

NAVAL AVIATION NEWS

THE FLAGSHIP PUBLICATION OF NAVAL AVIATION SINCE 1917

WINTER 2018

STALLION STRONG!



WHAT'S INSIDE

- ▶ New Air Boss: Vice Adm. DeWolfe Miller Outlines Priorities
- ▶ Fighter Pilots Recount Downing Syrian Jet
- ▶ Additive Manufacturing Becoming Standard



A pilot assigned to the "Skinny Dragons" of Patrol Squadron (VP) 4 climbs aboard a P-8A Poseidon aircraft at Naval Air Station Whidbey Island's Ault Field during a routine maintenance check.

U.S. Navy photo by MC2 Juan S. Sua

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VOLUME 100, No. 1

DEPARTMENTS

- 4 Flightline
- 6 Grampaw Pettibone
- 7 Airscoop

FEATURES

- 13 **Aerial Bucket Brigade:** Navy MH-60S Seahawks Assist During Wildfires
- 16 **NAVAIR Panel Highlights Digital Integration Strategy**
- 18 **Eight Minutes Over Syria:** Super Hornet Pilots Recall Downing of Syrian Aircraft
- 20 **King Stallion Demo Goes Off Without a Hitch**
- 22 **The Future of Flight Training is Virtual**
- 24 **Fuel Factor:** E-2D Conducts Successful Aerial Refueling Tests
- 26 **Navy Preparing for Carrier Onboard Delivery Transition**
- 28 **Marine's F-35B Expeditionary Envelope Expands**
- 30 **Talking With Lt. Nick "Bearshark" Green, TAC DEMO Pilot**
- 32 **Making Additive Standard:** 3-D Printing Becoming a Regular Part of Business
- 36 **Educating to Innovate with 3-D Printing**
- 38 Professional Reading
- Inside Back Cover Squadron Spotlight

ALSO IN THIS ISSUE

ON THE COVER



On the cover: The CH-53K demonstrates its value to the future battlespace as Marines, with a helicopter support team from Combat Logistics Battalion (CLB) 25 in North Carolina, arrange rigging and secure a Joint Light Tactical Vehicle (JLTV) to the aircraft on Jan. 18 at Naval Air Station Patuxent River, Maryland. (U.S. Navy photo by Emanuel Cavallaro)

The new year began with Vice Adm. DeWolfe H. Miller III relieving Vice Adm. Mike Shoemaker as Commander, Naval Air Forces (CNAF) Jan. 11. As the eighth Air Boss, Miller's top three priorities are warfighting, people and readiness. Read more about Miller's focus and goals in Flightline on page 4. In addition to the CH-53K's heavy lifting of the JLTV, this issue includes several articles on game-changing capabilities, such as the successful aerial refueling testing of the E-2D Advanced Hawkeye (page 24) and the expansion of the F-35B expeditionary envelope (page 28). Additive manufacturing capabilities are maturing rapidly at the Naval Air Systems Command, where 3-D printing is becoming a regular aspect of doing business (page 32). Join staff writer Jeff Newman as he explores 3-D printing for himself on page 36.

On the back cover: Aviation Electronics Technician 3rd Class Thomas Schuler, assigned to the "Royal Maces" of Strike Fighter Squadron (VFA) 27, stands by with chains on the flight deck of aircraft carrier USS Ronald Reagan (CVN 76) in July during Talisman Saber 2017. (U.S. Navy photo by MC2 Class Kenneth Abbate)

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Flightline

Warfighting, People and Readiness:

Top Priorities for New Air Boss

During his first month as Air Boss, Vice Adm. DeWolfe H. Miller III, Commander, Naval Air Forces (CNAF), shared his priorities with Naval Aviation News in the following questions and answers.

Sir, how has your role as Director, Air Warfare prepared you for your role as Air Boss?

My position at OPNAV N98 was a perfect job to prepare me for Commander, Naval Air Forces. As Director, Air Warfare, I was in charge of shaping the budget to support Naval Aviation. I established the requirements and fought for funding to support those requirements. Now, it is my job to take that funding and ensure that it is applied to the optimal organizations that will improve readiness and support our ability to fight and win in combat.

In addition to safety, what are your top three to five priorities?

My top priorities as the Air Boss are warfighting, people and the readiness of both. Paramount to our success is maintaining our laser focus on readiness recovery. It is a complex problem that requires cooperation from across Naval Aviation and the Navy writ large and aligns with the three pillars of manning, training and equipping. Through a methodical approach of repairing our current force structure while continuing to procure the latest generation equipment, we will ensure we balance current capacity with future capability. We will prepare our people to safely and flawlessly execute all duties on deck and in the air, and we will attract, hone and retain the best, most highly motivated and talented warriors and support their families. We will grow and sustain our people and equipment to meet all future warfighting requirements.

What is your perspective on aircraft readiness?

Aircraft readiness requires the three domains of personnel, aircraft and supply to work in perfect harmony. Having the right people in the right place at the right time with the right equipment is the key to success and will ensure we deploy combat-ready Naval Aviation forces that win in combat. Naval Aviation is full of tremendous leaders that are working feverishly to ensure Sailors have the tools they need to succeed. My job as the Air Boss is to weave the many stakeholders together to ensure the readiness generation machine is operating at its utmost efficiency.

What is the plan for the Navy's retirement of the F/A-18C Hornet? How will the impact to the Marine Corps be mitigated?

The Navy will have phased out F/A-18Cs in operational fleet squadrons by this time next year. Adversary and Reserve squadrons will continue to operate the aircraft to support the fleet, as required. As part of that transition to Super

Hornets, “best-of-breed” legacy aircraft will be transferred from those active Navy operational squadrons to the Marine Corps. This will allow the Marines to continue strike fighter operations in the F/A-18, as part of our air wings, while they transition to the Joint Strike Fighter.

What is the Naval Aviation Enterprise’s role, and how will you guide it as Air Boss?

Naval Aviation is a complex system of systems and not managed by a single process owner. The mission of the Naval Aviation Enterprise (NAE) is to sustain required current readiness and advance future warfighting capabilities at best possible cost. The NAE serves as the single framework for facilitating collaboration, transparency, cross-functional engagement, information sharing and process improvements that are necessary to drive stakeholders in removing readiness barriers and resolving warfighting degraders.

As the Air Boss, I am committed to continuing this important work. As the lead for the NAE—along with Lt. Gen. Steven Rudder, Deputy Commandant for Aviation, and Vice Adm. Paul Grosklags, Commander, Naval Air Systems Command—I intend to keep the stakeholders within the NAE focused on the top three priorities of warfighting, people and the readiness of both. Readiness recovery across all type/model/series (TMS), particularly within the F/A-18A-F TMS, is my foremost concern today.

What do you hope to accomplish as Air Boss?

My charter is to man, train and equip Naval Aviation forces to win in combat, tonight as well as in the future. I will continue to build upon the phenomenal efforts of Air Boss #7, Vice Adm. Mike Shoemaker. All good things come from “up” jets.

A native of Annapolis, Maryland, **Vice Adm. DeWolfe Miller III** grew up in York, Pennsylvania, and graduated from the U.S. Naval Academy in 1981. He holds a Master of Science from the National Defense University and is a Syracuse University national security management fellow and graduate of the Navy’s Nuclear Power Program.

His operational assignments include Training Squadron (VT) 19 in Meridian, Mississippi; Attack Squadron (VA) 56 aboard USS Midway (CV 41); Strike Fighter Squadron (VFA) 25 on USS Constellation (CV 64); VFA-131 and VFA-34 aboard USS Dwight D. Eisenhower (CVN 69); executive officer of USS Carl Vinson (CVN 70); Commanding Officer of USS Nashville (LPD 13); Commanding Officer of USS George H.W. Bush (CVN 77); and, as a flag officer, commander of Carrier Strike Group (CSG) 2, where he participated in combat Operations Enduring Freedom and Inherent Resolve.



U.S. Navy photo by Lt. Christopher Waddell

Vice Adm. DeWolfe Miller, commander, Naval Air Forces, looks through the sights of an SA-16 man-portable air defense system (MANPAD) simulator during a recent trip to the Naval Aviation Warfighting Development Center (NAWDC) in Fallon, Nev., Feb. 21. Systems technician Justin Clark explains how the system works.

We must improve aircraft availability and full mission capable (FMC) rates to meet our training and warfighting demands. Our aviators deserve and require more flight hours to prepare for and win in combat. It took several years for us to get in this state of readiness, and it will take years to get where we want to be. But there is goodness ahead for both current and future readiness. Also, I am 100-percent committed to our Sailors. It is my job to get them what they need to prepare for and win decisively in combat. If I can make their jobs or lives any easier, I will have succeeded.

Anything else you would like to add?

To the readers, thank you for everything you do each day to prepare us to win in combat. We fly, we fight, we lead...and we win! 🇺🇸

Miller’s shore tours include Air Test and Evaluation Squadron (VX) 5; aviation programs analyst Office of the Chief of Naval Operations (OPNAV N80); Strike Fighter Weapons School Atlantic; deputy director of naval operations at the Combined Air Operations Center during Operation Allied Force; Office of Legislative Affairs for the Secretary of Defense; aircraft carrier requirements officer for Commander, Naval Air Forces; and flag officer tours in OPNAV as director for Intelligence, Surveillance and Reconnaissance (N2N6F2); assistant deputy chief of naval operations for Warfare Systems (N9B); and most recently as director, Air Warfare (N98).

Miller became Naval Aviation’s 8th “Air Boss” in January 2018.

He has earned the Defense Superior Service Medal, Legion of Merit, Bronze Star, Meritorious Service Medal, Air Medal and other personal, unit and service awards. 🇺🇸

Grampaw Pettibone

Gramps from Yesteryear: September-October 2006

Illustration by *Ted Wilbur*

After doing ceremonial flyovers over the weekend, a section of Hornets took off from a civilian airfield for the short flight home. The flight lead elected to launch visual flight rules (VFR) and proceeded to a visual route (VR) for some section low-level work.

Weather and notices to airmen were checked during the brief, but no flight plan was filed, and the route was not scheduled with fleet area control and the local surveillance facility. The flight lead conducted a standard low-level briefing, including discussion of operational risk management and hazards along the route using his low-level chart. The wingman did not have a chart.

Prior to entering the VR route, the flight lead contacted flight service and stated their intention to fly the low-level route at 200 feet and 500 knots. At some point the flight lead noticed the section was two miles south of route centerline, so he called for a "check right" to redress the formation. During the turn, the flight lead descended below the route structure. Although he had his radar altimeter bug set at 180 feet, he didn't hear the radar altimeter warning tone as he lost altitude. He caught sight of a group of high tension lines running across a reservoir, but he was too low and going too fast to avoid them.

The lead Hornet struck the power lines 90 feet above the surface of the reservoir. The impact severed three of the four lines and sheared off all of the jet's antennas on the bottom of the fuselage and tore off the front half of the centerline drop tank. Both of the engines were foddied, and the starboard engine seized immediately.

The pilot started a climb while securing the starboard engine and assessing damage to the aircraft. He referenced his low-level chart and then started a left-hand turn for the nearest emergency divert field, which was 12 miles south. At the same time he attempted a crossbleed start on the starboard engine, with no luck.

The jet was rapidly decelerating, and the pilot selected full afterburner on the port engine in an attempt to maintain level flight. Meanwhile, the wingman, who had noticed the power lines sparking on the ground during the climb over the reservoir, attempted to



join his damaged flight lead. The wingman could not communicate over the radio because of the damage to the lead's antennas.

As his air speed continued to decay, the flight lead knew he was left with one option. He elected to hold ejection until 200 feet above the ground to ensure the aircraft wouldn't hit any homes or vehicles. Just over a minute after he had hit the wires, the flight lead ejected.

The pilot tumbled several times in the seat and hit the ground shortly after parachute opening. He didn't perform a parachute landing maneuver because he was distracted watching his stricken Hornet turn into a fireball after it crashed in front of him. He suffered a severely fractured right ankle and sprained left ankle. A civilian ambulance arrived within seven minutes, and the pilot was taken to a local hospital for treatment. ✈

**Grampaw
Pettibone
says ...**



First off, even with newfangled moving maps and such, Gramps ain't terribly comfortable with everybody in the flight not having his own low-level chart. Second, a low-level brief ain't much good if aviators don't stay within the route boundaries during the route. 'Nuff said. ✈

Miller Relieves Shoemaker, Becomes Navy's 8th Air Boss

SAN DIEGO—Vice Adm. DeWolfe H. Miller III relieved Vice Adm. Mike Shoemaker as Commander, Naval Air Forces (CNAF), during a Jan. 11 change of command ceremony in the hangar of Fleet Logistics Support Squadron (VR) 57 at Naval Air Station North Island.

Immediately following the change of command, Shoemaker retired after 35 years of naval service.

The Navy's "Air Boss" since January 2015, Shoemaker ensured the material readiness, administration and training for all Naval Aviation commands and provided operationally ready squadrons and aircraft carriers to the fleet. He also led the Naval Aviation Enterprise, a partnership between Navy and Marine Corps aviation organizations that work together closely to improve processes for more efficient and effective Naval Aviation forces.

During his tenure, Shoemaker focused Naval Aviation on its founding principles, eliminated barriers to sustaining strike-fighter inventory and secured funding for warfighting readiness. He improved quality of life and service while building the required readiness foundation for USS Gerald R. Ford (CVN 78) through to its commissioning. Shoemaker and his team also manned, trained and equipped multiple carrier strike groups for successful deployments, improved carrier maintenance and furthered the development of technology and platforms in the carrier air wing.

