in the Asia-Pacific region, conducting training and exercises with its regional allies. *Kitty Hawk* is the Navy's only permanently forward-deployed aircraft carrier operating out of Yokosuka, Japan.

U.S. Navy photo by Photographer's Mate 3rd Class John E. Wood.

A specially-painted Canadian CF-18 Hornet, made a special trip to St. Louis, Mo last month in honor of the aircraft's 20 years of service in the Canadian Air Force. The aircraft is part of an aerial demonstration team that will participate in a total of 18 air shows across North America this year.

Photo courtesy of Boeing



## AIM-9X RECEIVES DAEDALIAN AWARD



Raytheon AIM-9X Sidewinder Air-to-Air Missile .

*Editors note:*

*This article is an update on AIM-9X's acceptance of the Daedalian Award.*

*By Renee Hatcher*

*NAVAIR Public Affairs*

The Naval Air Systems Command (NAVAIR) and Raytheon AIM-9X Sidewinder Air-to-Air Missile Integrated Product Team received the Order of Daedalians' Weapons System Award for 2001 at the annual Daedalian Convention in San Antonio, Texas on May 26.

Capt. Dave Venlet, program manager for Air-to-Air Missile Systems (PMA-259), and Lt. Col. Ken Bailey, AIM-9X program manager, accepted the award. Rear Adm. James B. Godwin III, NAVAIR Program Executive Officer for Tactical Aircraft Programs (PEO(T)), also attended the award ceremony.

"This missile is really a team of professionals from Raytheon, the Navy and Air Force that worked so effectively with one common purpose in mind – to give the American warfighter dominance in air combat," Venlet said as he accepted the award for the team.

The AIM-9X program is a joint effort between the Navy and the Air Force that provides Navy, Air Force and Marine Corps fighter pilots with the technological edge required to dominate air combat in support of national objectives. The team is made up of people from NAVAIR Patuxent River, Md., NAVAIR China Lake, Calif., Eglin Air Force Base in Florida, Warner-Robbins Air Force Base in Georgia and Raytheon Missile Systems in Arizona.

"AIM-9X builds upon the venerable 50-year history of Sidewinder that began with the Naval Ordnance Test Station at China Lake, Calif.," Bailey said. "It is manifested today with the outstanding Raytheon designed seeker and thrust vector control giving it unbeatable seeker performance and maneuverability."

The Order of Daedalians, a fraternal organization of military pilots, presents this award every year to individuals, groups or organizations that have contributed the most outstanding weapons system development to the aerospace environment.

