WAVES

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Jessica McElman, a Carderock Division electrical engineer adjusts a magnetic field sensor in the model track located in the Magnetic Fields Laboratory in West Bethesda, Md., Oct. 15, 2014. (U.S. Navy photo released/Nicholas Malay)

FROM THE TOP

Capt. Richard Blank

Commanding Officer of NSWC, Carderock Division

During the month of November, we observe Veterans Day, a time to recognize the men and women who have put on the uniform and served our country. Without them we would not be the free and prosperous nation we are today.

In 1919, President Woodrow Wilson proclaimed Nov. 11 as Armistice Day to commemorate the end of hostilities in World War I a year earlier. The name was changed to Veterans Day in the 1950s, and the observance was expanded to honor veterans of all wars.

Here at Carderock Division, we have a very active Veterans Employee Resource Group (VERG). On Nov. 5, the Naval Station Ship Systems Engineering Station (NAVSSES) VERG held a Veterans Day ceremony in Philadelphia to pay tribute to our veterans, and our VERG in West Bethesda, Maryland, held their ceremony on Nov. 10.

Veterans Day is also an opportunity to remember the wounded warriors who are returning home. As citizens and compatriots, it is our responsibility to care for them and for their families – not just in the first days and months following their transition, but as they seek to craft careers and settle back in the rhythm of their lives.

I would like to point out one of the ways we have worked to create the support structure our returning servicemembers need to be properly helped to receive the best care possible. Recently, the Naval Sea Systems Command received the Disability Matters Workforce Award for its Wounded Warrior Hiring Program, allowing those who have been injured in the line of duty to continue serving their country as civilian employees.

Earlier this year, the Department of the Navy hosted a Wounded Warrior and Veteran Hiring and Support Conference. This conference provided resources and information to both jobseekers, and companies looking to hire returning wounded warriors and veterans seeking a position in the workforce.

On Nov. 5, Chairman of the Joint Chiefs of Staff Army Gen. Martin Dempsey spoke about the importance of hiring veterans at a symposium on Wall Street. As Gen. Dempsey pointed out, through their military careers veterans have learned to be adaptable in their jobs and are willing to take on challenging assignments

We have many veterans at Carderock Division, from all branches of our U.S. Armed Services, who are continuing to serve our country as civilians. The skills, work ethic and commitment they bring to the Navy and to our mission benefit us all. To all our veterans, thank you for your work to keep our country strong.

From left: NSWCCD Commanding Officer Capt. Richard Blank; Hugh Eagleton with VFW Post 5633; Gene Fox with VFW Post 5633; Danny Harris with VFW Post 5633; retired Army Col. Bernard Moxley Jr.; John Barrett with VFW Post 5633; NSWCCD's Kevin Mook; retired Staff Sgt. Bernard Moxley Sr.; and NSWCCD's Kyle Hathaway at the NSWCCD Veterans Day ceremony in West Bethesda, Md., Nov. 10, 2014. (U.S. Navy Photo by Rebecca Grapsy/Released)

TECHNICAL DIRECTOR'S CORNER

Dr. Joseph T. (Tim) Arcano Jr.

NSWC Carderock Division Technical Director

Vice Adm. William Hilarides, commander of Naval Sea Systems Command, has announced the winners of the first and second quarter fiscal year 2014 NAVSEA Excellence Awards, and I am proud to say that Carderock made an impressive showing.

According to NAVSEA, this has been a record year for nominations, 89 in total. Of these, NSWCCD had 41 employees on eight of the 27 winning teams. In addition, Tariq Al-Agba, formerly of NAVSEA 02 and now with Carderock Division, was named one of the 16 individual winners. An outstanding showing for us!

Recipients were recognized at the NAVSEA Excellence Awards Ceremony on Nov. 20. Our winners are all listed below, along with the teams of which they were members. Please take time to offer your congratulations to them.

I would also like to extend our congratulations to two additional Carderock Division employees. Jessica McElman, an electrical engineer who heads up our Theory, Modeling and Analysis Branch, was named one of 10 emerging leaders by the Society of Women Engineers during their annual conference in Los Angeles on Oct. 24. On Nov. 7, Dr. John Holmes, a senior scientist in the Underwater Electromagnetic Signatures and Technology Division, received the Department of Defense Distinguished Civilian Service Award at a ceremony at the Pentagon. This award is the highest honor that a DoD civilian employee can receive.

Congratulations and thank you to all the winners. You have ample reason to be proud. Thank you for your outstanding efforts.

Individual Award

Tariq Al-Agba, SEA 02

CVN Aircraft Elevator (ACE) Material Selection Team (SEA 05)

William J. Golumbfskie, NSWCCD Code 612
Daniel E. Jent, NAVSEA 05V3 (NSWCCD)
Christopher G. Lighty, SEA 05V1 (NSWCCD)
Daniel J. Stiles, NSWCCD Code 612

Ohio Replacement Ship Specification (PEO SUBS)

Robert A. Alperstein, NSWCCD Philadelphia Code 94
Robert L. Cascella, NSWCCD Code 841/ PEO Subs PMS397
Azael C. Gonzalez, NSWCCD Code 843/ PEO Subs PMS397
Nasim Iqbal, NSWCCD Code 841/PEO Subs PMS397

Industrial Ship Safety Team (SEA 05)

Mark T. Hampson, NSWC Philadelphia Code 668
Alfred J. Peters, NSWC Philadelphia Code 668

Ship Length Assessment Team (SLAT) (SEA 05)

Joseph T. Arcano Jr., NSWCCD
Gregory S. Koch, NSWCCD/SEA 05U6
John T. Leadmon, NSWCCD
Scott Patten, NSWCCD/SEA 05U6
Richard M. Ringenbach, NSWCCD Code 843/ PMS 397
Bradley S. Schafer, NSWCCD Code 90/PMS 397

USS CHANCELLORSVILLE Failure Review Board Ship Survivability Failure Investigation Team (FIT) (PEO IWS)

Becky Pasquale, NSWCCD Code 6510
David T. Wilson, NSWCCD Code 6640

Egyptian Navy Fast Missile Craft (EN FMC) (Team SHIPS)

Michael D. Anslow, NSWCCD Code 833
Cesar A. Artze, NSWCCD Code 841
David D. Eberhardt, NSWCCD Code 831
Kenneth A. Fischer, NSWCCD Code 955
Christian D. Johnson, NSWCCD Code 831
Andrew J. Paryzek, NSWCCD Code 831
Joseph C. Pfab, NSWCCD Code 832
John T. Phillips, NSWCCD Code 832
Roger B. Rupe, NSWCCD Code 833
Thaddeus J. Sadowski, NSWCCD Code 832

Failure Investigation Team of the USS HUE CITY (CG 66) Fire Failure Review Board (SEA 05)

Joseph T. Arcano Jr., NSWCCD
Michael S. Brown, NSWCCD Code 60
Louis O. Carl, NSWCCD Code 011X
Anthony Corma, NSWCCD Philadelphia Code 9350
Steven G. Fletcher, NSWCCD Philadelphia Code 6680
William C. Goins, NSWCCD Philadelphia Code 6502
Dennis M. Russom, NSWCCD Philadelphia Code 9340
Daniel J. Stiles, NSWCCD Code 6120
Benedict M. Zekas, NSWCCD Philadelphia Code 9300

LPD 17 ISEA Engineering Control Systems/Ship Control System Tech Refresh Team (NSWCCD)

Jaime M. Calderon, NAVSSES Code 955
Christopher L. England, NAVSSES Code 955
Dylan C. Jervis, NAVSSES Code 955
Gregory P. Mann, NAVSSES Code 955
Vincent S. Piesetzkie, NAVSSES Code 955
Richard C. Strong, NAVSSES Code 955

DoD Distinguished Civilian Service Award given to Carderock Division scientist

By Katie Ellis-Warfield, NSWCCD Public Affairs

Dr. John Holmes, a senior scientist in the Underwater Electromagnetic Signatures and Technology Division, Naval Surface Warfare Center Carderock Division receives the Department of Defense Distinguished Civilian Service Award at the Pentagon, Nov. 7, 2014. From left: Under Secretary of Defense for Personnel and Readiness Jessica Wright, Dr. Holmes and Principal Deputy Assistant Secretary of the Navy (Manpower and Reserve Affairs) Anne Davis. (Official photo/Released)

Dr. John Holmes, a senior scientist with the Underwater Electromagnetic Signatures and Technology Division at Naval Surface Warfare Center, Carderock Division (NSWCCD) in West Bethesda, Maryland, was awarded the Department of Defense (DoD) Distinguished Civilian Service Award for his contributions in stealth technology at the 59th annual awards ceremony at the Pentagon on Nov. 7.

"This award is the highest honor given by the Secretary of Defense to a DoD civilian and considering there are roughly 718,000 civilian employees across the DoD, this is a huge honor and achievement," said Don McCormack, executive director of Naval Surface and Underwater Warfare Centers.

"It is a special privilege to congratulate one of our own for being recognized at the DoD level for technical excellence in their scope of work. This was an incredible achievement just to be nominated," said NSWCCD Technical Director Dr. Tim Arcano. Six awardees were selected out of 15 nominations (three each from the Army, Navy, Air Force, Office of the Secretary of Defense and the Joint Chiefs of Staff).

In his 37-year DoD career, Holmes has significantly advanced stealth technology for the Navy, transforming the Underwater Electromagnetic (UEM) signature field in a fully integrated program of modeling, measurement, design and implementation of signature reduction technologies.

Holmes has been a driving force in understanding the mechanisms that create UEM signatures and developing countermeasures to reduce them. He is an international expert in electromagnetic field theory and wave propagation throughout the ultra-low frequency/extremely-low frequency band.

"John (Holmes) has done a lot of seminal work in his field that has laid the foundation for ship designs," said Dr. Paul Shang, NSWCCD Ship Signatures Department head. "Not only does he perform great technical work here on base, but he also goes into the field to participate in testing. He actively takes the time to mentor our young engineers and scientists. He is a tremendous asset to the Navy."

Holmes is the Navy's technical expert in electromagnetic silencing and his achievements have allowed the Navy to significantly lower its signatures levels and susceptibilities to electromagnetic threats for the first time since World War II.

Holmes said that he feels very honored and humbled. "It's only because of the great people I work with that I was able to get this award. I'm very flattered and proud, not only for myself, but for our division and the Navy to be able to get recognition like this," he said.

Holmes received his Bachelor of Science (1973), Master of Science (1974) and doctorate (1977) degrees in electrical engineering from West Virginia University. After completing his doctorate, he started work at Naval Surface Warfare Center, Dahlgren Division as an electronics engineer. In 1984, he transferred to NSWCCD and was promoted to senior scientist in 2004.

Over the course of his career, Holmes has been awarded Assistant Secretary of the Navy for Research and Development Dr. Delores M. Etter Top Scientists and Engineers of the Year Award in 2011, Carderock Division Rear Adm. David W. Taylor Award for Outstanding Scientific Achievement in 2010, NAVSEA Teaming Award for High Temperature Superconducting Degaussing Coils in 2009, Teaming Awards for SSN 774 Calibration in 2008, NAVSEA Scientist of the Year Award in 2006, David Packard Excellence in Acquisition Award in 1999, Operation Desert Storm Award in 1991 and Navy Meritorious Civilian Service Award in 1986.

Holmes has authored or co-authored 38 peer-reviewed papers and magazine articles, 14 patents and 81 technical reports. He has also written three books on the modeling, reduction and exploitation of a ship's magnetic signature.

Society of Women Engineers selects emerging leader Jessica McElman of Carderock Division

By Nicholas E. Malay, NSWCCD Public Affairs

Jessica McElman, a Carderock Division electrical engineer poses with a magnetic field sensor in the model track located in the Magnetic Fields Laboratory in West Bethesda, Md. Oct. 15, 2014. (U.S. Navy photo by Nicholas Malay/Released)

Jessica McElman, an electrical engineer at Naval Surface Warfare Center, Carderock Division (NSWCCD), was named as one of 10 emerging leaders by the Society of Women Engineers during their annual conference Oct. 24 in Los Angeles.

The prestigious award recognizes women engineers who are actively engaged in an engineering or technology profession, have demonstrated outstanding technical excellence as an individual resulting in significant accomplishments, and have 10 to 15 years of cumulative engineering experience.

"I am honored to be recognized by such a well-respected organization that strives to connect and support women engineers," McElman said.