Vice Chief of Naval Operations Adm. Bill Moran was the guest speaker at the ceremony. Commander, U.S. Pacific Fleet Adm. Scott H. Swift presented Shoemaker with the Distinguished Service Medal on behalf of the president for displaying extraordinary strategic vision, analytical insight and inspirational leadership as CNAF.

Shoemaker thanked all who sup-



U.S. Navy photo by Mark Carpovich

Vice Adm. DeWolfe Miller speaks at an All Hands Call, days after becoming the Navy's eighth Air Boss.

ported him throughout his career and commended Miller, whose call sign is "Bullet."

"It has been my distinct honor and privilege, and the highlight of my 35-year career, to serve as your Air Boss for the last three years," Shoemaker said. "This morning, I will turn over command of this great organization and all Naval Aviation Forces to Vice Adm. 'Bullet' Miller. He has had an extraordinary career as a light-attack and strike-fighter pilot, [commanding officer] of [USS] George H.W. Bush [(CVN 77)] on her maiden deployment, commander of the Bush Strike Group, and most recently, as your director of Air Warfare (N98) in the Pentagon. He is well versed in all the readiness issues facing Naval Aviation, as well as the future capabilities required to continue to pace the threat. He and his wife, Ellen, are the perfect choice to

lead Naval Aviation going forward, and I know you will support them the same way you all did Peg and me."

Miller addressed the men and women of CNAF for the first time as the Navy's eighth Air Boss and described the value of Naval Aviation.

"Look around you: We are Naval Aviation. We are a critical part of a larger Navy team. We stand on the shoulders of giants who preceded us," Miller said. "For me, those include legends like Dunleavy, Godwin, Tyson, Gortney, Keating, Shoemaker. We are lethal military professionals. We are courageous, disciplined and accountable. We serve with integrity, and we lead with humility and compassion. We excel in the air, and we make a difference in the world. We fly, we fight, we lead, we win."

Written by MC1 Paolo Bayas, CNAF Public Affairs. ✈

USS Gerald R. Ford Completes Aircraft Compatibility Testing One



U.S. Navy photo by MC3 Sean Elliott

An F/A-18F Super Hornet, assigned to the "Salty Dogs" of Air Test and Evaluation Squadron (VX) 23, takes off from the flight deck of USS Gerald R. Ford (CVN 78).

PATUXENT RIVER, Md.—Test pilots and engineers from Air Test and Evaluation Squadron (VX) 23 completed the first round of aircraft compatibility testing (ACT) aboard the Navy's newest aircraft carrier, USS Gerald R. Ford (CVN 78), Sept. 29 through Oct. 6.

CVN 78 is the first of the Ford-class aircraft carriers and includes many new technologies, including several related to aircraft launch and recovery. It is equipped with the Electromagnetic Aircraft Launching System (EMALS) and the Advanced Arresting Gear (AAG). Additionally, the flight deck shape and island superstructure location are different than previous classes of aircraft carrier, which gives a different airwake—the "burble"—as aircraft approach the ship for landing. Testing included certifying EMALS and AAG, evaluating the new airwake and conducting multiple instrument approaches to grant a Mode 2 Precision Approach Landing System (PALS) certification.

The previous CVN 78 testing, conducted in July 2017, consisted of four arrested landings and four catapult launches with one F/A-18F Super Hornet

aircraft from VX-23. The recent round of shipboard testing was performed with three VX-23 F/A-18E/F aircraft. More ACT aboard CVN 78 is planned for 2019 and will include operations with F/A-18E/F, EA-18G Growler, C-2 Greyhound and E-2 Hawkeye aircraft.

Testing consisted of 49 flight events, totaling 50.4 flight hours, and included shore-based field carrier landing practice for the test pilots, as well as shore-based arrested landings to verify each aircraft's instrumentation system. The shore-based arrestments were performed using the E-28 field arresting gear at Naval Air Station Patuxent River, Maryland.

While underway, a total of 83 catapult launches and 83 arrested landings were performed to verify EMALS and AAG performance. A total of 230 approaches were conducted and included a mix of intentionally off-nominal approaches and nominal PALS approaches to evaluate the burble's effects on approach handling qualities, as well as to support the "Mode 2" certification. Night testing included two launches, four touch-and-goes and two arrested landings.

"The VX-23 maintenance detachment,

which included contract support personnel and VX-23 Sailors, did an outstanding job ensuring the test aircraft were available and ready to support testing throughout the detachment," said Cmdr. Johannes Jolly, chief test pilot at VX-23. "The maintenance detachment overcame significant challenges and occasionally worked through the night to provide excellent support and enabled the successful completion of the test through their efforts."

Aircraft data will be reviewed to support software changes to both AAG and EMALS and to improve performance during future shipboard operations. Test pilot feedback will be used to inform fleet pilots on the airwake characteristics unique to this newest class of aircraft carrier.

Completing this testing successfully will set the stage for CVN 78 to conduct flight deck and carrier air traffic control center certification scripts with fleet F/A-18E/F squadrons during its next under-way period.

Written by Brian Kiernan, flight test engineer with NAVAIR's Fixed Wing Ship Suitability department, and Lt. Cmdr. Patrick Lakusta, test pilot with Air Test and Evaluation Squadron (VX) 23. 🦅

Lincoln Completes First F-35 Carrier Qualification

ATLANTIC OCEAN—The first nine fleet aviators qualified for the F-35C Lightning II after the crew of USS Abraham Lincoln (CVN 72) successfully completed fleet replacement squadron carrier qualifications.

Along with Lincoln, the “Rough Raiders” of Strike Fighter Squadron (VFA) 125, the “Grim Reapers” of VFA-101 and the “Vampires” of Test and Evaluation Squadron (VX) 9, accomplished many firsts while underway Dec. 7-11, including using the Autonomic Logistic Information System (ALIS) aboard a carrier and the Joint Precision Approach and Landing System (JPALS) in an operational setting.

“Thanks to the tireless work from VFA-125, VFA-101, VX-9, CVN 72 and the Lockheed [Martin] team, this detachment was able to successfully complete numerous milestones that will set the foundation for the future fifth-generation employment of the

F-35C into the carrier air wing,” said Cmdr. Scott Hulett, VFA-125’s executive officer.

An information infrastructure that allows operators to plan, maintain and sustain F-35C systems, ALIS provides a secure way to transmit up-to-date operations, maintenance, support, training and technical data to users and technicians worldwide. According to Lockheed Martin, the developer of the F-35C, ALIS is considered the information technology backbone of current and future aircraft throughout the DOD.

Lincoln operated in inclement weather during a portion of the qualification process, which gave the squadrons varying conditions to test JPALS, a new, all-weather landing system that works with the ship’s navigation system to provide accurate and reliable guidance for aircraft. Previously, F-35Cs had used JPALS only for developmental testing.

Completing the first fleet carrier qualification on the Navy’s newest aircraft involved support from many departments aboard the ship, including air, operations and the aircraft intermediate maintenance department, which conducted its first unassisted F-35C tire build.

“We could not have achieved our lofty goals without the dedication and expertise from everyone involved. We look forward to working with the CVN 72 team throughout 2018 as we continue to ensure fifth-generation power projection from the sea,” Hulett said.

The F-35C remains on track to deliver as an operational aircraft in 2018. By 2025, the Navy’s carrier air wings are forecasted to consist of F-35Cs, F/A-18E/F Super Hornets, EA-18G Growlers, E-2D Advanced Hawkeyes, MH-60R/S helicopters, MQ-25A Stingrays and CMV-22B Ospreys.

Written by MC2 Jessica Paulauskas, USS Abraham Lincoln Public Affairs.



Sailors prepare to launch an F-35C Lightning II, from the “Rough Raiders” of Strike Fighter Squadron (VFA) 125, during flight operations aboard aircraft carrier USS Abraham Lincoln (CVN 72).

U.S. Navy photo by MC Josue Escobosa



U.S. Navy photo by John F. Williams

A UH-1 Huey helicopter equipped with an Office of Naval Research-sponsored Autonomous Aerial Cargo/Utility System kit makes an approach for landing during final testing Dec. 12 at Marine Corps Base Quantico, Va.

Special Delivery: New Autonomous Flight Technology Means Rapid Resupply for Marines

QUANTICO, Va.—Autonomy options for the U.S. Marine Corps took a major step forward when officials at the Office of Naval Research (ONR) announced Dec. 12 a successful final helicopter flight demonstration with autonomous capability at Marine Corps Base Quantico, Virginia.

The demonstration was part of the Autonomous Aerial Cargo/Utility System (AACUS) program, a partnership between ONR and contractor Aurora Flight Sciences that will enable the Marine Corps to resupply forces on the front rapidly.

The system consists of a sensor-and-software package that can be integrated into any manned or unmanned rotary-wing aircraft to detect and avoid obstacles—such as telephone wires, other vehicles or large ground objects—in unfavorable weather conditions, or to facilitate autonomous, unmanned flight. This capability will be a welcome alternative to dangerous convoys or manned aircraft missions in all types of weather.

“This is more than just an unmanned helicopter,” ONR Executive Director Walter Jones said. “AACUS is an autonomy kit that can be placed on any rotary-wing platform and provide it with an autonomous capability. Imagine a Marine Corps unit deployed in a remote location, in rough terrain, needing ammunition, water, batteries or even blood.

“With AACUS, an unmanned helicopter takes the supplies from the base, picks out the optimal route and best landing site closest to the warfighters, lands and returns to base once the resupply is complete—all with the single touch of a handheld tablet.”

The need for this capability surfaced during Marine Corps operations in Afghanistan and Iraq. Cargo helicopters and resupply convoys of trucks bringing fuel, food, water, ammunition and medical supplies to the front lines found themselves frequently

under fire from adversaries or the target of roadside bombs and other improvised explosive devices. The AACUS is designed to be simple—an operator with minimal training can call up the supplies needed and order flights using a handheld tablet.

During the Dec. 13 demonstration tests, a Marine with no prior experience with the technology was given a handheld device and 15 minutes of training. The Marine programed the supplies and the destination quickly and easily, and the helicopters arrived promptly—even autonomously selecting an alternative landing site based on last-second no-fly-zone information added by the Marine. The demonstration featured a UH-1 helicopter flying autonomously on multiple missions.

“We’ve developed this great capability ahead of requirements, and it’s up to us to determine how to use it,” said Lt. Gen. Robert Walsh, commanding general, Marine Corps Combat Development Command. “The young Marines today have grown up in a tech-savvy society, which is an advantage. We’ve got to keep pushing and moving this technology forward.”

Officials say the AACUS represents a leap-ahead technology for the Marine Corps and Navy, moving unmanned flights far beyond the current standard, which requires a specialized operator to select a landing site and control an unmanned aircraft manually via remote.

“AACUS gives revolutionary capability to our fleet and force,” said Dennis Baker, AACUS program manager. “It can be used as a pilot aid to operate in GPS- and communications-denied arenas or allow fully autonomous flights in contested environments, keeping our pilots and crews out of harm’s way.”

Warren Duffie Jr. is a contractor for ONR Corporate Strategic Communications. 🦋

'Chilly Willy' Finds New Home

DAYTON, Ohio—The Naval Medical Research Unit of Dayton (NAMRU-D) accepted Aircraft 24, a decommissioned Marine Corps MV-22 Osprey tilt-rotor aircraft, for aerospace medicine research on Dec. 19.

Nicknamed "Chilly Willy" after the cartoon penguin, the aircraft previously spent the winters from 2003-2006 testing in Halifax, Nova Scotia. Chilly Willy was then used for several testing programs contributing to development and evaluation of many versions of flight controls and avionics software.

Now the MV-22 will support Navy medical research.

"The MV-22 will be used to conduct static aerospace medical research in an effort to provide solutions toward preventing musculoskeletal injury to tilt-rotor aircraft crew," said Lt. Cmdr. Matthew Doubrava, senior medical officer at NAMRU-D.

A major medical research command,

NAMRU-D is the home of the Naval Aerospace Medical Research and Environmental Health Effects laboratories.

NAMRU-D will also be using the aircraft to study en route care and determine the most useful way to load and employ aircraft in that role, Doubrava said.

NAMRU-D Commanding Officer Capt. Rees Lee accepted the aircraft upon delivery by Air Test and Evaluation Squadron (VX) 21 from Patuxent River, Maryland.

Although Aircraft 24 was used primarily for conducting developmental flight testing, the primary mission of the MV-22 is for transportation of troops, equipment and supplies from ships and land bases for combat assault and assault support.

Mark Hollady, MV-22 flight test engineer lead, said that the most important role of Aircraft 24 was to evaluate the platform's ice protection system in a natural icing environment. As a test

bed, the aircraft underwent extensive modifications, including installation of a flight test engineer control station, complex instrumentation system and the latest generation components for the ice protection system. The external configuration of the aircraft was modified to represent a Marine Corps MV-22 on one side and an Air Force CV-22 on the other to allow ice accumulation characteristics to be measured simultaneously for both aircraft configurations during a natural icing test program.

The U.S. Air Force School of Aerospace Medicine (USAFSAM)—located next to the NAMRU-D—will also reap the benefits of Chilly Willy and use it for en route-care training.

"The aircraft will be jointly beneficial to the research and training efforts conducted by NAMRU-D and USAFSAM," Lee said.

Stacey Geiger supports the 88th Air Base Wing Public Affairs Office. ✈



U.S. Air Force photo by R.J. Ortiz

A U.S. Marine Corps MV-22 Osprey belonging to Air Test and Evaluation Squadron (HX) 21 lands Dec. 19 at Wright-Patterson Air Force Base, Ohio. The aircraft was signed over to Naval Medical Research Unit-Dayton to be used in research to minimize injuries to aircrew members.



