

Salvage Efforts Continue for EA-18G Aircraft in San Diego Bay



From Commander, Naval Air Force, U.S. Pacific Fleet, Feb. 16, 2025

Members of the Mobile Diving and Salvage Company 3-8, assigned to [Explosive Ordnance Disposal Mobile Unit Three \(EODMU-3\)](#), continued salvage planning and operations today for the EA-18G

Growler that crashed in San Diego Bay on Feb. 12.

[Amphibious Construction Battalion ONE \(ACB 1\)](#), along with members from multiple Navy commands and local authorities, supported EOD personnel in positioning and anchoring a barge to support the upcoming salvage operations. Current estimates suggest the recovery operation may take up to two weeks.

We understand the impact this unfortunate accident has had on our community. Our foremost commitment is to engage in deliberate recovery efforts, prioritizing the safety of everyone involved—including local residents, servicemembers and partners. The [U.S. Navy](#) takes pride in our deep history here in San Diego and ask for the community's continued patience as we navigate through the recovery efforts. We are dedicated to safely recovering the wreckage, minimizing environmental impact, and ensuring the channel can return to normal traffic as soon as possible.

The [U.S. Coast Guard](#) has established a temporary safety zone for navigable waters in the vicinity of [Naval Base Point Loma](#) and Shelter Island in San Diego Bay. The safety zone is needed to protect personnel, vessels, and the marine environment from potential hazards associated with the crash. Entry of vessels or persons into this zone is prohibited unless specifically authorized by the Captain of the Port, Sector San Diego. Civilian vessels will not be permitted to transit in and out of the Shelter Island basin through the southwestern portion of the channel from Feb. 15 until the conclusion of salvage operations.

The public may notice heavy equipment near the Shelter Island harbor entrance as recovery operations continue. Individuals are asked to stay clear of floating cranes, barges, and other recovery vessels in the area and avoid interfering with ongoing recovery efforts.

During the recovery effort, some debris may float and wash

ashore in areas away from the crash site. The public is strongly advised not to approach, touch, or collect any debris that may wash ashore. [Naval Base Coronado](#) has established a reporting option for debris sightings. The public should report debris to: nbc_debris@us.navy.mil.

Additional Navy commands assisting in the recovery effort include [Navy Region Southwest \(California, Nevada, New Mexico, Arizona, Colorado, Utah\)](#), Naval Base Coronado, Naval Base Point Loma, [Naval Facilities Engineering Systems Command Southwest](#), [Naval Sea Systems Command](#) (NAVSEA) Supervisor of Salvage and Diving, and [Commander, Electronic Attack Wing, U.S. Pacific Fleet](#). These teams are working together to ensure a safe and efficient recovery operation.

After a 24-hour medical evaluation, the two aircrew members involved in the crash were discharged from the hospital the next day. The pilot and naval flight officer are assigned to @Electronic Attack Squadron ([VAQ-135 World Famous Black Ravens](#)).

Throughout the recovery, Commander, Naval Air Forces will continue to lead the investigation into the cause of the crash. That investigation is ongoing.

USS Harry S. Truman Conducts Emergent Repair Availability



MEDITERRANEAN SEA (Feb. 15, 2024) An F/A-18E Super Hornet, attached to the “Pukin’ Dogs” of Strike Fighter Squadron (VFA) 143, lands on the flight deck of the Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75) Feb. 15. (U.S. Navy photo by MCSN Mekhi Manson)

[By USS Harry S. Truman Public Affairs](#), Feb. 16, 2025

SOUDA BAY, Greece – The Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75) arrived at U.S. Naval Support Activity (NSA) Souda Bay, Greece, on Feb. 16 to conduct an Emergent Repair Availability (ERAV) on the ship’s starboard quarter following a recent collision.

Damage assessed includes the exterior wall of two storage rooms and a maintenance space. External to the ship, damage assessed includes a line handling space, the fantail, and the platform above one of the storage spaces. Aircraft elevator number three sustained no damage and is fully operational. Forward Deployed Regional Maintenance Center (FDRMC) will lead the pier side ERAV, including an assessment and follow-on repairs to damages sustained.