She has spent over 13 years working for NSWCCD in the Underwater Electromagnetic Signatures and Technology Division as a significant contributing force to the safety of the U.S. Naval Fleet through her work in corrosion-related static electric signatures.

McElman has successfully calibrated the impressed current cathodic protection systems on Navy submarines, and has published nearly 40 technical reports documenting her work for the division. As an electronics engineer, she quickly advanced to the electric signatures team lead and was promoted in 2012 to Theory, Modeling and Analysis Branch head overseeing the underwater electromagnetic signatures and technology research, development, test and evaluation work of over 30 Navy and Department of Defense contractor engineers and scientists.

As a supervisor, she oversees the technical work of the engineers and scientists in her branch who develop signature silencing technologies for the fleet's submarines and surface ships. She was also involved with the development, implementation and verification of a signature silencing technology insertion for USS Virginia-class submarines, which is in the process of being fielded.

McElman, whose husband is an active-duty U.S. Marine, said "I feel very connected to our Sailors and submariners and grateful for the opportunities I've had to contribute to the development of technologies that help keep our servicemembers from harm."

Outside of work McElman mentors other women engineers as a member of Alpha Omega Epsilon, an engineering and technical sciences sorority. She has served as treasurer and president of its International Executive Board.

McElman said she was thankful for her colleagues, sorority sisters and mentors who nominated her for this prestigious award. "Their kind words and support over the years as I have made my way through my career and school, multiple times, have been a real inspiration," McElman said. "I could not have accomplished what I have without their encouragement or my husband's support."

McElman is the eighth person to be certified as a Naval Sea Systems Command Cathodic Protection Design Specialist, and the only person to have gained this certification in the Underwater Electromagnetic Signatures and Technology Branch.

McElman has a Bachelor of Science in electrical engineering from Marquette University, a Master of Science in electrical engineering from North Carolina State University, and a second Master of Science in engineering management from Drexel University.

NADP employee completes rotation working on DDG 1000 – influences career path

By Joseph Battista, NAVSSES Public Affairs

Dan Santosusso recently completed three months working on the future USS Zumwalt (DDG 1000) – the Navy's newest destroyer – in Bath, Maine. His time working on the ship inspired him to look toward his future of developing electrical power systems for the Navy's next generation of ships.

Santosusso is taking every advantage of his time in the Naval Acquisition and Development Program (NADP) to try different things as he starts his naval engineering career at Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES).

"Being part of NADP allows me to try so many different things," said Santosusso, who earned bachelor's degrees in physics and electrical engineering from Widener University in 2012. "Right now I'm able to explore different areas to figure out what exactly I want to do in the future at NAVSSES."

His work on the Zumwalt was part of the NADP program's external rotation. The nearly three-year program includes an internal rotation, as well, but Santosusso said the opportunities do not end there. The program gives him the flexibility to work on many projects within NAVSSES' Electrical Power Research and Development Branch to help him find his niche within the organization.

NADP is a Department of Defense program designed to train and develop the future senior leadership of the Department of the Navy. Engineering participants must have a bachelor's degree in one of the following engineering disciplines: aerospace, chemical, computer, electrical, electronics, industrial, mechanical, ocean, marine, environmental, civil, systems, materials, architect, fire protection or naval architecture.

The program touts its benefits of providing challenging work, opportunities to become certified in a career field, an opportunity to obtain a graduate level degree and travel.

"The nature of the program is set up to get you into what you want to do," said Santosusso, who started his NADP experience in July 2012. "During the program you can find your niche and then the sky is the limit."

He said he knew little about the Navy and its many opportunities to do research and development before arriving at NAVSSES.

"I didn't think it was possible to get into research and development without a master's degree until I learned about opportunities with the Navy," said Santosusso. "I worked at other companies while in college, but never doing the things I get to do here."

He was encouraged to apply for NADP by a friend. He also heard about the program at Widener University from NAVSSES' Advanced Machinery Systems Integration Branch Head Tim Klingensmith, who promotes NADP to students at the school. Klingensmith is an Engineering Career Field Manager (CFM) for NADP with the Machinery Research and Engineering Department at NAVSSES.

"Utilization of the NADP program allows NAVSSES to hire, train and retain high-caliber candidates," said Klingensmith. "The overall curricula for the NADP were designed to bring an enhanced depth of knowledge to the workforce at their appropriate level of performance: entry, journeyman, and advanced."

Santosusso is currently working projects involving integrated power systems, high temperature superconducting and power system design.

"It's great having the flexibility to work on so many different projects, but I have to be careful to not spread myself to thin," Santosusso said. "Time management is very important when you have so much flexibility."

His external rotation at Supervisor of Shipbuilding, Bath (SUPSHIP, Bath) allowed him to see first-hand how the research and development projects he works on in the lab are incorporated into a ship.

"My rotation at SUPSHIP, Bath, provided a unique opportunity to gain first-hand knowledge of equipment someone from the design world only sees on paper or in the lab," said Santosusso. "Something as simple as walking the deck plates everyday gives you the ability to think about what Sailors on a ship would have to deal with in their everyday duties."

He said he enjoyed spending days on the ship troubleshooting problems with ship systems because, "these are the experiences that you learn from the most and will remember the longest. From a technical perspective, there is no better way to learn than being on the ship every day working through problems."

Dan Santosusso, electrical engineer with Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) Electrical Power Research and Development Branch, monitors a display at the DDG 1000 Land Based Test Site. (U.S. Navy photo by Joseph Battista/Released)

Santosusso said the engineers he worked with on the DDG 1000 were some of the most knowledgeable people in the world on the systems being installed and it gave him a unique opportunity to ask them questions and get immediate feedback. At the completion of his rotation, he logged his experience in a short paper he submitted to Klingensmith.

"It's my job as the CFM to provide educational guidance, development and counseling to participants like Dan Santosusso," Klingensmith said. "I monitor the employee's overall progress through annual reviews and periodic performance evaluations."

Santosusso, who is working toward a master's in electrical engineering at Villanova University, finishes his NADP stint in January 2015.

NAVSSES engineers receive patent for footwear cleaner and disinfectant

By Joseph Battista, NAVSSES Public Affairs

According to a 2008 study by Dr. Charles Gerba, microbiologist and professor at the University of Arizona, the outside of the shoe averages 421,000 units of bacteria with another 2,887 units found on the inside.

When Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) engineers Ana Maria Gulian and Paul Gulian learned this in 2008 they pondered the question "What if...?" The discussion that followed led to what became the Footwear Cleaner and Disinfectant invention issued in January 2014 as United States Patent No. 8,631,533. The apparatus is designed to significantly reduce the amount of bacteria and other harmful foreign substances found on footwear.

According to Ana Maria Gulian, Machinery, Power and Energy Systems Engineering Department acting head, and Paul Gulian, Sail Systems Engineering Branch mechanical engineer, the device cleans and disinfects footwear using one or more rotating brushes in conjunction with a disinfectant source such as upward looking ultra-violet (UV) radiation or the use of cold plasma technology.

"We are both Drexel University graduates and while reading an article about cold plasma applications in their alumni publication a few years ago, we realized it would work well in the device we were conceptualizing," said Ana Maria Gulian, who at the time was the Energy Conversion Research and Development Branch head. "Plasma is considered one of the four fundamental states of matter (in addition to solid, liquid and gas) and cold plasma has disinfectant type properties."

Plasma, an ionized gas, is very hot and commonly used to sterilize hospital equipment. In recent years, scientists learned how to create cold plasma near room temperature so it is safe for humans to touch. Cold plasma has been tested and proved effective in killing bacteria just as well as its hotter counterpart – making it a safe option for the Gulian's device.

According to Paul Gulian, the concept of the device has multiple configurations and is easily scalable. The rotating brushes and the low-level radiation source could be housed in a box-like support base in a stand-alone configuration or integrated into the flooring of an ingress or egress. The brushes remove debris from the soles of the shoes while the disinfectant attacks the bacteria.

Capt. Walter Coppeans, Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) commanding officer, presents patent awards to Ana Maria Gulian, Machinery, Power and Energy Systems Engineering Department acting head, and Paul Gulian, mechanical engineer with Sail Systems Engineering Branch, for their Footwear Cleaner and Disinfectant patent at the NAVSSES Quarterly Awards Ceremony in Philadelphia, Sept. 23, 2014. (U.S. Navy photo by Joseph Battista/Released)

The Gulians envision this device to have multiple applications both militarily and commercially. "I can see this being used, particularly at ingress and egress points, by military medical units in the field, as well as on ships. Commercially, I can see it being similarly used at hospitals or research facilities that require sterile environments. Even today with the transport of infectious diseases so common, maybe this is something that can be used in airports," said Paul Gulian.

This is Ana Maria Gulian's first patent, which qualified her to become part of the Carderock Division Inventors Club. Paul became a member when he received his first patent in 1999.

"You never know where an idea might take you," said Ana Maria Gulian. "A lot of people have great ideas. They just don't know how to go about putting it in on paper and submitting an invention disclosure that could lead to a patent award."

The first step, once a written description is developed, is to fill out and submit a Disclosure of Invention form to the Carderock Division's Office of Counsel. Then, the office evaluates the submission and brings it to the Invention Evaluation Board who determines if there is Navy interest. If so, they recommend submission of a patent application by the Office of Counsel. Finally, the Office of Counsel completes the required paperwork and submits the patent application. If a patent is awarded, as in this case, the United States of America as represented by the Secretary of the Navy is the assignee and the inventors are identified by name on the patent.

The process can be lengthy. The Carderock Division's Office of Counsel filed the Gulian's patent application on June 16, 2011.

Details of the patent can be read on the U.S. Patent Office website at:

http://pdfpiw.uspto.gov/.piw?Docid=08631533&homeurl=http%3A%2F%2Fpatft.usptogov%2Fnetacgi%2FnphParser%3FSect1%3DPTO1%2526Sect2%3DHITOFF%2526d%3DPALL%2526p%3D1%2526u%3D%25252Fnetahtml%25252FPTO%25252Fsrchnum.htm%2526r%3D1%2526f%3DG%2526l%3D50%2526s1%3D8,631,533.PN.%2526OS%3DPN%2F8,631,533%2526RS%3DPN%2F8,631,533&PageNum=&Rtype=&SectionNum=&idkey=NONE&Input=View+first+page

25 years of testing at DDG 51 Land Based Engineering Site

By Kate Hogarth, NAVSSES Public Affairs

Twenty-five years ago Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) witnessed the first full-power run of the DDG 51 Land Based Engineering Site (LBES) on Aug. 21, 1989.

According to DDG 51 LBES Program Manager Andy Cairns, LBES was planned and built to provide the DDG 51 acquisition program a risk mitigation environment for major hull, mechanical and electrical changes compared to previous surface combatants. As a result, NAVSSES engineers and technicians have a platform for immediate investigation, replication, analysis and resolution of both fleet and new construction vessel operational and maintenance problems with no impact on ship schedules.

DDG 51 LBES is the longest-operational test site for the largest class of destroyer the Navy has ever built. Today, this one test site supports 62 commissioned destroyers, as well as four additional hulls at various stages of construction or activation. "The capacity to accurately and spontaneously mimic in-service issues without having to travel to the ship has provided immeasurable value to the DDG 51 Class as well as a catalyst for distant support," Cairns said.

Cairns, a marine systems engineer for over 25 years at NAVSSES, oversees both hot and cold plant systems integration testing of U.S. Navy mobility and support systems and is heavily involved with both DDG modernization and new construction systems testing.

LBES reflects DDG 51's main engine room number two as it is laid out on a destroyer. It includes propulsion, electrical power generation and distribution, and auxiliary equipment. The layouts are identical, a Sailor can train on the test site and seamlessly walk onto a destroyer and know exactly where everything is in the engine room.

"LBES is significant in the sense that it really put our stake in the ground. We have always been involved in test sites but this is a large complex land based engineering site that was built for the first design of the DDG 51 to test the ship's reduction gear and machinery control systems," Patricia Woody, Machinery Research and Engineering Department head, said. "It was our first real entry into machinery controls. Today we have over 200 engineers at NAVSSES that do machinery controls systems work across many ship classes."

According to Cairns, all 62 of the original Flight I-IIA DDG pre-commissioning units have attended LBES training.

Naval Ship Systems Engineering Station (NAVSSES) engineers and technicians work on the DDG 51 Land Based Engineering Site (LBES). (Official U.S. Navy Photo/Released)

DDG 51 and DDG 53 pre-commissioning units were first LBES trained in the early 1990s with their crews returning for LBES training in 2010 during each ship's mid-life modernization.