U.S. Navy photo by MC Eleanor Vara

Capt. Tom Barber, Commander, Carrier Air Wing 2 and Cmdr. Jason Hutcherson, commanding officer of the "Bounty Hunters" of Strike Fighter Squadron (VFA) 2 complete their 1000th carrier arrested landing or "trap" Jan. 18 aboard the Nimitz-class aircraft carrier USS Carl Vinson (CVN 70).

Carl Vinson Aviators Complete 1,000th Trap

PACIFIC OCEAN—Two naval aviators joined an elite group Jan. 18 when they completed their 1,000th arrested landing aboard USS Carl Vinson (CNV70).

Capt. Tom Barber, the commander of Carrier Air Wing (CVW) 2, and Cmdr. Jason Hutcherson, the Commanding Officer of Strike Fighter Squadron (VFA) 2, landed aboard the aircraft carrier together in an F/A-18F Super Hornet while fellow aviators and aircrewmembers watched from the flight deck.

"It was great to see everybody from my squadron and the air wing up on the flight deck," said Hutcherson, a naval flight officer (NFO). "I was a department head of VFA-2 a couple of years ago and then to come back as the XO [executive officer], and now as CO, and to get 1,000 traps with the same squadron, it's been pretty rewarding." Barber said he was honored to complete the historic flight with Hutcherson and thanked him and the squadron for allowing him to fly their aircraft, named "Bullet 100."

"It was very special that two people were able to fly and reach this milestone together," Barber said. "This would not

have been possible if it wasn't for all the hard work of the Sailors of Carrier Air Wing 2 and USS Carl Vinson. Thank you."

Since Naval Aviation began in 1911, more than 180,000 pilots have earned their wings, but fewer than 360 pilots and 120 NFOs have reached the milestone of 1,000 traps. After joining the elite group, Hutcherson said he understood the honor wasn't earned alone.

"I hope that they recognize that getting 1,000 traps isn't just me," Hutcherson said, "It's the ship, it's the maintainers and it's all the supporters that we have as aviators."

For many who witnessed the 1,000th trap, the feat meant more than just an impressive number.

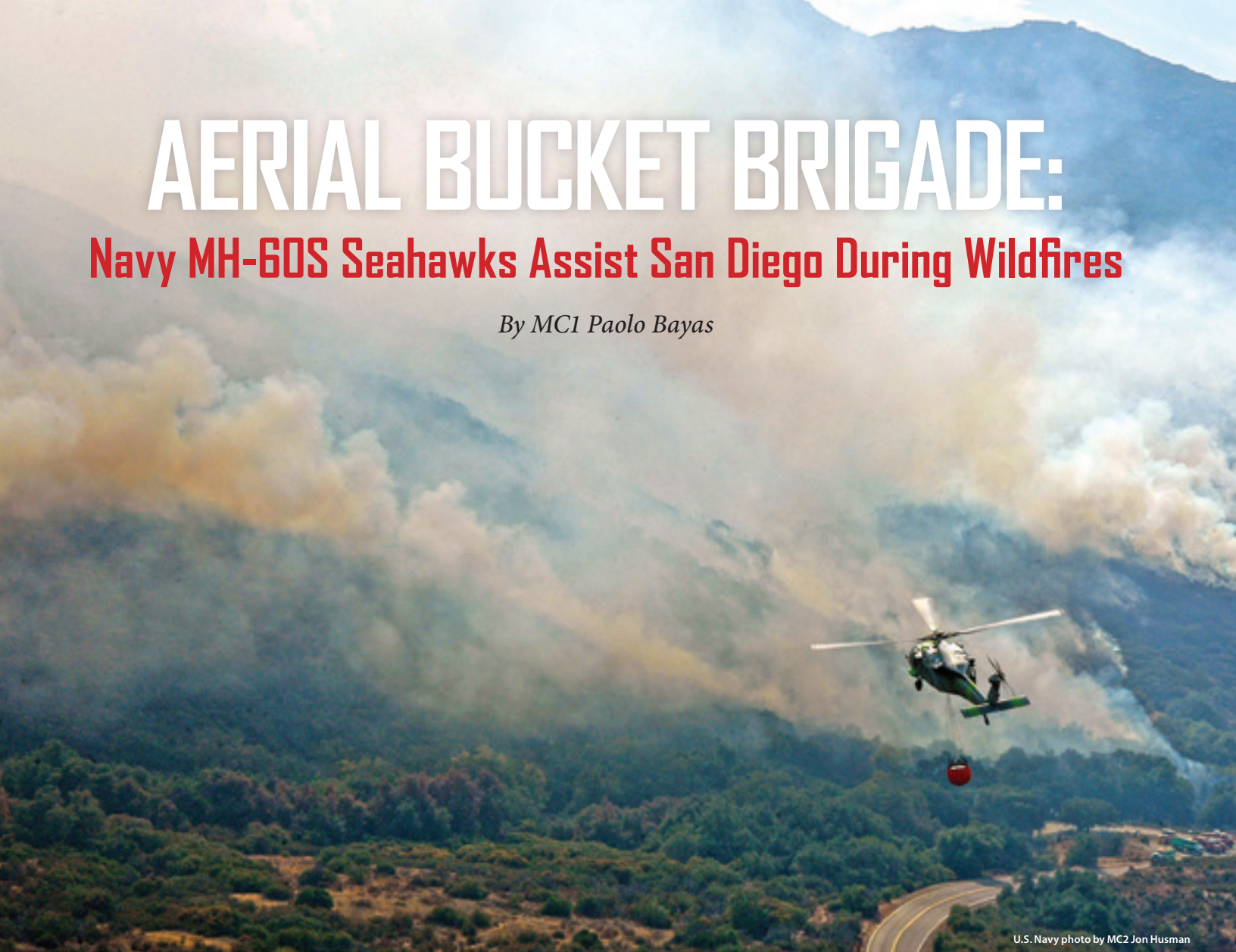
"I think it's reassuring to know that we are being led with experience," said Lt. John Cushing, a VFA-2 pilot. "Especially moving forward into this deployment, it helps to know the guys leading the way have literally done it a thousand times before."

Written by Mass Communication Specialist 2nd Class Rebecca Sunderland. 🇺🇸

AERIAL BUCKET BRIGADE:

Navy MH-60S Seahawks Assist San Diego During Wildfires

By MC1 Paolo Bayas



U.S. Navy photo by MC2 Jon Husman

An MH-60S Seahawk, assigned to Helicopter Sea Combat Squadron (HSC) 85, carries a bucket containing 420 gallons of water to dump on a wildfire in San Diego County.

While many residents of California may consider it paradise, the dangers of devastating wildfires are all too real. Last year was particularly hellish; between October and December fires scorched 1.38 million acres, killing 46, destroying thousands of buildings and causing billions of dollars of damage.

Things could have been much worse if not for the heroism of California Department of Forestry and Fire Protection (CALFIRE), who sent firefighters into harm's way, and also fought fires from above with their fleet of fixed- and rotary-wing aircraft. During times of crisis, that fleet includes MH-60S Seahawks from Helicopter Sea Combat Wing Pacific (HSCWINGPAC).

On Dec. 7, CALFIRE was battling seven fires at once, including the massive 280,000-acre Thomas Fire in Ventura County—the largest in state history. With all 50 of its aircraft in use, CALFIRE requested help battling the Lilac Fire in northern San Diego County, which would go on to burn more than 4,000 acres and destroy more than 150 buildings. The fire threatened Marine

Corps Base Camp Pendleton and several communities including Bonsall, Fallbrook and Oceanside. Within hours of receiving the call, the Navy's Helicopter Sea Combat (HSC) squadrons based at Naval Air Station (NAS) North Island had painted four helicopters with special pink outlines—to keep them visible through smoke—and dispatched two of them north to fight the fire.



U.S. Navy photo by MC1 Paolo Bayas

A naval aircrewman (Helicopter), assigned to the "Merlins" of Helicopter Sea Combat Squadron (HSC) 3, connects a "Bambi Bucket" to an MH-60S Seahawk helicopter in support of aerial firefighting efforts.



U.S. Navy photo by MC2 Jon Husman

Two MH-60S Seahawks retrieve water from a lake near a wildfire in San Diego County.

"When we saw the fires on the news, we began preparing our buckets and getting into the operational mindset," said Cmdr. Sean Rocheleau, HSC-3's Commanding Officer. "When the official call came from Third Fleet, we were ready to fly."

After arriving at Camp Pendleton and receiving a briefing from CALFIRE, the two helicopters, one from the "Merlins" of HSC-3 and one from the "Blackjacks" of HSC-21, were in the skies over the blaze, dropping 320 to 420 gallons of water from "Bambi buckets" onto hot spots to help protect local communities. After 18 drops and more than 5,600 gallons of water, the helicopters returned to Coronado, having helped contain the fire and protect homes.

"There are a lot of things we do where we don't directly see how we impacted the mission," said Naval Air Crewman (Helicopter) 2nd Class Mario Guardado of HSC-3. "Having done this, it is really satisfying to immediately see the impact of putting out fires to help our local community."

Navy helicopters are no stranger to fighting fires. CALFIRE also reached out to the Navy during the devastating 2003 Cedar fire that destroyed more than 2,200 homes in San Diego County. CALFIRE saw HSC squadrons, which fight fires at the Southern California Offshore Range (SCORE) at San Clemente Island, as a valuable force multiplier. A memorandum of understanding was signed which allows DOD aircraft to support CALFIRE when necessary and when all non-DOD aircraft are committed and unavailable.

Since this agreement, Navy HSC squadrons have provided aerial firefighting support for seven fires between 2006 and 2017.

"Military pilots are more than competent to fight fires. Hands down, if you go through a military flight training program, you are a good, solid pilot," said Lt. Cmdr. Jeff Laird, a pilot with HSC-3. "The Navy trains you to land on ships, fly in horrible weather and awful conditions, and looks at you as a weapons system, so flying becomes second nature. The only caveat is that we are much younger and inexperienced when it comes to fighting

fires. However, because of our competence through our training, the learning curve is much less steep for us.”

CALFIRE and HSCWINGPAC have a joint training program. HSC pilots and aircrew receive ground training from a CALFIRE representative. The training covers the description of a Fire Traffic Area, communication, language and fire terminology, and how and what to expect in the case that the Navy is called to provide support for aerial firefighting. The aircrews then conduct six initial water pickups and drops. Maintaining this qualification requires an additional two water pick-ups and drops every 180 days.

According to CALFIRE Battalion Chief Burke Kremensky, squadrons such as HSC-3 and HSC-21, which train annually to meet CALFIRE standards and have experience with firefighting on San Clemente Island, do an outstanding job in emergency firefighting missions.

“When CALFIRE first started working [with the Navy], there were growing pains, but the continued training and relationships we have fostered have made this a valuable program to San Diego,” Kremensky said. “The Navy has become an excellent partner, and I know the community of San Diego greatly appreciates their assistance.”

Navy HSC squadrons provide tremendous versatility to Navy commanders with the ability to conduct anti-surface warfare, anti-submarine warfare, search and rescue, drug interdiction, cargo lift, early warning, medevac and special operations support. But its ability to support civil authorities during times of disaster was apparent in 2017.

“Whether it was helping out during hurricanes Harvey or Maria or the wildfires, HSC helicopters made a big impact last year,” Rocheleau said. “Our aircrews train for a lot of different missions, but when they are supporting fellow Americans or their neighbors, they take a great deal of pride in that.”

Mass Communication Specialist 1st Class Paolo Bayas supports Commander, Naval Air Forces Public Affairs. 🦅



U.S. Navy Photo by MC2 Sebastian McCormack

A naval aircrewman, conducts a water drop during a wildfire.



U.S. Navy Photo by MC2 Sebastian McCormack

MH-60S helicopters from Navy HSC-3 and HSC-21 prepare to take off to combat a wildfire.

NAVAIR Panel Highlights Digital Integration Strategy

By Amy Behrman

Naval Air Systems Command (NAVAIR) is harnessing recent advances in digital technology and data integration to expand the fleet's tactical advantage.

NAVAIR leaders outlined the command's roadmap for "going digital" during a Dec. 7 panel presentation hosted by the Patuxent Partnership and the Association of Naval Aviation's Squadron #18. The panel was introduced by NAVAIR Commander, Vice Adm. Paul Grosklags, and moderated by NAVAIR's digital integration officer, Todd Balazs.

Other NAVAIR panelists included Dave Cohen, director for systems engineering; Brig. Gen. Greg Masiello, assistant commander for Logistics and Industrial Operations; and Steve Cricchi, assistant commander for corporate operations and total force.

Today, the percentage of mission capable aircraft across Naval Aviation is not where we want it to be, Grosklags said.

"Over the past seven years, we've underfunded our aviation readiness accounts by over \$6 billion," Grosklags said. "Even though budgets are on the upswing, we'd be naive to think we'll be able to fill in that deficit any time in our lifetime. The reality is we must change the way we do business to get after improving our readiness."

A Naval Aviation Enterprise initiative called "Sustainment Vision 2020" is designed to deliver effective and efficient flight line readiness through an integrated, globally managed, predictive and responsive sustainment system, Grosklags said.

During the panel, Grosklags outlined plans for the creation of Naval Aviation sustainment operation centers that will take advantage of the massive amounts of data and information that Naval Aviation platforms currently produce.

"Manned by fleet decision makers and a team of analysts, these ops centers would provide decision-quality insight into the terabytes of data we pull off our aircraft every year, including aircraft status data, predictive maintenance indicators, and the location and availability of spare parts, facilities and people," he said.