“While the ship is fully mission capable and the ship conducted flight operations following the collision, pulling into port for emergent repairs will enable the ship to continue deployment as scheduled,” said Capt. Dave Snowden, Harry S. Truman’s commanding officer.

An assessment team will conduct a full survey of damaged areas and develop a repair plan to be executed immediately following completion of the assessment. The assessment team includes structural engineers, naval architects, and other personnel from FDRMC and Norfolk Naval Shipyard (NNSY). They will be supported by ship’s force personnel and local industry partners for the repair effort.

“The Forward Deployed Regional Maintenance Center’s ability to mobilize resources within and outside the theater to conduct repairs underscores the warfighting capability of the world’s most powerful Navy,” said Vice Adm. J. T. Anderson, commander U.S. Sixth Fleet.

Deployed U.S. Navy ships routinely undergo planned and emergent maintenance periods such as mid-deployment voyage repairs and ERAVs, allowing forward-deployed ships to sustain maximal operational readiness. The United States’ relationships with Allies and partners provides access to ports around the world, granting the U.S. Navy strategic pier availability and resources critical for operational flexibility.

“The Harry S. Truman Carrier Strike Group (HSTCSG) units remain operational across geographic regions in support of their component commanders,” said Rear Adm. Sean Bailey, commander of HSTCSG. “Our mission has not changed and we remain committed to responding to any challenge in this dynamic and global security environment.”

The carrier strike group includes the flagship USS Harry S. Truman (CVN 75); Carrier Air Wing (CVW) 1, with eight embarked aviation squadrons; staffs from CSG-8, CVW-1, and Destroyer Squadron (DESRON) 28; the Ticonderoga-class guided-missile cruiser USS Gettysburg (CG 64); and three Arleigh Burke-class guided-missile destroyers, USS Stout (DDG 55), USS The Sullivans (DDG 68), and USS Jason Dunham (DDG 109).

HSTCSG's mission is to conduct prompt and sustained combat operations at sea and maintain a forward presence through sea control and power projection capabilities. For more information, visit DVIDS at <https://www.dvidshub.net/unit/CVN75>.

Fairbanks Morse Defense's American Fan Awarded Contracts for U.S. Navy DDG Cooling and Ventilation Equipment

American Fan working with Ingalls Shipbuilding and other shipbuilders to provide ventilation fans for ten Flight III destroyers

From Fairbanks Morse Defense

BELOIT, Wis. – February 18, 2025 – [Fairbanks Morse Defense](#) (FMD), a portfolio company of Arcline Investment Management (Arcline), has been awarded multiple purchase orders for its Ohio-based business unit, [American Fan](#), to provide [cooling and](#)

[ventilation fans](#) for ten [Flight III Arleigh Burke guided-missile destroyers](#). The equipment will be installed on future destroyers, including USS Thomas Kelley (DDG 140), USS Ernest E. Evans (DDG 141), USS Charles J. French (DDG 142), USS Richard J. Danzig (DDG 143), USS Michael G. Mullen (DDG 144), and DDGs 145-149.

The equipment installed on the destroyers will include [Gas Turbine Room Blowers \(GTRB\)](#), [Collective Protection System \(CPS\)](#) fans for ventilation against nuclear, biological, and chemical substances, and [Vaneaxial](#) and [Centrifugal fans](#) to provide machinery room and general shipboard cooling and ventilation.

In August 2023, the [Naval Sea Systems Command \(NAVSEA\)](#) awarded contracts to HII's Ingalls Shipbuilding division and another shipbuilder for the fiscal years (FY) 2023 – 2027 multi-year procurement of [DDG 51 Arleigh Burke-class destroyers](#).

HII's Ingalls Shipbuilding division, in turn, awarded American Fan contracts for seven DDG 51 class ships, DDG 141, DDG 142, DDG 143, DDG 145, DDG 146, DDG 147, and DDG 149. These contracts are among the first to support the Navy's FY 2023 plan to construct ten Flight III Arleigh Burke-class guided-missile destroyers over the next five years.