The 25th anniversary has significant meaning to NAVSSES Commanding Officer Capt. Walter Coppeans. He was commissioned as an ensign from the U.S. Naval Academy in 1990 with a bachelor's degree in system engineering. Following his graduation, he reported to pre-commissioning unit Arleigh Burke (DDG 51) as part of the plankowner crew. He served almost four years as an electronics warfare officer, communications officer and auxiliaries/electrical officer.

"This really is a full circle moment, if you would have told me when I took orders for DDG 51 that one day I would be in command of NAVSSES and in charge of the land based engineering site that helped make the crew so successful I would have told you, you were crazy," Coppeans said.

Toni Checchio, the lead DDG 51 LBES electrical engineer, is an LBES plankowner who started on the test site when it was still under construction. She has spent her entire career as an electrical engineer on the site.

LBES plankowner Charlie Gilligan was hired as an apprentice mechanic in 1987. He has been in his current position with the Power Transmissions Branch for the past 15 years as part of the LBES "test engineer gang" whose role is to test equipment, test software and support the fleet's needs. "LBES is the crown jewel of NAVSSES. It's well known in the Navy community and of course everyone wants to see it, there is nothing like it anywhere else in the world," Gilligan said.

LBES is a unique environment where you have a core group of people that literally spend all their time out on the test site. It is cramped quarters but the engineers and technicians are focused on what they are testing and how it relates to the fleet.

The DDG 51 Land Based Engineering Site (LBES) plankowners pose for a photo in front of the test site after the 25th anniversary celebration of its first full-power run on Aug. 21, 1989. Capt. Walter Coppeans, Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) commanding officer, presented each of the plankowners with a certificate during the event in Philadelphia, Sept. 15, 2014 (U.S. Navy photo by Joseph Battista/ Released)

LBES core staff plans and executes testing, oversees construction and design, and operates and maintains the site and flight upgrade integration. The in-service engineering agents at LBES manage respective configurations, equipment and systems integration, hardware, software and firmware test and integration.

"It is a great group of people. They make sure any equipment scheduled for installation on a destroyer is properly tested and safe before it ever reaches the Sailors' hands," Woody said.

Parag Shah, plankowner and systems engineer with the Machinery Control Systems Branch, describes LBES as the perfect place for research and development. "One of the best things to hear is this plant running, especially after you integrated equipment that you have worked on for the past two years of your life," Shah said. "You press the button, the engine lights off and everything is good."

Andy Cairns, Major Programs Branch at Naval Ship Systems Engineering Station (NAVSSES), shows Chief of Naval Operations Adm. Gary Roughead components of the DDG 51 Land Based Engineering Site (LBES) on July 22, 2011. (U.S. Navy photo by Joseph Battista/Released)

NAVSSES also has some history with "green fleet" or energy initiatives testing at DDG 15 LBES such as alternate fuels, hybrid electric drive and the energy storage module. Furthermore, some in-process fleet improvements such as solid state lighting and the networked thermal management control systems were most recently tested at LBES.

"This is something we didn't envision in the beginning but the Navy has evolved and fuel has become an issue and we have the capability of doing that. And again we are not tying up a ship," NAVSSES Chief Technologist Dr. E. Michael Golda said. "It is figured out here without tying up a front line asset. We have the flexibility and people who are experienced on that site."

Preparations for DDG Flight III are already underway and NAVSSES has started to expand the test site to reflect the equipment that will be under test in fiscal year 2018. According to Golda, there is easily another 25 years of testing and training to be done and NAVSESS might be setting a lot of records with this site.

"The value of the DDG 51 LBES equipment and systems is significant, but without the skill, dedication, and expertise of the DDG 51 LBES personnel it would not be the world-class test site that it is today. Furthermore it took significant investment by PEO Ships and SEA 21 leadership to build, update, refresh and maintain the site to keep it relevant for change and program risk reduction testing." Cairns said.

Vice Adm. William Hilarides, NAVSEA commander, always says "It's all about the ships," but at LBES it's all about the people who are all about the ships.

Naval engineers test free water in fuel detection technology upgrade on CVN 71

By Joseph Battista, NAVSSES Public Affairs

Naval Surface Warfare Center Carderock Division (NSWCCD) began a six-month test of two new ASTM D3240 certified jet fuel free water detection systems aboard USS Theodore Roosevelt (CVN 71) Aug. 4. ASTM is an independent organization who sets international standards for product quality and safety. One of the two new systems under test will eventually replace the current jet and diesel testing method used on all surface ships.

The two new direct reading systems, one using mechanical technology and the other electric, will replace the Free Water Detector Standard Cards – a test method in place for the last half-century. Free Water Detector Standard Cards are printed with fluorescent ink using standard printing technology developed during the country's colonial period.

According to Diane Mattingly, fuels in-service engineering agent (ISEA) with Naval Fluids Branch at NSWCCD in Philadelphia, the original printing plates used to make the cards have worn over time and cannot be reproduced.

Mattingly, who has a bachelor's degree in chemical engineering from Carnegie Mellon University, said accurately assessing how much free water is in jet and diesel fuel stored on ships is necessary to avoid potentially catastrophic outcomes for personnel and equipment. She explained how too much water in jet fuel can be catastrophic: Jets fly at altitudes where the temperature is low enough to cause water to freeze. If the jet fuel has too much water, it can freeze and restrict fuel from reaching the engine – possibly leading to engine failure.

Surface ship gas turbine engines using diesel fuel can break down when there is excess free water, however the damage is usually limited to the engine and does not necessarily put lives in jeopardy. Therefore, identifying a new test method, in the near future, to ensure continued accurate free water detection on ships is a priority for the Navy.

Free Water Detector Standard Cards are printed with fluorescent ink using standard printing technology developed during the country's colonial period. (Photo provided by Diane Mattingly/Released)

The current method requires Sailors to filter test fuel through a pad coated with a chemical that fluoresces under UV light when exposed to water. The pad and card are then analyzed visually in a black box under UV light. The box has a small viewing port that enables the Sailor to compare the test pad against the standard. The Sailor then determines which standard on the card the test pad resembles most. The standard it most closely matches on the card represents the amount of free water, in parts per million (ppm), in the fuel sample. All shipboard fuel is required to be tested in order to verify the amount of water in jet fuel is no more than 10 ppm and no more than 40 ppm for diesel fuel.

Mattingly trained USS Theodore Roosevelt Sailors how to operate the two detection systems. Since both technologies meet commercial standards, Sailor feedback is a key factor in deciding which technology best suits their needs.

The first device undergoing testing removes the use of the Free Water Detector Standard Card. The operator first calibrates the device according to the manufacturer's directions. Fuel is then filtered through a chemically treated pad, and the pad is placed into the unit's pad holder tray. The operator presses the test button and simultaneously moves the adjusting lever until the observation meter reads "0." The number below the adjusting lever is the amount of free water in the fuel.

In addition to removing the Free Water Detector Standard Card, the second device also eliminates the adjusting lever. The second device is calibrated according to the manufacturer's directions, and it uses the same sample pad and fuel sampling techniques as the other test methods. The operator inserts a fuel treated pad into the pad holder shuttle and closes it. The free water content value in ppm then appears on the electronic display.

Mattingly said once a device is selected the change out on surface ships should be straightforward. Both options are portable, and take up about as much space as the old technology – the Free Water Detector Standard Card method.

First of class destroyer completes generator light off

By Program Executive Office Ships Public Affairs

The Navy's Zumwalt class (DDG 1000) destroyer program continues to make significant progress achieving key shipbuilding milestones, completing ship generator light-off on Sept. 23, for the first-of-class ship, the future USS Zumwalt.

The lead ship, DDG 1000, is 92 percent complete and currently in the test and activation phase of construction at General Dynamics, Bath Iron Works. The ship is successfully activating its fuel systems, advanced induction motors (AIM) and generators, with fuel onload and AIM light-off completed in July. The generators are used to produce the electricity required to operate the ship- the first Navy surface combatant to employ and innovative Integrated Power System (IPS). Key design features that make the IPS architecture unique include the ability to provide power to propulsion, ship's service, and combat system loads from the same gas turbine generators.

"Light-off of DDG 1000's generators is a critical step forward in the activation, test and trials of the ship's systems," said Capt. Jim Downey, DDG 1000 program manager. "With deliberate and incremental test and activation, the DDG 1000 team is systematically retiring risk and preparing this highly complex ship for at-sea testing and eventual transfer to the fleet."

Completion of generator light-off represents the latest electrical system milestone in an effort that began years ago with early prototype testing at the Naval Ships Systems Engineering Station Land Based Test Site in Philadelphia. Lessons learned from this effort guided activation events onboard DDG 1000 including energizing the high voltage power system, lighting off the port AIM utilizing shore power to demonstrate operation of the propulsion motor system, and continual testing of the engineering control system responsible for the automated control of the engineering plant. Most recently, successful testing of the fuel oil service and transfer system allowed for the onload of fuel utilized in the light-off event.

Test and activation of the ship's systems will steadily continue, with activation of the ship's computer system, the Total Ship Computing Environment planned for later this fall. Zumwalt will begin at-sea testing in 2015 off the coast of Maine and is expected to arrive in San Diego, in the 2016 timeframe for an extensive period of operational integration with the fleet.

Upon entry into the fleet, Zumwalt-class destroyers will be multi-mission surface combatant designed to fulfill volume firepower and precision strike requirements.

These highly advanced surface combatants represent a significant leap forward in naval surface warfare capability through the use of advanced technologies. With significant signature reductions over previous surface combatants, increased automation, and reduced manning levels, Zumwalt-class destroyers will provide the fleet with the capabilities required for today's naval operations as well as critical resources to face the threats of tomorrow.

As one of the Defense Department's largest acquisition organizations, Program Executive Office Ships is responsible for executing the development and procurement of all destroyers, amphibious ships, special mission and support ships, and special warfare craft. Delivering high-quality war fighting assets - while balancing affordability and capability - is key to supporting the Navy's maritime strategy.

Navy frigate harvesting effort benefits Coast Guard

By Joseph Battista, NAVSSES Public Affairs

Engineers at Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) in conjunction with the Naval Sea Systems Command (NAVSEA) Surface Warfare Directorate (SEA 21) is assisting the U.S. Coast Guard with the harvesting of combat systems from five decommissioned U.S. Navy frigates (FFGs) for use on Coast Guard cutters. The result is more than $24 million in cost avoidance with more expected from a fifth harvested frigate. This effort leveraged assets from the Navy's large inventory of inactive and decommissioned ships and transitioned usable logistics assets to in-service ships.

"The Navy's FFGs will all be decommissioned by the end of fiscal year 2015, but the Coast Guard cutters have the same gun weapons systems, which will be around until the early 2030s," said Abe Boughner, with Auxiliary Ships/Acquisition Support Branch at NAVSSES.

In December 2012, the SEA 21, Surface Ship Readiness Office (SEA 21A) began the harvesting effort by proposing a plan to conduct an entire harvest of five decommissioned FFGs, listed as logistics support assets (LSAs), docked at the Navy's inactive ship maintenance facility in Philadelphia. This effort cultivated MK 75, 76mm/62 caliber gun mounts, as well as gun control panels, barrels, launchers, junction boxes and other components.

SEA 21 maintains more than 50 inactive ships for future disposal, donation, or transfer; and actively provides follow-on technical support to more than 150 ships in more than 50 partner navies and the U.S. Coast Guard. The Navy built a class of 51 guided missile frigates from 1975 – 1989 with an expected service life of 30 years. In December 2012, Roger Raber with SEA 21A, began the harvesting effort by proposing a plan to conduct an entire harvest of the five FFGs.

Raber coordinated with NAVSSES engineers E. Alan Karpovitch, P.E., the Navy's propulsion program manager, and Ashley Ferguson, mechanical engineer, to oversee the daily operations of removing items from the frigates. The Coast Guard Yard Ordnance Shop provided a team to assist Karpovitch and Ferguson with removal of gun mounts and other components from the FFGs while in dry dock.

"If I get a request for a part and it's feasible for me to pull it off a ship, I will," said Karpovitch. "Many of the pieces of hardware on these ships are still serviceable and can be recycled."

Timothy Wallace, equipment specialist with the Coast Guard Surface Forces Logistics Center (SFLC), provided a logistics asset request for the gun mounts in early fiscal year 2013. The gun mounts were deemed serviceable and a plan was enacted to remove them from the frigates. The SFLC worked in conjunction with Stephen Remsey, the Navy's MK 75 In-Service Engineering Agent, to coordinate the transportation of the gun mounts to U.S. Coast Guard Yard Curtis Bay in Maryland.