"A Naval Aviation Enterprise initiative called 'Sustainment Vision 2020' is designed to deliver effective and efficient flight-line readiness through an integrated, globally managed, predictive and responsive sustainment system."

"It's all about time," Balazs said, describing NAVAIR's digital transformation. "It's not just about digital; it's about leveraging digital tools to support a fundamentally different business model. We just can't accept that it takes 17 years to develop and deliver new weapon systems to our warfighters ... It's not acceptable that we have that many aircraft down."

According to Balazs, NAVAIR's digital transformation will take place across several layers of the enterprise, including business, technology and workforce.

"We're going to jump in and take advantage of available technology, pivot

as technology advances and make the most of our analytical skill sets, giving the workforce more time for critical thinking and empowering them to make decisions," he said. "We're focused on outcomes, organizing around products and moving toward a 'self-service' infrastructure that enables our people to build the apps they need to do their jobs."

Cohen described how close collaboration with industry will enable NAVAIR to dramatically slash acquisition cycle times, from 16-20 years to 8-10 years.

"We must start buying material and releasing to production from the day of contract award," he said. "Industry is ready to do it. We [the government] need to be there with them."

Cohen spoke about the advantages of model-based systems engineering, wherein industry leverages high-performance computing while government and industry engineers engage continuously on system designs via integrated, collaborative environments.

Cohen described NAVAIR's mission-effectiveness analysis work, which involves engineers collaborating with fleet representatives to match available assets and needed capabilities to current and emerging threats.

This analysis work identifies the needs or "gaps" that will inform investment and provide insight into the operational context of future systems, thereby enabling the government to bring industry into the process early on.

"It will enable us to reduce time and cost significantly," Cohen said. "We'll know what the warfighters want based on accredited mission-effectiveness analysis, modeling and simulation and



U.S. Navy photo

From left, are Bonnie Green, executive director, The Patuxent Partnership; Brig. Gen. Greg Masiello, assistant commander for Logistics and Industrial Operations; Steve Cricchi, assistant commander for Corporate Operations and Total Force; Todd Balazs, NAVAIR's digital integration officer; Dave Cohen, director for systems engineering; Vice Adm. Paul Grosklags, NAVAIR commander; and Mark Converse, Patuxent River Squadron CO, Association of Naval Aviation.

threat info, and we'll start off with a nearly mature conceptual or preliminary design.

"We're going to move away from large-scale design reviews and get on board with the asynchronous, chaotic way new systems are being developed in the commercial sector."

He said today's systems engineering technical review, or SETR, process is outdated and can impede development of new systems. With model-based systems engineering, government and industry engineers use accredited models to assess design attributes and performance and can review those designs on a daily basis, eliminating the need to prepare and review paper artifacts as well as prepare for and conduct large-scale design reviews.

According to Cohen, these models—high-fidelity, digital representations of platforms, systems and threats—will be carried forward to capabilities-based test and evaluation and live, virtual and

constructive simulation, allowing pilots to train to the high-end fight.

In his remarks, Masiello expanded on Sustainment Vision 2020, outlining the plan's key focus areas: maintenance planning, supply, infrastructure and manpower/training.

Like Grosklags, he believes Naval Aviation must do more to leverage data to improve readiness, citing the benefits of NAVAIR's Aircraft Management Dashboard (AMDB), software that integrates near real-time data and reports provided by fleet maintainers and squadrons on the status of their aircraft.

"AMDB provides everyone from four-star admirals to maintenance officers access to the same information on supply documents and associated maintenance actions, down to the individual aircraft," he said. "That level of transparency is a good thing. It enables us to make informed decisions together, in real time, to optimize fleet readiness."

Cricchi rounded out the panel by addressing NAVAIR's digital business transformation.

"The good news is we live in a data rich environment, and our challenge is to figure out how best to use that data to our advantage, which includes overcoming cultural barriers such as data ownership and access," he said.

According to Cricchi, access to personnel information such as skills, experience, locations and program assignments will let NAVAIR quickly assemble and deploy teams to urgent projects or reassign personnel to fill critical capacity gaps.

"Collecting and correlating available data will make us more predictive, which is central to increasing fleet readiness and capability today and in the future," he said.

Amy Behrman leads strategic and internal communications for NAVAIR Public Affairs. ✈

EIGHT MINUTES *OVER SYRIA*



Super Hornet Pilots Recall Downing of Syrian Aircraft

By Naval Aviation News Staff



U.S. Air Force photo by Senior Airman Rusty Frank

On June 18 in the eastern Mediterranean, Lt. Cmdr. Mike “Mob” Tremel, of the “Golden Warriors” of Strike Fighter Squadron (VFA) 87, was about four months into his deployment on USS George Bush (CVN 77).

That day, while flying with three other fighter jets southwest of the Syrian city of Raqqa, he would shoot down a Syrian Air Force Su-22 Fitter attack jet that was attacking partner forces, scoring the first U.S. kill of an enemy aircraft since January 1999.

Tremel and the rest of the air wing were supporting the Syrian Democratic Forces (SDF), a U.S. partner in the campaign to defeat the Islamic State, as they fought to retake Raqqa, which had served as the Islamic State’s de facto capital for more than three years.

Conducting these missions was different from previous campaigns in Iraq and Afghanistan, where coalition forces had flown more or less alone in the airspace. In Syria, the airspace was crowded with aircraft from all over, including Iraq, Russia and Turkey.

“The difference here was that not all the aircraft that were airborne were friendlies,” explained Tremel’s wingman, Lt. Cmdr. Jeff “JoJo” Krueger. “They weren’t necessarily enemies, but we certainly were not on the same side. So you didn’t know what they would do.”

In Country

Earlier on the 18th, Tremel and Krueger launched their Super Hornets from Bush, which was operating in the Mediterranean Sea. Their jets carried air-to-air

missiles for their own defense and that of ground units.

Over Syria, Tremel and Krueger had joined two other pilots when the Joint Terminal Attack Coordinator (JTAC) advised the four aircraft that pro-regime forces were firing upon the SDF near the town of Ja’Din.

“The advance [of pro-regime forces] into that area was very new,” Krueger said. “It had been just a couple days prior that things started heating up with them. They had always been in their own part of the world and us in our own.”

“The whole incident lasted only about eight minutes — from the time he spotted the jet on his radar to the moment the missile struck.”

Approaching Raqqa, the JTAC continued to update the pilots on the situation below. In the area around Raqqa, they joined U.S. Air Force assets and encountered a Russian jet, a Su-35. The aircraft was supporting the pro-regime forces, which also were fighting the Islamic State.

Russian forces have backed the regime of Syrian President Bashar al-Assad since 2015. Despite sometimes supporting opposing forces, Russian and U.S. pilots have assumed a respectful but vigilant attitude toward one another.

Tremel’s electro-optical sensor unit was performing a diagnostic, temporarily hindering his ability to track ground forces and provide the close air support. He volunteered to track the Russian jet.

“I’ll just extend out in air-to-air master mode, while [the other fighter pilots] are using air-to-ground master mode to monitor the situation on the ground,” Tremel explained in September, during a panel discussion at the 2017 Tailhook convention in Reno, Nevada.

“And that’s when I picked up another inbound aircraft from the south,” he said.

The Syrian Jet

The aircraft was many miles away, but northbound and approaching. A Boeing E-3 Sentry airborne warning and control aircraft used its more advanced radar to identify the inbound aircraft as a Syrian, Soviet-era Su-22 Fitter.

Tremel descended to execute a visual

identification. He offset his jet’s position and maneuvered to join up with the Syrian jet, about half a mile away. As the Syrian jet proceeded north toward the SDF, Krueger coordinated with the JTAC to keep Tremel updated on how close the aircraft was to the SDF’s position.

“Within 10 nautical miles of there [overhead the SDF’s position], the Syrian aircraft executed a dive,” Tremel said.



Lt. Cmdr. Mike Tremel, of the “Golden Warriors” of Strike Fighter Squadron (VFA) 87, stands by a F/A 18E Super Hornet. While on a combat deployment aboard aircraft carrier USS George H.W. Bush (CVN 77), Tremel shot down a Syrian Su-22 on June 18, 2017.

“At the bottom of his dive, he was about seven nautical miles from the position.”

With the aircraft fast approaching engagement range, Krueger advised executing a “head butt,” a maneuver in which a fighter jet passes close overhead another aircraft and shoots out flares, warning its pilot. Tremel executed three, but the Syrian jet was undeterred.

The Sentry issued warning calls over the aircraft emergency frequency, urging the Su-22 to reverse course, but the Syrian jet did not respond. Meanwhile, Krueger updated the JTAC.

“I’m talking to the JTAC to let him

know we got this situation going on,” he said. “So the guys on the ground can get their heads down.”

After its dive, the Syrian jet executed a climb, from Tremel’s perspective turning right and then left, positioning itself over the SDF’s position. When Tremel observed the jet release its ordnance, he knew what he had to do next.

Following behind the Syrian jet, Tremel armed an AIM-9 Sidewinder

short-range air-to-air missile, and fired. The Syrian jet’s defensive flares diverted the missile.

“It came off the rails quick,” Tremel said. “I lost the smoke trail and I had no idea what happened to the missile after that.”

Next, Tremel fired an AIM-120, an advanced medium-range air-to-air missile. It struck the back of the Syrian jet, sending it pitching right and down. A cloud of metal debris flew from the jet as the force of the explosion tore it apart.

The whole incident lasted only about eight minutes— from the time he spotted the jet on his radar, to the moment the missile struck.

Today

Today, six years into the Syrian War, the SDF backed by the U.S. have liberated the city of Raqqa but are still engaged in heavy fighting.

Tremel, Krueger and the rest of VFA-87 are home at Naval Air Station Oceana in Virginia. Though the incident quickly became widely reported by international media, Tremel, Krueger and the others say they treated the mission as any other. 🦋

King Stallion Demo

Goes Off Without a Hitch

By Emanuel Cavallaro

The powerful helicopter hovered overhead with its bulky payload, silhouetted against the morning sun, the culmination of several days of collaboration between engineers, cargo specialists and Marines.

It was a crisp January morning at Naval Air Station Patuxent River, Maryland, when a small group of Marines and Navy civilians looked on as the CH-53K King Stallion demonstrated a key capability, lifting a 18,870-pound Joint Light Tactical Vehicle (JLTV) about 100 feet above the ground. It hovered there about 10 minutes.

“The payload capability of this helicopter is unmatched—triple that of its predecessor and better than any other heavy-lift helicopter in production,” explained Marine Corps Col. Hank Vanderborght, program manager for the H-53 Heavy Lift Helicopters Program Office.

“Watching these two high-priority programs come together on the flight line was an exceptional sight,” he added.

Though the occasion marked the first time the advanced aircraft conducted an external lift of a JLTV, it had already demonstrated lifts of external payloads of concrete slabs weighing up to 27,000 pounds. In February, the CH-53K Integrated Test Team (ITT) planned to increase that external weight envelope to 36,000 pounds.

The capability should prove invaluable on the battlefields of tomorrow, allowing the aircraft to lift the JLTV, which weighs on average between 16,000 and 22,000 pounds, and drop it into small, confined areas where trucks and boats cannot go.

On the ground that morning, amid the brush rippling under the powerful downwash, was a helicopter support team of Marines from Combat Logistics

Battalion (CLB) 25. They had traveled from North Carolina to provide ground support during the demonstration, arranging the rigging and securing it to the aircraft using a single point hook—much in the same way Marines eventually will in the field.

The vehicle used for the demonstration was a four-seat model of the JLTV, known as the Combat Tactical Vehicle, supplied by the Army for the purposes of the demonstration. The JLTV is the Army and Marine Corps’ replacement for the High Mobility Multipurpose Wheeled Vehicle (HMMWV). Both it and the CH-53K are in the testing phases of their development.

The demonstration was a collaborative effort between the program office, the CH-53K ITT and the Naval Air Warfare Center Aircraft Division Internal Cargo Lab, which performed the initial design and testing for the rigging that tethered the vehicle to the aircraft.

It was the first time the team of Marines had ever secured the vehicle to a CH-53K, which is designed to replace the CH-53E Super Stallion. The Marines later remarked on the aircraft’s smooth hover and stability.

“Safety is paramount while underneath the bird, because you have so many variables with the downwash of the aircraft,” said Cpl. Ronald Fritter, CLB-25. “With the hook not moving around at all, little to none, it makes our jobs easier.”

Emanuel Cavallaro is a staff writer for Naval Air Systems Command Public Affairs. ✈

Marines, with a helicopter support team from Combat Logistics Battalion (CLB) 25 in North Carolina, arrange the rigging and prepare to secure a Joint Light Tactical Vehicle (JLTV) to the aircraft using a single point hook.

U.S. Navy photos by Emanuel Cavallaro



A CH-53K King Stallion lifts a JLTV during a demonstration on Jan. 18.

The Future of Flight Training is Virtual

By Jeff Newman



Flight simulation trainers are about to change, as Naval Air Systems Command looks to virtual and augmented reality technology to build trainers that are deployable, improve fidelity, make better use of training flights and save money.

The Naval Aviation Training Systems program office is developing new prototype trainers leveraging virtual reality (VR) and augmented reality (AR) technology for the F/A-18 fighter jet, TH-57 Sea Ranger training helicopter and T-45 Goshawk jet trainer, said Cmdr. Chris Foster, the program office's integrated product team lead for Air Warfare Training Development. Foster spoke as part of a Nov. 28 panel discussion on augmented, virtual and mixed reality in Navy training in Orlando during the 2017 Interservice/Industry Training, Simulation and Education Conference.