“Fairbanks Morse Defense and American Fan have a long history of supporting national security equipment and services that ensure reliable operations and minimal downtime,” said American Fan Vice President and General Manager Paul Brown. “The selection of American Fan to provide [ventilation equipment](#) for the DDG, one of the Navy's most important programs, reinforces their trust and value in our team and capabilities.”

American Fan's products are manufactured in Fairfield, Ohio, and are currently specified in over 35 U.S. Navy, Military Sea Lift Command, and [U.S. Coast Guard](#) shipbuilding programs,

including CVN, LCS, LPD, LHA, DDG, FFG, and more. They are designed to withstand the harsh conditions of the marine environment, including saltwater exposure, high humidity, and fluctuating temperatures. These fans are utilized in various onboard air-moving applications, such as ventilation for engine rooms or living quarters, cooling electronic equipment, or maintaining air circulation below deck.

BAE Systems Secures \$251 Million Contract To Support U.S. Navy's AEGIS Combat System

From BAE Systems, Feb. 17, 2025

Under this contract, BAE Systems will provide high-quality services in systems engineering, test and evaluation, logistics, system acquisitions, and cybersecurity.

In November 2024, the U.S. Navy awarded BAE Systems a five-year, \$251 million contract to provide the AEGIS Technical Representative (AEGIS TECHREP) organization with critical large-scale system engineering and on-site technical expertise for the complex combat system configurations for the U.S. Navy, the Missile Defense Agency, and the Foreign Military Sales program.

“For more than 40 years, BAE Systems personnel have collaborated closely with Sailors and civilians to enhance and modernize the fleet of AEGIS-equipped surface ships,” said Lisa Hand, vice president and general manager of BAE Systems’

Integrated Defense Solutions business. “Our team possesses extensive expertise in AEGIS and Ship Self-Defense Combat Systems, combined with the agility, innovation, and technical skills necessary to provide the U.S. Navy with the safe and effective combat capabilities required to achieve its mission goals.”

Under this contract, BAE Systems will provide high-quality services in systems engineering, test and evaluation, logistics, system acquisitions, and cybersecurity. Most notably, the company has contributed to the acceleration of the Program Executive Office Integrated Warfare Systems digital transformation strategy by developing and deploying unparalleled digital analytic tools across all these task areas.

These tools provide near real time mission impacts assessments caused by software deficiencies resulting in a greater focus on where best to invest in advancing critical combat capability to the Navy. The work will support Navy sites in Mt. Laurel, New Jersey; Bath, Maine; and Pascagoula, Mississippi.

Coast Guard Cutter Returns to Washington Following Law Enforcement Patrol



Coast Guard Maritime Security Response Team – West servicemembers conduct joint training with U.S. Coast Guard Cutter Active (WMEC 618) crews operating in the Pacific Ocean, Jan. 31, 2025. The Active returned to its Port Angeles, Washington, homeport after conducting a 65-day law enforcement patrol spanning more than 5,500 nautical miles off the coast of California. (U.S. Coast Guard photo by Petty Officer 2nd Class Brenton Kludt.)

From U.S. Coast Guard 13th District, Feb. 14, 2025

PORT ANGELES, Wash. – The crew of the U.S. Coast Guard Cutter Active (WMEC 618) returned home to Port Angeles, Friday following a 65-day law enforcement patrol off the coast of Southern California.

As America's maritime law enforcement agency, the Coast Guard is increasing presence in key areas to protect U.S. maritime borders, territorial integrity, and sovereignty.

The crew covered more than 5,500 miles patrolling off the coast of California in support of the Coast Guard District 11's Southwest Maritime Border Security operations. The

operations counter Transnational Criminal Organization activity in the Coastal California Region, and the United States Pacific Maritime Southern Border including alien interdiction operations.

Active's crew interdicted three vessels carrying 46 illegal aliens in total, while providing assistance and direction to aid in the apprehension of another 40 illegal aliens. The illegal aliens were all safely transferred to the custody of Customs and Border Protection agents in San Diego.