An MK 75, 76mm/62 caliber gun mount is removed from one of five U.S. Navy frigates being harvested by Engineers at Naval Ship Systems Engineering Station, Naval Surface Warfare Center Carderock Division (NAVSSES) in conjunction with the Naval Sea Systems Command (NAVSEA) Surface Warfare Directorate (SEA 21). The gun mount was supplied to the U.S. Coast Guard for use on their cutters. (U.S. Navy photo by Ashley Ferguson/Released)

"From the Coast Guard's standpoint the FFG harvesting has been a complete success," said Wallace. "The final cost avoidance estimate will not be known until after the fifth FFG harvesting is complete."

Some of the MK 75 mounts will be placed into the overhaul cycle at the Coast Guard Yard Ordnance Shop and returned to service onboard 270-foot Medium Endurance Famous Class cutters. One mount is slated to support the Coast Guard's sustainment program for parts no longer manufactured or are in short supply. Other components will be placed in the overhaul cycle, and then returned to service.

"This is the right thing to do," said Raber. "I sleep well at night knowing that the Coast Guard cutters are well outfitted with reliable equipment that is vital to their mission."

USS Vandegrift (FFG 48) and USCGC Mellon (WHEC 717) steam side by side during a division tactics exercise as part of Naval Engagement Activity (NEA) Indonesia 2010. In its 16th year, NEA is part of the Cooperation Afloat Readiness and Training (CARAT) series of bilateral exercises held annually in Southeast Asia to strengthen relationships and enhance force readiness. (U.S. Navy photo by Mass Communication Specialist 2nd Class David A. Brandenburg/Released)

NSWCCD hosts additive manufacturing conference

Timothy E. Hunt, NSWCCD Public Affairs

Dr. Jennifer Wolk (center) of Naval Surface Warfare Center, Carderock Division, Malinda Pagett and Anthony Zaita of the Office of Naval Research discuss the state of the Navy's current additive manufacturing capabilities during the Additive Manufacturing Working Group held Sept. 24-25, 2014 at Naval Surface Warfare Center, Carderock Division, West Bethesda, Md. (U.S. Navy photo by Nick Malay/Released)

Naval Surface Warfare Center, Carderock Division (NSWCCD) hosted a working group Sept. 24-25 at its West Bethesda, Maryland, facility to discuss the future of additive manufacturing (AM) and its impact on NAVSEA Warfare Centers and the Navy as a whole.

Organized and led by Dr. Jennifer Wolk, principal investigator for the Welding, Processing and Nondestructive Evaluation Branch at NSWCCD, the working group's goal is to foster greater interaction and to effectively coordinate technology development, resource sharing and technical expertise across Warfare Centers currently using additive manufacturing in their work.

This is the second major naval additive manufacturing event Carderock Division has hosted. In February 2014, the Office of Naval Research (ONR) sponsored the Naval Additive Manufacturing Technology Interchange (NAMTI). This two-day event hosted more than 170 participants from the military, government, industry and academia, representing the largest cross-section of Navy and civilian personnel assembled on the topic of AM for the Navy. NAMTI helped chart the path for AM integration in the Navy and produced a draft set of recommendations currently under review by ONR.

NSWCCD Technical Director Dr. Tim Arcano's opening remarks for the AM working group noted the importance of collaboration among Warfare Centers: "There are significant ongoing Navy coordination efforts in additive manufacturing. We hope this group gathered here will be able to support these collaborative efforts and provide a cohesive strategic vision that will create returns for the Navy that are greater than the sum of the individual parts."

Additive manufacturing, also known as 3-D printing, fabricates an object based on a three-dimensional model with layer by layer build-up. This capability has the advantages of speed of design and creation that also realizes a huge cost savings over conventional model making and manufacturing processes.

As this technology currently exists, even movable, multi-part items with joints can be produced that do not require assembly after creation. This is due to the layering process used where an object is built up layer by layer in a manner much like a page is printed. However, in 3-D printing, the ink has a greater thickness and the letters are placed on top of each other until the letter has not only length and width as done in traditional printing on paper, but height as well. The printing process can be done using a wide variety of materials, including plastics and metals.

Group participants agreed that, to date, the Warfare Centers currently make very effective use of AM equipment and techniques to create models, perform rapid prototyping for testing and evaluation and produce limited amounts of customized equipment. In support of their technical mission, AM has provided the Warfare Centers a powerful tool. Several excellent examples were noted during the meeting; one in particular focused on custom-engineered solutions from Naval Undersea Warfare Center Keyport for rapid tooling and manufacturing support.

Brian Mahoney, NUWC Keyport's deputy customer advocate for fleet Maintenance and

Applied Technology programs, said "While NUWC Keyport's Applied Technology Branch (where Keyport's AM resides) is focused on integrating systems that enhance maintenance and repair capabilities for the fleet, we look to AM for the direct manufacture of tooling, test fixtures and tactical end-use parts. Keyport has more than a decade of engineering experience in this exciting field and is dedicated to ensuring that the parts we make will perform exactly as intended in their operational environments."

"As a technical community, all Warfare Centers face a number of challenges with AM, including fleet application, production processing and material surety," Mahoney said. "That's where a rigorous partnership effort across Navy Warfare Centers, in close coordination with NAVSEA systems engineers and technical warrant holders, can provide significant benefit to the Navy's AM efforts in the years to come."

Additive manufacturing offers as-yet unrealized benefits with the supply of repair parts, as well as the small batch production of new pieces of equipment that would not justify the cost of setup of a typical industrial full production line. Storing parts for obsolete systems that are still in use would also no longer be required.

Over the course of the two-day event, the working group discussed current capabilities and future requirements for the various naval AM implementation efforts underway. Representatives from each Warfare Center provided background on their respective center's current equipment configurations and how they use AM.

The working group also identified several growing needs to support the future development and implementation of AM by the Navy:

- The ability to produce parts and equipment that meet military specifications and are immediately usable in an operational environment.
- Establishing a larger base of experts able to maintain and operate AM equipment and processes.
- Continuing research and development targeted at effective expeditionary and shipboard deployment of AM equipment.

Wolk considers the working group a significant and successful first step toward creating a unified vision and strategy for the use of AM by the Navy and other services. "Additive manufacturing is a cross-cutting technology that enables new materials, complex designs and a new way to view manufacturing on land and at sea. The Warfare Centers have utilized this technology to advance their technical missions and this working group provides an opportunity for enhanced collaboration."

This meeting represents a critical initial step in understanding the scope and capabilities in additive manufacturing throughout the NAVSEA Warfare Centers and in enabling future cross-Warfare Center collaboration. The participants also began to create and discuss recommendations for a Warfare Center additive manufacturing vision.

3-D printed test objects displayed at the additive manufacturing working group held Sept. 24-25, 2014, at Naval Surface Warfare Center, Carderock Division, West Bethesda, Md. The samples shown were produced during recent motion tests. They demonstrate variances that occur when printing objects while subjected to movements similar to conditions found on a ship at sea. (U.S. Navy photo by Nick Malay/Released)

Dr. Jack Templeton (left) of Naval Surface Warfare Center, Carderock Division, and Jay Stone of Naval Surface Warfare Center, Corona discuss issues related to deployment of additive manufacturing to the fleet during the Additive Manufacturing Working Group held Sept. 24-25, 2014, at Naval Surface Warfare Center, Carderock Division, West Bethesda, Md. (U.S. Navy photo by Nick Malay/Released)

Attendee Michael Robinson, technology management director for the Center for Innovative Machinery Design and Integration at Naval Ship Systems Engineering Station (NAVSSES) in Philadelphia, was appreciative for the opportunity the working group offered, "The meeting was extremely productive, excellent facilitation on Dr. Jennifer Wolk's part to get everyone focused on the same page to cover a large amount of material. I think AM will be a valuable tool for the Navy and I'm enthusiastic to see the synergy that can be offered by the Warfare Centers. Dr. Wolk created a very colloquial environment. Everyone offered valuable lessons learned and was very interested in opportunities for collaboration. It's a good start, but only the beginning of a lot of work that will be required to bring AM to the fleet."

The AM working group plans to meet via conference calls during the first quarter of fiscal year 2015, with the next face-to-face meeting tentatively planned for January 2015.

NSWCCD Acoustic Research Detachment upgrades pier capacity

By Timothy E. Hunt, NSWCCD Public Affairs

Demolition of portions of Pier 42 at Naval Surface Warfare Center, Carderock Division's Acoustic Research Detachment's facility in Bayview, Idaho, Sept. 9, 2014. (Photo provided by National Native American Construction/Released)

Naval Surface Warfare Center, Carderock Division's (NSWCCD) Acoustic Research Detachment (ARD), located in Bayview, Idaho, began the construction phase of a repair project to the facility's "Pier 42" and associated floating walkway on Sept. 8. The pier supports various barges and test platforms used by the detachment to conduct their research. Without these repairs, Pier 42 would only be able to support one test platform, and only during the summer months when Lake Pend Oreille is at its highest level. The repairs will provide the capability of simultaneously supporting up to three vessels or test platforms throughout the entire year.

The pier was built during World War II and was originally used to support shore-to-lake material transfer operations when the facility saw service as the Farragut Naval Training Station. The station was decommissioned in June 1946, and served in various roles for the state of Idaho and the federal government until it was re-purposed in the 1950s to support acoustic research for the David Taylor Research Center.

The current construction project is required to repair damage and reinforce the aging pier structure. Repairs are also needed to allow platforms to be secured farther out on the pier since water depth in the pier area lowers in the winter, making it difficult to tie up platforms and barges.

In 2006 portions of the pier were condemned by the Navy when their inspectors determined that structural degradation had progressed to a stage where something had to be done to maintain safe operational capability. Recent estimates to pursue a Military Construction (MILCON) project to fully demolish and replace the pier reached as high as $6.2 million, which led the project team to seek less costly solutions. Working with Chicago-based Collins Engineering, the team was able to develop a repair project that would restore operational capabilities and address all safety concerns at a significantly lower cost than the MILCON cost estimates.

Naval Facilities Engineering Command, who is managing the contract, awarded the project to local, woman-owned, National Native American Construction (NNAC) in August 2014. NNAC immediately began preparation for supporting this project to ensure completion within the short construction window allocated for this project. The project calls for removal of an overhead crane structure and 47 feet of damaged portions of the pier, installing new piles and bearing plates to support ARD's mobile crane, installing protective sleeves on 10 of the original piles and adding mooring dolphins to provide barge and vessel berthing capabilities. The project required a full evaluation of environmental impact to identify and address the environmental needs associated with repair operations. Personnel from Naval Station Everett in Everett, Washington, were asked to assist with obtaining the necessary permits for the project from the U.S. Army Corps of Engineers to keep the project on schedule and ensure the environmental requirements are met.

The environmental impact assessment was necessary because Lake Pend Oreille, where ARD is located, is a designated habitat for bull trout, which is listed as a threatened species. The ARD wharf area is also a popular spawning area for the Kokanee salmon, the primary prey species of the bull trout, and a popular species for the local sport fishermen. The presence of this indigenous wildlife has had an impact on the construction schedule as well as construction requirements. To ensure the project does not impact the Kokanee spawning season, all in-water repair work must be completed before Oct. 31. This deadline ensures the required cleanup can be performed before the Kokanee spawning season begins in November. A cleanup of the fish's spawning bed may be needed after construction to remove any silt accumulation and restore the lake bottom to its pre-construction state.

A "bubble curtain" will also be used as an environmental protection measure. This is because the underwater portion of the construction involves the installation of six new steel piles to support the mobile crane. These piles will be placed using vibratory pile driving, with the final "proofing" of the piles being done using a traditional pile-driver method. Pile proofing

could produce underwater sound pressure levels that may be harmful to the indigenous wildlife. The bubble curtain will be used to reduce and contain underwater sound pressure caused by the pile proofing.

Despite the environmental challenges, the project is proceeding on schedule. Site Director Alan Griffitts is quick to express the pride and gratitude he has for his project team, "Getting this project going has been a true team effort. The personnel from NSWCCD's Infrastructure Division (Code 102) and Environmental Office were instrumental in getting this project moving. The ARD has been trying to resolve the issue with our condemned Pier 42 for nearly eight years now, and we're finally able to make this a reality thanks to the dedicated efforts from a broad team consisting of members of the ARD Team, Code 1021 in Philadelphia, and 1023 in West Bethesda. In addition, the folks at Naval Station Everett provided excellent and timely support to ARD. They were instrumental in updating a key biological assessment report, as well as obtaining the necessary permits to begin construction. We're moving forward on schedule because of the vital support provided by all members of this team."

