



FRC SW

ALMANAC

Volume 7 - Issue 4



Half-Century of Service
E-2 Hawkeye
Milestone

Skipper's Corner:

FRCSW: A World Class Organization



Capt. Don B. Simmons, III

An integral part of the FRCSW culture is contained in the statement:

“We are a world class maintenance, repair and overhaul (MRO) facility.”

It's not a catch line. It's what we should strive for in our daily efforts.

Our strategic plan and management practices targeting continued process improvements, innovations, and our ongoing press for excellence have allowed FRCSW to achieve some significant credentials which speak for themselves.

In November 2009, FRCSW became the first naval command to achieve both AS (Aerospace Standards) 9100/9110 registrations, and the first DOD command to capture the certificates through the same audit.

AS 9100 was established on the quality system principles of the International Organization for Standardization (ISO) to meet governmental and regulatory requirements of the aerospace manufacturing industry.

AS 9110 was developed to address specific needs of the MRO segment of the aerospace industry including safety, reliability, and airworthiness of commercial, private and military aircraft MRO operations.

FRCSW marked another milestone 10 years prior to its ISO 9100/9110 registration by becoming the first federal facility to register to the ISO 14001. The ISO 14001 goal is to help organizations improve environmental awareness, performance and prevent pollution.

More recently, in May 2010, FRCSW once again scored another “first” within the Navy by earning certification from the Federal Aviation Administration as an authorized repair station under a limited radio-navigational rating.

These registrations are not one-time goals accomplished and then forgotten. The AS and ISO require re-registrations and certification audits to ensure compliance and progress within the respective program and FRCSW has consistently met or exceeded those standards.

The recognition, prestige and success in achieving and maintaining these standards have been, and are, in your hands. All of this is only possible through the teamwork and pride we take in our day-to-day work here.

Creating and adhering to a world class standard can only be accomplished when we are all pulling together. Improvements and innovations only come from you. If you have an idea to improve a process, let your supervisor know. If you notice excess equipment lying around or a simple lack of detail that detracts from our efforts, notify your supervisor.

The key to maintaining a world-class designation not only lies in holding the credentials and standards to excel within the industry, but more so, with the ability of our team to believe and to act like a world class organization. I know this organization is full of world class people...do you?

DON B. SIMMONS, III
Captain, U.S. Navy
Commanding Officer



Fleet Readiness Center Southwest



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FRCSW MISSION, VISION & VALUES

MISSION
DELIVER RESPONSIVE MAINTENANCE, REPAIR AND OVERHAUL PRODUCTS AND SERVICES IN SUPPORT OF NAVAL AVIATION AND NATIONAL DEFENSE OBJECTIVES.

VISION
BE THE PROVIDER OF CHOICE FOR AVIATION MAINTENANCE, COMMITTED TO CUSTOMERS, PARTNERS, WORKFORCE AND COMMUNITY.

VALUES
HONOR, COURAGE, COMMITMENT.

America's Navy – A Global Force for Good

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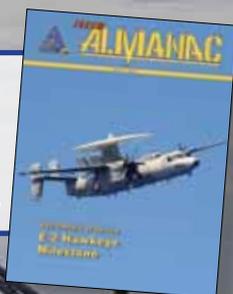
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About the Cover

An E-2C *Hawkeye* assigned to Airborne Early Warning Squadron (VAW) 115 "Liberty Bells" flies over the aircraft carrier USS *George Washington* (CVN 73) during an air-power demonstration.

Photo by MC3 Ramon G. Go



The bow of the USS *Ronald Reagan* (CVN 76) frames the hull of the USS *Carl Vinson* (CVN 70) at their berths at NAS North Island, Calif.

Photo by Scott Janes

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E-2 Hawkeye Marks 50 Years of Service to Fleet *NASNI Plays Historic Role*



An E-2C Hawkeye assigned to the Black Eagles of Carrier Airborne Early Warning Squadron (VAW) 113 prepares to launch from the catapult on the flight deck of the aircraft carrier USS *Ronald Reagan* (CVN 76).
Photo by MC3 Charles D. Gaddis IV.