To enhance the crew's military readiness, they conducted numerous training exercises with regional Coast Guard crews including an Air Station San Francisco MH-65 helicopter aircrew, the U.S. Coast Guard Cutter Terrell Horne (WPC-1131), a 154-foot fast response cutter homeported in San Pedro, Calif., and teams from the San Diego-based Coast Guard Maritime Security Response Team West.

Additionally, while operating offshore northern California, the crew responded to four search and rescue cases.

The Active is a 210-foot medium endurance cutter homeported in Port Angeles. Patrolling from the northern most part of the contiguous United States, and as far south as the equator, Active has conducted law enforcement, defense operations, and search and rescue missions for over 60 years.

The cutter is a multi-mission platform that falls under the operational command of the Coast Guard Pacific Area Commander. Protecting the American homeland and its territories is the Coast Guard's Pacific Area Commander's top priority. In doing so, the U.S. Coast Guard protects and defends against threats to the safety, security, and prosperity of the American public.

Successful Test of Long-Range Precision Fires



Long Range Precision Fires (LRPF) was successfully executed at Yuma Proving Grounds (YPG) in Yuma, AZ, Nov 2024. The event was completed with an AH-1Z Viper launching a single weapon by way of a wireless application.

From Naval Air Systems Command, Feb 13, 2025

PATUXENT RIVER, Md. – Late last year, the Marine Corps successfully executed its first live employment test of a new Long Range Precision Fire (LRPF) capability. The event was successfully executed at Yuma Proving Grounds (YPG) in Yuma, Arizona, where an AH-1Z conducted single launch by way of a wireless application via Marine Air-Ground Tablet (MAGTAB).

The November test at YPG exceeded the threshold requirements

with regards to position, navigation, and timing. This activity marks the first time a Marine Corps rotary-wing platform has employed a weapon system using a tablet-controlled device.

“Assessments of current and future capability gaps of the fleets needs identified this LRPF initiative as a cost-effective, long-range precision weapon for use against maritime and land-based targets,” said Col Scott Shadforth, Director, Expeditionary Maritime Aviation – Advanced Development Team (XMA-ADT).

This project is an Office of the Under Secretary of Defense for Research and Engineering (OUSD R&E) sponsored Defense Innovation Acceleration (DIA) project led by the XMA-ADT to evaluate cost-effective, long-range disparate effects in expeditionary and maritime environments.

Coast Guard Offloads More Than \$275 Million Worth Of Illegal Cocaine In San Diego



U.S. Coast Guard Cutter Waesche (WMSL 751) crewmembers offload bales of seized narcotics in San Diego, Feb. 13, 2025. The drugs, worth an estimated \$275 million, were seized in international waters of the Eastern Pacific Ocean. (U.S. Coast Guard photo by Petty Officer 3rd Christopher Sappey)

U.S. Coast Guard Pacific Southwest, Feb. 13, 2025

SAN DIEGO – The crew of the U.S. Coast Guard Cutter Waesche (WMSL 751) offloaded approximately 37,256 pounds of cocaine, with an estimated value of more than \$275 million, on Thursday in San Diego.

The offload is a result of 11 separate suspected drug smuggling vessel interdictions or events off the coasts of Mexico and Central and South America by the Coast Guard Cutter Waesche in December through February.

“The Waesche crew faced numerous challenges during this patrol, overcoming the hardest adversities and still had 11 successful drug interdictions,” said Capt. Tyson Scofield, commanding officer of the Coast Guard Cutter Waesche. “Their

dedication, strength of character, and resilience ensured the success of our mission, preventing over \$275 million worth of illicit narcotics from reaching the United States and protecting our communities from the devastating effects of transnational crime.”

Multiple U.S. agencies, including the Departments of Defense, Justice, and Homeland Security, collaborate in the effort to combat transnational organized crime. The Coast Guard, Navy, Customs and Border Protection, FBI, Drug Enforcement Administration, and Immigration and Customs Enforcement, along with allied and international partner agencies, all play a role in counter-narcotic operations.