Top right: Pier 42, the primary support pier for Naval Surface Warfare Center, Carderock Division's Acoustic Research Detachment in Bayview, Idaho in August 2014. The pier is showing its age, making it necessary to perform extensive repairs. (U.S. Navy photo by Alan Griffitts/Released)

Bottom right: A diver prepares to inspect the piles of Pier 42 at Naval Surface Warfare Center, Carderock Division's Acoustic Research Detachment's facility in Bayview, Idaho, Sept. 5, 2014. (Photo provided by National Native American Construction/Released)

NSWCCD engineer awarded journal's paper of the year

By Rebecca Grapsy, NWCCD Public Affairs

Jennifer Gaies, Metallurgy and Fasteners Branch, along with Prof. Michelle Koul of the United States Naval Academy, won the Best Paper Award from the Journal of Failure Analysis and Prevention for their paper, "An Environmentally Assisted Cracking Evaluation of UNS C64200 (Al-Si-Bronze) and UNS C63200 (Ni-Al-Bronze)."

The paper is based on an issue that appeared in the fleet where union nuts were cracking with no reason – the only environment known to cause cracking was not present. What started as a routine failure analysis turned out to be an interesting problem – because the environment known to cause the issue wasn't present, something must have changed. Materials are sometimes swapped in the fleet depending on cost or availability, so the material had to have been changed for the cracking to result.

Gaies and Koul tested several material combinations in air (to set a baseline), seawater, and an ammonia plus seawater combination, as ammonia-based cleaners are frequently used on ships and may have incidentally come in to contact with the nuts in question. What they found was that both materials suffered from environmentally assisted cracking in the presence of ammonia, but the aluminum-silicon-bronze, which is what the failed nuts were being manufactured from, also cracked in the seawayer environment, which was not expected.

Gaies studied mechanical engineering, and has her master's degree specializing in materials engineering from The Johns Hopkins University. She has been at Carderock since 2001.

Koul is a former NSWCCD employee and has been a professor of mechanical engineering at the United States Naval Academy (USNA) since 2000. USNA has some laboratory testing capacity Carderock does not. The Naval Academy and NSWCCD-West Bethesda frequently collaborate on projects, often involving Midshipmen.

What Gaies had expected to be a routing failure analysis ended up not to be the case. "The more we got in to it, the problem became much more interesting," she said, adding that the project was fun to work on and that what had started as a minor technical issue ended up being an interesting and engaging challenge.

NSWCCD's Technical Director's Innovation Challenge completes final phase

By Katie Ellis-Warfield, NSWCCD Public Affairs and Kate Hogarth, NAVSSES Public Affairs

Thirteen selected innovators representing 10 projects presented their "out of the box" ideas to Naval Surface Warfare Center Carderock Division (NSWCCD) employees and a panel of Navy customers during the final phase of the NSWCCD Technical Director's Innovation Challenge (TDIC) in West Bethesda, Maryland on Sept.3.

The panel consisted of division leadership plus science and technology professionals from the office of the Deputy Assistant Secretary of the Navy (DASN), the Office of Naval Research (ONR) and NAVSEA Program Executive Offices.

Dr. Tim Arcano, NSWCCD technical director, challenged the Command to come up with ideas aimed at addressing the needs of the Navy and to stimulate innovation in all business and technical areas relative to Carderock's mission.

Innovators were funded 20 percent of their time to develop their ideas using a three-phased approach: concept exploration, concept maturation and pathways to concept implementation. At the conclusion of each phase, projects were presented to a TDIC panel for advice and direction.

From left: NSWCCD Technical Director Dr. Tim Arcano; Pinkesh Bharatia; Ian Peek; Dr. Noel Guardala; Mary Lacey, deputy assistant secretary of the Navy, Research, Development, Test and Evaluation; Dr. Abner Rodriguez; John Almeter; David Nordham; Jim Smerchansky, deputy commander, Systems Engineering, Interoperability, Architectures and Technology, Marine Corps System Command; Dr. James Roche; Dr. Larry Schuette, director of research, Office of Naval Research; Dr. Stephen Potoshnik; Carl Siel, executive director, Program Executive Office Littoral Combat Ships; Dr. Shaun Anderson; Jim Thomsen, principal civilian deputy assistant secretary of Navy, Research, Development and Acquisition; Dr. Krista Michalis; Brittany Preston; NSWCCD Commanding Officer Capt. Rich Blank; and Garth Jensen pose on stage after the Technical Director's Innovation Challenge presentations in West Bethesda, Md., Sept. 3, 2014. The event was VTC'd to Bangor, Norfolk and Philadelphia (U.S. Navy photo by Katie Ellis-Warfield/Released)

Brittany Preston and Jennifer Ehrich: Lining titanium piping to prevent biofouling

Brittany Preston and Jennifer Ehrich, both materials engineers in NSWCCD's Corrosion and Coatings Branch, investigated antifouling paint and pipe lining technologies for controlling biofouling in titanium piping. Their goal was to see if there was a viable way to reduce maintenance costs and extend the service life of the titanium piping systems onboard LPD 17-22.

Preston and Ehrich, along with Elizabeth Haslbeck, an ecologist in the Corrosion and Coatings Branch, conducted a comprehensive engineering analysis to determine the feasibility of such a solution. "It's shown that there is definitely more research to be done, and it could be a viable option if the correct research is done and proves successful," Preston said.

Though pipe lining technology has been attempted by the Navy in the past, this is the first time a hull coating has been applied to the inside of a pipe. "The idea came about as sort of a, why can't we do this?" Preston said. "Chlorinators and dechlorinators are currently being used inside of the titanium pipes and are very expense, so we thought, why not look at this other option to see if it might be more cost effective and if it will even work?"

Preston said they plan to apply for 219 NISE funding to explore this pipe lining technology further once more baseline data has been collected and experimenting has been conducted. After that Preston hopes to use the available Navy customers for transition into the fleet.

Brittany Preston presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Ryan Hanyok/Released)

Dr. Noel Guardala: Development of a highly forward directed fast neutrons source

Dr. Noel Guardala, nuclear physicist with the Environmental Quality Division, explored the development of a highly forward-directed neutron source for the active interrogation of improvised explosive devices and other high-explosive threats using the principles of kinematic compression.

Currently there isn't an operational system in use that is mobile and can produce a forward directed beam. "Neutron systems have been evaluated and none of them actually work well in the field. They are stationary and they literally have to be placed on top of the threat object," Guardala said.

Guardala started working on this concept in 2008. He sought funding from a number of government agencies to no avail. "We had the full funding last year, but the money was pulled back so we were back to ground zero in terms of any significant external funding," Guardala said.

Guardala's goal is to eventually market this concept for significant funding in order to build a prototype. For the near future, Guardala hopes to secure funding to begin initial experiments here at Carderock's accelerator facility under his supervision. "We want to do as much of the basic science and systems engineering so that we could be ready if the full funding came through to build a prototype," Guardala said.

Dr. Noel Guardgala presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Ryan Hanyok/Released)

Dr. James Roche: Enhancing organizational decision cycles

Dr. James Roche presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Katie Ellis-Warfield/Released)

Dr. James Roche, an engineer with the Signatures Measurement Technologies and Systems Development Division, examined the existing neuroscience and psychology research related to Col. John Boyd's decision-making algorithm Observe Orient Decide Act (OODA).

For Roche, the TDIC offered him the time and funding to research his concept further. "Having a funded proposal placed me in a different light when I spoke with researchers from academia and other government agencies," Roche said.

Following the TDIC presentations, Roche was approached by Mary Lacey, deputy assistant secretary of the Navy for Research, Development, Test and Evaluation, to follow up with her on risk management and decision making. This communication led to Roche participating in a pilot course sponsored by Lacey's office on critical thinking for technical leaders.

Roche's advice to those looking to participate in next year's TDIC is to imagine their desired end state or objective as it would impact the organization. "Impacting the culture may be beyond the timeline, but addressing it in your schedule will benefit you in accomplishing your long-term objective," Roche said.

Dr. Stephen Potashnik: Remote atmospheric magnetometry

Dr. Stephen Potashnik presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Katie Ellis-Warfield/Released)

Dr. Stephen Potashnik, in the Underwater Electromagnetic Signatures Technology Division, examined the possibility of remotely measuring magnetic fields using naturally occurring gases in the atmosphere.

This concept was one Potashnik had been exploring at least a year prior to the TDIC announcement. "It is always useful to identify the limiting factors to your current performance whatever your area," he said. "To overcome a variety of noise sources, it would be useful to reach out and make a measurement closer to the target."

The TDIC presented Potashnik with the opportunity to review historic concepts on this topic as well as recent advancements, so that he was be able to host a workshop to solicit ideas and the academic community.

Potashnik hopes to continue working with the universities to further this concept and eventually involve ONR. "I would be interested in pursuing a Multidisciplinary University Research Initiative (MURI) with ONR, just to explore what might be possible," Potashnik said. "If the universities through their research can demonstrate something that will work in the atmosphere, people will take it from there."

Steve Polillo: Airfoil "flow multiplier" concept applied to underwater thruster design

Steve Polillo, special projects program manager for the Signatures Characterization and Analysis Division located at the Puget Sound Detachment at Naval Submarine Base Bangor, Washington, investigated the possibility of using the technology from the design of the household item the Dyson bladeless fan for an underwater propulsion/thruster application.

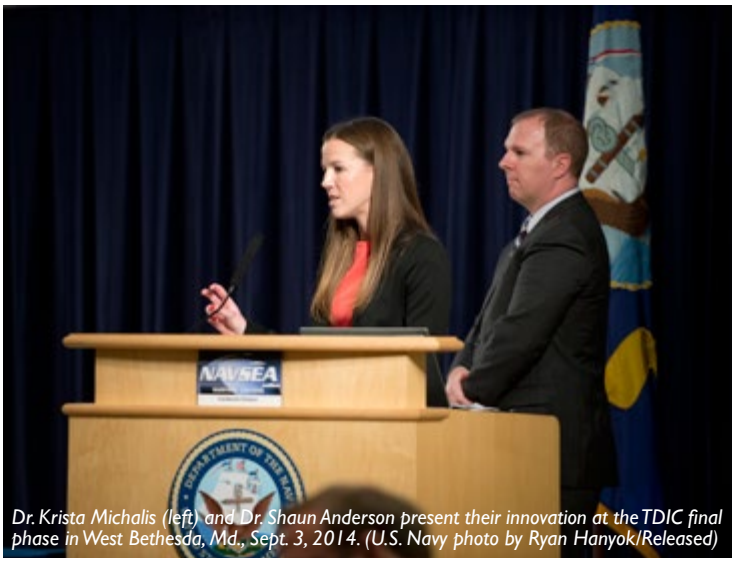
Polillo wanted to look into the unique nozzle shape associated with the Dyson bladeless fan and see if it could be a viable design for an underwater propulsion/thruster application. Polillo was able to determine that the Dyson nozzle did exhibit the same characteristic using water as it does when using air. "It was great to see an idea that has been rolling around in my head for quite a while grow," Polillo said.

Polillo said he enjoyed taking part in the TDIC not just from the research perspective. "It was a great experience from a professional development standpoint." Polillo said. "I got to meet some really interesting people at Carderock and use some of the facilities. Being out in Bangor, West Bethesda is not somewhere that I normally get an opportunity to work."

Polillo said he doesn't plan to continue to pursue this concept beyond this point but hopes others might. "My work related duties pretty much prevent me from pursing this concept further, but it would be wonderful if someone else decided to pick this up and maybe try to do some other things with it," Pololo said. "I can think of some very creative uses for this type of system if it was optimized for underwater performance."

NSWCCD employees look at a prototype based on the Dyson bladeless fan design at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Ryan Hanyok/Released)

Dr. Shaun Anderson and Dr. Krista Michalis: Compressive sensing and applications



Dr. Krista Michalis (left) and Dr. Shaun Anderson present their innovation at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Ryan Hanyok/Released)

Dr. Shaun Anderson and Dr. Krista Michalis, both mechanical engineers with the Structural Acoustics and Target Strength Branch, explored the possibility of using an emerging compressive sensing theory to reconstruct signals from fewer data measurement points with acoustic and vibration measurements.