The F/A-18 project calls for two networked Deployable Mission Rehearsal Trainers (DMRT) that use VR and AR "to look at whether the fidelity of the cues provided are sufficient to support the train-

trainer will later perform better during their initial low-level flights in an actual TH-57, Foster said.

Finally, T-45 systems will include one Augmented Reality Visual System (ARVS) training device and two VR PTTs. This technology offers the potential to both improve training fidelity and reduce the high lifecycle costs of the T-45's current dome-based simulators.

The ARVS will be integrated with an actual T-45 operation flight trainer (OFT), where the trainee will sit while wearing VR goggles.

"When you're looking through the goggles, you're going to be able to see outside the cockpit, but we also need there to be a virtual representation of the physical cockpit that the trainee would see," Foster said. "They should then be able to interact

cost point," McNamara said. "The resolutions are getting much better and higher, the latency is getting much lower, so we're able to see less sim sickness when you're wearing these, and more accurate tracking so that users can move fully in space or be stationary, depending on the training task. Because industry is pushing these limits, the government does not have to invest a lot of its own money into the technology to see it move further and faster."

In addition to the new flight trainers, VR could also play a key role in new immersive mishap awareness training, an effort managed by the NAWCTSD Battle Lab in collaboration with the program office and the Naval Survival Training Institute.

Spatial disorientation and loss of situational awareness remain a causal factor in many mishaps, but training to avoid and

"When you're looking through the goggles, you're going to be able to see outside the cockpit, but we also need there to be a virtual representation of the physical cockpit that the trainee would see, and they should then be able to interact accurately and reliably with the physical cockpit, but relying on its virtual representation."

ing tasks that we need to be able to train," Foster said. Thanks to VR technology, the trainer would deploy with a much smaller footprint than the platform's current, dome-based flight simulators.

A key question is whether the VR technology can represent a trainee's hand with enough accuracy for him or her to reliably manipulate a virtual, multi-function display and navigate its series of menus, Foster said.

Meanwhile, the two TH-57 VR part-task trainers (PTTs) will be aimed at making new trainees more comfortable before their first low-level familiarization flights.

"What we know is that low-level flights for students who are beginning their Navy training in TH-57s are quite overwhelming," Foster said. "It's very difficult to develop the sight picture that you need and to do it quickly enough when things move much faster on those first few flights, so there's very little learning that's actually taking place."

The hope is that students who take a few VR familiarization flights on a desktop

accurately and reliably with the physical cockpit, but relying on its virtual representation."

The plan is to network the ARVS trainer with two VR PTTs with capabilities similar to the F/A-18 DMRT. If the new trainers' cue fidelity proves sufficient, the intent is to use them to support training tasks that T-45 trainers currently cannot support, such as multi-ship training and tasks related to carrier qualification and basic fighter maneuvering, Foster said.

"The wonderful thing about VR right now is the entertainment industry is driving this technology further and faster," said Courtney McNamara, a senior computer scientist and principle investigator and Advanced Gaming Interactive Learning Environment team lead at Naval Air Warfare Center Training Systems Division (NAWCTSD).

"They're applying a lot of dollars, especially in the game environment, to make these accessible to all users at a very low

deal with such mishaps has changed little over the years, relying mostly on video or classroom training, Foster said.

"What we need is the capability to quickly and efficiently recreate mishaps based on information that we can pull from mishap reports and other data sources and use those data to update training but also provide a more immersive training environment for students," he added.

To that end, VR could provide that higher level of immersion, Foster said.

"So there's not just one way we might approach AR/VR/MR in trying to address known and future training capability gaps," he said. "There are a variety of ways, and from our perspective, it's important that we pursue all of those different avenues and make sure that, as we're going through the process, we're gathering feedback from the fleet to make sure we're hitting the nail on the head in terms of the things we need."

Jeff Newman is a staff writer and contributing editor for Naval Aviation News. 🦅

FUEL FACTOR



E-2D Conducts Successful Aerial Refueling Tests

By Tori Finagin

As part of an effort to deliver a long-awaited, game-changing capability to the E-2D Advanced Hawkeye, the first aerial refueling-equipped E-2D received 2,000 pounds of fuel during a Jan. 10 test flight at Naval Air Station (NAS) Patuxent River, Maryland.

The test aircraft received fuel from a U.S. Air Force KC-10 Extender. Air Test and Evaluation Squadron (VX) 20 conducted the three-hour test flight—the fourth and final threshold tanking test required by the program—in collaboration with the Air Force’s 418th Flight Test Squadron from Edwards Air Force Base, California.

This testing milestone reaffirms an on-schedule delivery of aerial refueling (AR), with production currently scheduled for 2018 and with initial operating capability set for 2020.

First Inflight Fuel Transfer

The first inflight fuel transfer occurred during a July 14 test at NAS Patuxent River, when the test aircraft engaged the refueling drogue trailing a Navy KC-130 Hercules and received 162 pounds of fuel. VX-20 conducted the four-hour test.

“Passing fuel for the first time airborne is a significant milestone in the

development of this critical technology for the E-2D, which increases the range and persistence of command and control the E-2D provides to the U.S. and allied forces,” said Capt. Keith Hash, E-2/C-2 Airborne Tactical Data System Program Office program manager.

The development test phase for the AR-equipped E-2D commenced officially with a successful first flight Dec. 19, 2016. The E-2D test aircraft received its AR modification at Northrop Grumman’s facility in St. Augustine, Florida.

Rigorous Testing

The program progressed smoothly through the initial testing scheduled for the AR-equipped E-2D.

In addition to the KC-10 and KC-130, the Advanced Hawkeye qualified to refuel with the Air Force’s KC-135 and the Navy’s F/A-18 Super Hornet. Testing will continue to expand refueling capacity with these tanker aircraft, while initial testing will commence with others,

including the KC-707 tanker operated by Omega Aerial Refueling Services, a private contractor.

With a wide array of tanking tests completed and scheduled, the program office team plans to qualify the E-2D’s aerial refueling capability with as many aircraft as possible, ultimately providing a large operational tanking envelope to the fleet.

While testing each aircraft, the team evaluates aircraft handling and the ability of the aircraft to refuel at varying altitudes and airspeeds.

The Long Flight to AR Capability

Since the E-2 Hawkeye debuted in January 1964, warfighters have identified repeatedly the need and desire for the E-2 to see farther and fly longer. Records from the 1960s contain notes discussing the development and addition of an AR capability to the E-2.

In the early 2000s, the Navy conducted proof-of-concept and risk-reduction tests

to demonstrate the feasibility of an AR-enabled E-2. These tests involved flying a Hawkeye with a faux refueling probe behind tanker aircraft. The probe was only a model, so fuel was never transferred, but the flights reinvigorated the effort.

The Navy gave the AR E-2D solid wings in 2013 by awarding an engineering, manufacturing and development contract to Northrop Grumman.

In collaboration with the program office, Northrop Grumman modified three E-2Ds to accommodate AR testing through 2018.

The changes to the original E-2D

include adding the fixed-fuel probe and associated plumbing, formation lighting and long-endurance seats, as well as flight control software and hardware changes.

The AR capability will allow the Advanced Hawkeye to remain on station longer—up to the limits of the aircrew and airframe endurance—equipping the fleet with a more effective E-2D and better battlespace coverage in support of the warfighter's mission.

Eyes and Ears

The Advanced Hawkeye patrols the skies as the airborne early warning command-

and-control aircraft currently transitioning to the fleet. The E-2D replaces the E-2C Hawkeye in providing airborne surveillance, tracking and battlespace management to the warfighter. Every day, men and women of all ranks, in all fields, depend on the information provided by the E-2 to protect against ever-evolving threats.

Soon, the fleet will be able to see farther, pacing an ever-evolving threat, while making far fewer pit stops for gas.

Tori Finagin is a communications specialist for the E-2/C-2 Airborne Tactical Data System Program Office. ✈



The aerial refueling-equipped E-2D Advanced Hawkeye receives 162 pounds of fuel from a U.S. Navy KC-130 Hercules during its first in-flight fuel transfer test July 14.

U.S. Navy photo by Liz Wolter



The aerial refueling-equipped E-2D engages the refueling drogue trailing from a U.S. Air Force KC-135 Stratotanker.

U.S. Navy photo by Liz Wolter





Navy Preparing for Carrier Onboard Delivery Transition

By Jeff Newman

Later this year, the Navy will begin a 10-year process of replacing the C-2A Greyhound with the CMV-22B Osprey as its carrier onboard delivery (COD) platform, according to a draft environmental assessment released Jan. 3 by U.S. Fleet Forces Command.

The Navy's plan calls for replacing the remaining 34 C-2A Greyhounds with 44 CMV-22B Ospreys beginning in 2020. The Navy-variant Osprey is scheduled to reach initial operational capability in fiscal 2021. The transition will get underway this year with facility renovations and some personnel actions at the Navy's existing East and West Coast Fleet Logistics Centers—Naval Station (NS) Norfolk, Virginia, and Naval Air Station (NAS) North Island, San Diego.

The CMV-22B is expected to reach full operational capability in 2024 and have completely replaced the C-2A by 2026. The Navy anticipates the full fleet of CMV-22Bs will be delivered by 2028.

A new, Navy-specific variant of the tiltrotor V-22 Osprey, the CMV-22B is being designed as a modified version of the U.S. Marine Corps' MV-22B, tailored to the mission of delivering cargo and passengers to aircraft carriers and, potentially, other ships at sea. To that end, the CMV-22B will boast extended range and a beyond-visual-range high-frequency radio for contacting ships beyond the horizon. It will also include a public address system for communicating with passengers.

Because the CMV-22B will operate out of the same locations as the C-2A, the transition is expected to have only minor impacts on the environment and local community, according to the draft environmental assessment.

In addition to the aircraft transition, the two existing COD squadrons—Fleet Logistics Support Squadron (VRC) 30

based at NAS North Island and VRC-40 at NS Norfolk—will be replaced with Fleet Logistics Support Multi-Mission Squadron (VRM) 30 at North Island and VRM-40 in Norfolk.

The Navy also plans to establish a V-22 fleet replacement squadron (FRS) and maintenance school, and is weighing whether to do so at Chambers Field at NS Norfolk or Halsey Field at NAS North Island. The current COD training squadron, Carrier Airborne Early Warning Squadron (VAW) 120, is located in Norfolk.

If the FRS—a training squadron—is located at Norfolk, it would increase the base's total COD aircraft from 17 to 20, and from 10 to 18 at North Island, while personnel at the two bases would increase by 54 and 161, respectively. The last C-2A would leave North Island by 2024, and Norfolk by 2026.

If the FRS is stationed at North Island, its COD aircraft would increase to 23 and it would add 341 personnel, while Norfolk would lose two COD aircraft and 126 personnel.

Until the training squadron is stood up, existing fleet logistics support squadrons will begin their transition to the CMV-22B by training with the MV-22B training squadron—Marine Medium Tiltrotor Training Squadron (VMMT) 204—and maintenance school at Marine Corps Air Station New River, North Carolina.

The Navy held public meetings on the draft environment assessment in January in Norfolk and Coronado, California.

Jeff Newman is a staff writer for Naval Aviation News. 🦅

Artist rendering courtesy of Boeing

Marines' F-35B Expeditionary

By Connie Hempel

The Marine Corps' F-35B is one step closer to initial operational test and evaluation as the Patuxent River Integrated Test Force (ITF) team wrapped up testing of the F-35B short takeoff/vertical landing (STOVL) envelope with sloped surface vertical landing tests in January and February.

"The Marine Corps is an expeditionary force capable of deploying on short notice to crises around the world—even to the most austere environments—and the F-35 has an exceptional expeditionary capability," said Maj. Michael Lippert, F-35 Patuxent River ITF test pilot and detachment officer-in-charge.

"Conducting the testing at [Marine Corps Auxiliary Landing Field Bogue, North Carolina] provides the Marine Corps with a unique opportunity to continue the test and development of the F-35 in the STOVL mode, while simultaneously exercising components of the [Marine Air-Ground Task Force's (MAGTF's)] Air Combat Element, specifically, the Marine Wing Support Squadrons at Bogue and [Marine Corps Air Station] Cherry Point."

The capability inherent in a STOVL jet allows the Marine Corps to operate in harsh conditions and from remote locations where few airfields are available for conventional aircraft, such as abandoned or primitive runways or long stretches of roadways. The aircraft can also operate from sites where Marines construct their own expeditionary runway or landing pads with AM-2 matting, similar to that used during the sloped surface testing.

Through a series of vertical landing maneuvers in simulated expeditionary conditions, the team hopes to ease current sloped surface vertical landing requirements for the F-35B.

"We hope to be able to relax the landing pad certification limits in terms of maximum slope/gradients in the context of expeditionary pads—existing and future," explained Bob Nantz, F-35 Pax River ITF performance/environmental technical specialist.

With Marines from the 2nd Marine Aircraft Wing (MAW) capturing real-time lessons learned, some of the test results will be instantaneous. However, much of the data will require significant analysis before any updates can be made to the fleet, Lippert said.

The Pax River ITF will analyze nearly 200 data test points to assess how well the F-35B operates on varying slopes, the impacts of head and tailwinds, and the effect of aft center of gravity in conjunction with ground slopes.

"These updates will eventually make it to our fleet aircraft, while the capabilities of the F-35 will continue to transform the way we fight and win," Lippert said.



The Marine Corps declared initial operational capability for the F-35B in July 2015. Since then the service has continued to mature the platform, through assessments such as the sloped surface testing, to further refine the operational concepts that allow the service to fully leverage the air system's capability.