The fight against drug cartels in the Eastern Pacific Ocean requires unity of effort in all phases, from detection, monitoring and interdictions to criminal prosecutions by international partners and U.S. Attorneys’ Offices in districts across the nation. The law enforcement phase of counter-smuggling operations in the Eastern Pacific Ocean is conducted under the authority of the Eleventh Coast Guard District, headquartered in Alameda, California. The interdictions, including the actual boardings, are led and conducted by members of the U.S. Coast Guard. The Coast Guard continues to increase operations to interdict, seize, and disrupt transshipment of cocaine and other bulk illicit drugs by sea. These drugs fuel and enable cartels and Transnational Criminal Organizations to produce and traffic illegal fentanyl threatening the U.S.

The Coast Guard Cutter Woesche is one of four legend-class national security cutters homeported in Alameda, California.

The Coast Guard Cutter Woesche’s crew can operate in the most demanding open ocean environments, and the vast approaches of the Southern Pacific, where significant narcotics trafficking occurs.

USS Tripoli to forward deploy to Japan



220917-M-MJ391-1231 Amphibious assault carrier USS Tripoli (LHA 7), right, sails next to amphibious assault carrier USS America (LHA 6) during a photo exercise in the East China Sea, Sept. 17, 2022. (U.S. Marine Corps photo by Lance Cpl. Christopher Lape)

From Ladonna Singleton, Feb. 13, 2025

The America-class amphibious assault ship USS Tripoli (LHA 7) will move to Sasebo, Japan, as part of a scheduled rotation of forces in the Pacific, the U.S. Navy announced today.

Tripoli will replace USS America (LHA 6), which will depart Sasebo and move to San Diego.

The forward presence of Tripoli supports the United States' commitment to the defense of Japan, enhances the national security of the United States and improves its ability to protect strategic interests. Tripoli will directly support the Defense Strategic Guidance to posture the most capable units forward in the Indo-Pacific Region.

The United States values Japan's contributions to the peace, security and stability of the Indo-Pacific and its long-term commitment and hospitality in hosting U.S. forces forward deployed there. These forces, along with their counterparts in the Japan Self-Defense Forces, make up the core capabilities needed by the alliance to meet our common strategic objectives.

The security environment in the Indo-Pacific requires that the U.S. Navy station the most capable ships forward. This posture allows the most rapid response times for maritime and joint forces, and brings our most capable ships with the greatest amount of striking power and operational capability to bear in the timeliest manner.

Maintaining a forward-deployed naval force capability with the most advanced ships supports the United States' commitment to the defense of Japan and the security and stability of the vital Indo-Pacific region.

USS Harry S. Truman Involved in Collision at Sea



The Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75), transits the Strait of Gibraltar, Nov. 25. (U.S. Navy Photo by MCSN Michael Gomez)

By U.S. Sixth Fleet Public Affairs, Feb. 13, 2025

MEDITERRANEAN SEA – The Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75) was involved in a collision with the merchant vessel Besiktas-M at approximately 11:46 p.m. local time, Feb. 12, while operating in the vicinity of Port Said, Egypt, in the Mediterranean Sea.

The collision did not endanger the Harry S. Truman (CVN 75) as there are no reports of flooding or injuries. The propulsion plants are unaffected and in a safe and stable condition. The incident is under investigation. More information will be released as it becomes available.

NPS Develops AI Solution to Automate Drone Defense with High Energy Lasers



Naval Postgraduate School faculty researchers Brij Agrawal, right, and Leonardo Herrera, center, observe U.S. Navy Ensign Nicholas Messina as he positions a Reaper drone model in an optical beam path that simulates how a laser weapon system engages a distant flying drone. (Javier Chagoya)

From Dan Linehan, Feb. 12, 2025

MONTEREY, Calif.— Lasers enable the U.S. Navy to fight at the speed of light. Armed with artificial intelligence (AI), ship defensive laser systems can make rapid, accurate targeting assessments necessary for today's complex and fast-paced operating environment where drones have become an increasing threat.

To counter the rapidly mounting threats posed by the proliferation of inexpensive uncrewed autonomous systems

(UAS), or drones, Naval Postgraduate School (NPS) researchers and collaborators are applying AI to automate critical parts of the tracking system used by laser weapon systems (LWS). By improving target classification, pose estimation, aimpoint selection and aimpoint maintenance, the ability of an LWS to assess and neutralize a hostile UAS greatly increases. Enhanced decision advantage is the goal.