Not only is Naval Air Station North Island (NASNI) the birthplace of naval aviation, but it is also the service entry point of the Navy's premier airborne early warning system aircraft: the E-2 *Hawkeye*. Fifty years ago, the first Hawkeye (A model) was delivered to Carrier Airborne Early Squadron (VAW) 11 aboard NASNI.



One year later, in 1965, the airframe's first aircraft carrier deployment occurred aboard USS *Kitty Hawk* (CVA 63). The Hawkeye's ability to guard against airborne threats set precedence for the protection of naval carrier battle groups that continues to this day.

Introduced by the Grumman Aircraft Company in the mid-1960s, the E-2 Hawkeye and its sister airframe, the C-2A Greyhound transport, are the only twin turbo-propeller aircraft to currently operate aboard naval aircraft carriers.

In the mid-1960s, avionics issues and technological advancements forced a series of modifications to the E-2A Hawkeyes, which became the variant E-2Bs in early 1969.

Production of the current version, the E-2C, began in 1973.

In-depth maintenance to the E-2C is handled in Building 460 at Fleet Readiness Center Southwest (FRCSW).

FRCSW performs two levels of scheduled maintenance on the airframe: a light periodic maintenance interval (PMI) 1 which is done at FRCSW Site Pt Mugu and FRC Mid-Atlantic, and PMI-2, or a heavy maintenance, at NASNI.

"The E-2 is on an 80-month maintenance cycle. So, every 40 months it goes through one of the PMI cycles," said Lt. Cmdr. Gabriel Hohner, military deputy integrated product team lead for the E-2/C-2 production line.

E-2 Hawkeye: 50 years of service

Approximately 200 FRCSW artisans and contractors, including sheet metal, engine mechanics and electricians, are assigned to the program. They also perform PMI procedures to the C-2A Greyhound in Bldg. 460 and at VRC-30's hangar at North Island.

"We send our artisans to (FRCSW Site) Pt. Mugu to do the E-2 PMI-1 event. It's really a material inspection of various parts of the airframe and associated components," Hohner said.

Sitting atop the E-2C Hawkeye is the detachable rotodome radar system. Spanning a 24-foot diameter, it houses two primary systems: a UHF radar antenna array and an Identification Friend or Foe ('IFF') antenna system.

On the body of the E-2C aircraft, artisans assess the attachment points of the flight control surfaces, the engines and similar areas identified in the PMI-1 specification. Sheet metal repairs are made and worn parts replaced, but if a larger repair is needed, an in-service repair (ISR) is generated.

"ISRs are a separate action from the PMI-1," Hohner noted. "So if we find a significant repair during a PMI-1, we will put in for an ISR because there's no allowance in the PMI-1 specification for in-depth repairs."

At Pt. Mugu, ISRs are not very common because the E-2C aircraft assigned to the squadrons there are the Hawkeye 2000, some of the newest in the fleet, that were manufactured in the early to mid-2000s.

Nevertheless, modifications to the E-2C Hawkeye 2000 have been underway at Pt. Mugu.

The Communications, Navigation, Surveillance/Air Traffic Management Systems (CNS/ATM) modification, or glass cockpit, is an upgraded avionics and navigation system that was mandated by the Chief of Naval Operations to meet International Civil Aviation Organization (ICAO) requirements. ICAO guidelines address CNS/ATM modifications to operate in international airspace.

"The CNS/ATM cockpit has been ongoing for the past five years at Pt. Mugu. This is the last calendar year for it, and the last aircraft (E-2) is scheduled to be complete this December. The C-2 airframe is already done, so we will be complete with all CNS/ATM mods at that point," Hohner said.

While the CNS/ATM modification is primarily limited to the E-2's cockpit and fuselage areas, PMI-2 is a substantial disassembly of the aircraft: Artisans remove the aircraft's wings, engines, landing gear and tail.