This theory was developed in the early 2000s for image compression and has since been utilized in other fields. A publicly released report commissioned by the DoD in 2012, the JASON group report, suggested the DoD be involved in shaping compressed sensing and how it is applied to radar systems. The JASON group is an independent group of scientists which advises the U.S. government on matters of science and technology.

"I was actually exposed to it in graduate school. It was a cutting edge theory in 2002 and lots of people have been applying it to radar, MRIs and imaging," Anderson said. "Nobody has really taken it too much into sonar or acoustics."

Anderson plans to submit a proposal for 219 NISE funding in order to develop this concept more. He also hopes to hold a meeting with potential Navy customers and interested parties within Carderock to see how compressive sensing can be utilized beyond the applications he is pursuing.

Ian Peek and David Nordham: Low pressure desalination

Ian Peek with the Energy Conversion Research and Development Branch and David Nordham with the Auxiliary Systems Branch at NAVSSES in Philadelphia investigated low pressure desalination techniques for shipboard desalination efforts.

"The TDIC program was a great experience and an opportunity to learn about an interesting topic," Peek said.

Peek and Nordham focused on applicability towards shipboard desalination systems, with the objectives of energy savings, reduced acquisition costs, and reductions in weight and maintenance requirements.

"There are current efforts to reduce the energy usage and maintenance requirements in shipboard desalination plants," Peek said. "This project is an attempt to realize even more improvements in shipboard desalination."

Ian Peek (left) and David Nordham present their innovation at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Katie Ellis-Warfield/Released)

Pinkesh Bharatia: 3-D printing radar bearings for submarine sails

Pinkesh Bharatia, mechanical engineer for NAVSSES in Philadelphia and part of the Advanced Data Acquisition, Prototyping Technology & Virtual Environments (adapt.ve) lab, investigated the use of 3-D technology and laser metrology scanning to create submarine sail bearings.

Bharatia and the adapt.ve team worked on a strategy for validating materials to have a bearing modeled and printed. Once the team has a prototype, they plan on putting it through a cycling test site to simulate fatigue and stresses. The goal is to one day print bearings instead of machining them.

"For NAVSSES to become a driver of this potential, material properties need to be vetted to ensure compliance with all requirements," Bharatia said. "There will be many opportunities to apply this to other systems and beyond. The radar bearing could be a great pilot program to begin the development of this technology."

According to Bharatia, additive manufacturing will become commonplace sooner than later. "We need to invest into the qualification of the outputs now such that they can have parts out in the fleet to begin reaping the benefits of this technology."

Pinkesh Bharatia presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Katie Ellis-Warfield/Released)

John Almeter: Concave/convex wiggle hull

Jon Almeter presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Katie Ellis-Warfield/Released)

Jon Almeter a naval architect with the Naval Surface Warfare Center Combatant Craft Division in Virginia Beach presented his idea on concave/convex "wiggle hulls." The objective of his project was to investigate the use of wiggle hulls to improve the drag of a craft.

Almeter, a graduate from the University of Michigan with a degree in marine engineering and author of numerous papers on small high speed craft performance, has been with Carderock Division for 30 years. His career focuses on high performance small craft.

"The TDIC allowed all of us to try new and innovative concepts without fear of negative consequences from failure. From the participants' perspective, it was all positives without negatives," Almeter said. "The TDIC resulted in the development of concave/convex wiggle hulls that may ultimately significantly reduce the drag of several classes of craft."

Abner Rodriguez: Cloud based automation and control

Abner Rodriguez presents at the TDIC final phase in West Bethesda, Md., Sept. 3, 2014. (U.S. Navy photo by Katie Ellis-Warfield/Released)

Abner Rodriguez, a computer engineer with the Fluid Systems Automation Branch at NAVSSES in Philadelphia, proposed cloud computing architecture for machinery control and monitoring.

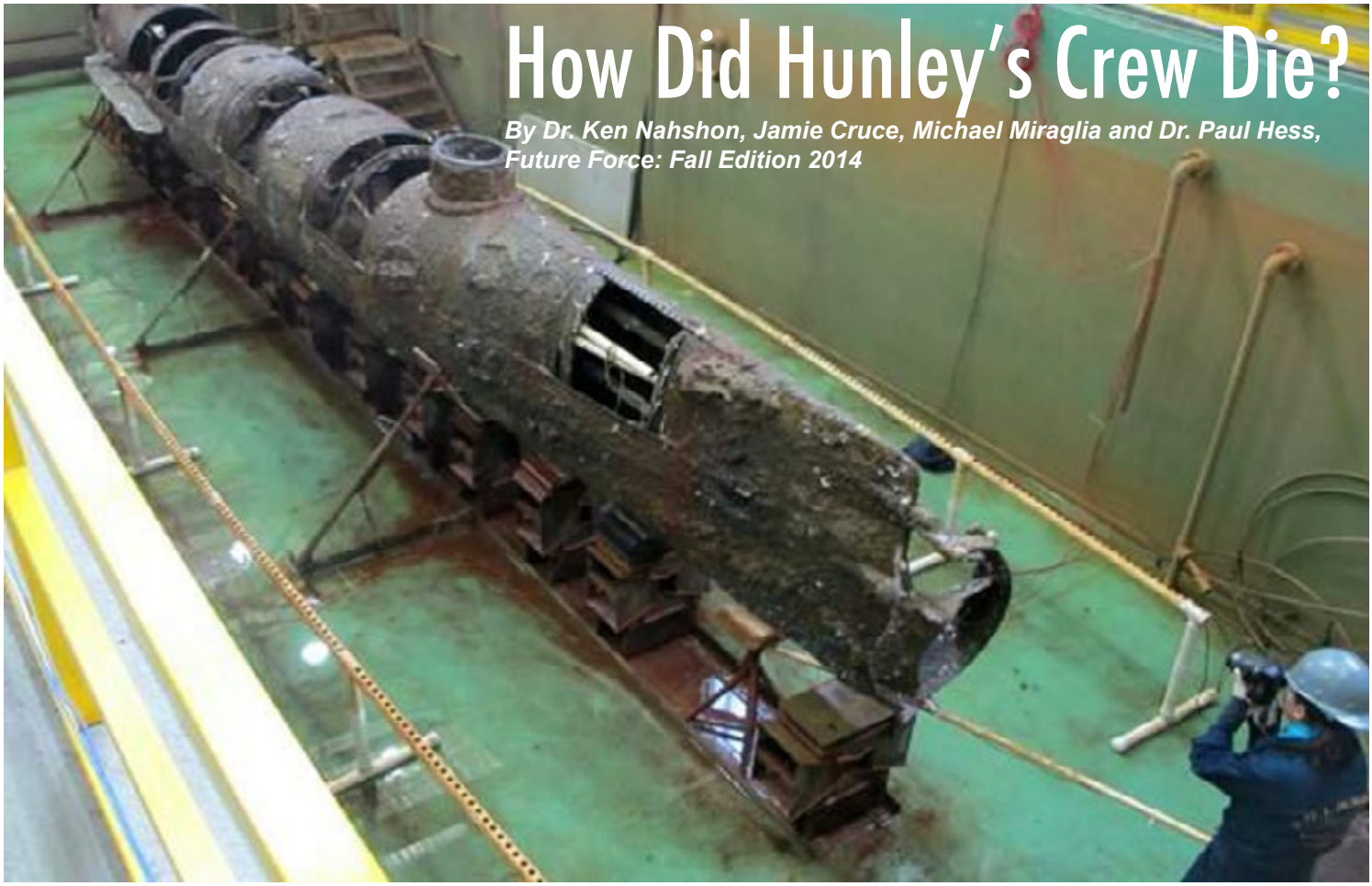
Rodriguez explained that cloud computing is a model for enabling convenient, on-demand network access to a shared pool of computing resources.

His objective was to develop a cloud-based control system architecture that consisted of various networked devices. The performance of the network devices would be monitored, controlled and tested under simulated workloads.

Through research, Rodriguez found that cloud computing could be beneficial in a number of ways including reducing costs of commissioning, maintenance and operation.

How Did Hunley's Crew Die?

By Dr. Ken Nahshon, Jamie Cruce, Michael Miraglia and Dr. Paul Hess, Future Force: Fall Edition 2014



Raised from its resting place off Charleston, South Carolina, in 2000, the Confederate submarine H.L. Hunley is still revealing secrets about the fate of its crew on the night of its sinking in 1864. (Photo by John L. Williams)

On 17 February 1864, the Confederate submarine H.L. Hunley attacked USS Housatonic, a Federal sloop-of war participating in the blockade of Charleston, South Carolina. The explosion resulting from the Hunley's torpedo sank the 1,240-ton ship in a matter of minutes, securing Hunley's place in history as the first submarine to sink an enemy combatant. Although the attack on Housatonic was successful, Hunley was lost at sea due to unknown circumstances with no survivors. Though various theories about the cause of Hunley's loss have existed for some time, the sequence of events during and after the attack remains a mystery.

In 1995, marine archaeologists sponsored by author Clive Cussler located Hunley's wreck off the coast of Charleston approximately 1,000 feet from the wreck of Housatonic. Five years later, Hunley was raised from the sea bottom and moved to a specially prepared tank facility at the Warren Lasch Conservation Center (WLCC), located at the Charleston Navy Yard. Once there, a team of archaeologists and conservators from Clemson University began working on studying and preserving the submarine.

WHAT HAPPENED?

Motivated by recent archaeological findings made at the WLCC, engineers in the Naval Surface Warfare Center Carderock Division's Survivability and Weapons Effects Department hope to shed light on what may have happened to Hunley and its crew using the Navy's most advanced modeling and simulation software and computational capabilities.

Recently, archaeologists at the WLCC uncovered a long wooden pole of a spar torpedo weapon system. It had been previously reported that Hunley used a line-operated torpedo system—one that was operated from a distance using a line to set off its explosive charge. In contrast, Civil War-era spar torpedoes usually consisted of an explosive charge fastened to a fixed-length spar used either in contact or proximity to the target vessel. Thus, Hunley would have been separated from the explosive charge only by the spar's length, generating a far more severe loading environment than that from a line-operated system. The Confederacy's largest spar torpedo, Singer's Torpedo, consisted of 135 pounds of black powder and a spar length of approximately 16 feet, along with a contact fuse. In this current study, the use of Singer's Torpedo is assumed; while it is possible a different design was utilized, it is likely the largest available spar torpedo would have been selected.

THE TEAM AND THE TOOLS

Realizing the significance of this finding, researchers at the WLCC, together with Dr. Robert Neyland, head of the Underwater Archaeology Branch at the Navy History and Heritage Command, contacted Carderock for assistance in interpreting the implications of this finding on Hunley. Fortunately, Carderock's Survivability and Weapons Effects Division—which performs analyses, testing, and vulnerability assessments of underwater and air-delivered threats on Navy ships, Marine Corps vehicles, and other structures—possesses the necessary computational capabilities to evaluate Hunley's attack on Housatonic using modeling and simulation.

With financial support from both the Office of Naval Research (ONR) and the Naval Surface Warfare Center, Carderock engineers began applying a newly developed high-fidelity

modeling and simulation tool, Navy Enhanced Sierra Mechanics (NESM). This tool, developed jointly by Sandia National Labs and Carderock, consists of a structural simulation finite element code, Sierra Mechanics, fully coupled to a computational fluid dynamics shock-physics code for underwater explosions, DYSMAS/FD, developed by the Naval Surface Warfare Center Indian Head Division. Using NESM, the fully coupled interactions between explosive products, water, and the responding structure can be captured. These features are critical to obtaining the correct response of a floating or submerged structure to an underwater explosion event.

To perform numerical analysis of a ship, submarine, or other platform in NESM, an appropriate numerical description, in the form of a finite element model (FEM), is required. The FEM consists of a numerical description that includes both geometrical and material properties. Fortunately, archeologists at the WLCC were able to provide the necessary details to develop the FEM including photos, drawings, and geometrical point-cloud scans of Hunley generated using both structured light and laser scan techniques. The scans provided the submarine's exact shape and dimensions and were used to generate an FEM of Hunley.

In addition to the FEM, the project developed a numerical description of the loading generated by a Singer's Torpedo. In contrast to modern mines or torpedoes filled with high explosives, the Singer's Torpedo was filled with black powder, a propellant. Unlike high explosives, propellants do not readily detonate, meaning the conversion of explosive to reaction products occurs on a relatively slow timescale. In addition, black powder is known to burn, or deflagrate, in a way highly dependent on pressure and the size of powder grains. To capture the appropriate physical phenomena, Carderock engineers developed a suitable burn model using a gas-injection feature originally developed to capture the behavior of underwater air guns.