The F-35B can conduct close air support, offensive and defensive counter air, air interdiction, assault support escort and armed reconnaissance as part of a MAGTF or in support of the Joint Force.

"Not only will this test expand the expeditionary envelope

Envelope Expands



The Marine Corps' F-35B variant makes a vertical landing at Marine Corps Auxiliary Landing Field Bogue, N.C., during sloped surface vertical landing testing.

Photo courtesy of Lockheed Martin/Dane Wiedmann

for the B-variant, [but also] working with the Marine Wing Support Squadrons at Bogue and MCAS Cherry Point showcases their unique skillsets and demonstrates the ability for our Marines and their equipment to precisely build expeditionary sites suitable for F-35 operations,” Lippert said.

Marines from the 2nd MAW staged the Bogue testing site for the Pax River ITF team by constructing sloped landing pads with AM-2 matting. Second MAW squadrons provide aviation ground support, enabling Marine Aircraft Groups to conduct expeditionary operations.

“Every opportunity that we get as a Marine Wing Support Squadron to provide aviation ground support is a highly valued opportunity,” said Gunnery Sgt. Julio Silva, Marine Wing Support Squadron (MSWW) 274 Expeditionary Airfield Services chief. “The information gained will not only help the Joint Strike Fighter program, but will also ensure that the expeditionary airfield capability is enhanced as we welcome the Marine Corps’ newest generation of aircraft into fold.”

Connie Hempel is the public affairs officer for F-35 Patuxent River Integrated Test Force. 🇺🇸

Talking With Lt. Nick “Bearsh

Story and Photos by Scot Meek

Editor’s Note: While covering the Tinker Air Force Base 75th Anniversary airshow, Aviation Photography Digest contributor Scot Meek had the opportunity to sit down with Lt. Nick “Bearshark” Green, one of the demo pilots for the Navy’s Tactical Demonstration Team.

As a TAC DEMO pilot, Green regularly performs in airshow displays—tactical demonstrations—that rival the Blue Angels and Thunderbirds in terms of their spectator numbers and popularity. The demonstrations are designed to showcase the versatility and power of the F/A-18A-D Hornet and F/A-18E-F Super Hornet aircraft. They also serve as a recruiting tool for Naval Aviation.

The Navy’s two TAC DEMO teams, one from the “Flying Eagles” of Strike Fighter Squadron (VFA) 122, out of Naval Air Station (NAS) Lemoore, California, and one from the “Gladiators” of VFA-106, out of NAS Oceana, Virginia, are the Fleet Replacement Squadrons (FRS) for the Hornet and Super Hornet squadrons. Their airshow demonstrations are flown by the instructor pilots of VFA-122 and VFA-106.

The teams’ primary mission is to train newly designated strike-fighter aviators and transition aircrews into the intricacies of operating and employing the Hornet and Super Hornet to their fullest capabilities.

What Squadrons were you with prior to flying with the TAC DEMO Team?

Prior to flying at VFA-106 (current squadron) I was at VFA-105, the “Gun-slingers.”

What is the selection process like for a TAC DEMO applicant?

Once you join the squadron, you express interest in joining the team, and the CO of the squadron then selects you based on seniority, proficiency and flight hours. If selected, you then go through a training syllabus and are ultimately approved by the commodore of the respective coast.



An F/A-18C Hornet operated by Strike Fighter Squadron (VFA) 106's tactical demonstration team sits on the tarmac at Tinker Air Force Base, Okla., prior to a flight piloted by Lt. Nick “Bearshark” Green.

Photo by courtesy of AviationPhotographyDigest.com/Scot Meek

ark” Green, TAC DEMO Pilot

Do you only fly the Hornet demos?

Yes, although I am a Super Hornet pilot by trade, I was fortunate to grab a dual qualification and now fly the Hornet demo.

From your perspective, what’s the hardest maneuver during a TAC DEMO display?

Although the entire routine is a challenge, the back side of the half-Cuban eight is challenging. The negative G and the roll timing make it extra challenging.

How do you mentally prepare yourself before you launch for a demo flight?

Every time I brief with the safety observer (usually a fellow pilot). Every time I mentally rehearse or “chair-fly” the routine and will factor in any obstacles from the overall brief or challenges specific to the airshow site.

What’s the most exciting moment during your tenure as a TAC DEMO pilot?

So far, the highlight has been performing for my family at the Tinker Air Force Base show. I’m still in my first season so I’m sure there are plenty more highlights to come.

Your scariest moment?

Not sure “scary” is the word, but the first airshow is always a rush. There is a ton of adrenaline pumping and you’re nervous performing these maneuvers in front of a crowd.

How did you get your call sign?

I have scars on my head from a surgery when I was young. When I joined my first squadron, they asked me why I had a scar on my head? I made up a story about a bear

attack and subsequently changed it to a shark attack. They came up with the name Bearshark or BS for short.

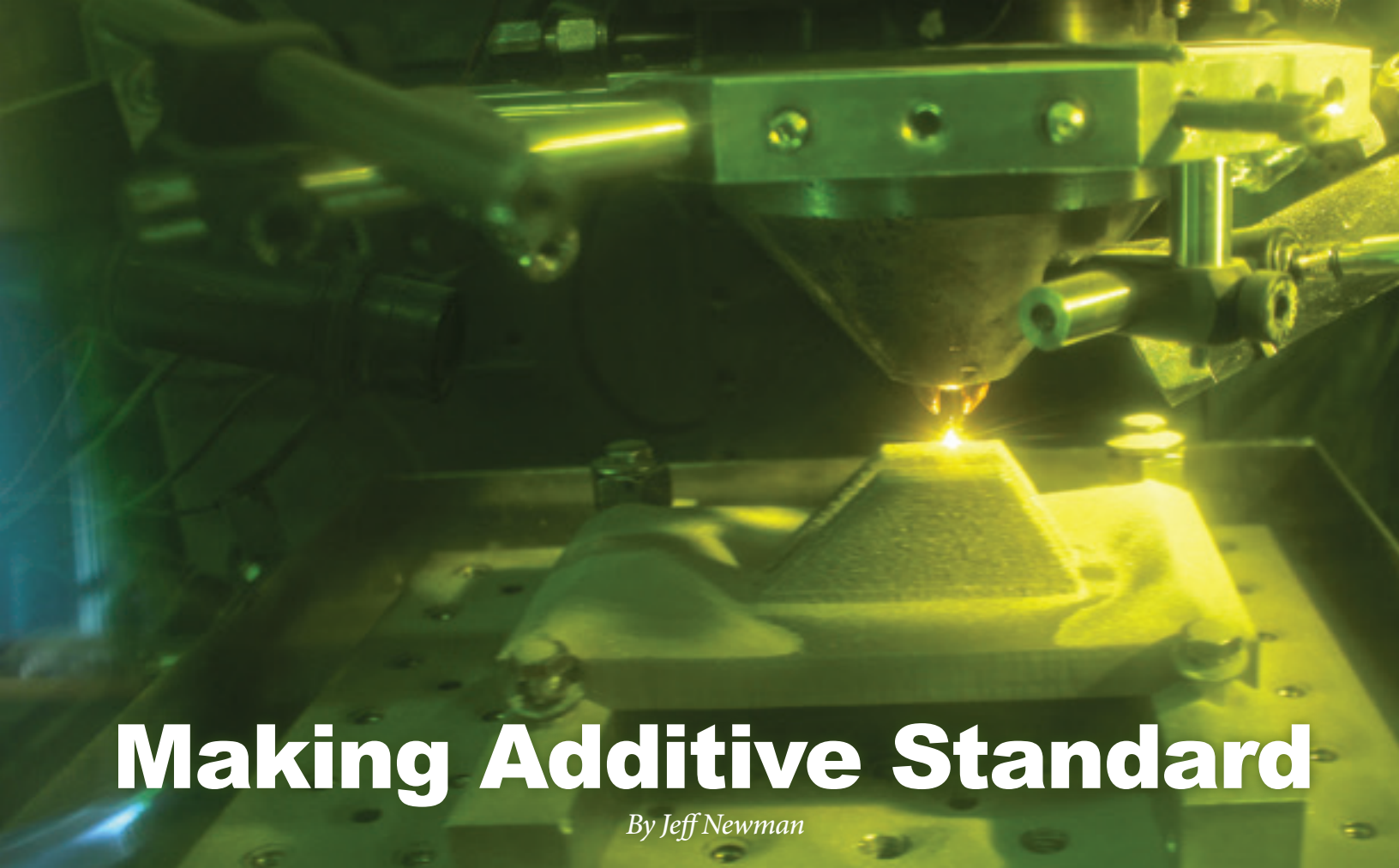
Scot Meek is an aviation writer and photographer. This interview was first published at AviationPhotographyDigest.com. 🐻



Lt. Nick 'Bearshark' Green.

Photo courtesy of Lt. Nick Green





Making Additive Standard

By Jeff Newman

NAVAIR Prepares to Make 3-D Printing a Regular Part of Business

Liz McMichael wants to put herself out of business.

Less than two years after her team first demonstrated the viability of a 3-D printed aircraft part, McMichael, the additive manufacturing (AM) and digital thread (DT) integrated product team (IPT) lead for Naval Air Systems Command (NAVAIR), is ready to begin an enterprise-wide integration of the technology.

Additive manufacturing is the process of building an object in layers using 3-D printers that extrude materials such as plastic polymers or powdered metals. Traditional or “subtractive” manufacturing typically involves cutting or machining bulk materials into an object.

Using digital models, 3-D printers can create in hours what would normally take days or weeks to make using traditional methods. The technology also allows for innovative designs that are either not

possible or impractical via subtractive manufacturing.

McMichael’s team has served as a one-stop shop for 3-D printing requests from NAVAIR program offices and the fleet alike since July 2016, when it flew its first safety-critical AM parts—a titanium engine nacelle link and fitting assembly for the MV-22B Osprey. It was the first time a naval aircraft had flown with a flight-critical part made using additive manufacturing.

But managing a large portfolio of AM components will be difficult for her relative-

ly small crew, so the team is working to begin scaling additive manufacturing into the NAVAIR enterprise. In other words, taking AM from a novel, promising technology, and making it a standard process directly available to program offices, operational users and industry partners.

“We want to make AM usable across NAVAIR, and ensure we have the tools and processes in place to make AM available and safe to use across Naval Aviation,” McMichael said. “That means that everyone who wants to use AM can use the tools and process we’ve put in place, and teach their people how to use AM safely and effectively. We want to have NAVAIR do additive manufacturing as an organization, not with just a small, dedicated team.”

Scaling a disruptive technology like additive manufacturing into NAVAIR has been a multistep process for the AM/DT IPT. First came proving that

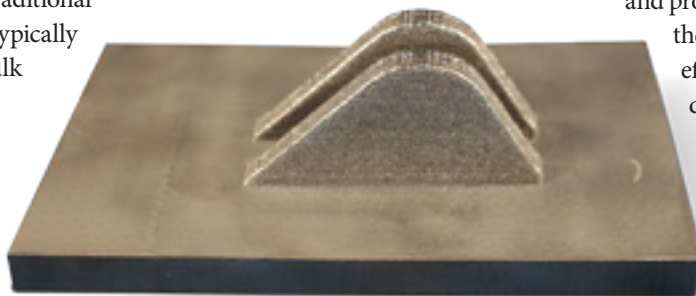


Photo courtesy of NAVAIR Prototype and Manufacturing Division and Penn State ARL

A finished, 3-D printed fitting for a V-22 nacelle link.



A fitting for a V-22 nacelle link mid-build inside a directed energy deposition 3-D printer at Penn State University's Applied Research Laboratory, which has partnered with Naval Air Systems Command in developing its additive manufacturing protocols.

Photo courtesy of NAVAIR Prototype and Manufacturing Division and Penn State ARL

the technology could be safely used for aviation, which the team accomplished with the July 2016 flight test.

Next was the effort to “scale up,” or demonstrate that AM technology could apply beyond an initial prototype. As of February, the IPT had a portfolio of more than 80 projects, and it hopes to have more than 1,000 parts approved within the next two years.

If a 12-fold expansion sounds like a tall task, McMichael points out that the team’s scope has already grown very quickly since July 2016.

“We have to keep it moving forward. Each time we approve an AM component, we are learning how to improve the process and go faster,” she said. “One of the most difficult things for a disruptive technology like this is expanding from doing it once to doing it a million times.”

Each of those projects represents a success for their respective program offices, both in terms of cost and turnaround time.

One of those greatest successes came last spring in the form of a flip-top valve for the

T-45 Goshawk that allowed training pilots to breathe cabin air up to a certain altitude. At a time when the T-45 fleet had been grounded due to concerns over physiological episodes, the valve allowed trainees to resume flying while fixes to the onboard oxygen generation system were put in place, ensuring that the training schedule for pilots could be maintained (*see sidebar on page 34*).

The IPT was brought in on May 22. Following ground and flight testing, it finalized a production plan for the valves May 27. The team then reached out across NAVAIR and Naval Sea Systems Command sites for available 3-D printers. Ultimately, six different sites helped print the valves, and an initial batch of 300 was shipped June 6. Another 500 were shipped by the end of July. It was the first time distributed AM production had been used to meet such a short timeline.

“That’s basically from start to finish, 300 out the door in around two weeks,” said Brennen Cheung, a member of the IPT’s Logistics Innovation Cell, which coordinated production of the valves. “We learned how we could use distributed printing and get good quality to meet an almost impossible timeline.”

The parts could have been delivered even

quicker had business practices been streamlined to allow it.