“We tear the plane down all the way to the fuselage. We strip all of the paint off, take all the parts off, and do the in-depth metal work looking for cracks and corrosion, and exfoliation, missing fasteners, and things like that,” Hohner said. “It’s not a complete overhaul, because it’s still governed by a specification and that tells us what to look for and what we have to repair before we reassemble the aircraft.”

“There are literally over a thousand parts to come off of these aircraft and go back on. Every part is critical, and these artisans do an excellent job,” he added.

Identifying damage on the aircraft is not always obvious. Non-destructive testing is one method used to determine the integrity of an aircraft section or part. Also, by using chemical or physical means, the aircraft’s corrosion preventive paint is removed to expose the base metal to reveal cracking or corrosion.

FRCSW averages about six E-2C PMI-2s annually.

“For older model Hawkeyes that are high-flight-time aircraft, we’re starting to see cracks develop in the wing butt (the exposed area of the upper wing fold). We have a repair procedure available if we find the crack in time, but it is something we see emerging as these aircraft get older,” Hohner said.

A Global Force for Good

Unlike the F/A-18 Hornet fighter, a high-flight-hour program will not be created to extend the service life of the E-2C, Hohner said. Instead, the E-2C will be phased out and replaced by the E-2D advanced Hawkeye.

“The E-2C will probably remain in the fleet for another four or five years and the first E-2D model slated for PMI is 2017. But that’s still tentative,” Hohner said.

To date, the E-2 airframe has participated in 16 major combat operations including the Vietnam War and Operations Iraqi and Enduring Freedom. ▲

I am FRCSW: John Powanda

Fleet Readiness Center Southwest “I Am FRCSW” video spotlights teammate John Powanda, a work leader in the E-2/C-2 program. Mr. Powanda brings 24 years of Navy experience to the command.



<http://youtu.be/YQitJGQYexM>

FRCSW Enlists 3-D Printer Systems to Bolster Manufacturing

By Gabe Draguicevich
IPT Lead, Code 9.7.0
Manufacturing, LM2500, MOFAC
Photos by Jim Markle



To expand its ability to provide the most accurate and timely repairs to fleet-bound aircraft, Fleet Readiness Center Southwest (FRCSW) relies upon 3-D printer systems to enhance its manufacturing processes.

With the ability to use materials from plastics to metals, a 3-D printer can create a three dimensional object by the successive layering of the material until the object is complete.

3-D printers are used in conjunction with Computer Aided Design (CAD) files that are created via 3-D modeling software. In turn, the software slices the design on a horizontal plane

for the layering application.

FRCSW uses three 3-D printer systems:

Stereolithography (SLA) is an additive manufacturing process which employs a vat of liquid ultraviolet curable photopolymer “resin” and an ultraviolet laser to build parts’ one layer at a time.

For each layer, the laser beam traces a cross-section of the part pattern on the surface of the liquid resin. Exposure to the ultraviolet laser light cures and solidifies the pattern traced on the resin and joins it to the layer below.



Reverse engineer David Price operates the Selective Laser Sintering (SLS) 3-D printer system in Building 472. Price recently created ducting for the internal cabin air circulatory system of an F/A-18 *Super Hornet* using the SLS printer. The ducting, made of powdered nylon, required approximately 13 hours to produce through the SLS layering process. FRCSW's 3-D printers are also used to create aircraft prototype components, CNC machine testing pieces, laboratory equipment, and form tools.



Sheet metal mechanic Craig Lentz, left, and reverse engineer David Price program the Fused Deposition Modelling (FDM) 3-D printer in Building 472. The printer is primarily used to create tooling to aide in the fabrication of sheet metal parts.

We have a SLA-8000 model machine from 3D Systems. The primary use of this machine at FRCSW is to produce fit check models to support engineering designs and scaled samples for our manufacturing personnel to use as guides for programming and fixturing.