With a model to capture the loading implemented and an FEM ready to be exercised, Carderock engineers began their analysis of the response of Hunley and its crew to the torpedo explosion using NESM on a supercomputer, Kilrain, located at the Navy's Department of Defense Supercomputing Resource Center at Stennis Space Center, Mississippi.

ANALYSIS

Initial analysis results indicate the presence of a long-duration, elevated pressure loading near the explosive charge. This is a direct result of black powders' slow-burning nature. In contrast to a high explosive, however, the observed pressures were found to be modest and result in a steady heaving motion of Hunley. Simulations indicated that the hull would not exhibit structural damage. This finding is consistent with what is being found during archaelogical excavations but not intuitive given Hunley's proximity to the explosion.

In contrast, the bubble resulting from the explosion's reaction products was found to be in direct and sustained contact with Housatonic's hull, providing a long-duration, high- pressure loading that would be more than capable of rupturing the ship's hull. Interestingly, the standoff of the torpedo's spar was just long enough to prevent direct bubble loading on Hunley.

Despite the apparent lack of hull damage to Hunley, these heaving motions may have injured or incapacitated the submarine's crew, caused failure on seals and other openings resulting in rapid flooding, or resulted in an unrecoverable trim state. It is important to note that no apparent evidence suggesting an escape attempt by the crew has been found—all crew member remains were found in their battle stations, all hatches were in a closed configuration, and all detachable ballast weights were found to be attached.

Current analysis efforts are focused on evaluating the potential for crew injury, particularly blunt trauma.

To capture the crew response to the explosion and resulting motions, an FEM of an automotive anthropomorphic test device, commonly known as a "crash- dummy," is being used. The device is close in size to the average Hunley crew member as estimated by the discovered human remains.

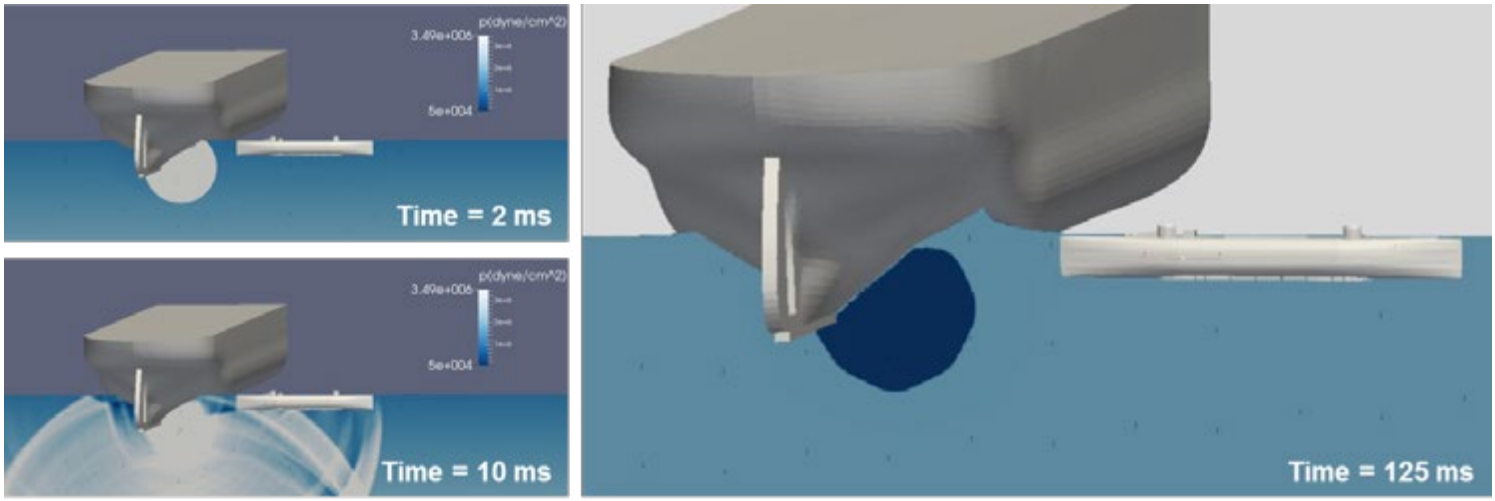
In addition to Carderock's effort, a separate ONR-funded effort being performed by Dr. Matthew Collette of the University of Michigan Department of Marine Engineering and Naval Architecture is examining the weights and stability of Hunley's design, as well as paths in which the boat may have sank to its final resting place.

This effort already has found that even a small inflow of water or an unstable trim state resulting from the heaving motions during the attack could have resulted in Hunley's sinking.

Once the current analysis efforts are completed, Carderock engineers should be able to help uncover the mystery of why Hunley sank. In addition, the continued development of modeling and simulation capabilities to perform advanced analyses such as those described above will facilitate an ever-increasing ability to design against or evaluate future threats to the Navy.

About the Authors:

Dr. Nahshon, Jamie Cruce, and Michael Miraglia serve in the Hull Response and Protection Branch at the Naval Surface Warfare Center Carderock Division. Dr. Hess is the Ship Systems and Engineering program manager at the Office of Naval Research.



This simulation of the explosion that rocked USS Housatonic shows the contours of pressure indicating the elevated pressure regions in white (left) and a view of the bubble created by the explosion, in dark blue, at its maximum size (right).

Composite patch repair completed on USS Vicksburg (CG 69)

Timothy E. Hunt, NSWCCD Public Affairs

Composite deck patch installed on USS Normandy (CG 60) in September 2014. (U.S. Navy photo by Bruce Wells/Released)

The Naval Surface Warfare Center, Carderock Division Structures and Composites Division deployed a team recently to USS Vicksburg (CG 69) to perform repairs to her forward shell plating. The repairs were made from Aug. 30-Sept. 1 at the Norfolk Naval Base.

Engineers David Knight, John Nolan and Bruce Wells were assigned to the team because of their extensive background with composite repairs. Wells' team has executed composite patch repairs to ships with hard operational requirements, which could not be supported by any other repair approach.

"Although Structures and Composites Division is not known as a repair activity, a unique set of circumstances has placed our team in a position where we have had to take ownership of not only the analysis and design, but also the implementation of composite patch technology for the Navy" said Wells.

The damage was discovered during a Continuous Maintenance Availability (CMAV) in July 2014 by the crew during painting. The location of the crack was on the forward plating. In addition to the crack, significant plate deformation was also discovered. This increased concerns over the sufficiency of a previously applied polysulfide sealant to maintain watertight integrity.

Because Vicksburg was less than a week away from the CMAV end date and contractor support was unavailable, the NSWCCD composite patch team was contacted and asked to perform the repair. Wells, in-service lead for composite patch repairs, traveled to the site to inspect the cracked plating.

Wells' inspection revealed that the cracking appeared consistent with a loss of material integrity (known as sensitization) in the aluminum plating, leading to stress corrosion cracking (SCC). Both of these conditions are prime factors for considering composite patch repairs over a traditional welded crop-and-replace approach that requires the physical removal of the metal and welding in a new piece of material. Stress corrosion cracking on aluminum superstructures has proven to be a reoccurring problem for the fleet, significantly impacting operational capabilities and maintenance budgets.

Following discussions with the Naval Sea Systems Command Ship Integrity and Performance Engineering Office (NAVSEA 05P) cognizant technical warrant holders (TWH) and Surface Ship Design and Systems Engineering Office (SEA05D) ship design manager, it was agreed that the double-sided (interior and exterior) composite patch that is usually used in situations like this was the best approach to minimize risk of further cracking and loss of watertight integrity. However, the two most critical considerations for this particular repair were not typical, making it necessary to deviate from the standard treatment method.

First, this type of patch had not been applied to such a large and growing crack before. This raised questions regarding the effective durability, as well as the potential for water intrusion into a compartment with sensitive electronics equipment.

In addition, the time window provided to the repair team was a very short one for the type of repairs required and would not provide enough time to erect the needed scaffolding on the exterior of the ship to apply to second side of the patch.

These factors drove the decision to perform

a single-sided repair as a short-term fix. The decision was further supported by recent data provided by composite patch material manufacturers and NSWCCD Composites Lab staff research that strongly indicated that even a single-sided composite patch could provide increased load capacity and improved fatigue life of cracked structures.

As work began, the repair was further complicated by the discovery of additional damage during surface preparation. Deformation in the plating below the visible crack discovered earlier indicated the strong possibility of a subsurface crack. To account for this, Wells decided to extend the coverage area for the patch.

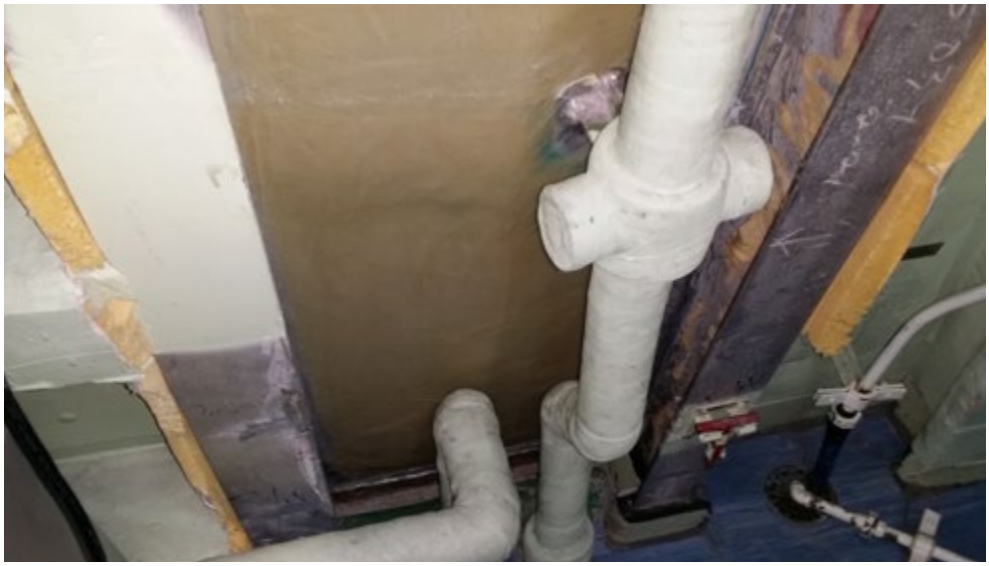
Other structural difficulties and access to the repair area also complicated the repair, making the repair particularly challenging both technically and physically for team members. This made it necessary for the team to perform the repairs from inside the ship in what the team describes as "limited" conditions.

Although composite patch repairs are individually funded by each respective ship maintenance budget, the team tries to maintain a small supply of long-lead items needed in the Composites Lab to quickly respond to urgent repair requests. In this instance, materials were on-hand, so it only took about two days to prepare for the repair; templates were made from the previous measurements taken during the July inspection, the fiberglass materials were cut in the Composites Lab and the necessary materials and equipment were inventoried and packed in advance of determining the actual installation date. A side benefit of meeting the ship in Norfolk was the reduced logistical burden for shipping materials; the team loaded a cargo van with the readied repair kit, drove to the Naval Station from West Bethesda and worked pier side from the van.

Composite patching began in 2010 as a small task funded by Surface Warfare Directorate (SEA21) to determine the feasibility of bonding to degraded and sensitized aluminum. Additional funding and support was provided by the Office of Naval Research (ONR331). After a successful test installation on USS Port Royal (CG 73), word spread about this developing repair approach, demand for this type of repair from the fleet was swift and overwhelming. Despite the large response, Wells is confident in his team's abilities; "Our team is small, but we're dedicated to doing our part to maintain readiness. We are committed to deliver on-time and on-budget support, regardless of logistical and physical circumstances."

To date, the team has completed over 50 repairs totaling more than 1,500 square feet of repairs, with the oldest patch now approaching four years of successful service. Although originally intended to provide a temporary repair capacity until welded repairs could be undertaken, patches

Before application of a composite patch aboard the USS Vicksburg (CG 69) in September 2014. (U.S. Navy photo by Bruce Wells/Released)



After application of a composite patch aboard the USS Vicksburg (CG 69) in September 2014. (U.S. Navy photo by Bruce Wells/Released)

are inspected annually and based on those results, maintenance teams often request continued use of the patch. Although the standard patch design is not designed to restore 100 percent of the original structural strength, these repairs continue to prove themselves in both cost avoidance and time savings over traditional repair procedures. Total ownership cost reduction provided by the patches are conservatively averaging 1/10 the welded repair costs (90 percent savings).