“What held us up wasn’t the fact that we had any technical issues with the printers; it was that we couldn’t get funding to people fast enough. It showed us that business processes need to mature at the same time as AM technology does,” McMichael said.

Another notable success was a small, plastic clip that attaches to the visor of an H-1 pilot’s helmet. The clips often snap when pilots bump into something, costing more than \$200 each to replace. The Logistics Innovation Cell developed an AM technical data package, or TDP, to ensure that a 3-D printed version would meet airworthiness requirements. Each clip now costs 75 cents to print.

“Each project has taught us more about how AM can address readiness and where the most value is. Scaling up from the first demo let us put a plan in place to get the right people and team to help mature AM processes so everyone can use them,” said Dan Krivitsky, the AIRWorks AM/DT lead. A Naval Air Warfare Center Aircraft Division organization focused on innovation, affordable solutions and rapid response, AIRWorks is part of the IPT, focused on integrating AM across Naval Aviation.

The same innovation cell that pro-

duced the H-1 clip has also designed a TDP that will allow the winch pendant housing for the MH-53E Super Stallion to be printed on demand. The housing protects the winch controller, and normally takes over a year to deliver to the fleet.

“This is another example



U.S. Navy photo by Emanuel Cavallaro

A 3-D printed flip-top valve as applied to a T-45 Goshawk breathing mask. The valve was created to allow T-45 students to continue syllabus flights while fixes were made to the aircraft’s Onboard Oxygen Generation System.

T-45 Solution Made possible by 3-D Printing

Following the April 2017 grounding of the T-45C Goshawk fleet due to concerns over physiological episodes, additive manufacturing played a key role in a temporary fix that got student pilots back in the air.

The operational pause began after T-45C instructor pilots reported they and their students had been experiencing an increasing rate of hypoxia—or oxygen deficiency—due to contamination of the aircraft's Onboard Oxygen Generation System (OBOGS). The pause was lifted after 12 days for instructor pilots, but students remained grounded until July, when a solution bypassing the OBOGS altogether allowed them to fly up to 10,000 feet, enough to cover roughly 75 percent of their syllabus flights.

Conceived by Rich Coughlan, a helmet team engineer with the Human Systems Department at Naval Air Systems Command (NAVAIR), the fix came in the form of a modified MBU-23 helmet mask that allowed student pilots to breathe ambient cabin air through its exhalation valve while keeping the inhalation port connected to an emergency oxygen supply. This gave students the ability to fly up 10,000 feet with confidence that, should they begin feeling hypoxic, backup oxygen was still available.

The modifications involved opening the exhalation valve to allow in cabin air, and replacing the inhalation valve with the combination valve from the older model MBU-12 mask, through which aircrew both inhale and exhale.

But a new exhalation port valve was needed so that student pilots could quickly and easily close off the cabin air if and when they needed to engage the emergency oxygen.

The design went through multiple iterations—"The first came out



U.S. Navy photos by Emanuel Cavallaro

"The point here isn't that we're trying to tell people how to print everything, but if you want to make things that go on an airplane, here's how you have to do it, and if you do it this way, you're good."

of where AM can help with readiness," said Jaleesa Needham, a materials engineer working with the H-53 program office to develop standards for the housing. "As 3-D printers start to become available to logistics and operational people, they'll be able to use our 3-D TDP to print parts when they need them. We have to make sure that they understand how to use the TDP, and they have the right materials and printers available."

The third step of scaling additive manufacturing across NAVAIR is scaling out, McMichael said. "Scaling out is about integrating the people you've trained and the tools and processes that you've developed into how NAVAIR does business," she said.

"AM right now is squarely between scaling up and scaling out," Krivitsky said. "AIRWorks is the key to scaling out as it serves as a bridge from the initial development of AM to full enterprise integration. It's a cross-functional team that's agile, so

we can staff quickly, bring people in and train them, and then they can go and train other people across the organization."

If the July 2016 flight test provided an initial demarcation point for NAVAIR's additive manufacturing initiative, another came in February with the team's release of two official AM standard work packages—one for low-risk, polymer aviation parts, and another for development of 3-D TDPs. These standards provide guidance for NAVAIR engineers on how to print AM parts so that they can be used safely and ensure that they can meet airworthiness requirements. They also let anyone who wants to use AM for Naval Aviation—be they a Sailor or Marine in the fleet, an engineer in a program office or an industry partner—understand how to work with NAVAIR to get AM parts approved and made.

"Anybody can print something," McMichael said. *(She's right. See the sidebar on page 36 for proof.)* "They need to be able

looking like a NASCAR gas cap,” said Alston Rush, another engineer with the helmet team—but once it was finalized, NAVAIR’s additive manufacturing team was called in to help get the new valves out to the fleet.

Brought onboard May 22, the team put a prototype through ground and flight testing before utilizing eight 3-D printers at six different sites to print and ship 300 valves by June 5, exactly two months after the operational pause began.

“This is an insanely short timeline. That’s basically from start to finish for 300 out the door in 15 days,” said Liz McMichael, NAVAIR’s additive manufacturing and digital thread integrated product team lead. “That was really eye watering.”

All told, the initial batch of valves was installed on T-45Cs by June 9. A second batch of 500 valves were shipped out between June 16 and July 20, with student flights resuming in late July.

“3-D printing is great for rapid prototype and design, and making things really quickly,” Rush said. “If you wanted to make this injection molded, it would probably take you a few weeks to a couple months to actually get your mold created and start making them. Once you make the injection mold, you can cut them out really quickly, but it’s that time difference between a few months and a couple weeks.”

The solution ended up having a short lifespan—by September, other fixes to the T-45C had students back flying on OBOGS again—so the valves would have likely never made it to the fleet had they been traditionally manufactured.

“We would have lost our timeline,” Rush said.

“Just the contract action to go back to the manufacturer would have taken too long,” Coughlan said. “We would have never even been able to send them money, so we would have never been able to get any of this done in time.”

And even though the valves were only used for about six weeks, getting back that month-plus of training flights proved crucial to keeping the student pilots on schedule.

“In the bigger picture, it’s larger than just losing a few months of training time; it shifts the entire schedule that the pilots have,” Rush said. “The beauty of this project was that it bought time, because we were getting so backlogged while we were making fixes to the jet, if it had reached a certain point, the pilots would have had to re-qualify. And after that, they would have had to completely restart their training, and three months would turn into a year, because they’d have to shift to the next class. And even bigger than that, the F/A-18 pilots that were in the fleet would have had to extend their tours of duty, so they couldn’t move up to higher positions, so it would have had long-term consequences on their careers as well.”

Jeff Newman is a staff writer for Naval Aviation News. ✈



able to print it in a way that meets required performance. We’re trying to ensure that people know that making aviation components requires some controls to ensure safety. The guidance provides the details of what controls are needed based on what a part does. If you want to make AM parts for naval aircraft, here are the people who can tell you how to do that.”

Krivitsky noted that industry has been anticipating NAVAIR’s release of additive manufacturing standards. Commercial vendors have been 3-D printing for years, but without standards, they haven’t known how to ensure that components would meet airworthiness requirements.

“The standards define the data that NAVAIR needs and how we are planning on qualifying vendors so that we can leverage industry to make AM parts,” he said.

Eventually the standards developed by the team will help facilitate operational manufacturing. The IPT is working with

Marine Aviation Logistics Squadrons to help define the tools and processes they will need to make AM components safely.

McMichael expects a standard work package for metal parts and vendor qualification to be released in the coming months.

But for the time being, the AM team will continue taking requests. To that end, the team will be launching a website where program offices or fleet Sailors and Marines can fill out a form and directly request parts that they’d like to make using AM. Those requests will be coordinated with program offices to prioritize and ensure that airworthiness requirements are met. The website will allow users to track the progress of their requests, access 3-D TDPs for approved parts, and ensure that users understand what level of approvals are needed to print parts. Until the web site is formally launched later this year, the team is taking requests via email at navair_am.fct@navy.mil.

“We’re getting a lot of requests now,” McMichael said. “The Naval Aviation community sees the potential for AM and wants to use it to solve problems. The reason we’re standing up a website is to centralize the requests so we understand the demand, and have a way to prioritize and manage them.”

The website and the AM standards for polymer and metal are the first major steps to scaling out additive manufacturing across NAVAIR, McMichael said. She’ll know it’s working if her cell phone stops ringing as often.

“Right now, if someone wants a 3-D printed part for Naval Aviation, they know how to contact the AM team directly,” she said. “But that approach doesn’t scale very well. With the website and NAVAIR AM email approach, we’ll have a much better understanding of the demand for AM, and be able to respond to it.”

Jeff Newman is a staff writer for Naval Aviation News. ✈

Educating to Innovate

By Jeff Newman

At the same time that more Sailor and Marines are turning to additive manufacturing to meet readiness challenges, the Naval Air Systems Command (NAVAIR) is beginning to educate its workforce on the potential 3-D printing holds to solve their own problems.

To that end, the Naval Air Warfare Center Aircraft Division (NAWCAD) has launched an initiative aimed at fostering innovation and, as part of it, begun offering introductory, intermediate and advanced “FABLAB Operator” courses on 3-D printing to any interested military personnel and civilians at Naval Air Station (NAS) Patuxent River, Maryland.

The courses are held in a classroom—rebranded the innovation hub or iHub—at NAWCAD’s technical library at NAS Patuxent River. The iHub boasts a row of Ultimaker 2+ printers that are for students and enterprising employees alike—a key aspect of the #NAWCmADe initiative.

Anyone who has taken the introductory course can go to the #NAWCmADe Sharepoint site and reserve time to use the iHub’s 3-D printers, said Ted Delbo, one of the course instructors and a member of NAWCAD’s Strategic Operations and Initiatives Team. Those who have taken the FABLAB Operator”class can use equipment in the initiative’s mobile fabrication lab, or FABLAB, a trailer normally parked outside the library containing large-volume 3-D printers as well as a com-

puter numerical control (CNC) mill, laser cutter and engraver, soldering station, modeling and drafting software, a station for designing circuit boards, and oscilloscopes and microscopes. Those who need help will be connected with an instructor, and Delbo said he meets anyone who signs up to use the workspaces at the library to get them set up.

As of mid-February, 230 people had taken one of the classes, and 18 projects had been completed using the #NAWCmADe facilities.

The initiative has already produced results. When Chuck Stouffer, an aerospace engineer with NAWCAD’s Propulsion and Power Engineering Department, discovered the FABLAB’s large 3-D printers during a three-day open house last June, he knew he could use them to solve a nagging problem the F/A-18E-F Super Hornet fleet was experiencing with the air vents on the jet’s vertical stabilizers.

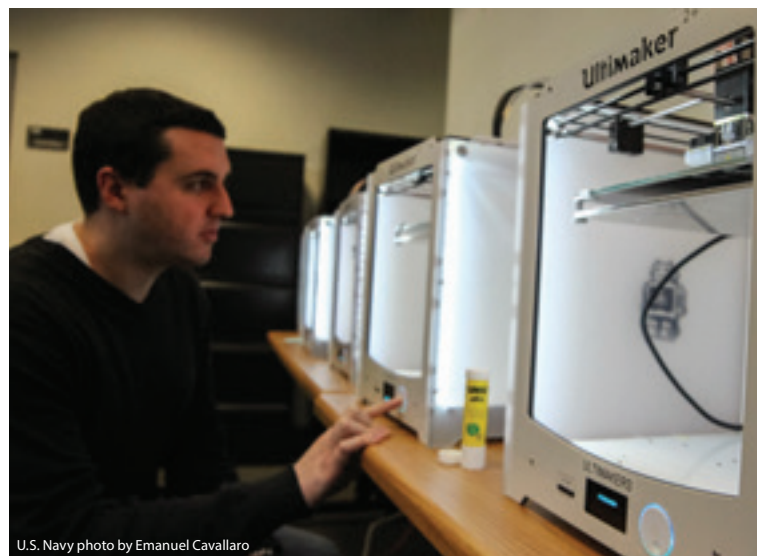
The vents allow ram air to pressurize the fuel tanks during flight. Every couple weeks aboard the Navy’s aircraft carriers, when the aircraft are washed to prevent corrosion from saltwater, the vents must be covered to keep water from getting into the fuel tanks. Currently, Sailors and Marines use a crane and cover the vents with speed tape, a pressure-sensitive aluminum tape used to make minor, temporary repairs to aircraft and race cars.

Looking for a quicker and better solution, the fleet asked Stouffer if his department could design a wash cover for the vents. Stouffer used computer-aided design (CAD) software to design a cover, which #NAWCmADe team member David Hamm



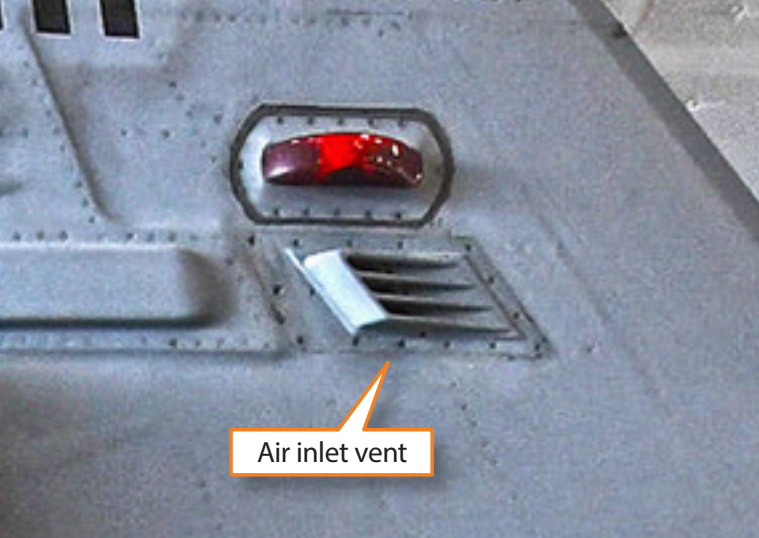
U.S. Navy photo by Emanuel Cavallaro

Class instructor Russell Gilbert, a mechanical engineer with Naval Air Naval Air Warfare Center Aircraft Division, works on his own project as students finish designing plastic coins towards the end of an introductory 3-D printing course offered Jan. 5 at the technical library at Naval Air Station Patuxent River, Maryland.