Selective Laser Sintering (SLS) involves the use of a high power laser (for example, a carbon dioxide laser) to fuse small particles of plastic, metal, ceramic, or glass powders into a mass creating a 3-D shape.

The laser selectively fuses powdered material by scanning cross-sections generated from a 3-D digital description of the part (for example from a CAD file or scan data) on the surface of a powder bed.

After each cross-section is scanned, the powder bed is lowered by one layer which thickness, a new layer of material is applied on top, and the process is repeated until the part is completed.

The machine in use at FRCSW is the SLS-60 from 3D Systems. Although this system produces Nylon parts, it is the only system capable of creating production flight approved parts for the F/A-18 Hornet fighter and the F-35 Joint Strike Fighter.

The ECS ducting within the cockpit are produced using this technology and material.

Fused Deposition Modelling (FDM) begins with a software program which processes an STL file (stereolithography file format), mathematically slicing and orienting the model for the buildup.

If required, support structures may be generated. The machine may dispense multiple materials to achieve different goals: For example, one may use one material to build up the model and use another as a support structure, or one could use multiple colors of the same type of plastic on the same model.

The model or part is produced by extruding small beads of plastic material to form layers because the material hardens immediately after shooting out from the nozzle.

I like to call this a "Computer controlled glue gun." A plastic filament is unwound from a coil and supplies material to the nozzle which can turn the flow on and off.

There is typically a worm-drive that pushes the filament into the nozzle at a controlled rate. The nozzle is heated to melt the material. The plastics are heated past their glass transition temperature and are then deposited by the gun head.

FDM uses the thermoplastics ABS, ABSi, polyphenylsulfone (PPSF), polycarbonate (PC), and Ultem 9085, among others. These materials are used for their heat resistance properties. Ultem 9085 also exhibits fire retardancy making it suitable for aerospace and aviation applications.

FRCSW has an FDM 400MC. It is the second largest machine that Stratasys produces. Our primary use of this machine is to create tooling that is used to aide in fabricating of sheet metal parts. We have successfully produced form blocks for our bladder press and drop hammer equipment.

These three differing approaches in technology give FRCSW the most amount of flexibility to produced 3-D printed parts.

Although FRCSW does not have a printer that produces metal parts (systems are still very expensive and not very reliable), the parts we do produce can be used for a wide variety of projects. ▲



51A, 530 Shops:

FRCSW Sailors Handle I-level Components Work

Photos by Jim Markle

AMAN Danielle Kelsey removes the inner rubber bushings from the center stabilator to an H-60 *Seahawk* helicopter. Kelsey works with eight other Sailors who perform intermediate level maintenance on more than 50 *Seahawk* components at the 51A work shop in Building 250.

In servicing the fleet's aircraft and components, Fleet Readiness Center Southwest (FRCSW) not only depends upon the knowledge and expertise of its depot-level artisans, but also the skill and determination of its Sailors.

Forty-seven of FRCSW's Sailors are assigned to the command's 500 Division, where the full spectrum of intermediate-level (I) work is performed to support aircraft components, composites and support equipment.

Nine Sailors attached to the 500 Division's 51A Shop in Building 250 primarily service components of the H-60 *Seahawk* helicopter.

"If this (H-60) work wasn't done here, then much of it would have to be shipped off. The I-level work we do would have to go back to Sikorsky or go over to rotor systems in FRC East or Norfolk," noted Chief Petty Officer Aviation Structural Mechanic (AMC) Charles Martens.

"We work on over 50 H-60 *Seahawk* parts that include tail landing gear struts, drive shaft covers, outboard stabs, flight control components, and cowlings. And we work on E-2/C-2 landing doors and oil flap assemblies," said AM3 Gene Arcilla.

Overall, the shop processes approximately 1,800 parts per quarter, according to Chief Petty Officer Aviation Machinist Mate (ADC) Tod Beights.

