Houthi Explosive USV Detonated in Red Sea Attack

BAHRAIN (Jan. 2, 2024) Vice Adm. Brad Cooper, commander of U.S. 5th Fleet, speaks with Sailors aboard the Arleigh Burke-class guided-missile destroyer USS Carney (DDG 64) after presenting combat medals to Sailors while the ship is in Bahrain, Jan. 2, 2024. Cooper also recognized the whole Carney crew with the Combat Action Ribbon. On Dec. 16, Carney Sailors shot down 14 Houthi unmanned aerial vehicles in the Red Sea. (U.S. Navy photo by Mass Communication Specialist 2nd Class Jacob Vernier)

By Richard R. Burgess, Senior Editor

ARLINGTON, Va.—An uncrewed surface vessel (USV) was detonated in the international shipping lanes Jan. 4 in the latest attack launched from Yemen by Houthi rebels.

“Fortunately, there were no casualties, and no ships were hit, but the introduction of a one-way attack USV is of concern,”

said U.S. Navy Vice Admiral Brad Cooper, commander, U.S. Fifth Fleet and commander, U.S. Naval Forces Central Command, and commander, Combined Maritime Forces, speaking to reporters in a June 4 teleconference.

The attack was the 25th against merchant ships in the Red Sea since mid-November.

In response to the attacks, Secretary of Defense Lloyd J. Austin III on Dec. 18 launched Operation Prosperity Guardian, a multinational effort to protect shipping through the Red Sea and Bab-el-Mandeb Strait. The Combined Maritime Forces under Commander, Task Force 153, are conducting the operation.

Cooper said that the coalition forces had shot down 11 drones, two cruise missiles, and two antiship ballistic missiles launched from Yemen since the operation began. In addition, three of four Houthi attack boats, which fired on U.S. Navy helicopters, were then destroyed by U.S. Navy MH-60 helicopters from the Arleigh Burke-class guided-missile destroyer USS Gravely and the aircraft carrier USS Dwight D. Eisenhower.

Cooper said a total of 61 drones and missiles had been shot down by U.S. Navy destroyers and F/A-18 Super Hornet strike fighters over the last two months. Other drones and missiles have been shot down by ships of the Royal Navy and French Navy.

Cooper made three key points in the conference:

“By number one, the number of nations participating has grown. Their contributions are meaningful, and our partners are doing great work at sea. Number two, about 1,500 merchant ships have safely transited the waters of the Red Sea since the operation began. And then number three, our collaboration with the maritime shipping industry has increased dramatically. We’re reassuring them through persistent communications that are characterized as two-way, both before and during transits, so

that’s going well.

“Now, having said this, the Houthi ruthless attacks have continued, as you know, and there are no signs their irresponsible behavior is abating,” he said.

Coast Guard Upgrades Two Detachments to Full Bases

By Richard R. Burgess, Senior Editor

ARLINGTON, Va. — The Coast Guard has upgraded two of its land-based detachments stations to full bases, according to two Coast Guard directives.

The Coast Guard’s Operational Logistics Command formally established Base St. Louis, Missouri, in ceremonies held Nov. 30, with Lieutenant Commander John Waters in command, and established Base Borinquen, Puerto Rico, on Dec. 12, with Lieutenant Commander Thomas Kai in command.

The directives noted that each base “provides a new junior command opportunity for the mission support enterprise.”

Base St. Louis will provice support to Coast Guard operations in the Western Rivers and heartland of the United States. Base Borinquen will provide support to Coast Guard operations in the Caribbean Sea and Atlantic Ocean.

Stand-off Offensive Sea Mine Capability Needed, Former Vice Chairman Said

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By Richard R. Burgess, Senior Editor

WASHINGTON – The United States needs a more capable and expanded offensive sea mine capability in order to deter China and defend Taiwan, said a retired former admiral who served as vice chairman of the Joint Chiefs of Staff.

“Mine warfare is going to be very important in a future conflict, especially if we can do it quickly after the start of the fight,” said retired Adm. James A. Winnefeld Jr., a former naval aviator, speaking Dec. 7 on a panel at the Defense Forum Washington of the U.S. Naval Institute and sponsored by Lockheed Martin and HII.