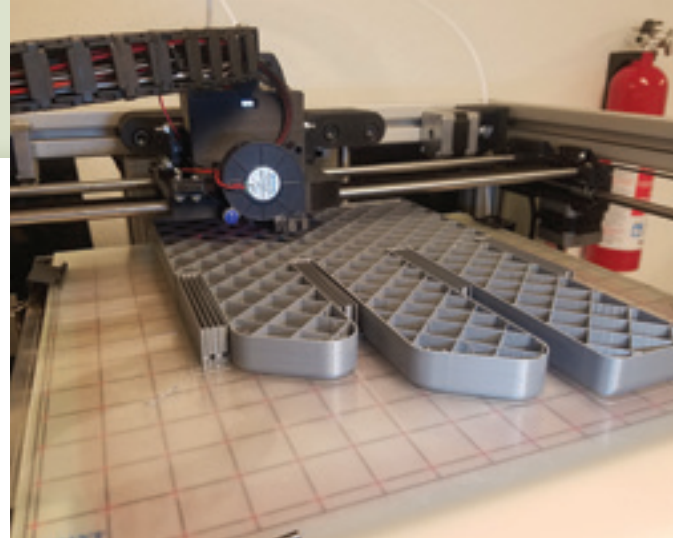
U.S. Navy photo by Emanuel Cavallaro

Naval Aviation News staff writer Jeff Newman watches as a 3-D printer builds a plastic keychain he designed as part of the Jan. 5 introductory 3-D printing course.



F/A-18F Super Hornet vertical stabilizer air inlet vent.

U.S. Navy photo by MC3 Victoria Foley



Proof-of-concept F/A-18 vent wash cover during 3-D printing.

U.S. Navy photo

optimized for 3-D printing. An oversized, proof-of-concept prototype finished printing in roughly 96 hours.

The design was sent to the F/A-18 Fleet Support Team (FST) at Fleet Readiness Center Southwest (FRCSW) in San Diego, which modified some dimensions and produced a second prototype that fit the actual aircraft vent. Three months after Stouffer attended the open house, the second prototype had been printed back at the FABLAB and shipped to the fleet to be threaded onto a 15-foot wash stick and applied to a Super Hornet vent. Fleet feedback will be incorporated into a final design, which will then be sent to the FST at FRCSW to be mass produced either in-house or by a commercial manufacturer.

In another success story, Stouffer was involved in an effort to mitigate contamination of the Super Hornet engine's variable exhaust nozzle (VEN) actuator due to water coming through the air vents.

Some of the actuators were sent to have their internal gears studied by NASA at the Marshall Space Flight Center in Huntsville, Alabama. But NASA could not disassemble the actuators because of a hard-to-reach sync nut that required special tooling to remove.

So, while taking one of the introductory 3-D printing courses, Stouffer designed and printed out a T-shaped tool designed to reach inside the actuator and remove the nut with no need for disassembly.

Stouffer tested the "T-Handle" tool and sent its data file to NASA the next morning, where researchers were able to print the tool out in less time than it would have taken to ship to Huntsville.

"It's a feel-good project, where you found a solution really inexpensively and were really innovative and quick," Delbo said.

Nothing so grand came out of my class, during which each student used CAD software to design a plastic keychain and coin. Once each design was completed, the CAD files were imported into a "slicing" program, which converts design files into code read by the 3-D printer.

Among the lessons I learned during the class:

- In the slicer program, you can set your object's "infill," or fill density. For instance, if you set the infill to zero per-

cent, your part will be hollow. Set the infill to 100 percent, and the part will be solid. Generally speaking, 20 percent infill is considered a healthy median between weight, cost and strength.

- Anything less than 100 percent infill manifests in a grid-like pattern, the shape of which can be customized. You can make your grid out of hexagons, squares, or even honeycomb, among other patterns. Apparently, according to class instructor Russell Gilbert, a MakerBot printer can replace your boring infill pattern with one in the shape of cats. It's called "catfill," in case you were curious.
- If there is a problem with a print, it's probably due to the build plate not being level. Gilbert estimates that 90 percent of botched prints stem from build plate level.

At the end of the class, I walked away with a rounded orange keychain reading "Naval Aviation News" and a blue "coin" in the shape of Darth Vader's helmet. More importantly, I felt comfortable with the process of designing basic objects in CAD software and exporting them to a 3-D printer. Delbo said it is this kind of learning, more so than the actual projects, that represents the real benefit of an initiative like #NAWCmADe.

"The 3-D printing classes are an excellent opportunity for engineers to learn how to take advantage of additive manufacturing for their work," said Nick Makrakis, a physicist in NAWCAD's Avionics, Sensors and Electronic Warfare Department. "You can go from little to no CAD knowledge to designing and printing prototypes very quickly."

A test pilot with Air Test and Evaluation Squadron (VX) 23, Lt. Ian Higgins said he signed up for the introductory class to familiarize himself with an emerging technology. According to him, he left the class with a "fundamental understanding of the 3-D printing process."

"I know it's state-of-the-art stuff that we're going to be using in the future," he added. "I don't see it going away. It's fantastic that NAWCAD provides this course. This shows they're looking for that leading edge that's going to allow us to develop future technologies."

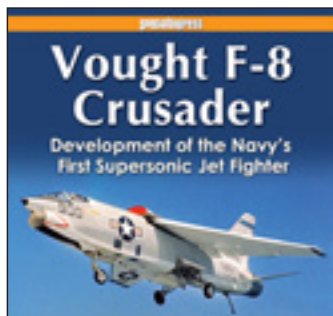
Jeff Newman is a staff writer for Naval Aviation News. ✈

Professional Reading

By Cmdr. Peter Mersky, USNR (Ret.)

Vought F-8 Crusader: Development of the Navy's First Supersonic Jet Fighter

By William D. Spidle
Specialty Press 2017



Many years after ending its service with the U.S. Navy and Marine Corps, Vought's sleek F-8 Crusader still remains an object of fascination for aviation historians and enthusiasts. I myself have written four books featuring the aircraft, and other aviation writers such as Barrett Tillman have written their own F-8 histories and articles.

With this latest historical effort, "Vought F-8 Crusader: Development of the Navy's First Supersonic Jet Fighter," author William D. Spidle limits his scope to the Crusader's early period, mainly to its original fighter and reconnaissance prototypes. This allows Spidle to indulge in a wide-ranging discussion of the aircraft's first years.

He does devote a chapter to the Crusader III, the powerful, shark-like aircraft developed from the F-8, though he says little about the Crusader's colorful Vietnam service, which is just as well because so much of that coverage is already available.

Starting with a quick overview of Vought aircraft following World War II, such as the TBY-2 Sea Wolf—an abortive successor to the highly successful TBF/TBM Avenger, the F6U Pirate—the first jet to have an afterburner, and the futuristic though troubled F7U Cutlass, Spidle charts the design and evolution of the XF8U-1. (Such was the initial designation of Vought's "world beater," before it was changed to XF-8A in 1962, when the DOD unified its designation and naming system for all military aircraft.)

In his book, Spidle draws on the many proposals and initial drawings to explore the development of the F-8 Crusader's pleasing shape, hallmark variable-incidence wings and its "droops"—the leading edge and trailing edge panels that permitted the Crusader to take off and land at lower speeds.

The technical descriptions for various designs—such as for the wing, the unit horizontal tail (UHT) and the hydraulics—are impressive. The write-up of the F8U-1's under-fuselage rocket pack, which included 32 2.75-inch rockets for various uses, is the most detailed I have seen. Although included in the production run of the F8U-1 (later F-8A), the pack was deleted in the F8U-1E (F-8B). (No one mourned its loss.)

Included in the book are many great photos of the F8U-1.

The author had unprecedented access to Vought's photo library, and he took full advantage of it. Every stage of the new fighter's design and prototype activities is shown. I've read a lot about the Crusader's first flights, but I've never encountered the level of detail I found in the text and photos of this book.

Among the many photos are several of John Konrad, Vought's chief test pilot, who took the Crusader up for its first flight. Konrad appears in an especially candid shot just after the first flight, still in his flight suit, while also wearing Oxford-style shoes and striped socks, as he discusses his impressions of the new plane.

The prototype Crusaders set several performance records and received close media attention. Perhaps the best-known record was that of a supersonic transcontinental flight of the U.S. in July 1957 by then-Marine Major John H. Glenn, who flew from California to New York in three hours, 23 minutes, 84 seconds. (Glenn of course would gain greater fame as an astronaut and the first man to orbit the Earth.)

Among the more unusual episodes in the Crusader story involved the one and only F8U-1T "Twosader," a modified F8U-2N (F-8D) outfitted with a second seat. The aircraft served long and well until July 28, 1978, when it crashed during a flight with a Vought test pilot and a lieutenant from the Philippine Air Force, which was in the process of buying refurbished Crusaders. The two-seater was never replaced, but it is shown in this new book.

The book also devotes space to the French Crusader (F-8Es), 40 of which served in the French Navy until the early 1990s. These aircraft required several refurbishments and alterations, including modifications necessary to allow for French munitions. The French loved their "Cruze" as much as their American compatriots loved their "Gator."

The book's final chapters discuss the F-8's work with the National Air and Space Administration (NASA) and how the first prototype now looks in the Museum of Flight in Seattle, Washington. As an alumnus of the Washington, D.C., Naval Air Reserve Light Photographic Squadron (VFP) 306, I can't help but wish the author's discussion of the refurbishment of this first F-8 had mentioned the hard work of the U.S. Navy's last Crusader squadron, VFP-206. The prototype was refurbished just in time to be displayed with the squadron's last operational RF-8G before the squadron's disestablishment in March 1987. Konrad himself was there to shake hands with the last U.S. Crusader commanding officer, Cmdr. Dave Strong, who had made the last ejection from an American Crusader on March 11, 1985.

Despite that perhaps unintentional omission, this exceptional book represents a fine effort by Spidle and, for the price, offers excellent value for the Crusader enthusiast. 🛩️

Squadron Spotlight

Training Squadron (VT) 10

Established: Jan. 15, 1968

Based: NAS Pensacola, Florida

Current Commanding Officer:

Cmdr. Kenneth Froberg

Mission(s): *To provide world-class primary and intermediate Student Naval Flight Officer (SNFO) training and prepare aircrew to fly with courage, fight with honor and lead with commitment.*

Brief History: The VT-10 "Wildcats" are the Navy's only primary training squadron of Naval, Marine Corps and international naval flight officer (NFO) candidates. Over the past 50-plus years, the squadron has trained NFOs in a variety of different aircraft such as the T-1A Jayhawk, T-2A/B/C Buckeye, TF-9J Cougar, T-39D/G/N Sabreliner, T-34C Turbomenter, T-47A Citation and the T-6A Texan II. On average, VT-10 trains more than 180 student NFOs annually. In fiscal 2017, the Wildcats conducted 6,863 sorties totaling 14,669 instructional flight hours.

VT-10's origins lie with the 1960 establishment of the Basic Naval Aviation Officers (BNAO) School as a division of NAS Pensacola's Training Department. Initially providing ground-based training for Naval Aviation observers, in February 1962 the BNAO School expanded to flight training with the assignment of nine UC-45J Navigators and six T-2As. In 1965, Naval Aviation observers were re-designated as NFOs, and on Jan. 15, 1968, the BNAO School was officially commissioned as VT-10. By November 1970, VT-10 had trained more than 6,000 student NFOs. Between 1972 and 1974, VT-10 doubled in size to accommodate an increased training requirement, maintaining 40 aircraft—10 T-39Ds and 30 T-2Cs. The squadron revised its training in 1984 and acquired 20 T-34Cs. Revolutionary changes were made to the NFO syllabus in 1991—to improve NFO air sense and situational awareness, 40 additional



flight hours were placed in the curriculum to allow for instruction in basic piloting skills, including aerobatics, takeoffs and landings. In June 2003, VT-10 flew its first student in its current aircraft, the T-6A. Its last T-34C sortie was flown in June 2005. To date, VT-10 is the sole provider of primary training for Navy, Marine Corps and international student NFOs through the T-6A Naval Flight Officer Training System (NFOTS) syllabi for integration into numerous fleet platforms.

Aircraft Flown: 42 T-6A Texan II

Number of People in Unit: 72 instructor pilots, 11 civilians and an average of 140 students

Significant Accomplishments:

- 30 Chief of Naval Operations Safety Awards, most recently in 2016
- 2 Chief of Naval Air Training (CNATRA) Training Excellence Awards, most recently in 2016
- 5 Grampaw Pettibone Media awards, most recently in 2016
- 2014 SECNAV Safety Excellence Award
- 6 Meritorious Unit Commendations
- 5 Chief of Naval Education and Training (CNET) Shore/Technical Training Excellence Awards
- 6 John H. Towers Awards for Safety
- 3 Cmdr. Theodore G. Ellyson Aviation Production Excellence Awards
- 6 Vice Adm. Robert Goldthwaite Awards for Training Excellence



U.S. Navy photo