Though they work side-by-side with the command's artisans, the Sailors do not routinely seek advice or instruction from them.

"The artisans don't regularly help or consult the Sailors because they're doing their own sheet metal processes, while we're removing bearings, doing inspections and reassembling parts," Martens said.

"We strip the flight control parts of their bushings and bearings and they stay in the (paint stripper) vat usually overnight. Then we clean them; then they go through the non-destructive inspection (NDI) and if they pass there, we reconstruct them with their bushings and bearings. Then they get a final check before they go to paint and are ready-for-issue," Arcilla said.



NDI procedures are used to identify miniscule cracks, corrosion, warping and separations within laminates and parts, and are a vital step to ensuring the integrity of repaired or refurbished aircraft components.

AM1 Rizza Brown said that the 530 shop performs NDI examinations on ferromagnetic (like iron) parts and non-ferromagnetic (like aluminum) parts.

Magnetic particle machines are the primary tools used to detect damage near the surface or subsurface of ferromagnetic parts.

Parts made of ferromagnetic material are magnetized and bathed with small ferromagnetic particles coated in a fluorescent dye. The magnetic field draws the particles into any cracks or flaws, and when exposed to a black light, damage appears as dark green, indicating a failed part.

Non-ferromagnetic parts are coated with fluorescent dye. When the dye is removed, a developing agent is applied that exposes cracks, corrosion and damages when viewed under a black light.

Brown added that the shop also handles NDI requests for hydraulic, armament, support equipment parts, and scheduled inspections in support of 23 tenant commands.

“Our Sailors are very resilient and have a keen ability to adapt to get these critical elements out in a timely manner. We’re incredibly proud of them and their ability to produce quality parts,” Martens said.

FRCSW delivered more than 135 aircraft to the fleet last fiscal year and approximately 20,000 components. ▲

“Our Sailors are very resilient and have a keen ability to adapt to get these critical elements out in a timely manner. We’re incredibly proud of them and their ability to produce quality parts,”

– AMC Charles Martens

Laser Alignment Fixture: FRCSW Advances Service to H-60 Seahawk Helicopters

Photo by Jim Markle



An H-60 Seahawk helicopter is positioned in the newly acquired H-60 alignment fixture in Building 333.

H-60 *Seahawk* helicopters that are serviced by Fleet Readiness Center Southwest (FRCSW) should be returned to the fleet a bit earlier now thanks to a new aircraft hard-point and laser alignment fixture recently assembled in Building 333.

“The hard-point alignment fixture and laser system will help us in the process of repairs and maintenance because we will be able to align every beam, drive shaft and engine mount,” said mechanic Rey Velunta.

The one-of-a-kind, steel-framed alignment structure surrounds the entire helicopter, and “produces results better than factory new.”

– Rodney Madsen



The steel-framed alignment structure is designed to envelop the 64-foot Seahawk, and is the only one of its kind in use by the Navy today.

“The fixture provides aircraft hard-point locations to perform quick alignment checks, and designated laser points where tracking balls are mounted. The tracking balls are very expensive mirrors. The laser is shot at the mirror, and that data is transferred to the (computer) program which does comparative readings of the aircraft alignment to the fixture and the aircraft drawing fuselage station, water line (a method of location on an aircraft) and butt line requirements. We create a 3D skeletal picture of the aircraft,” aerospace engineering technician Rodney Madsen said.

The unit uses wireless remotes for the jacking and lifting of the aircraft to fine tune and make adjustments. Electric motors control threaded rods that drive the jacks.

Costing more than \$1.5 million, the fixture is manufactured by ADC Engineering and is applicable to all H-60 models used by the armed forces.

Madsen said the notion to purchase the fixture occurred after a Class A mishap in Imperial Beach, Calif., involving a low-flight-hour MH-60 Seahawk.

“The forward-looking infrared turret mount hit the runway and pushed the nose of the aircraft up, so we needed to bring it back into alignment. We got with the F/A-18 Hornet group who uses a laser tracking system on the Center Barrel Plus and asked them to give us a hand,” he said.