“Mine warfare has a key role to play – if you think of the Chinese military as a center of gravity – but also has a key role to play if you think of the Chinese leadership as a center of gravity – by shutting down all of their ports fairly quickly,” Winnefeld said. “You can do that to counter a military … but also in legal terms understand that commerce can be a collateral damage associated with that.

“Frankly, we’re just not there,” the admiral said. “We are terribly short in numbers and technology of those systems. “There are some actions we can take—very quickly—at least partially rectify that. There are some technical actions we can take in the mid-term that would make it even better, but unless we focus on that, we will not be where we need to be.

Winnefeld pointed out that there is no community of offensive mine warfare officers in the Navy, and no champion of offensive mine warfare among flag officers, and he attributed that shortcoming as a reason for a lack of program support for offensive mine warfare. He noted that mine warfare and counter-mine warfare are “dramatically different from each other, and we need to have that community of offensive mine warfare.”

He referred to the occasions when U.S. ships were sunk or damaged by enemy mines in various conflicts and that the United States aircraft and submarines used offensive mining with great success against Japanese shipping and ports during World War II.

The principal U.S. mine is the Quickstrike, a conventional 500- or 1,000-pound bomb with a fuse and a Joint Direct Attack munition kit for precision guidance. It can be fitted with a wing kit that allows deployment at a standoff range of about 35 miles away from the aimpoint.

Because only a few aircraft types can deliver those mines close to China and survive the mission, Winnefeld recommends a

small propulsion engine such as a rocket motor be attached to the mines to allow the mines to be launched from a longer distance and in larger quantities.

“You could shut down every single Chinese port almost overnight if you did that,” Winnefeld said. “That’s powerful. That will strike fear into their hearts.”

Speaking later in the forum was Rep. Rob Wittman, R-Virginia, who said that offensive mine warfare “was a great capability that we have undersold through the years. If you look at our adversaries, they have very advanced mining technology.”

Wittman pointed out that mines are inexpensive and can be deployed with latency and activated when desired. They can be replenished relatively quickly. When combined with a more robust sensor networks, “we can have a tremendous deterrent effect at a very low cost per weapon.”

Coast Guard to SLEP, Expand MH-60T Helicopter Fleet as Sikorsky Delivers First New Airframe

Sikorsky delivered the first of 45 new airframes to the Coast Guard for the service-life extension of the service's MH-60T helicopter fleet.

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By Richard R. Burgess, Senior Editor

ARLINGTON, Va.—The U.S. Coast Guard has confirmed plans to expand is MH-60T Jayhawk helicopter fleet and make it the standard service-wide helicopter. The service life-extension of the current MH-60T fleet is being highlighted as Sikorsky, a Lockheed Martin company, delivers the first of 45 replacement MH-60T airframes to the Coast Guard.

Sikorsky on Nov. 30, 2023, delivered the first new "hull," as the airframe is called, which consists of the nose, cabin, and aft transition structure, combined as a single assembly, Sikorsky said in a release. Upon delivery, the new hull will be used to rebuild an older MH-60T with new and updated components by the Coast Guard's Aviation Logistics Center (ALC) in Elizabeth City, North Carolina starting in December 2023.

The Coast Guard's MH-60T fleet, the first of which originally began service as an HH-60J in 1990, is approaching the end of its service life of 20,000 hours per aircraft, with a current

average of 16,000 flight hours per aircraft.

During the SLEP of 45 MH-60Ts, “the Coast Guard ALC will remove all dynamic (moving) components, digital cockpit, mission systems, and engines, then rebuild each aircraft around an all-new airframe,” Sikorsky said, noting that the company’s Troy, Alabama, facility is the site of the hull manufacture.

Sikorsky President Paul Lemmo told reporters at a Nov. 30 teleconference that the new hulls would be identical to those in the HH-60Js delivered between 1990 and 1996, but also would receive an anti-corrosion sealant in the joints.

The Coast Guard awarded Sikorsky a $374 million contract to deliver all 45 MH-60T airframes to the ALC at a rate of 12 per year through 2027. Full-rate production will begin with fabrication of the fourth hull. The MH-60Ts going through SLEP will retain their Coast Guard serial numbers.