The tracking system of an LWS follows a sequence of demanding steps to successfully engage an adversarial UAS. When conducted by a human operator, the steps can be time consuming, especially when facing numerous drones in a swarm. Add in the challenges of an adversary's missiles and rockets traveling at hypersonic speeds, efforts to mount proper defenses become even more complicated, and urgent.

Directed energy and AI are both considered [DOD Critical Technology Areas](#). By automating and accelerating the sequence for targeting drones with an AI-enabled LWS, a research team from NPS, Naval Surface Warfare Center Dahlgren Division, Lockheed Martin, Boeing and the Air Force Research Laboratory (AFRL) developed an approach to have the operator on-the-loop overseeing the tracking system instead of in-the-loop manually controlling it.

“Defending against one drone isn’t a problem. But if there are multiple drones, then sending million-dollar interceptor missiles becomes a very expensive tradeoff because the drones are very cheap,” says Distinguished Professor Brij Agrawal, NPS Department of Mechanical and Aerospace Engineering, who leads the NPS team. “The Navy has several LWS being developed and tested. LWS are cheap to fire but expensive to build. But once it’s built, then it can keep on firing, like a few dollars per shot.”

To achieve this level of automation, the researchers generated two datasets that contained thousands of drone images and then applied AI training to the datasets. This produced an AI model

that was validated in the laboratory and then transferred to Dahlgren for field testing with its LWS tracking system.

Funded by the Joint Directed Energy Transition Office (DE-JTO) and the Office of Naval Research (ONR), this research addresses advanced AI and directed energy technology applications cited in the CNO NAVPLAN.

During a typical engagement with a hostile drone, radar makes the initial detection and then the contact information is fed over to the LWS. The operator of the LWS uses its infrared sensor, which has a wide field of view, to start tracking the drone. Next, the high magnification and narrow field of view of its high energy laser (HEL) telescope continues the tracking as its fast-steering mirrors maintain the lock on the drone.

With a video screen showing the image of the drone in the distance, the operator compares it to a target reference to classify the type of drone and identify its unique aimpoints. Each drone type has different characteristics, and its aimpoints are the locations where that particular drone is most vulnerable to incoming laser fire.

Along with the drone type and aimpoint determinations, the operator must identify the drone's pose, or relative orientation to the LWS, necessary for locating its aimpoints. The operator looks at the drone's image on the screen to determine where to point the LWS and then fires the laser beam.

Long distances and atmospheric conditions between the LWS and the drone can adversely affect the image quality, making all these identifications more challenging and time consuming to conduct.

After all these preparations, the operator cannot just simply move a computerized crosshair across the screen onto an aimpoint and press the fire button as if it were a kinetic

weapon system, like an anti-aircraft gun or interceptor missile.

Though lasers move at the speed of light, they don't instantaneously destroy a drone like the way lasers are depicted in sci-fi movies. The more powerful the laser, the more energy it delivers in a given time. To heat a drone enough to cause catastrophic damage, the laser must be firing the entire time.

If the drone continuously moves, then the laser beam will wander along its surface if not continuously re-aimed. In this case, the laser's energy will be distributed across a large area instead of concentrated at a single point. This process of continuously firing the laser beam at one spot is called aimpoint maintenance.

In 2016, construction of the High Energy Laser Beam Control Research Testbed (HBCRT) was completed by the NPS research team. The HBCRT was designed to replicate the functions of an LWS found aboard a ship, such as the [30-kilowatt, XN-1 Laser Weapon System](#) operated on USS Ponce (LPD 15) from 2014 to 2017.

Early on, the HBCRT was [utilized at NPS to study adaptive optics techniques](#) to correct for aberrations from atmospheric conditions that degrade the quality of the laser beam fired from an LWS. Later, the addition of state-of-the-art deformable mirrors built by Northrup Grumman allowed NPS [researchers to investigate further impacts of deep turbulence](#).