“We provided the coordinates of the MH-60 hard-points and the F/A-18 team performed the laser shoot before we began the repair so we could determine the extent of the structural misalignment and focus our repair on exactly where the damage was located.”

“Then we started disassembling the aircraft. It just so happened we had a donor aircraft that was another mishap aircraft, that wasn’t damaged in the same area. Because we couldn’t get the parts from the supply system, we evaluated the sections of structure we needed from the donor aircraft and determined that the parts we needed were serviceable, so we harvested the parts and put them on the aircraft being repaired.”

The laser was used again during the final assembly phase to help adjust the splice repair to align with the aircraft’s structure.

“Our final structural alignment readings were better than factory new,” Madsen said.

Ordinarily, aircraft subject to mishaps would undergo visual inspections to locate damages “... and then we’d go 10 to 20 percent beyond that area and remove and replace parts related to the structure hoping that we got everything fixed,” he said.

The alignment fixture can also be used on Seahawks that have experienced hard landings.

“All ship-board naval aircraft experience hard landings during their service life. The cumulative effect can eventually cause misalignment of the overall structure, and in the case of helicopters, significantly affect drive line and dynamic component premature wear,” Madsen said.

Hard-landed aircraft and those experiencing premature wear to the tail driveshaft components, were similarly serviced like mishap aircraft: The replacement of major sections of structure and dynamic components with the hope of catching all damage.

“With the alignment tool we will be able to verify the structural hard points and (laser) shoot those to determine exactly where the problem is. This will save manhours in troubleshooting and costs for parts, which will minimize the down time of the aircraft,” Madsen noted.

Though the alignment fixture does not have a bearing on the number of H-60 aircraft serviced or maintained by FRCSW, Madsen noted that it may play a future role in the airframe’s Integrated Maintenance Program (IMP).

The IMP targets the aircraft’s structural integrity and is performed in Buildings 306 and 308.

Under the IMP, the H-60 airframe undergoes Planned Maintenance Interval 1 (PMI-1) and PMI-2. PMI work divides the aircraft into six sections and is performed in two, three-year cycles. Four sections of the aircraft are evaluated during each cycle.

During PMI-1 the cockpit, cargo area, fuel system, tail pylon and tail rotor are examined. In PMI-2, artisans revisit the cockpit and cargo area, and also assess the tail cone and the upper deck of the aircraft and main rotor.

“Right now we don’t have a hard requirement in our IMP specifications to load every aircraft in the alignment fixture. Our goal is to do that. Ideally, this would be done during PMI-2 when the main transmission is removed,” Madsen said.

By placing aircraft in the fixture as they travel through the IMP process, the laser can record the aircraft’s structural alignment.

“When it comes time for a service life evaluation, we will have an absolute metric and database to show the structure of the aircraft through its service life,” he said. “It will show us what’s trending with the aircraft, and that will tell us where we need to direct our attention to the fittings and hard points to extend the aircraft’s life.”

“The better an aircraft’s structure and drive shafts are aligned, the smoother it will fly. Better aligned aircraft will last longer and cost less to maintain throughout their service life,” Madsen said.

Use of the alignment fixture began at the end of March, 2014.