Rear Adm. Michael Campbell, Coast Guard director of Acquisition Programs and program executive officer, also speaking at the teleconference, said that the Jayhawk fleet went through an earlier SLEP during which the airframe life was extended from 10,000 to 20,000 flight hours. He said that without the SLEP the MH-60T fleet would have to be grounded by 2028. With the current SLEP, the MH-60T fleet would serve into the late 2040s.

The first MH-60T with the new hull is expected to fly in June at the ALC.

The Jayhawks are put through overhaul every four years, with six in overhaul at any given time.

The Coast Guard currently operates 48 MH-60Ts, three of which will not receive the new hulls under this program because they were re-built with ex-U.S. Navy SH-60F or HH-60H helicopters. Some of the 45 Jayhawks receiving the new hulls also are ex-

U.S. Navy H-60s that were re-built as Jayhawks.

According to the Coast Guard, the H-60 Jayhawk medium range recovery helicopter fleet has saved more than 11,900 lives during more than 48,300 search and rescue missions since 1990, accumulating more than 730,430 flight hours," Sikorsky said in the release.

Campbell said the Coast Guard plans to increase the size of its Jayhawk fleet because of the capabilities of its national security cutters and forthcoming offshore patrol cutters and polar security cutters to hangar H-60 helicopters. The rotors and tail rotor boom of the MH-60T can be manually folded, but the rotors of the Navy H-60s have the capability to be electrically folded. The Coast Guard plans to install the electrical fold capability beginning in 2024.

The Coast Guard also plans to replace its fleet of 98 MH-65 Dolphin helicopters with MH-60Ts.

"The Coast Guard is moving forward with plans to transition the service's rotary wing fleet to a standardized, single-platform fleet of MH-60Ts," said Loretta Haring, Office of Strategic Planning and Communication (CG-925) Acquisition Directorate, in an email to reporters. "The Service plans to operate 127 airframes nationwide and intends to source the additional MH-60T hulls (termed "fleet growth") through a combination of both newly manufactured hulls and Navy conversion hulls. The number of each to be used has not yet been determined. The initial phase of fleet growth likely will be 36 hulls."

Navy’s Second Ford CVN to Join the U.S. Pacific Fleet

MEDITERRANEAN SEA (Oct. 11, 2023) The world’s largest aircraft carrier USS Gerald R. Ford (CVN 78) refuels from the underway replenishment oiler USNS Laramie (T-AO 203) in the eastern Mediterranean Sea, Oct. 11, 2023. The second Ford-class CVN, the future USS John F. Kennedy (CVN 79), will become a unit of the U.S. Pacific Fleet. (U.S. Navy photo by Mass Communication Specialist 2nd Class Jacob Mattingly)
By Richard R. Burgess, Senior Editor

ARLINGTON, Va. — The Navy’s second Gerald R. Ford-class aircraft carrier, the future USS John F. Kennedy (CVN 79), will become a unit of the U.S. Pacific Fleet when it makes its first deployment.

Captain Brian Metcalf, the Navy’s program manager for the Ford-class aircraft carriers, speaking Nov. 28 in a panel of the American Society of Naval Engineers’ Technology Systems

and Ships seminar, said the Kennedy would be delivered to the Navy in 2025. After commissioning and training work ups, the carrier would make a deployment to the Indo-Pacific region and arrive at its new homeport on the U.S. West Coast, he said.

Metcalf said the Kennedy is 90% complete at HII's Newport News shipyard.

He said that his program office plans to complete much of the Kennedy's Post-Shakedown Availability (PSA) work – that on the USS Gerald R. Ford (CVN 78) was completed during its own PSA and added a year of delay to delivery to the fleet – would be completed on the Kennedy during its construction before commissioning and would enable the Kennedy to enter its basic training phase on time.

The lead ship, Gerald R. Ford, is deployed to the eastern Mediterranean Sea and has had its deployment extended twice because of the Israel-Hamas War. Metcalf said the Ford's systems, including the Electro-Magnetic Aircraft Launch System and the ship's once-controversial weapon elevators were performing well.

He said that maintenance and modernization work on the Ford planned for early 2024 would have to wait, given the Ford's deployment extensions.