It is hoped that continued research will not only improve the processes for installation and maintenance, but provide additional uses in shipbuilding and refit. NSWCCD is investigating the potential to use non-welded repair technologies for addressing chronic tank-related issues and other, higher stress structural locations. Moving forward with deployment of composite technologies is seen as inevitable by the repair team, who believe that greater efficiencies and life-cycle ownership can be achieved through more integrated involvement with the Regional Maintenance Centers.

"We have enjoyed our on-site deployments. Having the opportunity to work with port engineers and ship's company has given us a great perspective on how our research affects the fleet. Our success and the positive feedback we receive is evidence of the flexibility and benefit this repair technology provides to the Navy," said Wells.

Work is underway using ONR Technology Insertion Program Savings (TIPS) funds to provide training for Navy maintenance personnel. The first training sessions for composite patching were conducted in October.

The current repair is expected to effectively carry Vicksburg through to a longer duration maintenance availability scheduled for late 2014.

NSWCCD Ship Design Group hosts modular ship design pioneer

Timothy E. Hunt, NSWCCD Public Affairs

The Naval Surface Warfare Center, Carderock Division Ship Design Group recently hosted Jack Abbott of AOC Inc. where he presented a lecture on the subject of "Modularity in Ship Design – Hindsight and Foresight." The presentation is part of a series of brown bag presentations that are part of NSWCCD's mentoring program. This particular lecture concentrated on lessons learned over his career as well as what he sees as the future of this concept.

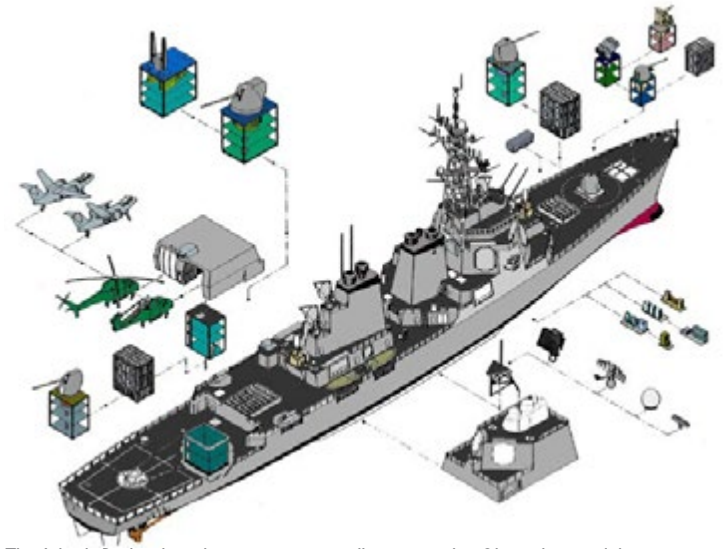
Abbott has been involved with the development of modular ship building since its beginnings in the mid 1970s. He has written several papers on the subject that are considered seminal in the field of modular ship design. He served as chief engineer aboard the USS Brane (DD 630) and in leadership positions for 13 major projects over his 51 year career. He is also a Life Fellow and Distinguished Service Awardee with the Society of Naval Architects and Mechanical Engineers and winner of the American Society of Naval Engineers "Jimmy Hamilton" Award.

One important lesson Abbott wants to pass on is very basic but key to seeing the value of modular ship design: change is inevitable. For a ship to remain useful for the Navy, it must be able to adapt to changing mission requirements and be able to incorporate new technology and improvements easily and affordably. He pointed out recent classes of surface combatants (DD963, DD993 and CG47) have all been retired before the end of their planned service life; an average of 20 years instead of 35. This has been a result of technology obsolescence and expensive upgrade costs to remain relevant.

Jack Abbott, of AOC Inc., speaks to NSWCCD employees during the Ship Design Mentoring Group meeting in West Bethesda, Md., Oct. 9, 2014. (U.S. Navy photo by Timothy E. Hunt/Released)

Abbott identified cost reduction during refits and modernization as the primary motivator in early Navy modular shipbuilding efforts. The value of modular design and building techniques during the initial design and construction did not catch on until the concept was proven by private industry and foreign navies; the British and Swedish navies in particular.

He also noted a shift in thinking that has occurred in terms of the importance mission reconfigurability, pointing to ships such as the DDG 51 and Littoral Combat Ship (LCS) designs as examples of this thinking.



The Arleigh Burke-class destroyer is an excellent example of how ship modularity concepts are currently employed in Navy shipbuilding. Modules center mainly around weapon and sensor systems due to the need for frequent upgrades. However, more recent developments are moving the modularity concept toward a mission rather than system oriented focus. (Graphic provided by Jack Abbott, AOC Inc.)

Interests in modularity at the Department of Defense level started with the Open Systems Joint Task Force (OSJTF) in 1994. The OSJTF approach, called the Modular Open Systems Approach (MOSA), establishes the process for developing a modular and open technical architecture. Going forward, the U.S. Navy has endorsed this approach as part of the Flexible Warship Initiative begun by OPNAV N96 in 2013. This latest interest by Navy management is a desire to lower total ownership costs while providing technical and mission relevance over the life of the ship. Along with a review of earlier modularity programs Abbott presented details on these recent Flexible Warship efforts.

Abbott also provided some observations of technology trends that he believes will have significant impact on ship capabilities as modules are created and replaced going forward. He sees ship capabilities increasing as future technologies combine with existing functions into smaller and lighter packages. This will lead to modules being repartitioned or subdivided further, allowing additional systems to be added in the newly available spaces. The end result would be an increase the capabilities of the ship and extending the useful service life of the platform, with a minimum impact on the hull, displacement, or ship support services.

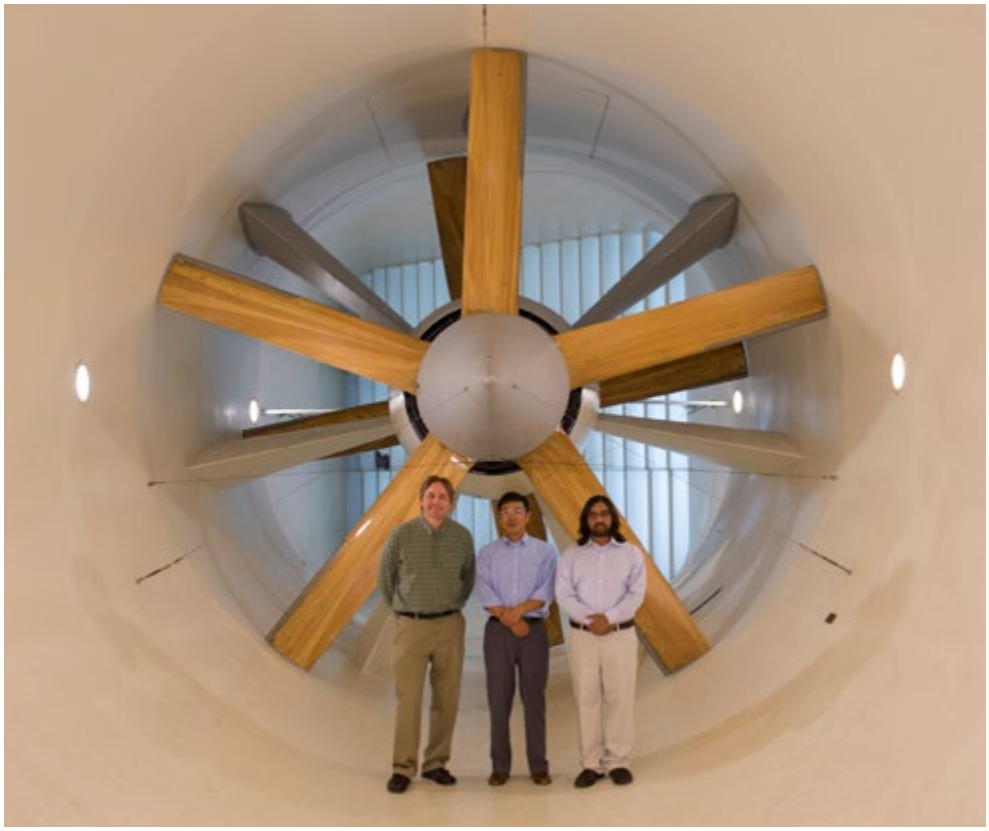
Abbott concluded his remarks by pointing out the need for engineers to shift their design approach from creating ships that "barely fit" initial payload systems on the platform, also known as "optimized design", to one where the platform can easily support module placement and integration for a range of present and future payloads. He also emphasized that for modularization to be successful, design goals and requirements must be identified early in the design process. Modularization design principles must also be actively embraced and not only by ship designers but by system developers.

NSWCCD celebrates a century-long history of experimental aerodynamics

By Rebecca Grapsy, NSWCCD Public Affairs

Rear Adm. David Taylor, the "father" of Naval Surface Warfare Center, Carderock Division (NSWCCD), opened the world's largest wind tunnel in 1914. It was the only facility at that time large enough to test complete models of aircraft and ship superstructures. Today, NSWCCD is home to the Navy's largest general purpose wind tunnel, which is operated by the Sea-Based Aviation and Aeromechanics Branch. The branch supports a broad range of customers with Experimental Aerodynamics expertise, which has been an instrumental part of Naval research and development for the past 100 years.

NSWCCD's history can be traced back to 1898 when Taylor completed construction of an experimental model basin at the Washington Navy Yard that propelled the Navy to the forefront of naval architecture and ship design. The basin was also used to evaluate the hydrodynamic performance of seaplanes, including the Navy's first aircraft, the Curtiss A-1. Taylor soon recognized the need for experimental wind tunnel facilities to support nascent naval aircraft development as well as ship topside design to support aircraft operations. This led to the construction of the Navy's "Experimental Wind Tunnel," which was located next to the experimental model basin in 1914. That same year Taylor became the Chief Constructor of the Navy – responsible for the construction of all Navy ships and aircraft. The experimental test facilities at the Washington Navy Yard enabled Taylor and his staff to make significant contributions to ship and aircraft design. Utilizing a rigorous scientific approach, Taylor transformed ship architecture and aircraft design in the U.S. Navy from an art to a disciplined engineering science.



From left: Wind Tunnel Test Director Kevin Kimmel, Research and Development Group Leader Dr. Peter Bi and Dr. Anish Sydney pose in front of the power section in West Bethesda, Md., Oct. 22, 2014. (U.S. Navy photo by James Contreras/ Released)

Dr. Nick Rosenfeld, an aerospace engineer in the Sea-Based Aviation and Aeromechanics Branch, conducts heel tests in NSWCCD wind tunnel in West Bethesda, Md., Nov. 12, 2010. (U.S. Navy photo by Ryan Hanyok/Released)

Construction of the much larger David Taylor Model Basin began at Carderock in 1936 to replace the aging experimental model basin, and it opened in 1939. Construction later began on a new aerodynamics laboratory in 1942, and by January 1944 the Aerodynamics Laboratory had transferred en masse from the Washington Navy Yard to Carderock. NSWCCD's facilities have since undergone various changes and upgrades that have enabled Carderock to support a broad range of efforts from fundamental ship and submarine design to the innovation and development of future unmanned systems and concepts. Experimental Aerodynamics has remained a fundamental NSWCCD capability throughout this evolution.

The Sea-Based Aviation and Aeromechanics Branch Head Dr. David Haas, stated that the branch's legacy in Experimental Aerodynamics, starting with the Navy's first experimental wind tunnel, includes "testing everything from the Curtiss A-1 to the DDG 1000." The Branch supports multiple NSWCCD technical capabilities including aerodynamic assessments of ship topside performance and ship/aircraft interface, assessments and design of aero propulsors for surface platforms, and assessments of underwater vehicles and systems including the Ohio-class replacement using similarity relationships between testing in air versus water. These capabilities, which have continually evolved since Taylor's early efforts more than a century ago, support a critical knowledge area that has helped NSWCCD remain a world class total ship systems organization. Haas added that Carderock's long history in experimental aerodynamics, longer than any other U.S. government organization, was documented in a recent paper presented at the 2014 American Institute of Aeronautics and Astronautics SciTech Conference that he coauthored with two other branch engineers, Eric Silberg and Kevin Kimmel.

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