F/A-18 Fuel Cell Installation

Photo Story by Scott Janes



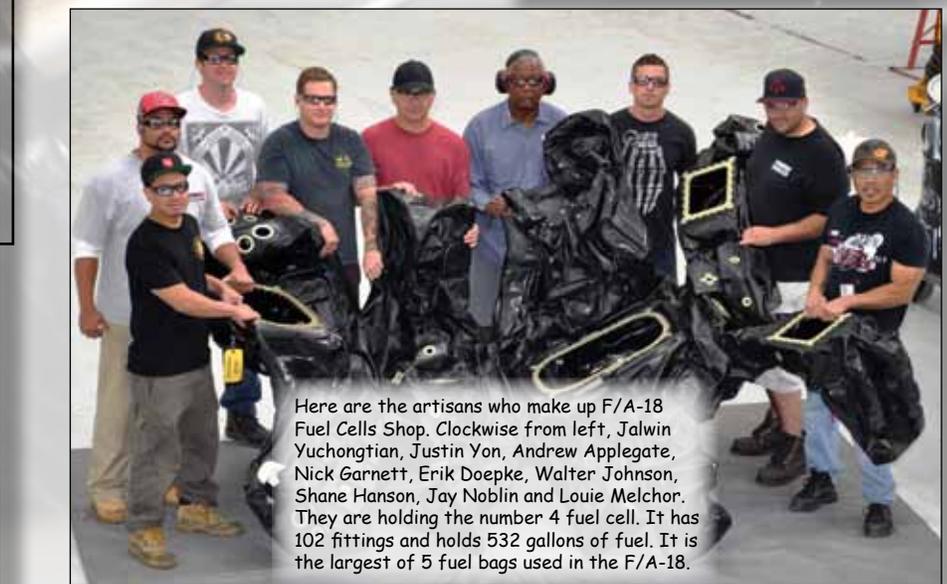
With the help of fellow artisans, Crew Leader, Shane Hanson, pulls a cargo strap tight to compress fuel bladder. Care has to be taken so as not to cut the rubber with the fittings. The bladder has to be compressed to be able to fit through a 15 inch diagonal hatch.

Journeyman Walter Johnson sorts out the over 450 parts that will be installed inside Fuel Cell 4. Commonly referred to as the plumbing the parts are composed of pipes, valves, fittings, hardware and a pump.



Crew Leader Shane Hanson wrestles collapsed fuel bag inside fuselage cavity for installation. Space is a premium in these fuel cavities. Often the smaller artisans are called in to finish the final steps of installation.

This is the view inside the aft access hatch to fuel cell 4. As you can imagine, the plumbing has to be installed in specific order. Install out of order and following parts will not fit. It takes 260 manhours to prep and install the number 4 fuel cell.



Here are the artisans who make up F/A-18 Fuel Cells Shop. Clockwise from left, Jalwin Yuchongtian, Justin Yon, Andrew Applegate, Nick Garnett, Erik Doepke, Walter Johnson, Shane Hanson, Jay Noblin and Louie Melchor. They are holding the number 4 fuel cell. It has 102 fittings and holds 532 gallons of fuel. It is the largest of 5 fuel bags used in the F/A-18.

SH-60F Seahawk PMI Service Ends



The final SH-60F *Seahawk* helicopter to undergo Planned Maintenance Interval (PMI) at Fleet Readiness Center Southwest (FRCSW) is delivered to Helicopter Sea Combat Squadron Three (HSC-3) "Merlins" at Naval Air Station North Island, Calif. Pictured are (from left) FRCSW acting Work Leader Chris Lozano, H-60 Assembly Supervisor Travis Cooper, H-60 Site Coordinator Jorge de Armas, ATC (AW) Angelina Peck, AD2 (AW) Fernando Tobar, and AD2 (AW) Corey Weatherstine. The SH-60F is primarily used by the Navy for antisubmarine warfare, and is being replaced by the MH-60S.

Photo by Chuck Arnold

FRCSW Delivers 21st Hornet in Fiscal Year 2014

Cmdr. Kerry Smith, FRCSW military program manager, left, and Lt. Julia Foerster, FRCSW aviation safety and flight check officer, prepare to depart the command's flight line to deliver an F/A-18 *Hornet* fighter to Marine Fighter Attack Training Squadron One Zero One (VMFAT-101) aboard Marine Corps Air Station Miramar. The D model F/A-18 had undergone the Center Barrel Plus procedure with Periodic Maintenance Interval One (PMI-1), and is the 21st Hornet to complete a maintenance cycle at FRCSW during fiscal year 2014.



Photo by Scott Janes



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