The next two Ford-class CVNs—Enterprise (CVN 80) and Doris Miller (CVN 81)—did not start as a two-ship procurement but since have been combined as a program to achieve cost reductions. Metcalf said that his program office is working within the current Future Years Defense Plan to ensure that procurement of CVN 82 and CVN 83 is a two-ship procurement.

P-8 Mishap in Hawaii Is Possible First Loss in Aircraft's Career

By Richard R. Burgess, Senior Editor

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ARLINGTON, Va. – A U.S. Navy P-8A Poseidon maritime patrol aircraft ran off a runway at Marine Corps Air Station Kaneohe Bay, Hawaii on Nov. 20, likely resulting in the first loss of one of the aircraft in the 10 years since it achieved initial operational capability.

"At approximately 2 p.m. local (Hawaii), a U.S. Navy P-8 Poseidon overshot the runway on landing at Marine Corps Air Station, Kaneohe Bay, and ended up in nearby water," the U.S. Third Fleet public affairs office said in a Nov. 20 release. "All personnel safely evacuated the aircraft. First responders

and emergency crews acted immediately to conduct an initial assessment and employed a temporary floating barrier, which is used to protect the environment."

The P-8A, shown in news photographs sitting partially submerged in the surf of Kaneohe Bay – is assigned to Patrol Squadron Four (VP-4), based at Naval Air Station Whidbey Island, Washington. No P-8s are permanently based at Kaneohe Bay but frequently rotate in for exercises and for detachments in support of homeland defense.

The P-8 equips 12 U.S. fleet and two reserve patrol squadrons. The Poseidon made its first operational deployment nearly a decade ago, in December 2013, with VP-16. Until now, none have been destroyed in mishaps. The Navy has not yet made a determination if the P-8A in Kaneohe Bay suffered strike damage.

"An investigation will be initiated," the 3rd Fleet release said. "More details will be released as they become available."

USS Thomas Hudner Shoots Down Drone from Yemen

NAVAL SUPPORT ACTIVITY SOUDA BAY, Greece (Oct. 2, 2023) The Arleigh Burke-class guided-missile destroyer USS Thomas Hudner (DDG 116) moors at the NATO Marathi Pier Complex as part of a scheduled visit to receive fuel and logistical support from Sailors and personnel assigned to Naval Support Activity (NSA) Souda Bay. NSA Souda Bay is an operational ashore installation which enables and supports U.S., Allied, Coalition, and Partner nation forces to preserve security and stability in the European, African, and Central Command areas of responsibility. (U.S. Navy photo by Nicholas S. Tenorio)
By Richard R. Burgess, Senior Editor

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ARLINGTON, Va. – A. U.S. Navy guided-missile destroyer (DDG) shot down a drone over the Red Sea, the Department of Defense said in a Nov. 15 release.

The release, relayed by Cmdr. Rick Chernitzer, force public affairs officer for U.S. Naval Forces Central Command, reads as follows:

“On November 15th and while transiting the international waters of the Red Sea, the crew of the USS Thomas Hudner (DDG 116) engaged a drone that originated from Yemen and was heading in the direction of the ship. The Hudner’s crew engaged and shot down the drone to ensure the safety of U.S. personnel. There were no U.S. casualties or any damage to the ship.”

The engagement is the second in the Red Sea is the second within the last month in which cruise missiles or drones have been shot down by U.S. Navy Arleigh Burke-class DDGs. On Oct. 19, the USS Carney (DDG 64) engaged and shot down four land-attack cruise missiles and approximately 15 drones launched by Houthi forces over the Red Sea in Yemen.

The Houthi missiles launched on Oct. 19 apparently were headed in the direction of Israel or the Carney. Israel has been engaged in combat with Hamas terrorists since Oct. 7. The Iran-backed Houthis have a history of using drones and missiles against Saudi petroleum infrastructure and U.S. Navy and other ships in the Arabian Sea.