Over the years, 15 masters and 2 PhD degrees have been earned by NPS officer-students contributing their interdisciplinary research into hardware and software related to the HBCRT. Investigations by U.S. Navy Ensigns Raymond Turner, MS aeronautical engineering in 2022, and Raven Heath, MS aeronautical engineering in 2023, added to this research.

Turner helped integrate AI algorithms into the HBCRT for aimpoint selection and maintenance, and Heath used deep learning to research AI target key points estimation.

Now the HBCRT is also being used to create catalogs of drone images to make real-world datasets for AI training.

Built by Boeing, the HBCRT has a 30 cm diameter, fine-tracking, HEL telescope and a course-tracking, mid-wavelength infrared (MWIR) sensor. The pair is called the beam director when coupled together on a large gimble that swivels them in unison up-and-down and side-to-side.

“The MWIR is thermal,” says Research Associate Professor Jae Jun Kim, NPS Department of Mechanical and Aerospace Engineering, who specializes in optical beam control. “It looks at the mid-wavelength infrared signal of light, which is related to the heat signature of the target. It has a wide field of view. The gimbals move to lock onto the target. Then the target is seen through the telescope, which has very small field of view.”

A 1-kilowatt laser beam (roughly a million times more powerful than a classroom laser pointer) can fire from the telescope. If the laser beam were to be used, it’s generated by a separate external unit and then directed into the telescope, which then projects the laser beam onto the target. However, its use with the HBCRT isn’t required for the initial development of this research, which allows the work to be easily conducted inside a laboratory.

With a short-wavelength infrared (SWIR) tracking camera, the telescope can record images of a drone that is miles away. Although necessary, replicating the view of a distant drone in a small laboratory is impossible. To resolve this dilemma, researchers mounted 3D-printed, titanium miniature models of drones fabricated by AFRL into a range-in-a-box (RIAB).

Constructed on an optical bench, the RIAB accurately

replicates a drone flying miles away from the telescope by using a large parabolic mirror and other optical components. This research used a miniature model of a Reaper drone. When a SWIR image is taken of the drone model by the telescope, it appears to the telescope as if it were seeing an actual full-sized Reaper drone.

The drone model is attached to a gimble with motors that can change its pose along the three rotational flight axes of roll (x), pitch (y) and yaw (z). This allows the telescope to observe real-time changes in the direction that the drone model faces.

Simply put, pose is the orientation of the drone that the telescope “sees” in its direct line of sight. Is the drone heading straight-on or flying away, diving or climbing, banking or cruising straight and level, or moving in some other way?

By measuring the angles about the x-, y- and z-axes for a drone model in a specific orientation, the pose of the drone can be precisely defined and recorded. This important measurement is called the pose label.

The NPS researchers created two large representative datasets for AI training to produce the AI model for automating target classification, pose estimation, aimpoint selection and aimpoint maintenance. The AI training used convolutional neural networks with deep learning, which is a machine learning technique based on the understanding of neuropathways in the human brain. A [recent journal article in *Machine Vision and Applications*](#) by NPS faculty Leonardo Herrera, Jae Jun Kim, and Brij Agrawal describes the datasets and AI training in detail.

Each piece of data in the dataset contained a 256´256-pixel image of a Reaper drone in a unique pose with its corresponding pose label. Lockheed Martin used computer

generation to create the synthetic dataset, which contained 100,000 images. Created with the HBCRT and RIAB at NPS, the real-world dataset contained 77,077 images.

“If we train on only clean pictures, it won’t work. That is a limitation,” says Agrawal. “We need a lot of data with different backgrounds, intensities of the sun, turbulence and more. That’s why when using AI, it takes a lot of work to create the data. And the more data you have, the higher the fidelity.”

For the AI model, three different AI training scenarios were generated and compared to determine which scenario performed the best. The first scenario only used the synthetic dataset, the second used both the synthetic and real-world datasets, and the third only used the real-world dataset.