Coast Guard to Lay Up Some Cutters, Boats in Face of Recruit Shortfall

By Richard R. Burgess, Senior Editor

The Reliance-class medium-endurance cutter Reliance, shown here in 2022, will be decommissioned and three sister cutters will be laid up, pending decommissioning. *U.S. Coast Guard*

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ARINGTON, Va.—The U.S. Coast Guard will lay up several cutters and patrol boats because of a service-wide manning shortage, moves that will reduce the Coast Guard's capacity for operations in the near term as the service grapples with the shortage of personnel.

The Coast Guard is short of some 3,000 personnel because in large part of shortfalls in recruiting in fiscal 2024.

"The Coast Guard is short nearly 10% of the entire enlisted workforce and cannot continue to operate as we have historically with fewer people," wrote AJ Pulkkinen in the October 31 announcement posted on the Coast Guard website. "To mitigate the workforce challenge risk in a deliberative and strategic fashion, the Vice Commandant, Adm. Steven Poulin, has provided specific temporary operational guidance to adapt

our operations while prioritizing lifesaving missions, national security and protection of the marine transportation system."

"The Coast Guard cannot maintain the same level of operations with our current shortfall – we cannot do the same with less. Conducting our missions is often inherently dangerous, and doing so without enough crew puts our members and the American public at increased risk," wrote Commandant Adm. Linda Fagan and Master Chief Petty Officer of the Coast Guard Heath Jones.

"There will be no loss of search and rescue (SAR) capabilities," the announcement said. "However, we will temporarily adjust operations to prioritize our lifesaving missions, national security, and protection of the Marine transportation System. "

"As cutter crews are not scalable, the only way to reduce the workforce of the cutter fleet is to reduce the number of operating cutters," the announcement said. "Previously planned cutter decommissionings will continue, including the [Reliance-class] Coast Guard Cutter Steadfast [WMEC 623]. Some cutters will be placed in a special status awaiting either decommissioning or future reactivation. In some cases, the crews will do a hull swap to lay up the cutter with the largest pending maintenance requirement.

The cutters and patrol boats affected include:

- Three 210-foot Reliance-class medium-endurance cutters (WMECs) will be placed in layup, pending decommissioning.
- Seven 87-foot Marine Protector-class patrol boats (WPBs) will be placed in layup, pending reactivation.
- Five 65-foot harbor tugs (WYTLs) will temporarily not be continuously manned but will be kept in a ready status in case icebreaking is needed.

- Two 154-foot Sentinel-class fast response cutters (WPCs) will commence uncrewed Recurring Depot Availability Program (RDAP) at the Coast Guard Yard in Baltimore, Maryland. The next 154-foot WPC scheduled for RDAP will deliver the hull to the Coast Guard Yard and swap hulls with a cutter that has completed drydock.

The cutbacks will affect 44 shore stations and 36 aids-to-navigation teams (ANTs) as well, which have more personnel than the prescribed staffing standards.

"The stations will be reduced to their staffing standards and the ANTs to one billet below their staffing standards," the announcement said.

Other shoreside changes include, but are not limited to:

- Crews at all 23 seasonal station smalls will transfer to their parent command.
- The six non-response units (boat forces units without SAR responsibilities) will suspend operations and their crews will be reassigned in assignment year (AY) 2024.
- The identified 19 stations whose SAR response capabilities are redundant will be deemed Scheduled Mission Units. Three of these 19 stations will be ports, waterways, and coastal security (PWCS) level one-Scheduled Mission Units."

"The 'Trackline to 10,000,' to have ten thousand members assigned to afloat units, is still the goal for our future fleet and we will get there," said Capt. John Driscoll, the Chief of the Office of Cutter Forces, in the release. "We need to adjust our operating capacity now so we can prepare for the future. We will gradually grow fleet capacity back through continued construction of ships with the latest technology and the best crew habitability. Our cutter fleet is in demand globally, and I can see our cuttermen continuing to explore

new locations as our ship operations are dedicated to the highest priority missions.

“The Coast Guard has always answered the call when faced with incredible challenges,” Driscoll said. “We will take this challenge head-on and use it as an opportunity to prepare for the future.”

AI-Powered Drones: A Revolutionary Solution to Navy Corrosion Challenges

Unmanned aerial vehicles have played an important role in combat since the late 1960s, particularly in reconnaissance missions. Today, with the help of AI, small, autonomous drones such as Skydio's sUAS platforms can leverage this reconnaissance capability to combat one of the most stubborn challenges to fleet readiness: corrosion. These smart drones can simplify the detection of this $7 billion dollar annual problem for the U.S. Navy, and also reduce the cost of controlling it.

A Smarter Approach to Predictive Maintenance

Corrosion can be mitigated to some extent, but it can never be eliminated. Furthermore, the rate of corrosion on any given ship on any given mission cannot be accurately predicted. This means that scheduled preventive maintenance often takes place either too early, which wastes money, or too late, which can put the structural integrity of a ship's hull at risk, while giving ships an appearance not reflective of the United States as a world naval power.

In contrast, condition-based maintenance aligned to the most current condition of a hull ensures optimal timing for maintenance. This is where autonomous drones come into play. Visual data gives commanders and naval engineering teams a corrosion assessment in near-real time, so they can accurately determine the timing and the level of maintenance required for optimized maintenance operations.

The Value of Visual Data

Today, hull inspections are still often conducted by sailors on painter boards. This antiquated approach has three problems. First, it takes crew members away from their primary tasks at a time when many ships are already undermanned. Second, the results of personal observations are conveyed

verbally or in written form, and words are limited. The level of detail and the potential urgency could be subject to misinterpretation, depending on the individuals providing and receiving the reports. Third, personal observation is a slow and tedious process.

The visual data drones provide is more precise than words, and is available in near-real time. This speed, convenient for inspections, is crucial during or after kinetic or dynamic events. The AI-powered platform can obtain immediate damage assessments. Detailed visual data can be forwarded to shipyards prior to the ship's arrival, allowing for optimal planning, so resources are properly allocated, aligned and timed; reducing maintenance backlogs and getting ships back to sea faster.

AI-Powered Obstacle Avoidance

Manually flown small drones have a well-earned reputation for being difficult to fly. Skydio's sUAS platforms use AI to deliver new consistency to flight operations, enabling safe, secure, repeatable and reproducible results in anyone's hands. Software-defined obstacle avoidance simplifies and automates pilot operations while reducing training time for the operators to be proficient to fly their missions. More personnel can be trained faster, complex flying missions can be executed and critical infrastructure can be inspected safely and routinely. Other AI-powered features include automated workflows that produce textured models on the drone in just minutes, with no additional computers or systems needed – and no special training burdens. Machines should aid human team-mates, rather than adding unaccounted for burdens, and the right autonomous drones can do exactly that for ship commanders, sailors, and maintainers, ultimately changing the landscape of naval maintenance.

About Skydio

Founded in 2014, Skydio is the leading US manufacturer of autonomous drones utilizing breakthrough AI. Skydio designs, assembles, and supports its products in the US from its San Mateo, CA headquarters, offering the highest standards of supply chain and manufacturing security.

Systems Models Keep Submarines Mission Ready

BY TRACY GREGORIO

An important, yet often underappreciated challenge for undersea warfare is keeping submarine systems well-maintained and available. Every command has a budget for reliability, maintainability, and availability (RMA), but those resources are limited and need to be carefully allocated to keep warfighting systems mission-ready.

For decades now, maintenance planning has been performed by seasoned engineers who understand how component lifecycles and failure rates can affect their systems. This process of expert-driven failure modes and effects analysis (FMEA) is time consuming, expensive, and can take months to complete by veterans whose expertise is sorely needed elsewhere.

Additional time is also needed to evaluate changes using the Risk Management Framework (RMF), to identify cybersecurity vulnerabilities that may degrade system availability.

Model-Based Approach.

To address this challenge, a model-based system engineering (MBSE) approach is starting to automate failure mode analysis,

facilitating more efficient RMA planning. This shift provides additional time for design optimization, refinement of reliability predictions, and comprehensive analysis of casualty reporting. The result is better mission-readiness for our fleet, while consuming fewer resources.

Reliability analysis is important to ensure that a warfighting platform has no single point of failure across its many components. Between a ship's tight spaces and funding limitations, it's impossible to go to sea with spares for everything.