Because the large sizes of datasets and their individual pieces of data required enormous amounts of computational power for the AI training, the researchers used an NVIDIA DGX workstation with four Tesla V100 GPUs. NPS operates numerous NVIDIA workstations. And in December 2024, to continue advancing AI-based technologies, [NPS formed a partnership with NVIDIA to become one of its AI Technology Centers.](#)

“Once we’ve generated a model, we want to test how good it is,” says Agrawal. “Assume you have a dataset with 100,000 data. We’ll train on 80,000 data and test on 20,000 data. Once it’s good with 20,000 data, we’re finished training it.”

U.S. Navy Ensign Alex Hooker, a [Shoemaker Scholar](#) who recently earned his M.S. in astronautical engineering from NPS and is now a student naval aviator, contributed to testing the pose estimations of the AI model.

“A way to improve the reliability of the model at predicting the pose of a UAS in 3D space by taking 2D input images is detecting what’s called out of distribution data,” he says. “There are different ways to detect whether an image can be

trusted or whether it is out of distribution.”

By feeding the test data images from the dataset into the existing AI model and then comparing the output poses from the AI model to pose labels of the test data images, Hooker could continually train and refine the AI model itself.

Working now with Agrawal is NPS Space Systems Engineering student U.S. Navy Ensign Nicholas Messina, who graduated from the U.S. Naval Academy in aerospace engineering last year and is a [Boman Scholar](#) headed for the Nuclear Navy career track after NPS.

“My thesis is a little bit of a sidestep in the way that I am working with artificial intelligence and optics, but Dr. Agrawal and Dr. Herrera have been great,” said Messina. “My research is specifically working on optical turbulence prediction and classification. I train my AI models off large image datasets and am working to improve accuracy in how the model predicts the wavefronts from a picture.”

Because an LWS views the 3D drone flying far away as 2D images in the infrared spectrum, the features of the drone’s shape effectively disappear into a silhouette. For example, the silhouette of a drone flying directly head-on would look the same as if it were flying away in the exact opposite direction.

The researchers solved pose ambiguity for the AI model by introducing radar cueing. Tracking data from a radar can reveal if a drone is approaching, withdrawing or moving in some other way. For the AI training, the pose labels of the drone images were used to mimic real radar sensor output. The team also developed a separate method to simulate the radar data and provide radar cuing during LWS operation if actual radar data is not available.

Overall, the AI model from the scenario using only the real-world dataset performed best by producing the least amount of

error.

For the next phase of the research, the team transferred the AI model to Dahlgren for field testing on its LWS tracking system.

“Dahlgren has our model, which we trained on the dataset collected indoors on the HBCRT and complemented with synthetic data,” says Leonardo Herrera, who runs the AI laboratory at NPS and is a faculty associate in the Department of Mechanical and Aerospace Engineering. “They can collect live data using a drone and create a new dataset to train on top of ours. That’s called transfer learning.”

Creating more data under additional conditions and of other drone types will also continue at NPS. Just because the AI model is already trained on a Reaper doesn’t mean it’s reliable for other drones. But even before the AI model can be deployed, it must first be integrated into Dahlgren’s tracking system.

“We now have the model running in real-time inside of our tracking system,” says Eric Montag, an imaging scientist at Dahlgren and leader of a group that developed an LWS tracking system currently in use by High Energy Laser Expeditionary (HELEX), which is an LWS mounted on a land-based demonstrator.

“Sometime this calendar year, we’re planning a demo of the automatic aimpoint selection inside the tracking framework for a simple proof of concept,” Montag adds. “We don’t need to shoot a laser to test the automatic aimpoint capabilities. There are already projects—HELEX being one of them—that are interested in this technology. We’ve been partnering with them and shooting from their platform with our tracking system.”

When field testing occurs, HELEX will start tracking from radar cues and use pose estimation to automatically select an aimpoint. The tracking system of HELEX will be semi-

autonomous. So, instead of manually controlling aspects of the tracking system from in-the-loop, the operator will oversee it from on-the-loop.

Besides LWS, this research also opens other possibilities for use throughout the fleet. Tracking systems across other platforms could also see potential benefit from this type of AI-enabled automation. At a time when shipboard defenses can be threatened by massive waves of drones, missiles and rockets, a jump in the efficiency of determining friend or foe, and engaging hostile threats, could be a game-changer to speed decision-advantage.