One organization using this new MBSE approach is the Undersea Communications & Integration Program Office, PEO C4I / Program Manager, Warfare (PMW 770). Their Program Manager, Captain David Kuhn explained, "If spares are not available, we have to plan for alternate ways of accomplishing a mission, even if it's less stealthily. To ensure we optimize our ability to change parts and/or have redundant paths for missions, we build forecasts based on how often parts are used. If a component fails early and there is no spare on board, it could be a mission kill."

The MBSE models enable program managers, like Kuhn, to create forecasts better and faster, while
tying together different engineering disciplines and stakeholder communities. "Engineers specialized in systems design, cyber, and reliably each have their own approach," said Kuhn. "They need different views and have historically used different models. Now they use the same model, each getting the views they need, and enabling analysis that just couldn't be done before."

Confidence in Outcomes

These consolidated models enable analysis and simulation on a fully validated data set that increases confidence in predicted outcomes. Kuhn illustrated the value of this

analysis by describing a recent upgrade needed to improve system monitoring through the addition of passive data taps. “What normally would have needed 60 or 90 days we accomplished in a couple weeks, letting us quickly deploy the upgrades to the fleet.”

The models also enable green or less experienced engineers to address critical maintenance planning elements. “MBSE helps new people coming on to look at a failure diagram and understand it faster and more accurately,” notes Kuhn. This MBSE approach is being used by engineers adapting systems to field on the new classes of submarine to plan and optimize their maintenance schemes. This approach will ensure that component failures don’t interfere with the platform’s most important mission threads.

“The hull designs of the new sub class have an impact on how we design and maintain our antenna systems,” explained Kuhn. “Through the MBSE model, we saw how a change in one subsystem increased tensions in another. While each element was meeting its defined requirements, the model showed that failure risk increased. While we might have eventually caught the issue, the model helped us see it easily and early in the design cycle.”

The MBSE model also generates the reports and views needed to get system changes through the
RMF approval process. Kuhn, explaining the practical consequences, stated, “We use the model to assess RMF compliance faster and with more accuracy, in part by eliminating the possibility of ‘fat finger’ data re-entry errors. Our team says they can complete RMF diagrams in a third of the normal time.”

That is a huge time-saver for engineers, and a safety net against errors. The system uses the following key components:

1. A digital model of the warfighting platform is created to replicate all components, connections, and system functionality. This model is capable

of simulating every system operation, effectively capturing the interactions between various components. It also illustrates their relationship with the officers and sailors who are responsible for the operation and maintenance of the system.

2. The model is populated with reliability data from COTS manufacturers and field experience, generating reliability diagrams correlated to mission threads.
3. Engineers use the model to simulate planned maintenance or upgrades and test operational threads for mission success, reviewing different alternatives for impacts on mission readiness.
4. The models export field-level instructional resources directly into interactive electronic technical manuals (ITEMs). This reduces the cost and time needed to give sailors up-to-date information for their individual hull, so they can maintain mission readiness and quickly respond to unexpected failures.

This approach is not limited to the latest-generation submarines. Maintenance planners are constantly dealing with obsolescence replacement.

“Our C4I systems make heavy use of commercial off-the-shelf servers and hard drives that go obsolete in as little as four years,” said Kuhn. “The models help us identify where one change drives a companion change in another system. For instance, we might need to make a firewall change for data to flow properly. We have to replace those elements quickly without waiting for a major availability cycle that might be five years out. We can’t afford for our systems to be the reason a sub is not out at sea.”

Transition Challenges

There are challenges in moving to a new approach in terms of

the tools and skillsets needed by the workforce. Comparing MBSE transition challenges to those encountered during the shift to Computer-Aided Design (CAD), Kuhn said, “Just as we had to transition from engineers with drafting expertise into those who could work in CAD, now we need engineers that know how to use MBSE tools. It’s not as easy as opening Microsoft Word, but it can be done. The real key will be changing entire processes to adapt to the MBSE models. Using the same old processes, but just layering on the new tools will not be effective. It requires a cultural change, just as happened when we went from pencil drafting to CAD.”

This approach can improve the maintainability of any sea-going platform with integrated MBSE models that span engineering disciplines, cyber, RMF compliance, and reliability. It doesn‘t happen overnight, but can make an impact, one model and one command at a time.